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Stakeholders' Analysis using Value Chain Analysis: AHP in action

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ABSTRACT

Choosing stakeholders to be involved in an agricultural value chain research is a complex problem. Many researchers have used different qualitative and quantitative methods but few have tried the multi-criteria decision making algorithm which has ability to combine both methods. The approach used in this research is of great importance to those researchers who are involved in any research studying optimization of evaluation processes in different agricultural value chains. In addition, it can be used to enhance decision making in any phase of research requiring the ranking of evaluation criteria in order to make an informed decision.

Keyword*: agricultural, maize value chain, selection, stakeholder, actor, multi-criteria decision making algorithm*

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1. INTRODUCTION

The current move of doing agriculture research is towards participatory, pluralistic, demand-led and market oriented, so the future of agriculture research should focus on multi-stakeholder or multi-actor view. This means, each actor in a value chain research need to interact and reach agreement with multiple actors such as farmers, extension agents, researchers, input dealers, transporters, processors, community organizations and other actors within and outside the entire value chain. Agricultural value chain in this paper refers to the inter-linkages between and within actors involved in the production, processing and distribution of inputs, outputs as well as coordination and governance structures in the chain, the institutional environment within which the chains operate, and flow of goods and information (Furuholt and Matotay, 2011). Therefore, a strong link between actors is essential hence the need for effective and efficiency communication in all stages, right from input supply, production, and delivery of outputs to ultimate consumers. To achieve an effective and efficiency communication among actors, it requires effective and efficiency communication channels too. The recent development, availability and lowering of cost of the ICT tools has opened an opportunity to bridge the linkage between different actors using lCTs enabled multi-criteria decision making tool. Linking actors in value chain involves connecting them via a weak or strong link. The goal in a value chain is to add value to a product as it moves from different actors in a chain (Changwony, 2012). For this study, the Porter's and Kaplinsky's definition of value chain was adopted (Kaplinsky, and Morris. 2000; Porter, 1985: page 10). It states that value chain is

> "the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers, and disposal after use".

The stakeholder involves an individual or group of people or an organization with interest with a research being done or promoted (Mayoux, 2003; Bammann, 2007). Examples of value chain in agriculture are: maize value chain, timber value chain, beef value chain etc (Furuholt and Matotay, 2011). Researching an agricultural problem in form of value chain has recently been widely taken as a tool to address critical problems facing agriculture in different countries (Zimmerman and Maennling, 2007). By researching agricultural problems in a value chain manner makes it easy to rectify the complex problem in a holistic and sustainable manner since agricultural problems are rarely solved at the single actor rather than in linkage of multi-actors. Thus by doing so the problem is solved as a whole from production to consumers rather than solving it as a single entity.

1.1 STAKEHOLDER ANALYSIS IN AGRICULTURAL VALUE CHAIN

One of the importance of doing stakeholders' analysis is that the researcher can use the results of the analysis to identify the key stakeholders and to evaluate their knowledge, interest, positions, alliances and importance in relation to the research to be undertaken (Varvasovszky and Brugha, 2000; Mayoux, 2003; Bammann, 2007). This adds value to the researchers' effectiveness involvement to the research activities and also, it can increase their motivation to support the research endeavor. Thus, stakeholders analysis which has been done well in advance before commencing of the research act as early warning system to the participating stakeholders in the project. This has advantages of avoiding to effort needed to mitigate the unforeseeable mistake and errors in future. Hence the probability of having a successful research project becomes higher.

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> *The higher the stakeholders interest in the business the greater the pressure to influence the goings and direction of the business because of the potential benefits or harm to their business arising from the firms actions (Changwony, 2012:page 14).*

Choosing stakeholders in any value chain research project is a complex problem (Davison, Deeks and Bruce, 2003; Ananda and Herath, 2003; Bourne and Walker, 2005; Hermans and Thissen, 2009; Mwesige, 2010; Nichiforel, 2011). This is due to the fact that the process of stakeholders' analysis involves identifying the key stakeholders, developing a list of all possible stakeholders, evaluating priority of multi-stakeholders with experts, having dialogue/interview with stakeholders and choosing highly ranked stakeholders (Nichiforel, 2011). All these processes are associated with uncertainties since in most cases the evaluators do have insufficient information about different stakeholders (Sanga, 2010a). Thus in order to handle the ambiguity of aggregating the results from each step there is a need of a method/tool/algorithm, which will make it easy to combine qualitative and quantitative measures from each stage (Sanga, 2010b). The application of Analytical Hierarchy Process (AHP), multi-criteria algorithm, to help users in evaluation problems has been widely used (Genova et al., 2004) in other sectors but none has been done in stakeholders' analysis in agricultural value chains (Ananda and Herath, 2003; Furuholt. and Matotay, 2011). Nevertheless from the literature review, many researchers have done stakeholders' analysis using matrix method, venn diagrams and participatory value chain mapping methods (Davison, Deeks and Bruce, 2003; Ananda and Herath, 2003; Bourne and Walker, 2005; Hermans and Thissen, 2009; Mwesige, 2010; Nichiforel, 2011; Mayoux, 2003). But these mentioned methods do not rank the stakeholders' objectively as per user predefined criteria. Ranking stakeholders / actors of the value chain is necessary so that the characteristics of each group or individual or an organization is known in advance before any intervention is done. This is necessary while doing stakeholder analysis of the research in a value chain. Brugha and Varvasovsky (2000) argue that stakeholders analysis help to understand actors' behaviour, intentions, interrelations, agendas, interest and the resources they either have or will bring to the research projects. This kind of information is very important for a researcher so that she/he can make an informed decision when performing the research. Having such information it will be easy to understand the actors who don't or do need to be empowered through provision of resources or skills / knowledge. Varvasovszky and Brugha (2000) mentioned the importance of using qualitative and quantitative methods in stakeholders' analysis but did not show how.
Nichiforel (2011) analysed stakeholders in forest sector of Romanian using a matrix method. Its advantage of matrix method is that it is easy to use since it applies intuition after researcher has collected enough qualitative data about different stakeholders. The only problem of Nichiforel's method is that it is not objective (i.e. quantitative) approach. It is difficult to alleviate bias attached to this subjective (i.e. qualitative) method.

