Defining and Valuing the Relationship

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Defining and Valuing the Relationship Pattern of Actors' Involvement on Cattle Farming Systems using Stakeholder Network Analysis in West New Guinea, Indonesia

Pendefinisian dan Penilaian Pola Hubungan Keterlibatan Aktor Pada Sistim Peternkan Sapi dengan Menggunakan Analisis Stakeholder Network di Papua Barat, Indonesia

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Abstrak

Sapi merupakan salah satu peternakan prioritas utama di Indonesia. Ternak sapi telah memainkan peran penting dalam aspek ekonomi dari total pendapatan. Sebagai peternakan prioritas karena berbagai keterlibatan dan peran pemangku kepentingan. Studi dilakukan di Manokwari pada bulan April-Juni 2019 dengan menggunakan focus group discussion terhadap dua puluh individu, kelompok dan lembaga massa yang diwakili. Pertanyaan yang dibahas mengenai latar belakang, pengiriman sumber daya, interkonektivitas antar aktor, intervensi dan inovasi. Temuan utama adalah bahwa aktor yang dikelompokkan mendominasi, diikuti oleh aktor hukum, lembaga swasta, peran pemangku kepentingan dan memiliki efek positif karena kepentingan. Namun, ancaman eksis baik secara langsung tetapi tanpa efek balik. Tiga sumber daya bersama teratas adalah akses, kepuasan, dan waktu yang dihabiskan. Aktor dapat memiliki program jangka panjang dengan keberlanjutan menggunakan sumber daya netral hingga kuat. Hubungan aktor ditemukan dalam tiga kelompok, yaitu positif, negatif dan tidak ada hubungan. Intervensi sangat dibutuhkan, yaitu waktu yang dihabiskan, kepuasan, kebijakan, pengetahuan dan akses. Prioritas inovasi akan keterampilan, kebijakan, dan pengetahuan.

Kata kunci: Analisis jaringan pemangku kepentingan; Intervensi dan inovasi; Pelaku; Sumber daya bersama; Usaha peternakan sapi.

Abstract

Cattle is one of the top priority animal agriculture in Indonesia. It has played significant roles in economical aspect of Total revenues. Those are due to stakeholders' involvement. Study was done in Manokwari from April to June 2019 by using focus group discussion towards twenty various represented individuals, groups and mass institutions. The queries discussed concerning background, resources delivery, interconnectivity amongst actors, intervention and innovation. The primarily finding is that grouped actors dominated, followed by laws actors, private types institutions, stakeholder role and having positive

effect due to importance. However, threat existed directly without turn-back effect. The three top shared resources were access, satisfaction, and time spent. Actors can have long term period program with sustainability using neutral to strong power resource. Relationship of actors found in three groups, i.e. positive, negative and no relationship. Intervention was urgently needed, i.e. time spent, satisfaction, policy, knowledge and access. Priority of innovation will be skills, policy, and knowledge.

Keywords: Actors; Cattle farming business; Intervention and innovation; Shared resources; Stakeholder network analysis.

INTRODUCTION

Cattle in Indonesia is the first and top rank of animal agriculture bred and kept extensively by small-scale farmers (Tawaf and Lengkey 2007; Setianto *et al*., 2014) and intensively by big companies in shapes of various livestock farming systems (Satya *et al*., 2004). It clears that the form of cattle farming systems in Indonesia developed by all related stakeholders. Therefore, stakeholders and its network play prominent roles in development particularly agriculture sector (Freeman 2015). Examples are found in village administration such as village cooperation. Empirical study discussed by Resti *et al*. (2017) in dairy cattle at Bogor. Cattle bred and kept ranged from almost all provinces and regions in Indonesia. The involvement of many stakeholders and other parties shaped how farms can sustain in terms of economic, social and environment indicators (Rahardjo 2013). In economic terms, particularly the prices of beef cattle, Komalawati *et al*., (2019) discussed concerning price volatility and its effect on supply responses in Indonesia.

Many publications of stakeholder and actor analyses discussed without background and back-bound of the actors (Grimble and Wellard 1997). Actors and stakeholders' analysis commonly discussed qualitatively by drawing diagrams and pictures. Whereas, many can be done by a bit more quantitatively compute the pattern and relationship of the network. Shapes of actors in line with individual, group and mass determine how actors have to be approached (Muniesa 2015). Law status and types of organization become the criterion of legality in playing prominent roles (Hajjar *et al*., 2019). Legality will provide certainty and respect of involvement, beside trustworthy. Roles as stakeholders and shareholders will affect how contribution should be delivered in determining cattle business beneficiary and production. Example is explained by Iyai *et al*. (2016) in Manokwari, West Papua-Indonesia.

