# ANALYSES OF TECHNICAL AND NON-TECHNICAL COMPONENTS OF PIG KEEPING SYSTEMS IN MANOKWARI, WEST PAPUA INDONESIA

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**ABSTRACT**

The purpose of research was to describe technical and non-technical baseline information regarding pig farming systems in Manokwari, West Papua. Participatory situation analysis was used to gain the baseline information. Due to the interest in finding many correlated data, multivariate analysis using principal component analysis (PCA) was performed. Prior to PCA cluster analysis was applied. The results of this research showed that there were 15 groups/classes, through which observations and components can be derived upon. Several components show strong correlation however some do not. Correlations [Pearson (n)] are severely shown by recording, see-middleman and opinion of present pig keeping. In second axis (F2, F1+F2), correlation is strongly seen in recording, number of meet farmers and see consumers. Artificial insemination is negatively correlated in axis one and two along with visited extensionists for first axis and second axis. Implications of these findings are that technical and non-technical components have correlation and induced each other, e.g. following courses have impact on pig management behavior. However, there is a need for further study to numerically show the relation and/or impacts from those components.

Key words: principal component analysis, agglomerative hierarchical clustering, technical and non-technical components, urban and rural pig farmers, Manokwari.

## ANALISIS KOMPONEN TEKNIS DAN NON TEKNIS PADA SISTEM PEMELIHARAAN TERNAK BABIDI MANOKWARI, PAPUA BARAT INDONESIA

**ABSTRAK**

Penelitian bertujuan untuk mengetahui hubungan dan behavior baseline komponen teknis and non-teknis peternakan babi dilakukan di Manokwari, Papua Barat.Studi partisipasi menggunakan partisipasi situasi analisis dilakukan untuk mendapatkan baseline informasi digunakan Principal component analysis (PCA). Sebelum PCA juga dipakai analisia gerombol (CA) untuk melihat kecenderungan pengelompokan baseline data. Hasil penelitian diperoleh 15 grup/kelas. Pada analisis PCA diperoleh beberapa komponen yang menunjukkan nilai positif misalnya *recording*, number of meat farmers dan seecon sumers. Artificial insemination menunjukkan tidak ada hubungan pada F1 and F2 bersama dengan *visitedextensionist* untuk F1. Implikasi dari kecenderungan ini adalah bahwa komponen teknis dan non-teknis peternakan babi memiliki hubungan dan saling mempengaruhi satu dengan yang lain, misalnya kegiatan mengikuti kursus memberikan dampak pada tingkah laku manajemen peternakan babi. Namun untuk membuktikan semua kecenderungan ini diperlukan studi lebih lanjut secara numerik.

Kata kunci: Analisis komponen utama, agglomerative hierarchical clustering, componen teknis dan non-teknis, peternak babi urban dan rural, Manokwari

## INTRODUCTION

Pigs indeed play a vital role in Papuan life, place high rank of agriculture animal and are reared for various functions such as local and regional meat demand, marriages, funerals, anniversaries, and other social-related activities (Iyai, 2008; Pattiselanno & Iyai, 2005). Although pigs are highly valued, this is likewise shown in the way pigs are raised. In the coming future pigs may not sufficiently sustain Papuan livelihoods due to many pressures.

Numbers of pressures derived from on-farm pigs and off-farm pigs can be technical and non-technical components. Technical and non-technical determinant factors hold the continuity of pig keeping systems in Papua. Pig keeping systems in West Papua, particularly in Manokwari, are currently facing many pressures such as growing population and urbanization and importations of other livestock products delivered outside West Papua, such as poultry and beef (Woran *et al*., 2009). Nowadays, urban consumers tend to alternate their consumption of pork with other livestock and fish products or in other words, consumers' preferences are changeable. Social acceptance towards presence of pigs is reduced due to the smell of pig units (Phung, 2006) and religious reasons (Ashari *et al.*, 1995). Increasing numbers of non-pork consumers have resulted in the decreasing numbers of pig farms, in reluctances of consuming pork, and decreased land availability. Local government policies tend to neglect smallholding pig farmers in Manokwari by recently issuing a regency policy or housing animals (Wonatorei, 2009).

