Stakeholder Definition for Indonesian Integrated Agriculture Information System (IAIS)

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Abstract. Stakeholders plays an important roles to determine the system requirements. Stakeholders are people or organizations that has an interest to the enterprise. Timely and effective consultation of relevant stakeholders is a paramount importance in the requirements engineering process. From the research and analysis of system stakeholder finds that there are four stakeholder groups in IAIS. Stakeholder analysis is being implemented by identifying stakeholder, stakeholder category, and analysis interaction between stakeholders.

1. Introduction
Indonesia is one of the biggest agricultural countries in the world. Wide areas in Indonesia are good places to grow various plant and trees. Based on World Bank, Indonesia has 1.905 km² which 12% of the area grows agriculture product and bring benefit to the communities, either farmers or farmers communities. Agriculture sector also supports 12% of Gross Domestic Product from 2010 – 2013. Productivity in Agriculture sector needs to be improve. Increasing productivity will increase agriculture sector player’s welfare. One of the approaches to increase productivity is by implementing information and communication technology for agriculture sectors. Integrated Agriculture Information System is a computer based system which consists of some application in Agriculture. This research sets up a study group focussing in Indonesia Integrated Agriculture Information System (IAIS). IAIS is a system to fulfil stakeholder’s requirement. Stakeholder play an important role in this system as information source and information recipient in this system. Thus, information requirements of stakeholders should be analysed and documented and then adequate Information Systems (IS) should be developed.

Stakeholders participate in the system requirement engineering. Stakeholders are related to each other and interact with each other (Sharp, et. al., 1999). Interactions between stakeholders including: (1) Exchanging information; (2) Exchanging products; (3) instructions; (4) providing supporting tasks. By analysing stakeholders can help to understand the requirements of system for each stakeholders. As the Sharp, et. al. (1999) has been studied that every system engineering needs stakeholders. IAIS also needs stakeholder for its system. Thus, in this research try to achieve goal to analyse and define the stakeholders. IAIS involves interorganizational stakeholders and by analysing the needs of the stakeholders can be useful as a mechanism to expose conflict that might be appeared in the future and different expectations from different stakeholders.
2. Literature Review

2.1. Agriculture Information System

In the world, Agriculture Information System is an interesting and recent research topic. This topic is an interdisciplinary topic between agriculture science and information technology. There are some applications that is developed to help the farmers to increase the productivity. In Iran, Hosseini and Rezaei (2013) reported a Management Information Systems for agriculture. Management Information Systems are tools to give a farmers to access a wide range of integrated data sets. Rolling (1998) reported that an agricultural information systems is generated, transformed, transferred, consolidated, received, and fed back in such a manner that these processes function synergistically to underpin knowledge utilization procedures. Supporting the Hosseini and Rezaei (2013), Babu, et. al. (1997) consider that Management Information System in the agriculture can help farmers to: (1) plan the effective resources to cultivate the land and its crop; (2) choose the best alternatives to produce and take part in the cultivation; (3) manageable day to day operations for processing the land.

Another systems in Agriculture is agriculture trade systems that facilitate the farmers to maintain the crop price. This system connects the farmers with business people and company that work in the agriculture sectors. One of the system in crop trading and pricing is Infotrade which implements in Uganda and Portable Agricultural Market Information Collections (PAMIC) which implements in China (Xu, 2013a). Xu (2013a) in his report discovers that to strengthen the agricultural information monitoring, portable agricultural market information collections (PAMIC). This system is integrated with GPS Satellite Positioning, 3G Information real – time transmission, and stylized information collection. This system will help the productivity since it uses mobile technology to develop the systems. Wen, etc (2007) reported that mobile technology is suitable for the farmers since farmers are easy to get access to this technology comparing with other technologies.

Another systems developed for Agriculture sector is China Agriculture Monitoring and Early Warning System (CAMES) (Xu, 2013b). This system is developed based on the consideration for world of food security. Besides, China is also well known as a country that is prone to natural disasters (Xu, 2013b). Based on that problems, China tried to develop CAMES which has an objective to create an integrated agriculture multi-market, multi-product, multi-area, and multi-function. This system was real-time monitoring and analysing all kinds of variables, dynamic monitoring, evaluating, simulating, prospecting, and early-warning systems for agriculture product and productions. CAMES also provides knowledge management systems that has function to query agricultural product forecasting.