Understanding the background and the back-bound of the actors are utmost important (Mayulu and Sutrisno 2014). Best fitted and appropriate actors can play significant roles in promoting and sustaining cattle farming system, particularly in Indonesia and specifically in West Papua. Iyai and Yaku (2015) identified several livestock farming systems in Manokwari, West Papua. Each livestock farming system established has certain relationship and typical involvement of various interests. Therefore, it is urgently needed to deeply digging 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 of the cattle farming systems. Characteristic of stakeholders or institutions can provide direction in executing implementing programs.

One powerful social network analysis beside Gephi (Bastian *et al*., 2009) and Netmap (Schiffer 2007) is Social Network Visualizer beside SmartPLS (Ringle *et al*., 2005). The Social Network Analysis (SAN) is so far an adequate and appropriate software to compute network and relationship (Krupa *et al*., 2017). 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, defining and valuing involvement and relationships of stakeholders with related to

cattle business beneficiary become the objective of this research.

MATERIALS AND METHODS

Research was done in Manokwari, West Papua. Several organizations, groups and individuals representing institutions were selected and interviewed using focus group discussions (Moleong 1991). Approaches done by using referenced found during searching relevant data and information concerning their involvement in development and establishment of cattle sectors in global Indonesia and particularly Manokwari, West Papua province. 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 by the reasons that bunches of information and data 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 cattle development in West Papua, particularly in Manokwari. Manokwari is the central development of cattle farming according to local livestock provincial offices and Ministry of Agriculture, The Republic of Indonesia. All stakeholders grouped into local community, government, banks, markets, private transportation and university.

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

No	Institution	Roles and Responsibility
1	cattle farmers	Individuals and/or groups of farmers who are keeping cattle in their yards
2	Retailers	Individuals and/or groups of community
3	Consumer	Individuals who buy and consume the meat product
4	Butchers	Individuals who do slaughter the meat of livestock
5	Regency livestock offices	Ruled policy and regulation with related to cattle
6	Extensions	Serving farmers extension service with related to knowledge and skills of cattle farming
7	Veterinarian	Serving health of animals and farmers needs
8	Crop farmers	Provide feed materials for men and animals
9	Local government	Provide policy and regulations
10	Financial institutions	Provide loans and account for farmers
11	Grass farmers	Planting animal feed with related to grass and legumes
12	Middle men	Provide and distribute sale cuts
13	Village cooperation	Provide and distribute farmers need and production of farmers
14	Local village community	Perceiving and determining community perception
15	Village officers	Provide community needs
16	Market	Provide and distribute sale cuts
17	Cattle shipping	Provide transportation in and out of an area for cattle transportation
18	Restaurant	Providing animal based product for consumers
19	Quarantine officers	Individuals who are working under organization to make sure incoming and out-coming of livestock transportation.
20	Inseminators	Individuals who are serving the animal reproductions

During the research, data and information related to organizational function and characteristics of the cattle business-related stakeholders, i.e. shape of organization, status of low, types of organization, roles, effect and importance of organization gathered. We also collected factors concerned traits and turn-back effect towards cattle farming development. In knowing the roles and presence of the stakeholders, we also recorded the sharing

resources of organization, duration of period, continuity of the resources, power of resources and intervention done so far by 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), and Hierarchical clustering (HCA). 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, C_{ii}, 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 actors who are structurally equivalent, 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 correlation coefficient (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.. Hierarchical clustering (or hierarchical cluster analysis, HCA) is a method of cluster analysis which builds a hierarchy of clusters, based on their elements dissimilarity. In 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 own 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 form a clique if they are all connected to each other. 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 to each other. 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 steps in running this SocNetV version 2.5 presented Figure 1. To catch the intervention shared by organization, we also look up into details what intervention done and shapes of innovation done by

stakeholders. All data collectively entered into a Microsoft Excel worksheet and tabled into manuscript.