In small part, communication and transfers of knowledge are lagging behind. Transfers of knowledge amongst local farmers are stag as well as are from extensionists to farmers.

In developing animal production systems, particularly smallholding farming systems, the farming households are the center (Perkins, 2002). Thereby, innovation in terms of messages and technical issues has to be based on farmers' needs, experience, values and opinion (Boogard *et al*., 2006). It seems that Boogard *et al*. (2006) had recommended some technical and non-technical issues that have to be addressed upon. By knowing farmers' perceptions and experiences, it will enable other important stakeholders and policy makers to improve or alter their development and policy messages. This research was done aimed at in describing technical and non-technical baseline information that are faced by pig farmers in determining and shaping their pig farming systems in Manokwari, West Papua.

## MATERIALS AND METHODS

In study the technical and non-technical baseline information, participatory situation analysis/PSA (Conroy, 2005) was employed using 50 pig farmers' experiences and day-today pig keeping information in Manokwari.These pig farmers were coming from the six districts of Manokwari Regency, i.e. Northern Manokwari District, Eastern Manokari District, Western Manokwari, Warmare, Prafi and Masni. Some farmers were interviewed in urban and some were in rural areas. In urban areas selected farmers originated from Anggrem, Borobudur, Fanindi, Wosi, Amban and Susweni, while in rural areas selected farmers originated at Tanah Merah, Nimbai, Waseki, Aimasi, Mokwan, Mimbowi, SP-8 Masni, Bremi and Warbefor (Iyai, 2008). Interviews using questionnaire were done to collect baseline information *w.r.t. technical* and non-technical components that are faced and have been shaping low productivity of pig farmers. Focused questionnaires were concerning technical components were using artificial insemination, use of boars, recording management, and non-technical components consisted of times of meeting farmers, visited extensionist, see expertise, see middlemen, see consumer, following related pig keeping courses, sources of information, and opinion of present pig keeping system. Several questions were made of closed questionnaire and some opened questions. We thought that a tiny, trash and blur information could be indeed contributing and describing a phenomenon and its dynamics of human livelihood including pig farming. Due to many collaborating baseline data, parametric analysis, i.e. multivariate analysis using *principal component analysis* (PCA) was applied (Harris, 2001; Al-Kandari & Jolliffee, 2005; Jolliffee, 2002). In this analysis we did not mathematically provide formula, but instead of using it in application of animal agricultural field. We did not apply for matrix rotation either using Kaizer normalization or Gamma, Tau and the power for Promax (Ho, 2006). As it is known,the PCA helps in depicting relational parameters, seeking un-correlating between parameters and graphing two and three dimensional graphs. Prior to PCA, clustering analysis using *Agglomerative Hierarchical Clustering* (AHC) (Hiraishi *et al.*, 2001) was employed in classifying similarity and dissimilarity parameters into three diagrams based on unweighted pair-group average (UPGA). In Principal component analysis (PCA), we incorporated eleven factors, i.e. factor 1, factor 2, factor 3 and factor 11 which consisted of technical factors, i.e. the use of artificial insemination, use of boars, recording management and non-technical factors, i.e. times of meeting farmers, visited extensionist, see experts, see middlemen, see consumer, following related pig keeping courses, sources of information, and opinion of present pig keeping system, respectively. The PCA was applied to find correlation among the factors (Soemartini, 2008; Jolliffee, 2002). In statistical analysis, qualitative and quantitative data were recorded and stored in Excel database (2003). Further, all data were analyzed using principal component analysis (XLstat, 2009) to understand correlation between the factors. Agglomerative hierarchical clustering (AHC) was used in classifying constraints in similarity classes.