2.2. Farmers Needs in Agriculture Information System

ICT plays an important role as a new perspective to develop the agriculture sector. However, farmers still have problems to get information that is easily to be understood. This information will help farmers to decide agricultural production improvement. Thus, farmers will have a better result in decision and generate greater profit. Besides, implementation of ICT will increase their competitiveness for greater market (Cecchini and Scott, 2003; Courtright, 2004).

These the following farmer’s information requirements for ICT implementations (Milavanovic, 2014):

1. Information on Crops: Farmers need some information related with crops and plants, such as: (1) categories of seeded crops; (2) size of the land with specific crops; (3) time of dropping seeds; (4) time to harvester; (5) yields, etc. These information are needed to help farmers to plan their crop.

2. Information on Production Techniques is an information to help farmers in new production techniques. It helps farmers to improve its ability to increase their production skills.

3. Information on Production Equipment and Agricultural Inputs is an information to help farmers to know the tools for soil and plant processing. These information also are able to help farmers learn how to use the tools and farmers equipment.

4. Market Information is an information to support farmers in gaining the best prices for their products, information on market of various agricultural products should be created. This information facilities farmers to access prices of various markets.
Farmers need ICT application to support its daily operation in agricultural production. These applications will play great role in operation management and help to decide based on real time data (Milavanovic, 2014). Henderson, et. al, (2006) reported that by using internet can help to improve communication and to create business opportunities for agricultural communities. Farmers, researchers, cooperatives, suppliers, and buyers can use the internet to exchange ideas and information and to govern business as well.

Leitgeb, F., et. al (2011) suggested an Innovation system based on farmer’s experience. Leitgeb, F., et. al (2011) claimed that farmer’s experiments and innovations are crucial to prepare agriculture for global change. Cuban farmers participate to help building up a socially based knowledge pool and leads to agricultural development. Thus, it helps to build community based systems that can help the farmers share their knowledge to others and help to improve others knowledge. The innovative capacity of individuals and groups is a powerful element of Agricultural Innovation System that can contribute to the system’s resilience.

3. Research Methodology

In conducting this research, the following methodology is done:

3.1. Initial Study for Implementation of ICT in Agricultural Sector

Initial study was conducted in 2015. There are 77 participants from Yogyakarta participated in this study. From the data gathering through interview, questionnaire, and study group. The participants are chosen from the farmer communities in Yogyakarta. This research gained and discovered these information as follows: (1) General characteristics of farmers in Yogyakarta are: 75% of the farmers are 40 years old, Farmers graduated from Senior High School, have been working as a farmers for more than 10 years; (2) The use of ICT and Internet in Agricultural sector is still limited, example farmers use smartphone to look information about agriculture; (3) Farmer lacks of IT literacy, especially related with the use of smartphone, computer, and internet; (4) 66% of the farmers are eager to join and participate in ICT training; (5) ICT infrastructure in rural areas is available, either through telephone or wireless network; (6) Computer application that farmers needs are information about prices, farming tools and technique, product marketing and sales, land processing technique, and post-harvest product processing. This initial study is a very important foundations to support the next step in defining the stakeholders and its information (Delima and Purwadi, 2015).

3.2. Literature Review of Stakeholder Requirement in Agriculture Information Systems

After conducting the initial / preliminary study, the next phase is literature study related with stakeholder’s information requirement (Milavanovic, 2015; Delima and Purwadi, 2015; Leitgeb, F., et. al, 2011). Purpose of this study to discover the information needs for each stakeholders involved in agriculture systems. From the literature study, it is found that farmers needs the following information:

