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Mapping Strategic and Sustainable Relevant Actors of Poultry Production and Business Using Stakeholder Network Analysis

(Pemetaan Pemangku Produksi dan Bisnis Unggas Strategis dan Berkelanjutan Dengan Aplikasi Analisis Jaringan Stakeholder)

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ABSTRACT. Stakeholders and their network place top rank of value chain business and ruled prominent roles in the livestock development sector particularly poultry commodity. The involvement of many stakeholders and other parties is questionable because they perform and shape the market and business chain. The study was done in Manokwari using focus group discussion towards twenty-four various represented individuals, groups and mass organizations. The key queries discussed concerning the introduced background of the organization, shared resources, inter-connectivity amongst actors, intervention and innovation preferences and shared by actors. Stakeholder Network Analysis was employed to run the network and relationship between actors using the Pearson Correlation Coefficient and Hierarchical Clustering Analysis. The finding is that the stakeholders in the poultry farming systems are dominated by private group actors who are working in groups to manage the farms and its value chain process and officially have been under laws. These actors commonly act like positive important stakeholders, who ruled the farms. The threats are real and exist and should be lowering as much as possible to mitigate the turn-back effect. The top five shared resources are access, spaces, time, policy, knowledge and skills. Those resources will stay longer to sustain the strong needs of poultry farms. The relationship of actors is dominated by the ranges of correlation are varying in between negative, neutral to positive. Actors are not delivering the intervention and innovation yet. Actors with low interest and low power should then be promoted to high interest and high power by using aids, guidance, and services from each actor from its value chain and cooperation and farming business.

Keywords: intervention and innovation, poultry farming business, shared resources, stakeholder network analyses

ABSTRAK. Pemangku kepentingan dan jaringannya menempati peringkat teratas dalam bisnis rantai nilai dan memegang peran penting dalam sektor pengembangan peternakan khususnya komoditas unggas. Keterlibatan banyak pemangku kepentingan dan pihak lain patut dipertanyakan. Penelitian dilakukan di Manokwari dengan menggunakan FGD terhadap dua puluh empat perwakilan individu, kelompok dan ormas. Pertanyaan utama membahas tentang latar belakang organisasi yang diperkenalkan, sumber daya bersama, interkoneksi antar aktor, preferensi intervensi dan inovasi dan dibagikan oleh aktor. Analisis Jaringan Pemangku Kepentingan digunakan untuk menjalankan jaringan dan hubungan dengan menggunakan Koefisien Korelasi Pearson dan Analisis Pengelompokan Hirarkis. Temuannya adalah bahwa para pemangku kepentingan dalam sistem peternakan unggas didominasi oleh pelaku kelompok swasta yang bekerja dalam kelompok untuk mengelola peternakan dan proses rantai nilainya dan secara resmi berada di bawah undang-undang. Aktor ini biasanya bertindak seperti pemangku kepentingan penting yang positif, yang mengatur pertanian. Ancaman itu nyata dan ada dan harus diturunkan sebanyak mungkin untuk mengurangi efek balik. Lima sumber daya bersama teratas adalah akses, ruang, waktu, kebijakan, pengetahuan, dan keterampilan. Sumber daya tersebut akan bertahan lebih lama untuk menopang kebutuhan kuat peternakan unggas. Hubungan antar aktor didominasi oleh rentang korelasi yang bervariasi antara negatif, netral hingga positif. Para pelaku belum melakukan intervensi dan inovasi. Pelaku dengan kepentingan rendah dan kekuasaan rendah kemudian harus dipromosikan menjadi kepentingan tinggi dan kekuasaan tinggi dengan menggunakan bantuan, bimbingan, dan layanan dari masing-masing pelaku dari rantai nilai dan koperasi dan usaha tani.

Kata kunci: intervensi dan inovasi, usaha peternakan unggas, sumber daya bersama, analisis jaringan stakeholder

INTRODUCTION

The industrial and business of the poultry around the world (Devendra and Thomas, 2002), for instance, have been developed and it has been due to the involvement of many stakeholders and shareholders' interest and intervention. Each stakeholder cares and desires not limited to increasing their business and market-oriented (Nurfadillah *et al*., 2018). However, it has a vision also to providing feeds for the world (Bradford 1999). Stakeholders and shareholders have

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prominent roles in creating the compact demand and business of livestock products, particularly poultry production. Examples are described by Martindah and Ilham (2019) and Mollenhorst and de Boer (2010). The looks of poultry products available on food stores shall attract the interest of consumers to buy the products.

Many stakeholders play a role in determining the process and product of livestock development, particularly the poultry sector (Priyono and Priyanti, 2018). They shaped and formed business and value chains officially by the laws for both international and national levels, i.e. state (central government) and regional, i.e. governor and regency (Nurfadillah *et al*., 2018). Therefore, we should know what and why are stakeholders and/or actors themselves. A stakeholder is defined as individuals, groups, and institutions that have relations both direct and indirect effects in changing a certain process (Freeman, 2015). However, there are stakeholders as well which are not formed and shaped in their interaction by the laws. They are real and play a strategic and prominent role in determining development. The core is stakeholders, which are many and vary according to their roles and responsibilities.

In developing livestock farming systems specifically poultry sector, many parties are interlinked and shaped the complex systems of this agribusiness chain. The complex system of poultry development is including social, economic and environment, it has definition and known its roles. Without knowing the roles of systems, it is hard to drive the parties that play vital roles in shaping the looks of the poultry development. Every stage of the poultry development has its process and been related to parties and/or involved stakeholders. An example comes from industrial and business of the livestock sectors, particularly poultry business.