## RESULTS AND DISCUSSIONS

### Agglomerative Hierarchical Analysis of pig farmers

In using Agglomerative Hierarchical Principal (Davidson & Ravi, 2005; Hiraishi *et al.*, 2001), clustering is done commenced at the individual /or observation sampled data. This is apparently contrary with divisive techniques, e.g. TWINSPAN analysis (Terbraak & Smilauer, 2003) . In TWINSPAN, clustering is commenced with all samples (sites) in one cluster divided this into more clusters. In cluster analysis we could reduce complex data set, identify patterns in data set by identifying clusters of observation and components. Added to this and more important is to generate hypotheses on interactions between observation and components in the field of animal agricultures. The objectivity of this analysis is by making a subjective choice among the clustering techniques and choices often depend on whether the results are agriculturally meaningful. *Agglomerative Hierarchical Clustering* (AHC) (Davidson and Ravi**,** 2005) was resulted in a binary clustering tree or Dendogram (Fig. 1). Dendogram is a graph explaining the progressive of the data. Using dendogram would guide readers to gain ideas of a suitable number of classes, in which data can be grouped upon. Agglomeration performed in Unweighted pair-group (UWPG) average linkage (group average) is a good compromise between the two preceding criteria and provides a fair representation of the data space properties. Other properties could be derived upon was a truncation, i.e. a straight dotted-line. The dotted-line in the Fig. 1., shown that >80% of all observations shaping these three classes had high similarity. The progressing of similarity decreases simultaneously up to 0.48 or 48%.

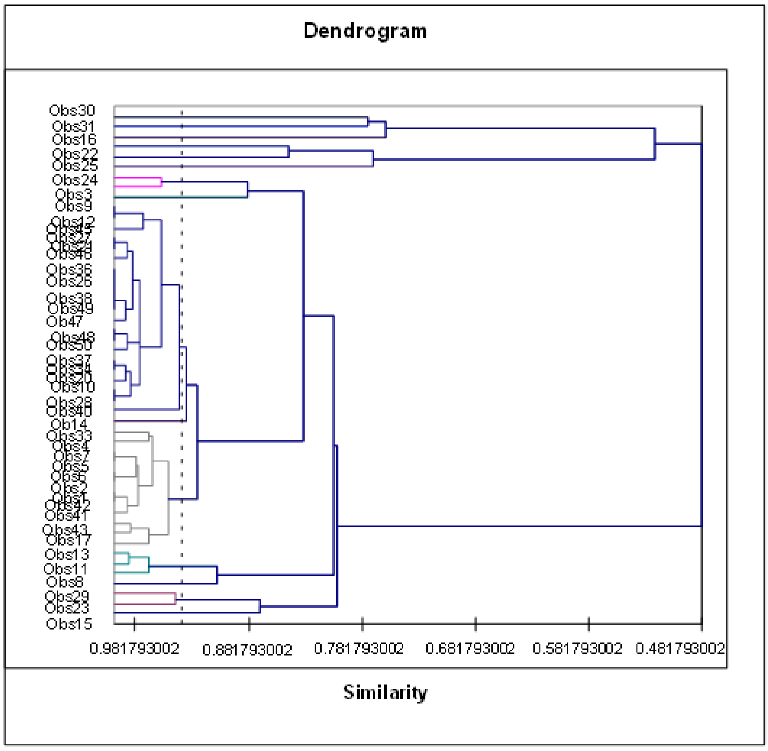


Figure 1. Agglomerative Hierarchical Clustering of Technical and Non-Technical Components of Pig farmers in Manokwari. Dotted-line shown truncation.