1. Information related with crop which is needed to help farmers to plant the crop.
2. Information on tools and technique to cultivate the crop, including the land preparation, land selection, crop selection, harvest, and post-harvest processing. To have the latest and newest farming technique, Integrated Agricultural Information System should cooperate with researchers who have a passion and research in agriculture sectors.
3. Market information is needed for farmers as useful information’s to broaden the market. Farmers also need to have access to business sector to gain information about crop price, seeds price, product price, tools and equipment price (Milavanovic, 2014)
4. Farmers has much experience. Delima and Purwadi (2015) reported that most of Indonesian farmers has been working for 10 years. Thus, it is a good perspective to develop IAIS by conducting participatory and knowledge sharing (Leitgeb, F., et. al, 2011). Participatory encourage farmers to be participate more actively and share with other farmers. Thus, it can broaden their knowledge.
5. Integrated Agriculture Information System also has to cooperate with government. Government can help development of IAIS by give some support in regulations and funds.

3.3. Set up the Stakeholders Category, Stakeholders Maps, and Stakeholders Matrix.
Stakeholder category, stakeholder maps, and stakeholder matrix are needed to draw stakeholders involved and participate in IAIS. By analyse and grouped into several groups based on its power and interest

4. Analysis and Discussions

4.1. Stakeholder Category
Based on literature study, there are 23 stakeholders involved and participate in IAIS. Those stakeholders can be categorized into 4 following categories: (1) Farmers; (2) Researchers; (3) Public Sector; (4) Business Sector. These categories to ease in fulfilling information needs for each stakeholder. Stakeholder category identifies stakeholder group and its member for each category. Table 1 below gives clear definition of stakeholder categories, its roles, and its member for each category.

Table 1. Stakeholder Category

| Stakeholder Category | Roles | Members |
|----------------------|-------|---------|
| Farmers              | The main actor in the Integrated Agriculture Information System; Consumer of Financial Services; Information sources; Organize farmers and give accesses to third parties | Farmers, Farmers Union / Farmers Community |
| Researchers          | Information sources; research and development; interaction between researchers and farmers to develop new technology; accompaniment and provide training to farmers about new technology and new development in agriculture sector. | Faculty Member of Agricultural Science; Faculty member of Information Technology; Higher Education Researchers |
| Public Sector        | Provide information technology infrastructure, physical infrastructure (like reservoir, land); Distribute fertilizer, seeds, farming tools and equipment; Regulate price, standardization; Provide information and data related with Agriculture. | Ministry of Communication and Information; Ministry of Public Workers; Local Government; Ministry of Agriculture; Welfare NGO; Agricultural NGO |
| Business Sector      | Financial services and insurance; Produce pesticide, fertilizer, farming tools and equipment; Distribute and selling crops; Information sources in agriculture sector | Transportation and Courier Services; Fertilizer and pesticide manufacture; Distributor; Suppliers for farm equipment’s and tools; e-Commerce and e-Channels; Banking and Financial Institutions; Telecommunication providers / operator; Cooperation; Information Technology Practitioners; Retailers (including online store); General Distributors; Distributor of Agricultural Products; Distributor of Agricultural Derivatives Products; Supplier of Agricultural Equipment; |

Table 1 shows the stakeholder group, roles, and its member (who is categorized in this part). The main stakeholder for this information system are farmers and farmer communities. They are involved because it helps to organize the farmer.

The second stakeholder in this IAIS are researchers from two major, Agriculture science and Information Technology. Agriculture Science Researchers are needed to give some input for the agriculture systems and technics, new technologies in agriculture, crop diseases and its medication, crop selection process and technics. Researchers from information technology is competent and capable to plan, develop, and maintain the information system and its architecture.

Public sector involves some ministries who are interested and have some power in this system. Government, either municipalities or ministry, involve in Integrated Agricultural Information System (IAIS) by providing access and infrastructure to the Information Technology. Government and NGO also can help to support funding to develop IAIS. Business sectors provide some support starting from
financial services, pesticide, fertilizer, farming tools and equipment, distribution path and courier services.

### 4.2. Stakeholder Power and Interest

The next process is analysing power and interest of each stakeholder in relationship with IAIS. This stakeholder analysis is the technique used to identify who participates actively in IAIS. This research analyse the power and interest of each stakeholders based on its function in agriculture sector. The bigger the function in agriculture sector will make the stakeholder have bigger power and interest in Indonesia Integrated Agriculture Information System.