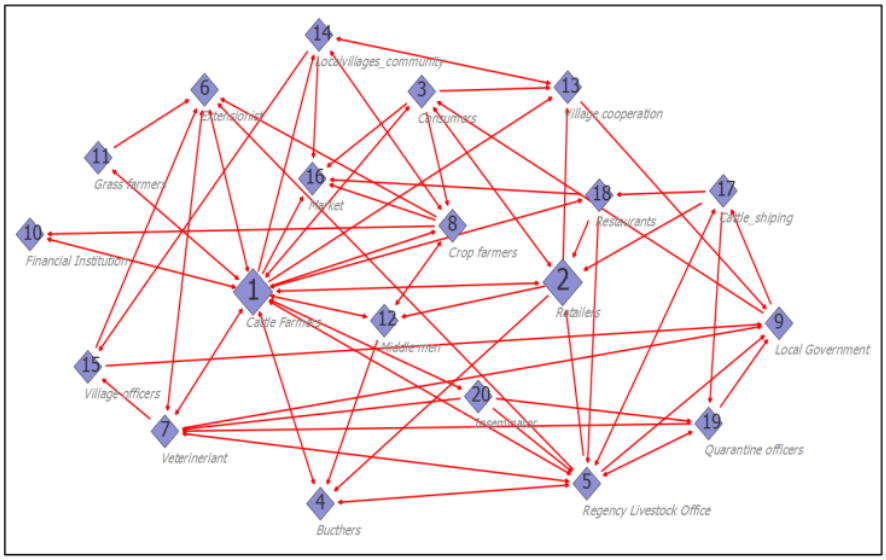

Figure 1. Drawing relationships of actors' involvement on cattle development in West New Guinea.

RESULTS

CHARACTERISTIC OF ORGANIZATION

We investigated the shapes of the organization, status by law, types, roles, effect, importance, threats, and turn-back effect. Shapes of organization as actors can be grouped into three types, i.e. individuals, group and mass. We found organizational typed dominated by 10 group actors (50%), followed by 8 individuals (40%) and two mass actors of organization (10%). This portrait that cattle actors' development in West New Guinea was on the stage of local and traditional organization. They have no bargaining position in determining the shapes and rate of cattle development. We identified that the actors of cattle development ruled by law (50%) and the rest had no ruled by law. The law of institutions determines the legality and power in sounding policy of development. Types of organization established in cattle business sector were grouped in private and state institutions. We found 14th groups were private (70%) and the rest 30% was states. The roles of organizations played by actors were stakeholders (55%) and shareholders (45%).

Table 2. Descriptive pattern of organization of cattle actors in West New Guinea.

No.	Description of actors	Sum	Proportion (%)
A	Shape of organization		
	Individual	8	40
	Group	10	50
	Mass	2	10
B	Law		
	Law	10	50
	No law	10	50
C	Types		
	Private	14	70
	State	6	30
D	Roles		
	Stakeholder	11	55

No.	Description of actors	Sum	Proportion (%)
	Shareholder	9	45
E	Effect		
	Positive	12	60
	Negative	10	50
F	Importance		
	Importance	18	90
	Unimportant	2	10
G	Threat		
	Direct	12	60
	Indirect	8	40
H	Turn back Effect		
	Feedback	7	35
	No feedback	13	65

Effects felt by cattle business cycles on involved stakeholders were stated 12 actors had positive effect (60%) and only 10 actors in between had negative effect (50%). We interested in records the importance of the actors in ruled the cattle business beneficiary. A number of 90% actors (18 organization) stated important and the rest had stated less important (10%). To assure the continuity of this business we measured the threat buried on business of cattle. We recorded 12 organizations had direct threat toward the development of cattle production and the rest 8 actors had indirect effects. We finally eager to seek whether cattle business beneficiary had turn-back effect amongst 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' characteristics of actors in reality, we concluded that cattle business beneficiary can sustain and has future development in West New Guinea.

AVAILABLE AND STATUS OF RESOURCES

Shared resources inside cattle 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 cattle 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%). Example explained by Tawaf and Lengkey (2007) in Indonesia. Another experience was shared by governance programs in Brazil (Hajjar *et al*., 2019).

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

No.	Resources	Sum	Proportion (%)
A	Sharing resources		
	Policy	7	35
	Finance	7	35
	Space	13	65
	Time	17	85
	Access	20	100
	Satisfaction	20	100
	Knowledge	14	70
	Skills	13	65
	Threat	8	40
	Power	8	40
	Feed materials	9	45
B	Duration of period		0
	Short term period	3	15
	Long term period	17	85
C	Continuity of resources		0
	Sustain	18	90

No.	Resources	Sum	Proportion (%)
	Unsustain	2	10
D	Power of resource		0
	strong	8	40
	neutral	10	50
	weak	2	10
E	Intervention		0
	Need	17	85
	Unneeded	3	15

Duration of 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 unsustain (10%). Power of resources dominantly found was neutral actors (50%) followed by strong power (40%) and weak power (10%). Weak power need further intervention and innovation in terms of resources' needs. The need of Intervention was found in 17 actors (85%) and the rest were no need to intervene (15%). Delivery intervention can be made with related to policy, finance, knowledge, skills and relevant needs (Ventura *et al.*, 2016). These types of intervention will further explain in the subsequent discussions. To provide highlight of the position and how strength the relationship, we organized an analysis of stakeholder network analysis (SNA). The graph of Figure 3 highlighted the mental model of this relationship.