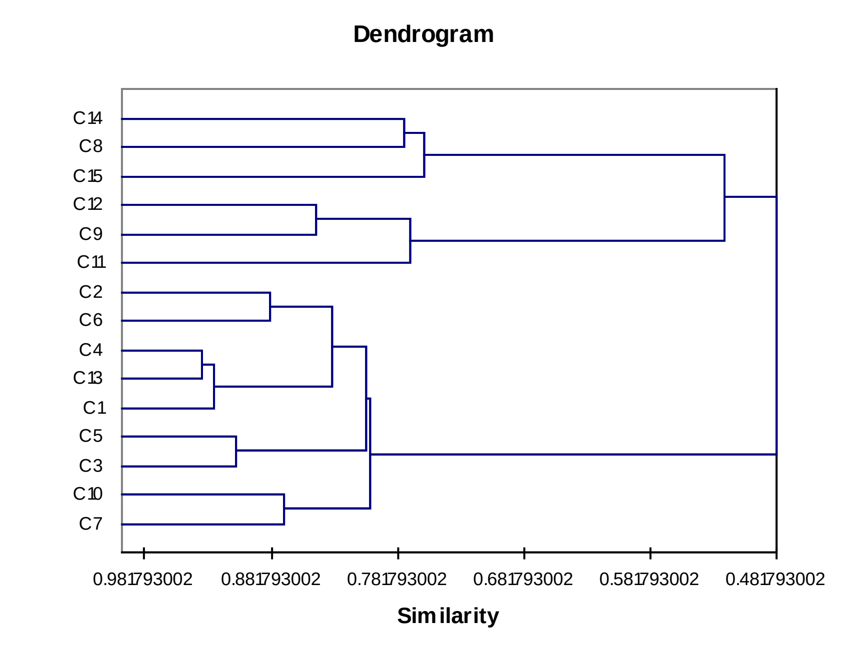


Figure 2. Summary of a binary tree diagram clustering of technical and non technical components of pig keeping systems in Manokwari.

Through this analysis, AHC, we could classify 15 classes (Fig. 2). From this baseline information, reduced classes will be aimed for. Similar perception or experiences will bring the farmers into productivity rather than lagging behind of information.

Based on this finding, we could derive 15 classes (Fig. 2). In grouping similarity of components, strong similarity was shown by components of C4-C13 (> 90%). Other components having similar variances and strong similarity were C4-C13 and C1 (> 88%), C5-C3 (88%), C2-C6 (> 85%) and C10-C7 (> 80%). Similarity is slightly decreased shown in right grouped components' flows, which meant that high dissimilarity exist.

It was apparently seen that the fourth class had the most number observations grouped there (21 Observation or 42%). Class1 had shared equal number of urban and rural pig farmers (24%). Class5 was signed by 3 urban pig farmers (6%).

In small-scale pig keeping systems we could find that there were a lot of technical and non-technical components that vary. The differences are due to constraints (Iyai, 2008), experiences and perception-related factors. Based on this analysis there were several observations that had only one observation (2%), i.e. class 3, class 6, class 7, class 8, Class 9, Class 11, Class 12, Class 13, Class 14, Class 15. Why we had several individual classes particularly in rural areas proven that small-scale pig farmers in rural has many constraints posed and interests of other related components such as extensionist as representative of local government have no play a significant roles.

The result also found that there were two observations, i.e. 2nd and 10th class, three observations (6%) were seen class 5, 12 observations were found in class 1 and the rest was 21 observations (42%) that had similarity were in the fourth class.This implied that we could omit one observation due to clumsy. Similarity is widely dispersed from urban to rural pig farms because several observations were found in similar classes.

Data in Table 2. revealed that urban pig farmers had various groups compared to rural pig farmers,with regard to technical and non-technical components,. This means that several farmers had performed various circumstances that were hampered their farming activities, such as example drawn in Zimbabwe by Chiduwa *et. al*., (2008). In terms of technical components, not only did urban farmers not have efforts being done, but the rural farmers also faced similar situation. In few occasions and only in the few farmers, attempts had been made for instance to meet veterinarian and so forth.

Table 1. Summary of observations clustered into 15 classes

| Class | Observation | Pig keeping systems (Urban/Rural) | Frequency (Percentages) |
|---|---|---|---|
| Class1 | Obs1,Obs2,Obs4,Obs5, Obs6, Obs7, Obs14, Obs33, Obs40, Obs41, Obs42, Obs43 | U++/R+ | 12 (24) |
| Class2 | Obs3, Obs9 | U++ | 2 (4) |
| Class3 | Obs8 | U+ | 1 (2) |
| Class4 | Obs10, Obs18, Obs19, Obs20,Obs21, Obs26, Obs27, Obs32, Obs34, Obs35, Obs36, Obs37, Obs38, Obs39, Obs44, Obs45, Obs46, Obs47, Obs48, Obs49, Obs50 | U+/R+++ | 21 (42) |
| Class5 | Obs11 Obs13 Obs17 | U+ | 3 (6) |
| Class6 | Obs12 | U+ | 1 (2) |
| Class7 | Obs15 | U+ | 1 (2) |
| Class8 | Obs16 | U+ | 1 (2) |
| Class9 | Obs22 | R+ | 1 (2) |
| Class10 | Obs23, Obs29 | R+ | 2 (4) |
| Class11 | Obs24 | R+ | 1 (2) |
| Class12 | Obs25 | R+ | 1 (2) |
| Class13 | Obs28 | R+ | 1 (2) |
| Class14 | Obs30 | R+ | 1 (2) |
| Class15 | Obs31 | R+ | 1 (2) |