In table 2 below, there are 4 quadrant in this matrix, as follows: (1) Stakeholders which have high power and high interest in IAIS should fully engage and make the greatest efforts to satisfy. Stakeholders in the area of key players also can make the development of IAIS fail if study group is not maintain well; (2) Stakeholders which have high power and less interest should work not too much with these stakeholders because they may become bored with the report that system developers send; (3) Stakeholders which have low power and high interest should be informed adequately. IAIS developer also should talk to them to ensure that there is no major problem arising; (4) Stakeholders which have low power and low interest only monitor and keep them informed in development of IAIS.

| **Table 2. Stakeholder Power and Interest Matrix** |
|--------------------------------------------------|
| **Keep Satisfied (Low Interest, High Power)**          | **Key Players (High Interest, High Power)** |
| Ministry of Communication and Information  | Ministry of Agriculture |
| Local Government                             | Farmers |
| Telecommunication Operators                 | Distributor of Agriculture product |
| Ministry of Public Works                     | Farmers Union |
| Transportation Services                      | |
| Ministry of Research and Higher Education (Medium Interest, Medium High Power) | |
| Banking (Medium Interest, Medium High Power)  | |
| Cooperation (Medium Interest, Medium High Power) | |
| **Minimal Efforts (Low Interest, Low Power)**       | **Keep Informed (High Interest, Low Power)** |
| NGO in Public Welfare                        | NGO in Agriculture |
| IT Academician                               | Manufacture for pesticide and fertilizer |
| IT Practitioners                             | Supplier of farming tools and equipment |
| Distributor of Derivatives Product            | e-Commerce (Medium high power, Medium low interest) |
| General Distributor (Medium low interest, medium low power) | Academician in agriculture sector |
|                                                  | Agriculture instructor / advisor |

### 4.3. Stakeholder Interaction Matrix

Stakeholders in IAIS needs different kind of information. Each stakeholder with different role needs different information. This information comes from interaction between stakeholders. Thus, stakeholder interaction and information matrix should be set up to identify information needed for every stakeholders. There are two parts in stakeholder’s interaction matrix. One stakeholder plays as an information source and another as an information recipient. This matrix can be found on table 3 below:

| **Table 3. Stakeholder Interaction and Information Needed** |
|----------------------------------------------------------|
| **Source** | **Recipient** | **Information** |
| Farmers      | Researchers     | Current state information related to technology, tools, equipment, and treatment in farming |
|              | Public Sector    | Information related with phase in farming; current planting and its schedule for every phase; Information related with current crop diseases, obstacles and problems in farming, regulation issues in agriculture; needs for farming |
|              | Business Sector  | Information related with agriculture products (fertilizer, pesticide, tools, equipment); information related with financial aids and funding |
| Researchers  | Farmers          | New issue in agriculture; New method for planting and farming; Research finding in agriculture |
Table 3 reflects interaction between stakeholders specifically. This interaction happens because of the information exchange among the stakeholder. IAIS has to be able to link information needs for the stakeholders automatically through fulfillment of the data and information. System developers, in this case the organization has a role as IAIS active user.

5. Conclusions and Future Works

1. Stakeholder analysis is the process to identify individual, groups, organizations, or government that are affected by the systems. IAIS has 23 stakeholders involved from academician, farmers, government, NGO, and private sector / business sector. Those 23 stakeholders are groups into 4 stakeholders: (1) Farmers; (2) Researchers; (3) Public Sector; (4) Business Sector. Those stakeholders are grouped based on its interest and information needed in IAIS.

2. Development of IAIS also conducted stakeholder’s relationship and information sharing for among those stakeholders. While the information needs between stakeholder is able to shape the interaction among stakeholders. There are 12 interactions which provides different information between the information source and recipient.

3. Stakeholders are also analyze and grouped into several groups based on its power and interest. Those to reflect the participation of each stakeholders in the development of IAIS and interest in implementation of IAIS.

The future works to develop the IAIS are: (1) Developing Business Architecture as a foundation for business rules and business processes for IAIS; (2) Identifying the Data and Application Architecture based on Vision Architecture and Business Architecture; (3) Developing technology framework to implement and build IAIS.

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