The SNA output (Figure 3) depicted the picture of SNA based on Power centrality. Of Figure 2. and Table 4., we succeeded in mapping interlinked network relationship amongst cattle actors in production systems. In Central Java, constraints faced by cattle farmers made in causal loop diagram by Setianto *et al.*, (2014). We also evaluated this connectivity and suggest adding links between grass farmers 11 to markets 16, financial institution 10 to village cooperation 13, restaurant 18 to village cooperation 13, regency livestock officers 5 to grass farmers 11.

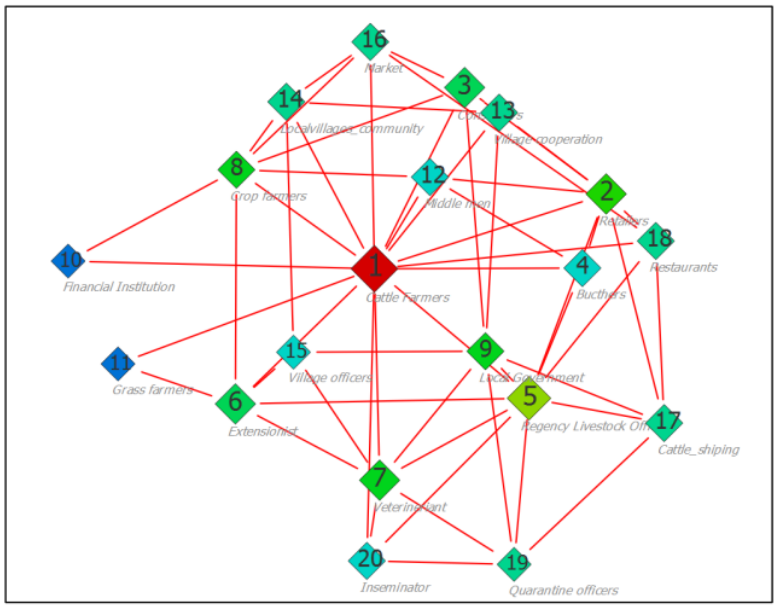

Figure 2. Stakeholder Network Analyses (SNA) of Cattle actors' relationship based on Power centrality index and Kamada-Kawai (Force-directed model). Small and big size cubes indicated power. Changed red to greed and blue colors indicating importance and strategic actors' involvement from lower to high power.

On one hand we analyzed important position of a board that is relevant to business, i.e. drug and food research board. This board will have a strategic position in protecting and assuring quality and healthy beef. Down to Table 4., several actors 1-20 had positive clear correlation with PCC=1. Actors with PCC=0 had no relationship at all. However, the rest had negative correlation (PCC<0) and several had neutral relationships.

Actors had positive correlations were 1 vs 8 (PCC=0.182) and 16 (PCC=0.067). Retailer 2 had positive correlation with butchers 4, crop farmers 8, local government 9, financial institution 10, grass farmers 11 (Serey et al. 2014), middle men 12 , market 16 , restaurant 18 and inseminator 20. In one hand, consumers 3 (Shabrina *et al*., 2015) had positive relationship with butchers 4, extensions 6 (Satmoko and Lestari 2018), financial institution 10, grass farmers 11, middle men 12, village cooperation 13 (Satmoko and Lestari, 2018), local village community 14, market 16 (Hajjar *et al*., 2019), cattle shipping 17, and the last but not least restaurant 18 (Priyanti *et al*., 2014). Butchers 4 (Rachman ., 2017) had strong correlation with retailers 2, consumers 3, extension 6, veterinarian 7, crop farmer 8, financial institution 10, grass farmers 11, middle men 12, village cooperation 13, and restaurant 18.

Table 4. Matrix correlation coefficient of Pearson (PCC) of cattle actors.