**The PCA, Eigenvalues, Cumulative Variances and Eigenvectors in Technical and Non-Technical Information of Pig Farming Systems in Manokwari**

The principal component is a useful data reduction technique which works by reducing inter-correlation amongst components (Harris, 2001). The advantages of PCA are twofold, i.e. PCA is able to reduce multicolinearity and able to present data with simple structure without losing the essence in it. In PCA (Smith, 2002) we produced a new variable that has new combination of components. The properties of PCA consist of eigenvalues, variances, cumulative variances, and eigenvectors (Harris, 2001; Al-kandari & Jolliffee, 2005).

Eigenvalue/lambda ( $\lambda$ ) is used to measure the fraction of variation explained in the data set (Harris, 2001; Smith, 2002). The eigenvalue ( $\lambda$ ) and percentage variance (variability) of the F1 axis was 1.925 and 19.253%, respectively. This Eigenvalue is lower than that 3 and this explains that there was a low linearity in axis one (F1) as well as in the second axes (F2), i.e. subsequently 1.819 and 37.440%. The proportion of the variance is merely the eigenvalue for that axis divided by the total variance, i.e. the sum of the diagonal of the cross-product matrix. These properties have underpinned meaning.

The values of Eigenvectors ($x$) contain a set of scores that show the weight of each variable, i.e. components on each axis of PCA (Smith, 2002; Hiraishi *et al.*, 2001). The eigenvectors ($x$) vary between -1 to +1 and if the value of the eigenvector ($x$) for a specific variable is close to absolute of 1, it is more important to weight on the axes. Variables of factors drawn from pig farmers are shown in Table 2.

Table 2. Values of PCA, Eigenvalues, Cumulative variances and Eigenvector of Technical and Non-Technical Information

| Eigenvalues: | Principal Component Analysis: | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 |
| Eigenvalue, ( $\lambda$ ) | 1.925 | 1.819 | 1.476 | 1.191 | 0.978 | 0.769 | 0.644 | 0.528 | 0.383 | 0.288 |
| Variability (%) | 19.253 | 18.187 | 14.758 | 11.906 | 9.782 | 7.693 | 6.437 | 5.277 | 3.825 | 2.882 |
| Cumulative % | 19.253 | 37.440 | 52.198 | 64.105 | 73.886 | 81.579 | 88.016 | 93.293 | 97.118 | 100.000 |
| Eigenvectors, (*x*): | | | | | | | | | | |
| Artificial (Y/N) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Use_Boar | 0.093 | -0.521 | 0.287 | -0.099 | 0.205 | 0.270 | 0.113 | 0.670 | 0.043 | 0.224 |
| Record (Y/N) | 0.323 | 0.459 | 0.032 | -0.323 | -0.192 | -0.091 | -0.239 | 0.449 | -0.517 | -0.090 |
| Times_meet Farmers | 0.148 | 0.561 | 0.038 | -0.270 | 0.179 | 0.083 | 0.428 | 0.135 | 0.586 | 0.077 |
| Visited_Extensionist | 0.000 | 0.194 | -0.239 | 0.697 | -0.318 | 0.209 | -0.166 | 0.413 | 0.257 | -0.098 |
| See-Experts | -0.545 | 0.112 | 0.134 | -0.231 | -0.325 | -0.143 | -0.366 | 0.091 | 0.209 | 0.554 |
| See_Middleman | 0.418 | -0.221 | 0.012 | -0.343 | -0.371 | 0.378 | -0.398 | -0.222 | 0.373 | -0.177 |
| See_Consumer | -0.208 | 0.299 | 0.288 | 0.094 | 0.517 | 0.552 | -0.414 | -0.130 | -0.105 | -0.063 |
| Foll_Course | -0.068 | -0.115 | -0.559 | -0.198 | 0.474 | -0.309 | -0.407 | 0.226 | 0.240 | -0.189 |
| Source_Info | 0.067 | -0.005 | 0.667 | 0.168 | 0.041 | -0.516 | -0.201 | 0.064 | 0.264 | -0.375 |
| Opinion_present keeping | 0.584 | 0.044 | 0.004 | 0.284 | 0.225 | -0.197 | -0.223 | -0.174 | 0.019 | 0.638 |

