

Using SMS Gateway's Model to Strengthen Agriculture's Stakeholders Relation With Farmers

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Abstract—Agricultures' problems have not been elaborated in the ICT model. The problems need to be solved with an adoption of technology which is called as ICT that is consist of ICT Mediated Agriculture Extension in rural areas to disseminate the knowledge of information by Decision Support System (DSS), Management Information System (MIS) and Expert System (ES) by SMS Gateway's Model for the User Interface and Knowledge Management System. So, the knowledge of agriculture, therefore describes an emerging field focused on the enhancement of agricultural and rural development through improved information and communication process. The main objective of study is to provide an Interface to farmers and stakeholders (governments, agriculture researchers, non-governmental organizations, inter-farmers, national traders & exporter, cooperatives, fertilizer producers) and to facilitate linking up of stakeholders' dual-communication. ICTs, users in a sustainable way through knowledge management by using SMS gateway's model will spread agricultural information in grass root level for fast-moved solving at farmers' special field cases.

Keywords—SMS gateway; ICT; rural development; user interface

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I. INTRODUCTION

Gap information among the updated agriculture's information, market, weather is a relevant background information to develop the technology of information in agriculture information. Farmer frequently responds less action – getting losses-in reason of lacking the information. When the problem emerges in the field, farmer need to solve

the problem quickly based on a credible information that could be accessed by the farmer. A quick respond is one tool to handle field problems and will mitigate the plant not decaying by many diseases. So that, a technology information will leverage agriculture problems, to revolutionize the fast mitigation in the agriculture field.

In developing many methods of agriculture progress non-governmental organizations and centre of agriculture developments use ICT's approach to elaborate problems in agriculture site to find the better solution and an efficiency service (Sompong and Rampai, 2014). They have undertaken ICT as support in solution, handing in hand with the agriculture's main sector. Collecting and distributing data that related with agriculture issues is a lack of handling in the effective way. Agriculture researcher has strong skills in main subject: planting, insect management, social economic factors and so on. However, how to collect, provide and distribute the fresh, valid and accurate data are still biased.

Moreover, communication's relational pattern for strengthening the knowledge management between agricultural stakeholders and farmers still has a laxity. Agricultural researches and best planting practices have resulted many breakthrough, yet communication obstacles cause the agriculture progress slow down.

In the site, farmers are difficult to get a quick solution to handle many cases in disease, plant, worker, climate change and irrigation. The problems appear because no-communication mode between the higher communications level to the lower. The communication presents at long-time interval with offline-mode.

The field expert visits regularly, giving some comments and suggestions. But in a real situation, when the problems coming out to penny, the expert does not exist. Hence the communication is interrupted.

Inability of gathering, distributing and seeking the information are one of the obstacles to agriculture symptoms. The agriculture symptoms always on the technical side and do not elaborating against the social side such as communication, social engagement and human behaviour. Therefore, lack of the communication is the significant aspect for agriculture failure. SMS gateway as the digital mode will help technologically the communication failures from the high

agriculture level communication to the low level. SMS has advantages to send the simple, exact, participatory, smart comments in individual gates and grouped gates. In Individual gates, farmer can communicate with two people in dual-communications, but in grouped gates the farmers may elaborate more in discussion mode with many arrays communications.

In effective ways, farmers and stakeholders need SMS gateway administration to traffic the communication, in the cases effecting of the Information and Communication Technologies (ICT) integration into society (Capuk and Kara, 2014). The administration has role in collecting, distributing, learning with all agriculture data members: knowledge, cases, and support entries. The services should organize in programming, supporting artificial intelligence of the system. The services should give the solution in line with the problem context and the expert must send an immediate solution using SMS gateway in short-time.