In many tropical and developing countries, involvement of stakeholders is undoubted real. Some play a vital role in controlling the powers, resources, and access even controlling the threat such as issue of green house gases (Iyai and Runtuboi, 2016) and societal perception (Mollenhorst and de Boer, 2010; Hou *et al*., 2018). They are playing vital roles and sharing important relationship. Their relationships are rich and various in shaping the looks and acceleration rate of poultry development. It seemed that inside and outside development aspects of poultry production should be linearly understandable developed and clearly mapped (Crossley *et al*., 2009; Huang *et al*., 2020; ; Prado-lorenzo and Gallego-a, 2011; Nurek, 2020; Borgatti *et al*., 2003; Springer, 2011; Mandarano, 2009). Without mapping and understand this poultry business circle chain, it is hard and difficult to sustain poultry development, particularly in Indonesia and specifically in West New Guinea. So far, the existing stakeholders do not count yet by farmers, government, and shareholders. They have no power to bargain and work out from the limitation and sources of several sufficiency. Therefore, mapping and having explicit stakeholder input in what and how they contribute to the poultry sector has become the focus of studies. One powerful analysis of social network relationships 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 (Crossley *et al*., 2009; Huang *et al*., 2020; Holman, 2008; 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 the involvement and relationships of stakeholders according to poultry business sector become the priority of this research.

MATERIALS AND METHODS

Research was done in Manokwari, West Papua. We selected several organizations, groups, and individuals to collect all relevant data and information. Using desk study of qualitative research, we collected information from research report, policy document, articles, daily newspapers, and magazines. We considered doing this by the reasons that bunches of information and data are spread out and available even each and cheapest to get. We were concerned about the roles of stakeholders and shareholders in shaping and determining the pattern of poultry development in West Papua, particularly in Manokwari. Manokwari is the central development of poultry farming according to local livestock provincial offices. All stakeholders were grouped into local community, government, banks, markets, private transportation, and university.

During the research, we were composed information and data related to organizational function and characteristics of the poultry business-related stakeholders, i.e. shape of the

organizations, status of law, types of organization, roles, effect and importance of organization. We also tried to collect data and information about traits and turn-back effect towards poultry farming development. Through understanding the positions and involvement of the stakeholders, we have documented the organization's sharing resources, the length of the time, the resource consistency, the power of resources and the organization's intervention to date. To order to capture the intervention discussed by the company, we also analyze to depth what intervention has been achieved and the types of progress created by stakeholders. All data was collectively put into Excel database and manuscript-filed.

Table 1. Stakeholders and their responsibility and roles under the poultry development sector

No	Actors	Roles and Responsible
1	Poultry farmers	Individuals and/or groups who are raising poultry.
2	Breeder	Individuals and/or groups who are producing the breed of poultry.
3	Supplier	Individuals and/or groups who are providing tools and facilities for poultry production.
4	Government	State institution for both national and local that work to provide policy and programs and resources with related to poultry production.
5	Extension agent	Serving farmers extension services with related to knowledge and skills of poultry production.
6	Retailer	Providing retails for selling poultry production.
7	Inseminator	Providing services for animal reproduction.
8	Village cooperation	Provide and distribute farmers' need and production of farmers.
9	Food court/Restaurant	Providing animal based product for consumers.
10	Traditional market	Provide and distribute sale cuts.
11	Crop farmers	Provide feed materials for men, industries and animals.
12	National Shipping	Providing shipping facilities for transporting animals.
13	National airplane	ZProviding air cargo facilities for transporting animals.
14	Quarantine officer	Institution that are working to control transportation of incoming and out-coming of animals.
15	Police	Institution that are working to protect safety of animal transportation, trading and trafficking.
16	Banks	Provide loans and account for the farmers.
17	Consumers	Individuals who buy and consume the meat product of poultry.
18	Feeder	Provide supply of feed for animals.
19	Retribution officers	Provide retribution of taxation for government.
20	Harbor inspector	Institution that are working to control transportation of incoming and out-coming of animals.
21	Airport inspectors	Institution that are working to control transportation of incoming and out-coming of animals.
22	Fishermen	Individuals and/or groups of fishermen working to provide fishes and its products as ingredient for animal feed.
23	Market officers	Provide spaces for seller and buyers inside market places.
24	Vehicles agent	Individuals who are working to provide transportation in transporting the animal products and its facilities.

Source: (Manokwari, 2017, 2018, 2019; Papua Barat, 2017, 2018, 2019) (Fapet-UNIPA, 2009; Kabupaten Arfak, 2016; Fapet-UNIPA, 2018)

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 Pearson Correlation Coefficient (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 nxn 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 product-moment correlation coefficient 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 measure of centrality of degree proposed by Gil and Schmidt. For each node u, this index sums its degree (with weight 1), the size of the neighborhood in 2nd order (with weight 2), and in general, the size of the neighborhood in kth order (with weight k). Thus, for each node u the most important other nodes are its immediate neighbors and then the nodes of the 2nd-order neighborhood, 3rd-order neighborhood, etc., are in decreasing importance. The amounts obtained for each node is defined by the total node numbers in the same variable minus 1. This index can be computed in both graphs and digraphs, but is usually better suited for indirect graph. 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 the Stakeholder Network Analysis's context, these clusters usually consist of network actors (Lein, 2004; Hauck *et al*., 2016; Crossley *et al*., 2009; Dempwolf *et al*., 2012; Nurek, 2020; Holman, 2008). 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 (Crossley *et al*., 2009; Blok *et al*., 2015; Dempwolf *et al*., 2012). 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 shape 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 proposed by Stephenson and Zelen (1989) that focuses on how knowledge might spread over many different paths. Unlike SC and BC, IC metric uses all the paths weighted by tie strength and distance between actors. The score of the IC is the uniform IC (IC divided by the sumIC) and can be interpreted as the proportion of the total flow of information regulated by each actor. Note that

standard IC 'values sum to unity, unlike most other centrality measures.

Since there is no known generalization of the theory of information centrality to directional relationships by Stephenson & Zelen, the index should be calculated only for undirected graphs, and is more relevant in weighted graphs / network. Note: In order to calculate this index, SocNetV drops all isolated nodes and symmetrizes the adjacency matrix (if necessary), even when the graph is directed (Wasserman & Faust, p. 196).