Values of eigenvectors in particular F1 had shown slightly positive weighing particularly in opinion of present pig keeping (F1=0.548) and the rest had shown low positive weighing. Hence, negative weighing was found, i.e. see-experts, see consumers, and following courses. This means that numerous numbers of farmers did not take into account these technical and non-technical components.Application of Artificial Insemination in pigs had not been applied yet (F1=0.000; F2=0.000) instead of using local parental and natural mating using sows and boars such as done by smallholder pig farmers in the Philippines (Lenada, *et al.*, 2005; Lee, *et al.*, 2005), while visiting (ed) extensionist could be found in few farmers (F1=0.000; F2=0.194).

**Correlations of technical and non-technical components the first two axis**

Components of Techniques consisted of using AI, using boars, recording management. Components of Non-Techniques consisted times of meeting farmers, visited extensionist, see experts, see middlemen, see consumer, following related pig keeping courses, sources of information, and opinion of present pig keeping system.

Table 3. The Pearson correlation of Technical and Non-Technical Components in Pig Farming Systems at Manokwari, West Papua.

| Components | Correlations between variables and factors: | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $r_{F1}$ | $r_{F2}$ | $r_{F3}$ | $r_{F4}$ | $r_{F5}$ | $r_{F6}$ | $r_{F7}$ | $r_{F8}$ | $r_{F9}$ | $r_{F10}$ |
| Artificial (Y/N) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Use_Boar | 0.130 | -0.702 | 0.348 | -0.108 | 0.202 | 0.237 | 0.091 | 0.487 | 0.027 | 0.120 |
| Record (Y/N) | 0.449 | 0.619 | 0.038 | -0.352 | -0.190 | -0.080 | -0.192 | 0.326 | -0.320 | -0.048 |
| Times_meet Farmers | 0.205 | 0.756 | 0.046 | -0.294 | 0.177 | 0.073 | 0.343 | 0.098 | 0.362 | 0.041 |
| Visited_Extensionist | 0.000 | 0.261 | -0.291 | 0.761 | -0.314 | 0.183 | -0.134 | 0.300 | 0.159 | -0.053 |
| See-Experts | -0.757 | 0.151 | 0.163 | -0.252 | -0.321 | -0.125 | -0.294 | 0.066 | 0.129 | 0.297 |
| See_Middleman | 0.580 | -0.298 | 0.015 | -0.374 | -0.367 | 0.331 | -0.319 | -0.161 | 0.231 | -0.095 |
| See_Consumer | -0.289 | 0.404 | 0.350 | 0.103 | 0.511 | 0.484 | -0.332 | -0.094 | -0.065 | -0.034 |
| Foll_Course | -0.095 | -0.155 | -0.679 | -0.216 | 0.469 | -0.271 | -0.326 | 0.164 | 0.149 | -0.101 |
| Source_Info | 0.094 | -0.006 | 0.810 | 0.183 | 0.041 | -0.453 | -0.161 | 0.047 | 0.163 | -0.202 |
| Opinion_present keeping | 0.810 | 0.059 | 0.005 | 0.309 | 0.223 | -0.173 | -0.179 | -0.126 | 0.012 | 0.343 |

Table 3. shows that the coefficient of correlation r (Pearson's r) reveals the relationship between the PCA scores and individual variable used to construct the axes (Goldberg, 1997; Hurnik *et al*., 1994). The table of correlation coefficient can be quite helpful in providing a quick interpretation of the ordination. Axis of F1 has higher coefficient correlation (Pearson r).

Pearson correlation r (Fig. 3.) shows that components of zone, breed raised, distance to market, distance to town and land size have severely positive values and wealth status and litter size had likewise, negative values. In axis two, component of $r_{F2}$ had higher positive value in litter size ($r_{F2}$=0.945) than distance to town (r=0,316), zone (r=0.225), wealth status (r=0.223), land size (r=0.188) and breed-raised (r=0.009). Distance to market had negative correlation or dispersed far from axis two (F2).