Actor^Actor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1.000	0.000	-0.126	0.000	-0.346	-0.126	-0.545	0.182	-0.303	-0.192	-0.192	0.000	-0.200	-0.200	0.000	0.067	-0.200	-0.200	-0.200	-0.289
2	0.000	1.000	-0.089	0.357	-0.000	-0.089	-0.171	0.043	0.257	0.068	0.068	0.102	-0.000	-0.000	-0.408	0.236	-0.000	0.236	-0.000	0.102
3	-0.126	-0.089	1.000	0.218	0.000	0.048	-0.023	-0.023	-0.252	0.509	0.145	0.491	0.378	0.630	-0.055	0.126	0.126	0.378	-0.126	-0.055
4	0.000	0.357	0.218	1.000	0.000	0.218	0.157	0.157	-0.105	0.250	0.250	0.375	0.289	-0.000	-0.250	-0.000	0.289	0.577	-0.000	0.375
5	-0.346	-0.000	0.000	0.000	1.000	-0.218	0.314	-0.314	-0.105	0.000	0.333	0.250	0.115	-0.346	0.250	-0.115	0.346	0.115	0.346	0.250
6	-0.126	-0.089	0.048	0.218	-0.218	1.000	0.206	-0.252	0.206	0.509	0.145	0.218	-0.126	0.378	-0.055	0.126	-0.126	0.126	0.126	0.491
7	-0.545	-0.171	-0.023	0.157	0.314	0.206	1.000	-0.099	0.121	0.105	0.454	-0.105	0.061	0.061	0.157	-0.182	0.303	0.061	0.303	0.419
8	0.182	0.043	-0.023	0.157	-0.314	-0.252	-0.099	1.000	-0.319	0.105	0.454	-0.105	0.303	0.061	0.157	0.303	-0.424	0.061	-0.424	-0.105
9	-0.303	0.257	-0.252	-0.105	-0.105	0.206	0.121	-0.319	1.000	-0.245	-0.245	-0.367	-0.182	0.061	-0.105	-0.182	0.061	0.061	0.303	0.419
10	-0.192	0.068	0.509	0.250	0.000	0.509	0.105	0.105	-0.245	1.000	0.444	0.667	0.192	0.577	-0.167	0.577	-0.192	0.192	-0.192	0.250
11	-0.192	0.068	0.145	0.250	0.333	0.145	0.454	0.454	-0.245	0.444	1.000	0.250	0.192	0.192	0.250	0.192	-0.192	0.192	-0.192	0.250
12	0.000	0.102	0.491	0.375	0.250	0.218	-0.105	-0.105	-0.367	0.667	0.250	1.000	0.289	0.289	-0.250	0.289	-0.000	0.289	-0.289	0.062
13	-0.200	-0.000	0.378	0.289	0.115	-0.126	0.061	0.303	-0.182	0.192	0.192	0.289	1.000	-0.067	0.289	0.467	0.200	0.200	-0.067	-0.000
14	-0.200	-0.000	0.630	-0.000	-0.346	0.378	0.061	0.061	0.061	0.577	0.192	0.289	-0.067	1.000	-0.289	0.200	-0.333	0.200	-0.333	0.000
15	0.000	-0.408	-0.055	-0.250	0.250	-0.055	0.157	0.157	-0.105	-0.167	0.250	-0.250	0.289	-0.289	1.000	0.000	-0.000	-0.289	0.289	0.062
16	0.067	0.236	0.126	-0.000	-0.115	0.126	-0.182	0.303	-0.182	0.577	0.192	0.289	0.467	0.200	0.000	1.000	-0.067	-0.067	-0.333	0.000
17	-0.200	-0.000	0.126	0.289	0.346	-0.126	0.303	-0.424	0.061	-0.192	-0.192	-0.000	0.200	-0.333	-0.000	-0.067	1.000	0.200	0.200	0.289
18	-0.200	0.236	0.378	0.577	0.115	0.126	0.061	0.061	0.061	0.192	0.192	0.289	0.200	0.200	-0.289	-0.067	0.200	1.000	0.200	0.289
19	-0.200	-0.000	-0.126	-0.000	0.346	0.126	0.303	-0.424	0.303	-0.192	-0.192	-0.289	-0.067	-0.333	0.289	-0.333	0.200	0.200	1.000	0.289
20	-0.289	0.102	-0.055	0.375	0.250	0.491	0.419	-0.105	0.419	0.250	0.250	0.062	-0.000	0.000	0.062	0.000	0.289	0.289	0.289	1.000

PCC=0 where there is no correlation at all, PCC>0 when there is positive correlation, PCC<0 when there is negative correlation.

Actors had negative correlation were cattle farmers 1 with consumers 3, regency livestock 5, extension 6, veterinarian 7, local government 9 (Yustika *et al*., 2014), financial institution 10, grass farmers 11, village cooperation 13, local village community 14, cattle shipping 17, restaurant 18, and quarantine officer 19. Cattle farmers in Central Java experienced similar facts (Setianto *et al*., 2014). The quarantine officer 19 has negative correlation with cattle farmers 1, consumer 3, crop farmers 8, financial institution 10, grass farmers 11, middle men 12, village cooperation 13, local village community 14, and market 16. Example was explained by Vasco *et al*. (2018) in Ecuador. The inseminator 20 had negative correlation with cattle farmers 1, consumer 3, and crop farmers 8.