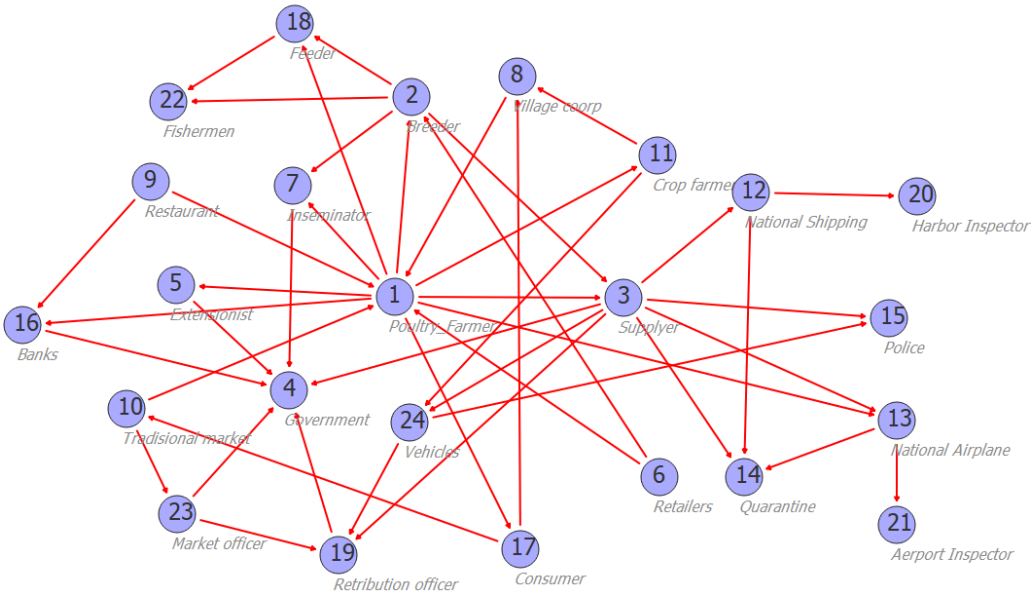

Figure 1. Design of actors on a map relationships using SNA under poultry sector.

In order 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 the 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 presented Figure 1. To capture the organization-shared action, we also look at specifics of what projects are being performed and the types of creativity that stakeholders produce. All data collectively entered into Microsoft Excel worksheet and tabled into manuscript.

RESULTS

Dynamic Performance of Stakeholders

All stakeholders in the sectors of poultry farming system (PFS) were grouped into local community, government, banks, markets, and private transportation. Local community organization consisted of poultry farmers, breeders, suppliers, retailers, village cooperation, restaurant, crop farmers, consumers, and fishermen. Government actors consisted of government, extension servicers, inseminators, quarantine officers, police, retribution officers, harbor inspectors, airport inspectors, and market officers. Private actors are national shipping, national airplane, and vehicles. Banks consisted of all financial institution including credit units. These stakeholders can be grouped based on working activities, i.e. production up to the business process. At the level of production, involved stakeholders are the breeders, feeders, labors, and crop farmers. At the business process, stakeholders involved were consumers and harbor porter. Related- and interlinked-stakeholders around government are market officers, harbor officers, inseminator, income office region (retribution officers), sub-district officer, village officers, extension services, quarantine officers, veterinarian, community security, and police officers. Banks provide credit or loans. The market provides retailers and food courts. Private transportation provides shipping and vehicles.

Shapes of the organization as actors in leading poultry farming systems grouped into

three types, i.e. individuals (33.33%), group (58.33%) and mass (8.33%). Individual stakeholders consisted of poultry farmers, breeders and suppliers, The group actors consisted of vehicle agent, fishermen, market officers, airport and harbors. Mass typical actors consisted of consumers, and crop farmers. We identified that the actors of poultry development ruled by law (58.33%) and the rest had no ruled by law (41.67%). Types of the organizations established in the poultry business sector were grouped in private and state institutions, subsequently 58.33% and 41.67%. The roles of organizations played by actors in poultry farming systems were stakeholders (54.17%) and shareholders (45.83%).

Table 2. Characteristic of poultry actors.

No.	Institution	Sum	Proportion (%)
A	Shape of organization		
	Individual	8	33.33
	Group	14	58.33
	Mass	2	8.33
B	Law		
	Law	14	58.33
	No law	10	41.67
C	Type		
	Private	14	58.33
	State	10	41.67
D	Roles		
	Stakeholder	13	54.17
	Shareholder	11	45.83
E	Effect		
	positive	23	95.83
	negative	4	16.67
F	importance		
	importance	20	83.33
	Unimportant	4	16.67
G	Threat		
	Direct	11	45.83
	Indirect	13	54.17
H	Feedback		
	Feedback	13	54.17
	No feedback	11	45.83

Effects felt by the PFS business cycles on involved stakeholders stated 23 actors had positive effect (95.83%) and only 4 actors in between had negative effect (16.67%). We were interested in records the importance of the actors in ruled the poultry business beneficiary. A number of 88.33% actors (20 organizations) stated important and the rest had stated less important (16.67%). To assure the continuity of this business we measured the threat buried on the business of poultry. We recorded 11 organizations had direct threat (45.83%) toward the development of poultry production and the rest 13 actors (54.17%) had indirect effects. We were finally eager to seek whether poultry business beneficiary had turn-back effect amongst actors. The finding of this research reported no turn-back effect found inside 11 institutions (45.83%) and only 54.17% had turn-back effects. By knowing these factual characteristic of actors in reality, we concluded that poultry business beneficiary can sustain and has future development in West New Guinea.

The finding and phenomenon faced by poultry farming systems was access (79.17%) and spaces in ranges of 58.33%. The other shared resources offered were time (33.33%), policy (25%), knowledge (25%), skills (25%), power (25%) and feed materials (20.83%). Satisfaction and financial aids were needed subsequently, i.e. 16.67% and 12.50%.