**Distribution of Technical and Non-Technical Components**

The principles of PCA (Jolliffee, 2002) are that components pointed in opposite directions are strongly negatively correlated with one another. There were more or less four distinctive groups of plots. Groups were dispersed at quadrant I, II, III and IV as well as close and/or near observations. Components at the right angles are independent of one another. Observations dispersed close to those components had nearest relationship. This means that those observations had association with each other w.r.t. technical and non technical components. Fig. 3. i.e. Biplot graph is used to plot components /or ordination and observation /or species ordination in one ordination diagram. Many observations in general were found close and near to quadrant II, III and IV (Fig. 3). It was interesting seeing this Biplot diagram (Fig. 3). In the plots are the nearest observations placed. Besides, in Biplot we could find inter-component distances and inter-observation distances.

In quadrant I, components of techniques and non-techniques subsequently were i.e. using AI, using boars, recording management. Components of non-techniques were times of meeting farmers, visited extensionist, see experts, see middlemen, see consumer, following related pig keeping courses, sources of information, and opinion of present pig keeping system. Young (1956) cited by Walgito (1994), reveals that perception is a result of activities of observation, interpreting and given value towards physical objects and social objects. Observation depends on what is the stimulus that is present in its circumstances. Mar'at (1981) cited by Walgito (1994), reveals that perception is an observation process, which is influenced by information flows coming from different circumstances.

Quadrant I had several components, i.e. times meet farmers, provided recording, visited extensionist, opinion present pig keeping and artificial insemination. These components had no association with component in quadrant II, i.e. see consumers and see experts. This means that consumers and experts do not play a role in determining these components of technical and non-technical components (see vector grouped in quadrant I). Hence, income generation (Peters, *et al*., 2005) has to be provided by both side so that margin prices will not be slightly different between farmers, middleman and consumers.

If most farmers revealed any contribution devoted by these two components, then the distribution of these components quadrant II would change automatically on quadrant IV or III. This will be read that there are associations between these components. Finally there is independency between components in quadrant I and quadrant IV. Hence, quadrant I and quadrant III were dependent. In quadrant II, see consumers and see experts were grouped. These two components were not associated (strongly negative correlated) with quadrant I, i.e. times meet farmers, provided recording, visited extensionists, opinion present pig keeping and artificial insemination.Technically and non-technically there is a prone that see consumer and see expert components are lagging behind due to lack of visiting extensionists and discussion stimulated amongst farmers. These are inducing farmers who are reluctant to provide recording of their farm-baseline information and further declining in opinion of present pig keeping. A recent approaching study was reported by Peters (2001) in Wamena, Papua. However, these need further study, whether the mentioned components exist and give strong impact on farmer productivity.

Following courses a lone was in Quadrant III. Several observations were slightly close and dispersed adjacent this component. It seemed that no many courses-pig related had been organized by local government or related institutions. Even though Chambers (1989), revealed that innovation has to be primary provided for the farmers. Components in quadrant III had negative association with components in quadrant IV, i.e. use boar, see middlemen, and sources of information. Components in quadrant III were independent with components in quadrant I, i.e. times meet farmers, provided recording, visited extensionists, opinion of present pig keeping and artificial insemination. Seeing this relation is becoming interesting. Limited following courses or courses followed by farmers might give severely impacts on experiences and farming management behavior, such as using boars, seeing middlemen, searching related information (Woran *et al.*, 2009), e.g. printed and electronic information. This author revealed that animal agricultural baseline information systems had 58.63% with grade of *adequate*. Therefore, these phenomena need further assessment. Observation 12 dispersed farther from components or in other word, had low correlation with components. It can be summarized that due to lack of following courses, using boars of high genetic traits were limited and artificial insemination was neither. Producing breed of pigs in Papua Barat, including Manokwari, reported by Woran *et al*. (2009). They indicated that the achievement of pig breed in Papua Barat was 93.20%, but indicators were unclear and immeasurable. Artificial insemination (AI) is hardly practiced in Indonesia (Liano & Siagian, 2002; Kunavongkrit & Heard, 2000). This is due to the fact that no facilities and infrastructure exist (Woran *et al.*, 2009; Iyai, 2008). Seeing middlemen or establishing marketing network in urban and rural was lagging behind as well as sharing information amongst farmers and between farmers with extensionists.