Actors had no correlation were cattle farmers 1 with retailers 2, middle men 12, village cooperation 15. The retailers 2 had no correlation with cattle farmers 1, regency livestock officer 5, village cooperation 13, local village community 14, and quarantine officer 19. The consumer 3 had no correlation with regency livestock officer 5. The butcher 4 had no correlation with cattle farmers 1, regency livestock officer 5, local village community 14, market 16 and quarantine officer 19. The inseminator 20 had no correlation with village cooperation 13, local village community 14, market 16 (Priyanti *et al*., 2014).

MAPPING INTEREST AND POWER

Down to Figure 3., it was interested in mapping actors into other indicators of powers and interest (Bryson 2007). We considered this as importance due to organizational theoretical background (Grimble and Wellard 1997). Example was discussed by Ariansyah *et al*. (2013) in Bogor. We grouped these two indicators into four quadrants (Qw1-Qw4). In the first quadrant (Qw1), we had no actors involved with low power and high interest. However, in the second quadrant (Qw2), we identified cattle farmers, regency livestock officers and retailers had high power and high interest. Similar situation shared by Setianto et al (2014). Less dominant actors of involvement found in this quadrant.

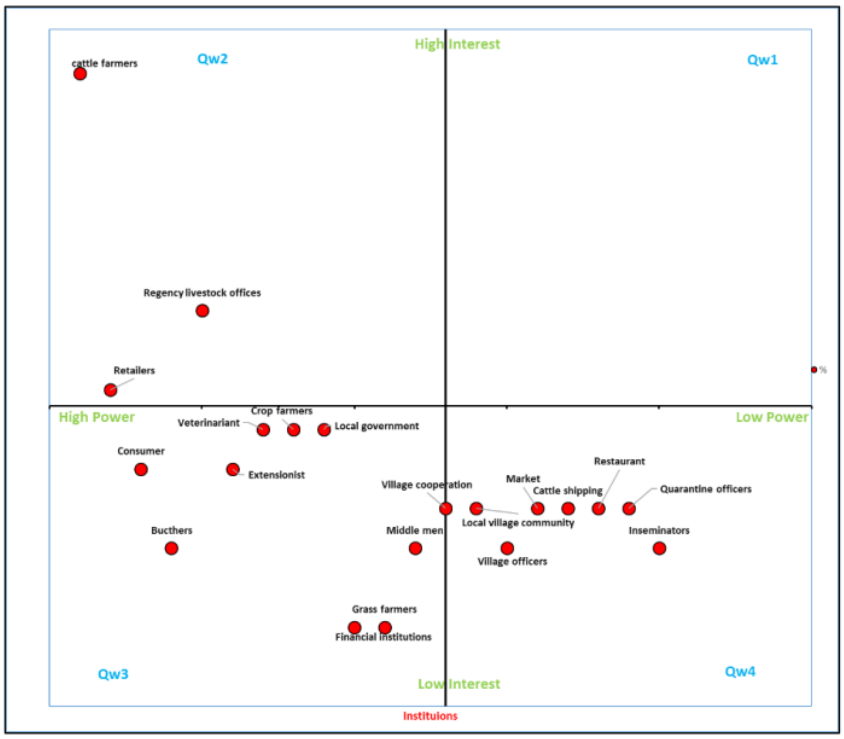

Figure 3. Stakeholder mapping on power and interest relationships under cattle farming systems.

Contrary with third quadrant (Qw3), 10th actors were found and distributed in this quadrant. They apparently were actors with high power but had low interest as well. They were consumers, butchers, extensions, veterinarians, crop farmers, local government (Yustika *et al*., 2014), village cooperation, middle man, grass farmers and financial institutions. These actors dominantly distributed in this segment of relational roles and plays. The last segment is a fourth quadrant that was dominantly also found filled by several organizations. They were markets, restaurant, quarantine officer, inseminators, village cooperation, cattle shipping, and local village community. Example of poor market management was explained by Tavirimirwa *et al* (2013) in Zimbabwe.

Analyzing the places on quadrant by some actors, we suggest to promote several actors' capacity building, roles and power. We aim to revitalize these organizations to have better roles and responsibility. Actors in Qw1 should move to Qw2. Actors in Qw3 should move as well in Qw2. And finally, actors in Qw4 move to Qw2. This is done by reasons that actors will have better high interest and high power. Seeing this importation of actors' network analyses (ANA), we pursued it by analyzing clustering using Hierarchical Cluster Analysis (HCA).