Duration period in sharing resources organized by actors consisted of short term period (58.33%) and long term period (78%). Of the actors' profile, we found continuity of resources, i.e. sustain (66.67%) and unsustain only 33.33%. The power of resources found was dominantly categorized by strong power actors (41.67%), followed by neutral actors (37.50%) and weak

actors (20.83%). Weak power should be promoted further intervention and innovation in terms of resources. Power to market access will enable income generation reached by farmers. The need for intervention was found in 12 actors (50%) and the rest were no need to intervene (50%). Delivery intervention can be made by using policy, finance, knowledge, skills and relevant needs (Ventura *et al*., 2016; Kodoati *et al*., 2014). These types of intervention will further explain in the subsequent discussions.

Table 3. Resources, power and intervention.

No.	Resources	Sum	Proportion (%)
a.	Sharing resources		
	Policy	6	25
	Funds	3	12.5
	Space	14	58.33
	Time	8	33.33
	Access	19	79.17
	Satisfaction	4	16.67
	Knowledge	6	25
	Skills	6	25
	Power	6	25
	Feed materials	5	20.83
b	Duration of period		
	Short term	14	58.33
	Long term	18	75
c	Continuity		
	Sustain	16	66.67
	Un Sustain	8	33.33
d	Power (Strength)		
	Strong	10	41.67
	Neutral	9	37.5
	Weak	5	20.83
e	Intervention		
	Need	12	50
	No need	12	50

The SNA output (Figure 2.) depicted the picture of SNA based on Power centrality. Of Figure 2. and Table 4., we succeeded mapping interlinked power relationships of networks amongst poultry actors in production systems. There were three strong actors found in this study, i.e. poultry farmers 1, suppliers 3 and breeders 2. The breeders 2 had connection with village cooperation 8, government 4 with fishermen 22, village cooperation 8 with supplier 3, actor restaurant 9 with village cooperation 8, actor restaurant 9 with traditional markets 10, traditional markets 10 with crop farmers 11, banks 16 with village cooperation 8 and banks 16 with fishermen 22. These correlations explained by Leroy *et al*. (2017) and Günther and Hüske (2014).

Table 4 shows several actors, 1-24, had a positive clear correlation with PCC=1. Actors with PCC=0 had no relationship at all. However, the rest had a negative correlation (PCC<0). Actors had positive correlations were poultry farmers 1 with breeders 2, government 4, village cooperation 8, quarantine officers 14, consumers 17, airport inspectors 21 and fishermen 22. Actor breeders 2 had positive correlation along with poultry farmers 1, government 4, extension service 5, retailers 6, inseminators 7, village cooperation 8, restaurant 9, traditional markets 10, crop farmers 11, national shipping 12, national airplane13, quarantine officers 14, police 15, banks 16, consumers 17, feeders 18, and fishermen 22. While actor suppliers 3 had a positive correlation with extension service 5, retailers 6, inseminators 7, restaurant 9, crop farmers 11, national airplane 13, quarantine officers 14, police 15, banks 16, feeders 18, retribution officers 19, harbor inspectors 20, airport inspectors 21, fishermen 22, market offices 23, vehicles 24. Actor vehicles 24 had a positive correlation with supplier 3, government 4, village cooperation 8, national shipping 12, national airplane 13, quarantine offices 14, police 15, retribution officers 19 and market offices 23. Our findings confirmed the finding of Leroy *et al*. (2017).

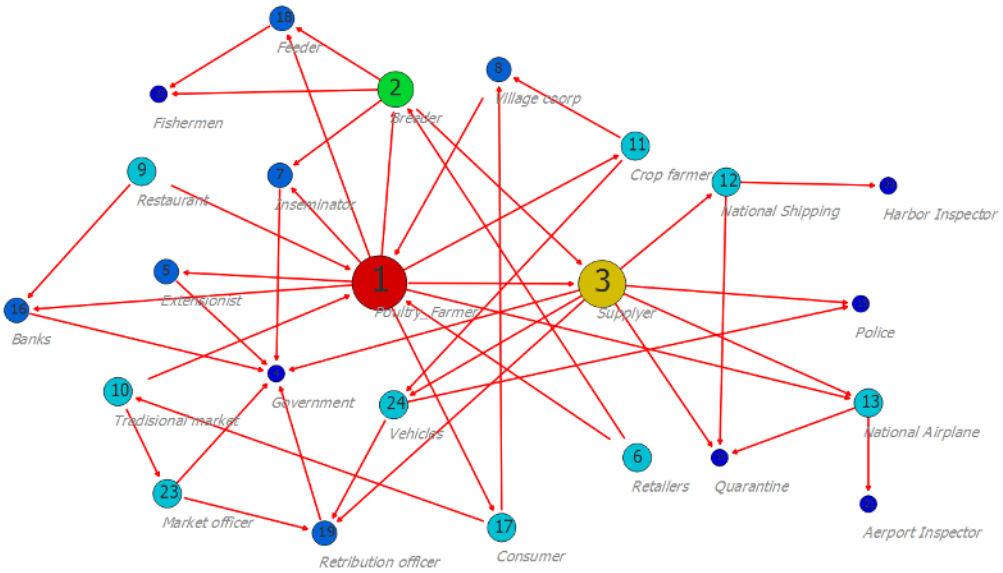

Figure 2. Stakeholder relationships analyzed based on power centrality (analysis referred to supplement data). Small and big cycles determined the power. Changed red to green and blue colors meant the importance and strategic of actors from high power to sub-dominant actors.