The impact of SMS gateway will be proven quickly and then the system needs improvement of evolutionary way to respond the real problem in community. Many real problems with the solution will enrich society knowledge. When the real problem and the solution become encyclopaedic work, the system can mature the agriculture knowledge management in the community. There are social aspects which a technology must respond the social environment: participation in improvement, dissemination of information in easy access and dual-communication with multi-stakeholders. ICTs provide opportunities for greater communication and a vehicle of democratization and liberation not cultural and economic domestication (Capuk and Kara, 2014).

The scope of the paper is to define the problem in the agriculture field and convert it to the ICT solution in the modelling of information relation among actors, issues and organizations. The focus is how to translate the agriculture problem into ICT solution. The objective of the paper uses a methodology to transfer problems to a platform of ICT solutions. The solution can implement with using coding-modes, when the developing stage will be declared.

II. REVIEW OF RELATED LITERATURE

The context of topic is the adoption of ICT grows massively in many field, however it goes slowly in the agriculture field. The agriculture field in suburban does not have a good infrastructure to handle information system. One of ICT tools in suburban is a handphone –not smartphone- that enable an exchange of information each other in two-ways platform. In suburban, the technology of handphone could be explored as the tool to solve problems on information interaction in agriculture field. The agriculture field needs the ICT adoption for decision support to solve agriculture problems.

The ICT adoption in the position of decision support system explains how the sector gives significant leverages to grow in the ecosystem.

The rapid and meaningful development in ICT has entered a lot of potentialities to achieve the suitable governmental aims

in decision support system (Bakhshizadeh et al., 2010). In the decision support system, the ICT makes the system process to manage content in form of information management and intelligent system. The system process as the heart of thinking system is supported with keypad + display or monitor as the communication tools screen for a user interface.

Information and communication process are the key of the system which involves people to need the knowledge management and decision system. The rural Information and Communication Technology Centres (ICT Centres) play an important role in rural development through improving e-governance in agriculture and rural areas (Alibayg et al., 2010). The agriculture and rural areas system have these characteristics: making decision on fluctuating prices, potential commodities in the future market and weather information to plant in farms.

The ICT in the agriculture and rural areas has a role to link-up stakeholders and agricultural encyclopaedias to inform real fact of problems and how to handle them. The ICT handles many problems, mediates human resources system, agriculture knowledge system and environment of production process and business.

To materialize the dissemination of agriculture information needs a technology in a simple way to operate, easy to access and the application by farmers. A selection of technology will be an artefact presents in the sustainable condition. The failure of technology of information sometimes is happened because of mismatching social problems and the technology solution (Alibayg et al., 2010). So that, the system engineering needs to how the social environment works.

ICT application achieves the productivity, growth, involvement, engagement and effectiveness of environment. The dynamic environment will present when the ICT application becomes friendly to use in the each other activity. The ICT's impact clearly influences the environment as many of best practices are proved, sustain and meet the expectations.

Historical background of literature reviews showed that the development of technologies in suburban that is presented in a traditional way to digital way grows slower. In the traditional way, farmer collected information using the cycle of weather, animal information and cultural habits. In a modern way, after the radio broadcasted, farmer listen the agriculture information regularly from the show. Meanwhile, government pushed the farmer to establish farmer group as the media to discuss many relevant problems that related to the radio show- either community radio or national radio - and with offline-mode the agriculture expert came to the location. At the early 21 decade, the digital way is introduced, but in suburban the technology does not develop well. To push the information technology, it is needed to check the proficiency of technology in solving many issues in agriculture field.

Regarding with agriculture technology matters, Clarke's Three Laws said that the limit of the possible is go beyond into the impossible, any sufficiently advanced technology is indistinguishable from magic: explaining how wireless network technology is transforming the ways people work and communicate. Similar with Clarke, McLuhan (1964) said that

in Understanding Media after more than a century of electric technology, we need to extend our central nervous system itself in global embraces, abolishing both space and time as far as our planet is concerned. To extend the central nervous system in agriculture field, the ICT adoption needs: (1) hardware that enables farmer shares information resources, reducing cost and making it possible for more people to take better advantage of powerful networking, (2) software that enable people to share data and software programs also increasing efficiency and productivity, (3) trained people to enable work together, play together, and communicate in the way that are otherwise difficult or impossible.