In quadrant IV, many observations were dispersed close and around some components. Use boars, see middlemen, and sources of information were grouped in this quadrant. It seemed that many observations were distributed adjacent this quadrant and components. Farmers in this quadrant had used their own boars (Lee *et al.*, 2005), see middlemen in selling live pigs or slaughtered pigs, and finding information themselves.

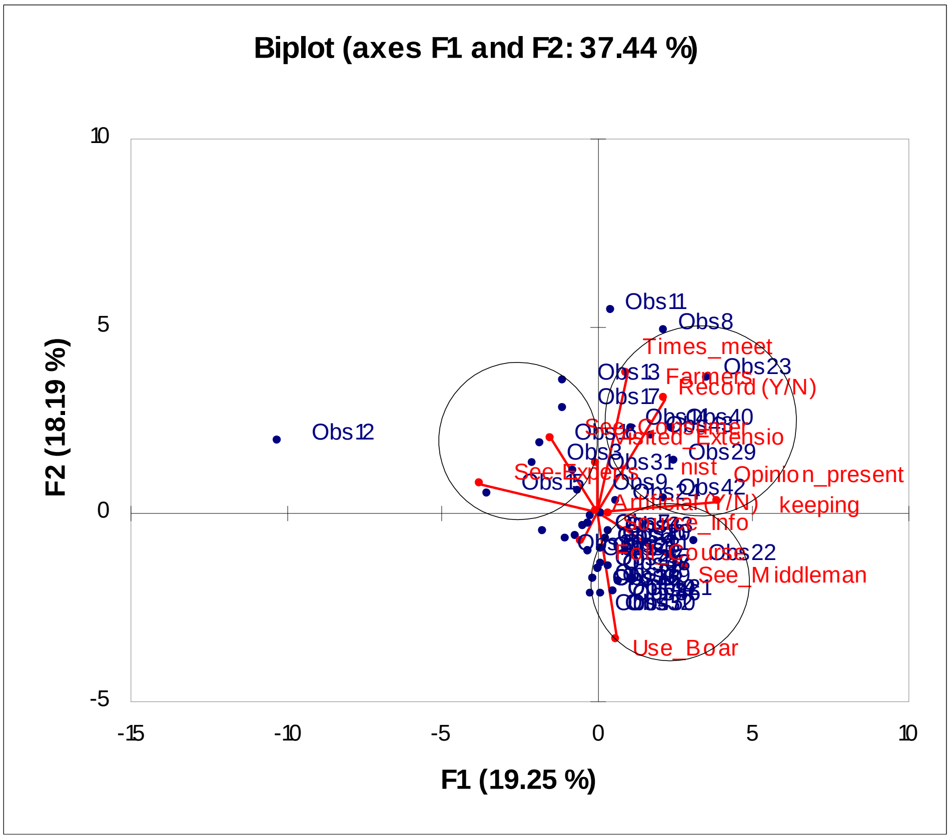


Figure 3. Distribution of observations and components in the two-first Principal Component Analysis axes (F1 and F2).

## CONCLUSIONS

Using Agglomerative Hierarchical Clustering 15 classes or groups w.r.t. technical and non-technical components of pig keeping systems can bederived.In urban groups, pig farmers were similarly drawn w.r.t. their technical and non-technical components. While in rural classes are slightly similar. Several components show strong correlation however some do not correlations [Pearson (n)] are severely shown by recording, see-middleman and opinion of present pig keeping. In axis two (F2, F1+F2), correlation is strongly seen in recording, number of meet farmers and see consumers. Artificial insemination is negatively correlated in axis one and two along with visited extensionists for axis one (F1) and axis two (F2). Implications of these findings are that technical and non-technical components have correlation and induced each other, e.g. following courses have impact on pig management behavior. However, there is a need for further study to numerically reveal the relation and or impacts from those components.

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