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

Actors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1.000	0.145	-0.497	0.145	-0.328	-0.025	-0.158	0.095	-0.025	-0.158	-0.158	-0.158	-0.262	0.095	-0.025	-0.158	0.095	-0.158	-0.262	-0.227	0.192	0.277	-0.158	-0.037
2	0.145	1.000	-0.248	0.111	0.174	0.174	0.073	0.073	0.174	0.073	0.073	0.073	0.258	0.073	0.174	0.073	0.073	0.364	-.000	-0.120	-0.120	0.174	-0.218	0.000
3	-0.497	-0.248	1.000	-0.248	0.389	0.389	0.488	-0.033	0.078	-0.033	0.228	-0.033	0.115	0.228	0.078	0.228	-0.033	0.228	0.115	0.269	0.269	0.078	0.228	0.115
4	0.145	0.111	-0.248	1.000	-0.174	-0.174	-0.218	-0.218	0.174	0.073	-0.218	0.073	0.000	0.073	0.174	-0.218	-0.218	-0.218	0.258	-0.120	-0.120	-0.174	0.037	0.258
5	-0.328	0.174	0.389	-0.174	1.000	0.455	0.798	0.342	0.455	0.342	0.342	-0.114	0.270	-0.114	-0.091	0.798	0.342	0.342	0.270	-0.063	-0.063	-0.091	0.342	-0.135
6	-0.025	0.174	0.389	-0.174	0.455	1.000	0.798	0.342	0.455	0.342	0.342	-0.114	0.270	-0.114	-0.091	0.342	0.238	0.798	-0.135	-0.063	-0.063	0.455	-0.114	-0.169
7	-0.158	0.073	0.488	-0.218	0.798	0.798	1.000	0.238	0.342	0.238	0.238	-0.143	0.169	-0.143	-0.114	0.619	0.342	0.619	0.169	-0.079	-0.079	0.342	0.238	0.169
8	0.095	0.073	-0.033	-0.218	0.342	0.342	0.238	1.000	0.342	0.619	0.238	-0.143	0.169	-0.143	-0.114	0.238	0.238	0.238	-0.169	-0.079	-0.079	-0.114	-0.143	-0.135
9	-0.025	0.174	0.078	0.174	0.455	0.455	0.342	0.342	1.000	0.342	0.238	-0.114	0.270	-0.114	-0.091	0.342	0.342	0.342	-0.135	-0.063	-0.063	-0.091	-0.114	-0.169
10	-0.158	0.073	-0.033	0.073	0.342	0.342	0.238	0.619	0.342	1.000	0.238	-0.143	0.169	-0.143	-0.114	0.238	0.238	0.238	0.169	-0.079	-0.079	-0.114	-0.143	0.169
11	-0.158	0.073	0.228	-0.218	0.342	0.342	0.238	0.238	0.238	0.238	1.000	-0.143	0.169	-0.143	0.342	0.238	0.619	0.238	0.169	-0.079	-0.079	-0.114	-0.143	0.100
12	-0.158	0.073	-0.033	0.073	-0.114	-0.114	-0.143	-0.143	-0.114	-0.143	-0.143	1.000	0.507	0.238	0.342	-0.143	-0.143	-0.143	0.169	-0.079	-0.079	-0.114	-0.143	0.169
13	-0.262	0.258	0.115	0.000	0.270	0.270	0.169	0.169	0.270	0.169	0.169	0.169	1.000	0.169	0.270	0.169	0.169	0.169	0.100	-0.063	-0.093	-0.135	-0.169	0.270
14	0.095	0.073	0.228	0.073	-0.114	-0.114	-0.143	-0.143	-0.114	-0.143	-0.143	-0.143	0.169	1.000	0.342	-0.143	-0.143	-0.143	0.169	0.552	0.552	-0.114	-0.143	-0.169
15	-0.025	0.174	0.078	0.078	-0.091	-0.091	-0.114	-0.114	-0.091	-0.114	0.342	0.342	0.270	0.342	1.000	-0.114	-0.114	-0.114	0.674	-0.063	-0.063	-0.091	-0.114	-0.169
16	-0.158	0.073	0.228	-0.218	0.798	0.342	0.169	0.238	0.342	0.238	0.238	0.238	0.169	-0.143	-0.114	1.000	0.238	0.238	-0.169	-0.079	-0.079	-0.114	0.238	0.100
17	0.095	0.073	-0.033	-0.218	0.342	0.342	0.238	0.238	0.342	0.238	0.619	0.619	0.169	-0.143	-0.114	0.238	1.000	0.238	-0.169	-0.079	-0.079	-0.114	0.238	-0.093
18	-0.158	0.364	0.228	-0.218	0.342	0.798	0.169	0.238	0.342	0.238	0.238	0.238	0.169	-0.143	-0.114	0.238	0.238	1.000	-0.169	-0.079	-0.079	0.342	-0.143	-0.169
19	-0.262	-.000	0.115	0.258	0.270	-0.135	0.169	-0.169	-0.135	0.169	0.169	0.169	0.100	0.169	0.674	0.169	0.169	-0.169	1.000	-0.093	-0.093	-0.135	0.169	0.100
20	-0.227	-0.120	0.269	-0.120	-0.063	-0.063	-0.079	-0.079	-0.063	-0.079	-0.079	-0.079	-0.093	0.552	-0.063	-0.079	-0.079	-0.079	-0.093	1.000	-0.043	-0.063	-0.079	-0.093
21	0.192	0.174	0.269	-0.120	-0.063	-0.063	-0.079	-0.079	-0.063	-0.079	-0.079	-0.079	-0.093	0.552	-0.063	-0.079	-0.079	-0.079	-0.093	-0.043	1.000	-0.063	-0.079	-0.093
22	0.277	0.078	0.078	-0.174	0.455	0.455	0.342	-0.114	-0.091	-0.114	-0.114	-0.114	-0.135	-0.114	-0.091	-0.114	-0.114	0.342	-0.135	-0.063	-0.063	1.000	-0.114	-0.135
23	-0.158	-0.218	0.228	0.073	-0.114	-0.114	0.238	-0.143	-0.114	-0.143	-0.143	-0.143	-0.169	-0.143	-0.114	0.238	0.238	-0.143	0.169	-0.079	-0.079	-0.114	1.000	0.169
24	-0.037	0.000	0.115	0.258	-0.135	-0.169	0.169	-0.135	-0.169	0.169	0.100	0.169	0.100	0.169	0.270	-0.169	-0.169	-0.169	0.100	-0.093	-0.093	-0.135	0.169	1.000