Relationships of cattle actors

There were three leaves (Fig. 4.), i.e. single (simplicifolius) consisted of actor cattle farmers. The second is double (bifolius) which consisted of actor consumers number 3 and village cooperation 13, butchers 4 and middle men 12, cattle shipping 17 and restaurant 18, extension servicer 6 and village officer 15. Example of cattle shipping explained by Gorsich et al (2016). And third one was triple (trifolius) which consisted of actor number 2 retailer, crop farmers 8 and market seller 16 followed by financial institution 10, grass farmers 11, and local village community 14 including actors veterinarian 7, local government 9 and quarantine officer 19. Actors consumers 3 and village cooperation 13 had closed relationship along with actor butchers 4 and middle men 12, financial institution 10 and grass farmers 11, village community 14, cattle shipping 17 and restaurant 18, extension servicer 6 and village officer 15; actors veterinarian 7 grouped into local government 9, quarantine officer 19, and inseminators 20. These had similarity in terms of roles and responsibility. The δ clade consisted of actor cattle farmers (1) and clade β which consisted of clades α (actor retailers 2, crop farmers 8, and market 16) and actor regency livestock offices 5.

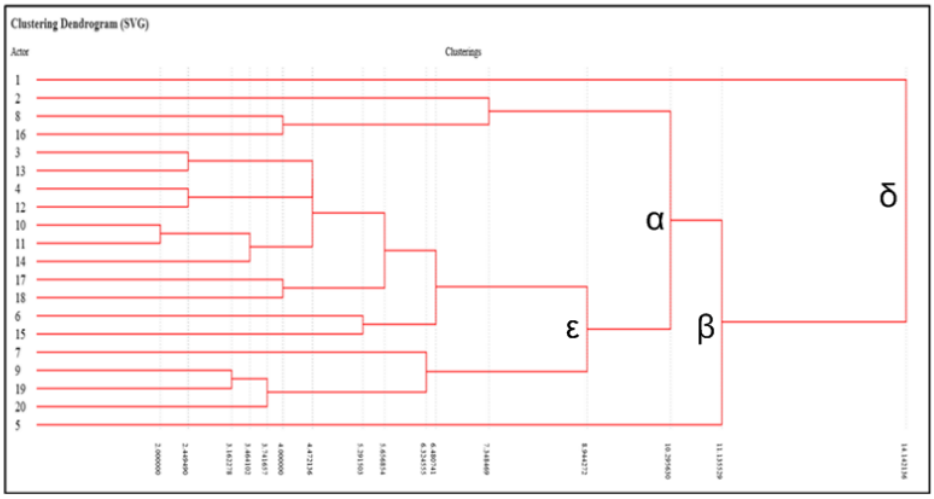

Figure 4. Hierarchical clustering analyses of cattle actors' relationship.

Finally, clade ε which consisted of actor consumers 3, village cooperation 13, butchers 4, middle men 12, financial institution 10, grass farmers 11, local village community 14, cattle shipping 17, restaurant 18, extension servicer 6, village officer 15, veterinarian 7, local government 9, quarantine officer 19 and inseminators 20 were more similar than actors 2, 8 and 16. Cluster δ which consisted of leaves regency livestock offices 5, market 16, cattle shipping 17 and restaurant 18 differed from number cattle farmers 1, butcher 4, extension servicers 6, crop farmers 8 …village cooperation 13 due to hierarchical relationship. Clades with similar height had similar to each other. Clades with dissimilar height had dissimilar relationship. Actors quarantine officer 19 and inseminator 20 along with actors of financial institution 10 and grass farmers 11 had similar relationship. Actors of middle men 12 and local village officer 14 and market 16 and cattle shipping 17 had also closed relationship.

Intervention and Innovation

In ensuring sustainability, intervention is utmost needs. We identified 18 actors needed policy intervention (90%) (Gollnow and Lakes 2014). More than half of the 14 actors (70%) needed financial intervention. For instance, by improving grassland and/or pasture as reported by Oliveira et al (2017). We found 17 else stakeholders which need spacing intervention. Spacing intervention meant for infrastructure and wholesale cooperation, exampled in Thailand (Hasan *et al*., 2015).It seemed that 19 stakeholders needed intervention for time resource. In one hand more than 80% of actors (16) need access intervention. In a small number of intervention of satisfaction was mentioned by 18 actors. Some actors (17) needed intervention of knowledge side. Less than 20% (4 actors) needed intervention of skills.

Table 5. Intervention and innovation provided by cattle actors.