III. METHODOLOGY

To fulfil the research objective: studying the obstacles, problems and the effective way in dual and grouped communications, the study needs and constructs a model to find the best relation between farmers and stakeholders in communication. To construct the model, the methodology of study shows as the follows.

The methodology uses the **technology adoption mechanism** (SMS gateway) which elaborates three artefacts: networking technology, management information and trained people driver.

The methodology to answer the enabling environment need a sophisticated method, embedded the ICT adoption. Infrastructure, technology and institutionalizing are the common concepts in the ICT adoption (Behera et al., 2015). The ICT adoption needs the system of analysing the environment, so that we need the data collection.

Data collection is important to gather problems, needs, organization issues, pattern of communications and how to capture to availability of SMS gateway. The qualitative data are captured and employed by using thematic and analysis approaches.

The steps to present a model are developed in using a methodology: 1) capturing the agriculture problem in communication; 2) identifying solution with ICT adoption; 3) applying the ICT adoption; 4) transferring the social side to technical side; and 5) storing the developed model developed. The study sampling was in Lembang – West Java Indonesia.

IV. RESEARCH FINDINGS

4.1. Capturing the agriculture problem in communication

Clearly, the problem in communication always emerges in rural areas. This is because a geographical reason in which the farm and the agriculture Centre are distance. There are 3 main problems in rural areas: interrupting communication, losses in no communication and inadequate information of production management. The problems are shown in the box 1, 2 and 3.

Box 1 Problem on interrupting communication

Ac Long red pepper diseases
Long red pepper needs the height level more than 1000 meter above level sea to growth. Farmer frequently plants in this conditions, unfortunately the climate occasionally changes in high water evaporation. The plant is easily attacked by fungus diseases. Fungus diseases cause a quickly decay to the long red pepper. If the farmers could anticipate the disease immediately, the plant will save. A quick anticipation is needed in term communication with expert. The communication needs the technology of communication, in this case is SMS gateway. By using SMS gateway, farmer could communicate easily with the experts or stakeholders.

In box 1 the cases showed that the interrupting communication make the farmers could not take a solution that related with the problem quickly. This interrupting communication affect the economy benefits. The research found that the economy benefits of communication shown in the box 2. In the situation where highly fluctuating price is happened.

In agricultural commodities, the communication is the key to solve the problem on losses.

Box 2 Economy Benefits in Communication

Horticulture prices fluctuating day by day
Farmers occasionally get losses when price of products quickly dropped. Agricultural commodity prices are always fluctuates in range of 5%-25% day by day. The farmers need to know prices in the market. However, farm location is far away to the market. The obstacles are needed a technology to solve the problem in order to provide the price in the real time. The technology will ease the connection between farmers and wholesalers in the market. The technology is recall as SMS gateway.

Box 3 shows about the importance of forecasting in the agricultural commodities. The farmers need information about certain commodities when the planting season coming. Farmers will select the potential and marketable commodities in the future.

Box 3 Potential commodities will be planted

Price of commodities depend on the future market
Before planting horticulture commodities, farmers need to calculate the future price. The farmer uses the instinct to take a decision to which commodities he/she wants to be planted. It is better for farmer to use data from a research market. Centre of agriculture research always has data for a calendar planting, however farmers cannot access the data. The farmers need ICT adoption to make a communication connection regularly, hence they could access information including the planting calendar. SMS gateway is powerful tool for farmers, hence they can communicate regularly. In addition to that, farmers can dig any information using SMS gateway to plan which potential commodities is needed to be planted.

Many potential problems in rural areas appear because of leak information. The problem is such as social, environmental, and cultural problem. ICTs increase additional value for farmers and end-users in a sustainable way through knowledge management (Behera et al., 2015). The SMS gateway is a solution to operate ICTs in a robust condition.