Actors had negative correlation were poultry farmers 1 with suppliers 3 (PCC=-0.497), extension service 5, retailers 6, inseminators 7, restaurant 9, traditional market 10, crop farmers 11, national shipping 12, national airplane 13, police 15, banks 16, feeder 18, retribution officers 19, harbor inspector 20, market offices 23, and vehicles 24. Actor breeder 2 with suppliers 3, harbor inspector 20, airport inspector 21, and market offices 23. Actor supplier 3 had a negative correlation with poultry farmers 1, breeder 2, government 4, village cooperation 8, traditional market 10, national shipping 12, and consumers 17. Actor 24 had negative correlation with poultry farmer 1 (PCC=-0.037), extension service 5 (PCC=-0.135), retailers 6, inseminator 7, restaurant 9 (PCC=-0.135), traditional market 10 (PCC=-0.169), crop farmers 11 (PCC=-0.169), banks 16 (PCC=-0.169), consumers 17 (PCC=-0.169), feeder 18 (PCC=-0.169), harbor inspector 20 (PCC=-0.093), and airport inspectors 21(PCC=-0.135). Actors with no correlation (PCC=0.000) were breeder 2 with retribution officer 19 (PCC=0.000) and vehicles 24 (PCC=0.000); government 4 with national airplane 13 (PCC=0.000); and vehicle 24 with breeder 2 (PCC=0.000).

Actors' Relationships

Figure 3 shows it was interested in mapping actors into other indicators, i.e. powers and interest (Bryson, 2007). We considered this as important due to organizational theoretical background (Grimble and Wellard, 1997). 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 poultry farmers with the suppliers which had high power and high interest. Less dominant actors of involvement found in this quadrant. Based on the SNA graph (Figure 2), two important key actors are poultry farmers and suppliers. These two actors have high interest and high power in developing poultry production and agribusiness. However, sum numbers of actors have weak and/or weak relation.

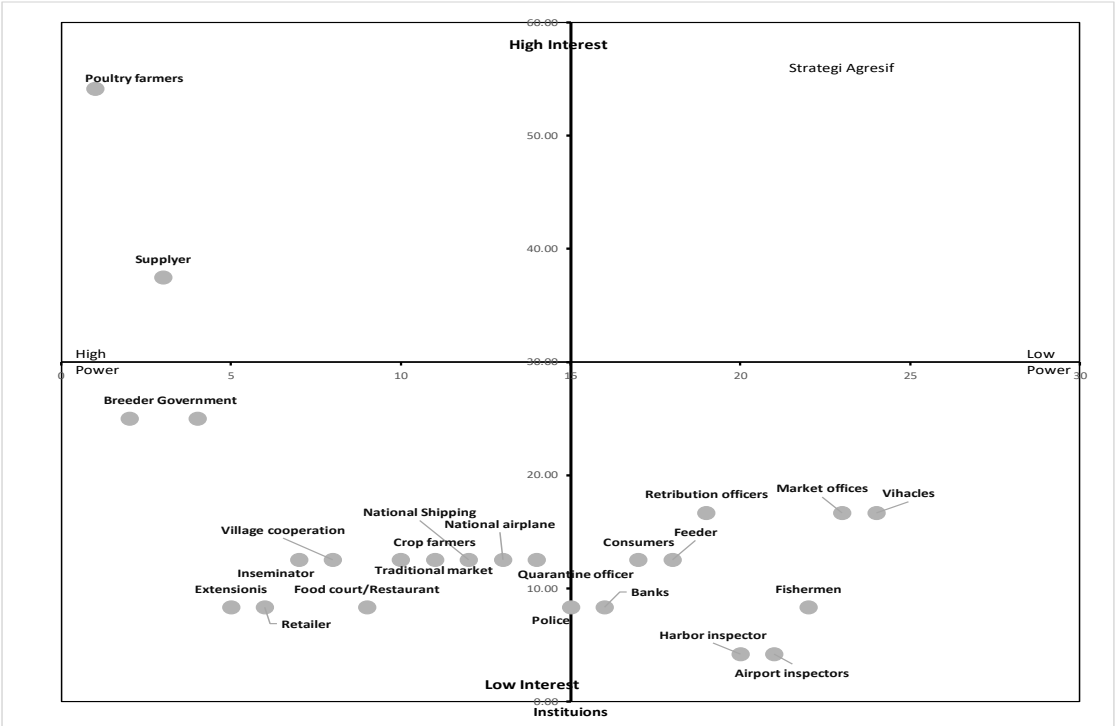

Figure 3. Stakeholders' mapping on poultry farming systems in West Papua

Poultry farmers have strong relation to inseminators, feeders, consumers, extension officers, crop farmers, breeders, and national air plane officers. However, these actors have low interest. This occurred by the reasons that the rest of actors have not shared similar resources and interest in establishing mutual cooperation in promoting acceleration of poultry production. Similar experiences faced by suppliers. Suppliers have strong relation to national shipping, government, police, retribution officers, vehicles and quarantine officers. However, several of them were in weak relations. Figure 2 and Figure 3 proven that high interest and high power relation can bring mutual cooperation. As long high interest actors have low interest, development of poultry production in West Papua will not change and develop significantly.

Contrary to the third quadrant (Qw3), 13th actors were found and distributed in this quadrant. They apparently were actors with high power but had a low interest as well. They were extensions, inseminators, village cooperation, restaurant, traditional market, crop farmers, national shipping (PT. PELNI), national airplane, quarantine officers, police. These actors 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 banks, consumers, feeder, retribution officers, market offices, vehicles, fisherman, airport, and harbor inspector.