No.	Intervention	Sum	Proportion (%)
a	Intervention		
	Policy	18	90
	Finance	14	70
	Space	17	85
	Time	19	95
	Access	16	80
	Satisfaction	18	90
	Knowledge	17	85
	Skills	4	20
	Threat	6	30
	Power	10	50
	Feed material	6	30
b	Innovation		
	Policy	6	30
	Finance	2	10
	Space	2	10
	Time	0	0
	Access	3	15
	Satisfaction	3	15
	Knowledge	5	25
	Skills	7	35
	Threat	2	10
	Power	1	5
	Feed material	3	15

More than 30% of actors (6) needed intervention with related to threats (30%) they faced. Several actors (10) needed power (50%), feed material (30%), and skills (20%), but some were requested for sustaining the cattle business beneficiary. Differs from intervention, what innovations actually needed are questionable and shall be addressed to obtain clear concept and programs for improve cattle business in West Papua.

Innovation needs to assure the sustainability of cattle business. In policy sector, we found six actors (30%) for policy innovation. Examples and experience reported by Gollnow and Lakes (2014). Specific innovation was regulation, law, standard operating procedures, research and development, monitoring and evaluation and taxation. Example explained by Hasan *et al*., (2015) in Makassar, Indonesia. In financial and space sectors, two actors (10%) needed innovation. Financial innovation will be designed to make it easy-access, and easy-payback with low rate loan. Related to space. Access and satisfaction of actor services needed by actors for innovation, including feed materials (10%). Knowledge (25%) and skills (35%) needed by actors for innovation programs. Example shown in biogas technology as reported by Wahyudi (2017). We found few proportion of threat (10%) responded by two actors. The threat should be avoided and solved such as in Makassar, Indonesia (Hasan *et al*., 2015). Further Mappigau *et al*. (2015) explained trust and communication to reduce cost and increased revenue to avoid threat. While power component was also urgent done by few actors (5%).

DISCUSSIONS

Of Table 2, the statistic of stakeholders shown conformity of boards, inside and outside performances of actors. The format of organization such as mass, group even individual will induce the rate and acceleration of each actor itself. From the view point of law, ruled and official stakeholders will enable the stakeholders to have access and trust in building cooperation and resources. States actors will also provide services and guide on the basis needs. Status of stakeholders and shareholders will make it clear on how each actors should deliver aids and services. Reducing impact of negative effect on actors and increasing positive impact will bring better effect on cattle farming production and shared beneficiary. Direct threat is higher than that of indirect one. It then needs serious action in reducing direct impact. Threat origin from animal health, wastes including livestock emission (Mariantonietta *et al*., 2017; Cardoso *et al*., 2016), forage management (Zanten *et al*., 2016) and price uncertainty (Asmarantaka *et al*., 2019). However, turn back effect depicts un feedback loop effect of actors but, special attention should warn the actors.

Resources are needed as input to stimulate livestock farming system and enhancing farmer capacity. Table 3 picturing shared resources at least needed by cattle farming production was eleven materials. Policy is strategic one. Example explained by Asmarantaka *et al*. (2019). This finding proved that access on and satisfaction for resources are priority willingness followed by time spent and knowledge. Satisfaction can be shaped in terms of economical-, social and amusement (Alam and Dwijatmiko 2013). Low and high interest (including low and high power) actors can be an indicators of measurement. All parties have to move from low interest (Qw3 and Qw4) to high interest (Qw1 and Qw2), so as power too. It has to change from Qw1 and Qw4 to Qw2 and Qw3. The changes depend on roles and responsibility of each actor, including all willingness of actors to have better future and prospect of cattle business beneficiary. This is according statement of Laurance *et al*. (2014). Long term period shown how serious stakeholders in establishing livestock development. Even they can sustain and tend to have neutral and strong in pursuing targeted livestock development. A such explained by Gerssen-gondelach *et al*. (2017). Therefore, in general they need further intervention and innovation. It can be seen in Table 4 that, network and interlinked actors consisted of positive, neutral and negative. Meaning that negative network need adaptation and adjustment with local condition and targeted goals of livestock development. According to Table 5, time allocation, satisfaction, policy (Laurance *et al*., 2014), spaces, knowledge and access are the top six programs of intervention, according to the finding. Added to this was feed

materials (Flintan *et al*., 2019). Meaning that, actors shall bring and deliver intervention based on these priorities. In line with innovation, skills and policy, and knowledge are the three top priorities.

CONCLUSIONS

Cattle actors' involvement is found important in determining improvement of cattle production and business beneficiaries. Although direct threat is higher. However, this does not have turn back effect. Resources offered are dominantly by access, satisfaction, time, knowledge and skills. Therefore, intervention is needed. Several actors have positive clear correlation and the rest are negative and neutral. Actors grouped from interest and power which grouped cattle farmers and regency livestock office. Some actors have power, but some have weak power. Some have interest but some are having less of interest.

CONFLICT OF INTEREST

We stated and clarified that there is no conflict of interest with any financial, personal, or other relationships with other people or organizations related to this research and manuscript.

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