4.2. Organizing the solution with ICT adoption

Result from farmers’ interview showed that it is needed to transform the social side to the technical side. Information and Communication Technologies (ICTs) offer huge opportunities for all to progress (Koliousska and Andreopoulou, 2013). The research should elaborate it in from a point of view. SMS gateway is powerful to prepare one to many, one to one, many to one, or many to many communication.

Table 1 Type of communication and rule of application

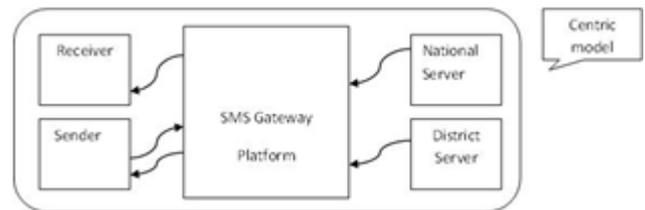
Type of communication	Description of utilities	Rule of Application
One to one	Specific issue related to locations of farm with extension officers	Set the system in SMS common default and make sure the connection to extension officers number with the definite code from the farmer number
One to many	The common issue needs the multi-perspective	(1) Farmer send the Common issue using a definite code in the phone, the SMS Machine respond and send it to Related stakeholders, giving the answer. Related stakeholder send it through the SMS machine and finally the tool resend it to the farmer (2) Centre of agriculture Research needs specific Information to be sent to Farmer specially for crucial Information
Many to one	Specific issue need clarification from farmers	Centre of agriculture research need a clarification on crucial issue from farmers. In the system, it is sent to the farmers and farmers send back to the system for free
Many to many	The common or Specific issues need analyze by Multi-stakeholders	Expert sends issues to many stakeholders and they respond it by conducting in circle of discussion among them.

The arrays of communication have presented in SMS gateway. The research need to enter code to in many types of communication. It is quiet easy to develop the SMS gateway to connect the communication in these models. In table 1 shows that the development of model clearly follows the robust application.

4.3. Applying the ICT adoption

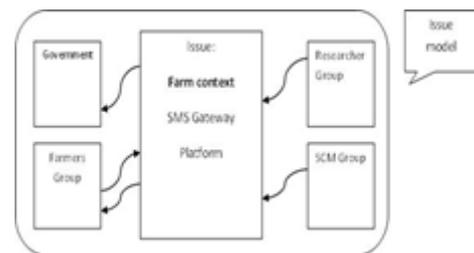
The research has analysed the data, obtained more information from oral conversation in the structured and semi-structured with farmers, coding the applications and finally pushes the interactive SMS gateway as the tool of ICT adoption. The infiltration of new technologies in the agricultural sector is a fact (Botsiou and Dagdilelis, 2013). The interactive SMS gateway responds problems on the farm, in line with the result of interviews and code of application. The study has to base the belief of farmers to improve their life with ICT adoption.

Figure 1 A development of model done by organization’s point of a view



In figure 1, SMS gateway platform is organized by point a view which follows the actor. The actor works in the organization style so that the intervention can be done by the pattern of organization. The Pattern of organization pay attention to the hierarchy of organization which tell the channelling information works.

Figure 2A development of model done by issue’s point of a view



In figure 2, the model follows the issue which crucially occurs in the farm. The topic will be shifted to how the stakeholders can push the solution in many aspects. The strength of model is the multi-disciplines provide the solution to one problem in the farm. It is a system perspective to find an integrated solution.

Two models will be SMS gateway platform development. This is a crucial point to develop to make the system simpler. For this, the development needs the iteration frequently to make it simple to be used for farmers.