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 the Qw1 (government) should move to the Qw2. Actors in the Qw3 (extensions, inseminators, village cooperation, restaurant, traditional market, crop

farmers, national shipping, national airplane, quarantine officers, and police) should move as well in the Qw2. And finally, actors in Qw4 (banks, consumers, feeder, retribution officers, market offices, vehicles, fisherman, airport, and harbor inspector) shall 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). There were three leaves (Fig. 4.). The first is single (simplicifolius) consisted of actor supplier 3. The second is double (bifolius) which consisted of actor poultry farmers 1 and breeder 2, government 4 vs retribution officers 19, crop farmers 11 and police 15, national shipping 12 vs harbor inspector 20, feeder 18 and fishermen 22. The third is triple (trifolius) which consisted of actor national airplane 13-quarantine officer 14-vehicles 24; extension services 5-inseminator 7-retailers 6; village cooperation 8-consumers 17-traditional market 10. These had similarity in terms of roles and responsibility. The δ clade consisted of clade β and clade α. Clade ε consisted of actor government 4, retribution officers 19, national airplane 13,..., feeder 18, and fishermen 22. Clades with similar height had similar to each other. Clades with the dissimilar height had dissimilar relationship.

Hierarchical Clustering Analysis contributed to the function of grouping objects that are considered relatively similar. The distance between the actors is small or relatively similar. Suppliers have functions that are not similar to or the same as those of poultry farmers and breeders. Poultry farmers and breeders depended on how intense the relation of suppliers.

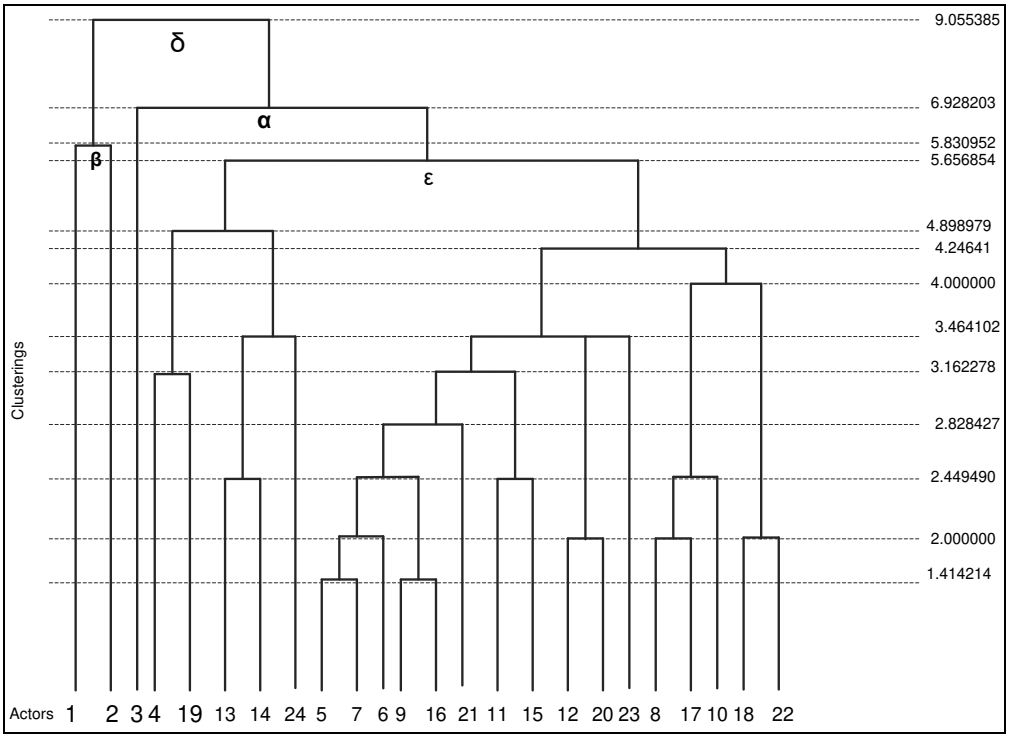

Figure 4. Hierarchical clustering analyses of poultry actors' relationship.

Intervention and Innovation

We were also interested in measuring the intervention needs of the poultry business. We ended up with sixteen stakeholders (50%) needed interventions to drive their roles in providing resources. The equal number of stakeholders as well do not need further intervention to provide services and guidance for the poultry business.

Intervention needs to assure the sustainability of poultry beneficiary of business. In the policy sector, the 12 stakeholders (50%) shown intervention of policy. In the budgeting sector, the 8 stakeholders (33%) need intervention. We found 9 stakeholders (38%) which need spacing intervention. Furthermore, more than 50 % (12 actors) need access. In small number of interventions of satisfaction was mentioned by one actor (4%). Several actors, 3 organizations (13%) needed intervention of knowledge side (Kodoati *et al*. 2014). As much as 46% of stakeholders (11

actors) needed the intervention of skills. The roles of extension agents are obvious clear as explained by Waithaka and Shepherd (2006). No threat found by stakeholders in business of poultry which was faced by stakeholders. Not many actors needed power, but some (3 actors) were requested for sustaining the poultry business beneficiary (13%).

Differs from intervention, what innovations are actually needed are questionable and shall be addressed to obtain clear conception and programs to improve poultry business in West Papua. Intervention needs in some ranges of efficient poultry farming and animal welfares (Dawkins, 2017), as the business of poultry has been recorded facing these two issues. Innovation needs to assure the sustainability of poultry business. In financial sector, the four stakeholders (16.67%) need innovation. Providing easy-process and access of loans and services need further concerns of the financial institutions. This relationships needs collaboration amongst science and industry (Schodl *et al*., 2015; Pakage *et al*., 2018). Application for access by technology of application (paper less) will allow the farmers to apply for the loans to Some actors seemed needed innovation of spaces, time, access, satisfaction, knowledge, skills, powers, and feed materials, i.e. one actor, two actors, seven actors, two actors, seven actors and six actors, two actors, respectively. Few actors needed innovation in satisfying the services and avoiding the threats.

Table 5. Intervention and innovation inventoried in development poultry sectors.