4.4. Transferring social side to technical side

Table 2 Social side to technical side

Social side	Technical side
Environmental issue: knowing the situation of the diseases spreading, pollutant, weather condition and water management	SMS gateway transfer the data both micro and macro environment from the centre of agriculture research
Cultural issue: people literacy on agriculture issue increases day by day	SMS gateway transfer encyclopaedia of agriculture issue
Economical issue: price condition and the future market development always updated	SMS gateway transfer the updated price and forecast the potential commodity in the future market

All the social issues have to transfer in social solution using technology assistance. The transfer process can be formulated using technology platform that match with the social problems. In regard with how the social problems work using technical side, first we must make clearly definition of social problems. Then, we search the technology platform which is able to produce the solution clearly and straight-forward on output. Integral ICT solutions help to plan and verify common targets (Mayer, 2013). Table 2 explain how the social side to technical side work together.

We can make a formulation which the automated process can work after input of the problem enters to the processing box and results the output of solution. The solution works using the algorithm and coding process applications.

4.5. Maintaining and storing model

New technologies and applications are developed, in light to promote better communication with the citizens, to facilitate innovations in organisations and to create competitive advantages (Savulescu, 2014). ICT in rural areas development needs the simple model. It is an answer of ICT complexity adoption with using the website and internet service in ICT centre which have the low effectiveness. ICT centre which uses the internet services has low diffusion of agricultural information.

The diffusion of agricultural information is a key to increase effectiveness. ICT adoption will push the input and output of agriculture values, community business, and employment opportunities. In purpose of maintaining the ICT model, the research indicates that the effectiveness related to the simplicity in rural areas. Storing model needs the availability in socio-ware, techno-ware, and maintain-ware. If the rural areas support in socio-ware, techno-ware and maintain-ware, the sustainability of model will survive and hold out. Cost, time and good response rate are major concerns in SMS gateway (Alam et al., 2014).

Table 3 Comparing the simplicity and the effectiveness of two types of ICT adoption

Internet service Based ICT centre	SMS gateway based ICT centre
Complexity in Access	Simple in access
Necessity of infrastructure	No necessity of infrastructure
Application complex	Application simple
Uneasy in use	Easy in use

SMS gateway as ICT adoption in rural areas has many of special qualities: in access, infrastructure, application and function rather than the internet based ICT centre. The internet based ICT centre sometimes fail to make robust service in rural areas. The challenge is how the model of SMS gateway could be proven in agriculture model. SMS gateway has succeed in health, public services and employment sector. In agriculture sector it is just need a replication from the best past practices. The advantages of agriculture will grow in exponential growth: reliability, size, speed, efficiency and cost. It is relevant, all of these digital innovations are possible because of Moore's law (George and Ben, 2009).

The convergence of SMS gateway is at another heart of digital agriculture, most farmers work based on earning their living working with words, numbers and ideas. Farmers ride a wave of social change with information technology which first they shape, thereafter they shape them (McLuhan et al., 1967)

SMS gateway will coexist with farmers to transform rapidly and irreversibly. The agriculture businesses create new market overnight. An instant worldwide communication changes the way business work and becomes the extensions of farmers (McLuhan, 1964).

V. CONCLUSION AND RECOMMENDATION

1. ICT adoption is an immediate need in rural areas which the farmers live with the agriculture sector. The Agriculture sector always recommend in the agriculture base on the major, and the minor in the non-agriculture base such as communication. The framework has to reverse so that the agriculture sector needs the new point of view.
2. The cases have proved that the communication in the agriculture business is relevant to improve the quality of development. ICT adoption is a tool to increase the values of agriculture sector to empower the farmers. A good connection between multi-stakeholder and farmers will is necessity to strengthen the hub quality of communication in agriculture issues.
3. ICT adoption needs an enabling model to get a simplicity in applying the technology adoption. The enabling model should has strong relation with SMS gateway based ICT centre rather than the internet service based. The SMS

gateway model undertakes duties to push the rural areas developments in providing and disseminating agriculture practices and encyclopaedia to strengthen the model of knowledge management. The technology in the future can be improved using the autonomous and intelligent system.

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