No.	Indicator	Sum	Proportion (%)
A	Intervention		
	Policy	12	50
	Fund	8	33
	Space	9	38
	Time	0	0
	Access	12	50
	Satisfaction	1	4
	Knowledge	3	13
	Skills	11	46
	Threat	0	0
	Power	3	13
	Feed materials	4	17
B	Innovation		
	Policy	12	50.00
	Fund	4	16.67
	Space	1	4.17
	Time	2	8.33
	Access	7	29.17
	Satisfaction	1	4.17
	Knowledge	2	8.33
	Skills	7	29.17
	Threat	0	0.00
	Power	6	25.00
	Feed materials	2	8.33

DISCUSSIONS

This paper discussed how involvement of poultry actors in the sector of agribusiness. We have described the typical organization patterns as in Table 2 with their characteristic. We found that there was a large scale cooperation in this relation of poultry business (Bremmers and Omta, 2004; Foti *et al*., 2018). Characteristic of actors popped up in the actors as identified in the Table 2 explained dynamic, and roles played by each actor. From the shapes of institution, it found grouped actors were dominant, officially laws, they are private, stakeholders, had positive effects, important, the threat was indirect, and lastly they were had feedback effect (Lein, 2004; Mandarano, 2009; Springer, 2011; Blok *et al*., 2015; Holman, 2008). The typical actors will then determine resources, power and intervention they had. We encountered several constraints, which do not so far make possible by all stakeholders. Lack of

services (Nguthi, 2007), programs (Baltenweck *et al*., 2019), budgets (Mayulu and Sutrisno, 2014) and human resources (Iyai *et al*., 2016; Asminaya *et al*., 2018), i.e. community services, loans, facilities (slaughtering house, shipping, restaurant, market, business unit, mini feed meal), rules and regulations, technical poultry production (breeding and low production), policy (importation, taxes and retribution) and safety of business (killed animals, thief, death). Access played significant role in driving fluent dynamic and continuity of the sustainable poultry development(Mollenhorst and de Boer, 2010; Mutibvu *et al*., 2012; Devendra and Sevilla, 2002; Bradford, 1999; Devendra, 2004). Spaces was in line with land availability, followed by time and policy. It seems that the existence of the actors would like be induced by these four aspects.

We also described resources, power and intervention, in Table 3, that should be highlighted to promote sustainable poultry business under this case study. The shape of Figure 2 implied that actors do not have adequate characters that should exist and can enrich the rules of actors in business sector. These inflow and outflow lines from actors to actors do not fully set it up. From the inflow line of the SNA (Figure 2), the poultry farmers were depended on village cooperation, restaurant, traditional market, and retailers. From the outflow line, poultry farmers determined breeder, feeder, inseminator, extension services, consumers, national airplane business, suppliers, and crop farmers. Many outflow lines resulted negative and positive impact on the agribusiness of the poultry (Figure 2). The figure shown us that there are 5th characters of actors. The 1st is poultry farmers, the 2nd is supplier and the 3rd is breeders. The 3rd actor grouped into production actor. Technical poultry production with related to knowledge and experience (Martindah and Ilham, 2019) will enhance and enable farmers to keep production of poultry obtaining optimal production. Therefore, up to date knowledge and skills in terms of how to offer quality feeds (Peiretti, 2018), reproduction management , breeding selection (Kijlstra and Eijck, 2006) and artificial insemination must become the priority known by farmers (Leroy *et al*., 2017). Best experience shared by Pondok Pesantren Agribusiness in Central Java (Harjanto *et al*., 2019).

The 4th is retailers, vehicles, market officers, traditional market, restaurant, crop farmers, national shipping, and national airplane services. Those actors in the 4th were business actors. And the 5th is government, extensionist, banks, retribution officers, inseminators, fishermen, feeder, village cooperation, harbor inspectors, polices, airport inspector and quarantine officers. Those were governmental-related actors apparently. This is due to the reason that negative, un law, unimportant, direct threat and feedback effect of the relation amongst actors. Other implications made from these relations that lowering and weakening these were undistributed and incomplete resources, power and interventions (Table 3). These two tables (Table 2 and Table 3) brought steady relation amongst actors as computed in Table 4. Figure 3 described and implied the interest and the power of these actors. Bringing actors from low interest and low power to have better high interest and better high power is needed. It has positive impact on the strength of the relation and empowering each capacity. Figure 4 described actors' grouping and/clustering. We derived this relations of actors into three groups (Simplicifolius - trifolius). Here we grouped actors based on roles and responsibility. Therefore, the implication is that state and private actors can play prominent roles by providing umbrella laws, i.e. rules and regulations. Lastly, in the Table 5 we highlighted intervention and innovation that can be made by the roles of each actor. Actors can play more than two intervention and innovation. The weakness and un-empowerment actors must be supported by high power actors in particular policy, funds, skills and power.

CONCLUSIONS

We conclude that the stakeholders in the poultry farming systems are dominated by private community actors who work in groups to control the farms and their cycle of value chain, and have been officially under regulation. Such actors are usually acting as stakeholders who are regulated by farms as being of positive value. The threats are real and existent, and should be reduced as much as possible to mitigate the effect of turn-back. Access, space , time, policy, knowledge and skills are among the top five shared resources. Such services must stay longer to support the poultry farms' strong needs. The actor relationship is dominated by the ranges of correlation which differ from negative to neutral to positive.

The implication and further sight are that large scale cooperation found, which has possibility to establish relation and mutual cooperation. We also success in records characters of actors' organization that benefited every mutual relation. We argue that in delivering and sharing

resources, power and intervention, under these relationship, each mutual actor can have similar understanding and trust in promoting better sustainable poultry development.

This paper presents broad and specific actors' relationship particularly in poultry business. We believe the concept of this actors' relations can bring new insight in mapping complexity of organizations and institution involvement. The concept can be employed for other cases with related to livestock development in other world by investigating organization characteristic of actors, addressing resources, power and intervention. Further analyses can be proceeded by computing Correlation Coefficient of Pearson (PCC) and mapping the interest and power in two dimensional graph and lastly inventorying all intervention and innovation that seems can be achievable.

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