Hermans and Thissen (2009) analysed different methods for stakeholder analysis. They argue that social network analysis, cognitive mapping and conflict analysis are methods that can employ different theoretic perspectives focused on different aspects of multi-actor processes. They mentioned that its disadvantage is that it differs as per evaluator's expertise and time available for doing evaluation. Thus, a meaningful approach is needed for actor analysis which combines a range of available methods (e.g. empirical, analytical, experimental and theoretical).

Davison, Deeks and Bruce (2003) showed how it is important to involve stakeholders within a change process so that there is successfully managed change. The participatory user involvement in any project helps to reduce resistance from user. They developed and used a technique called stakeholder

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identification and analysis (SIA). It is a method that engages the users of a system in the problem solving and reengineering of their own work-based problem areas. The SIA technique aids the identification and analysis of system stakeholders, and helps view the projected outcome of system changes and their effect on relevant stakeholders with attention being given to change resistance to ensure smooth negotiation and achieve consensus.

Bourne and Walker (2005) developed a tool that that can help to map, and visualize, stakeholder power and influence in a given organization. Success or failure of any project depends on the power and influence of the stakeholder involved. It is from this method, they developed a tool called stakeholder-circle tool. The tool is developed for each project through a methodology that identifies and prioritises key project stakeholders and then develops an engagement strategy to build and maintain robust relationships with those key stakeholders. The disadvantage of Bourne and Walker tool is that it was conceptual paper thus empirical paper is needed to validate the effectiveness of the tool they developed.

Thus from the literature review, one can deduce the need for a holistic (i.e. integrated empirical and analytical) approach for stakeholder analysis in a given value chain. This paper presents a work towards this end using analytical hierarchy process algorithm (AHP). Early attempt by researchers in applying AHP in agricultural projects was in examining the scope and feasibility of the AHP in incorporating stakeholder preferences into regional forest planning (Ananda and Herath, 2003).

The research question poised was "How stakeholders' analysis can be done using value chain analysis?" In our research project titled "The role of mobile phones towards improving the coverage of extension services: a case of maize value chain in Kilosa District" stakeholders' analysis was required to be done before proceeding with other research activities (i.e. inception workshop, baseline survey, data collection and data analysis, implementation of web and mobile based farmers' advisory information systems). The output of stakeholders' analysis initiated other activities in the maize value chain analysis (VCA). VCA was done as per Kaplinsky and Morris (2000) which involves identification of full range of functions required to bring a product / service from conception to end use. Other activities were: (i) mapping the chain (ii) identifying governance structures within the chain (iii) exploring areas of upgrading within the chain (iv) assessing benefits in the chain participation (Kaplinsky and Morris, 2000).

Since previous researches concentrated much on method for stakeholders' analysis without showing how the research processes were managed, this study differentiate from them by using a research methodology called Soft Systems Methodology (SSM). SSM managed research processes in a circular manner which makes easy for a research to map and visualize the pattern of how stakeholders' were identified, selected, evaluated and then engaged to accomplish the project objectives (Sanga, 2010b). The strong and weak links between stakeholders need to be identified before the start of the project so that the project intervention is done at right node to the right stakeholders (or actor) at right time and location. The previous researches in Kilosa were done without consideration of stakeholders' analysis (Lwoga, 2010; Mtega and Msungu, 2013; Sife et al., 2010; Lwoga et al., 2011; Sanga et al., 2013a; Sanga et al, 2013b).

2. RESEARCH METHODOLOGY

The research methodology which was used to manage different research processes was Soft Systems Methodology (SSM) (Figure 1). The research processes were handled by SSM since they were messy or ambiguous or fuzzy. SSM is a system thinking methodology (Checkland and Scholes, 1990). It differs from the traditional system engineering methodology which first tries to look for the objective or goal and then work backward towards that objective or purpose or aim or goal. In multi-criteria decision making it becomes difficult to define the multi-objectives. Thus the objective becomes part of the problem and only

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group consensus on what need to be defined as objective is necessary. It is from this that SSM is a methodology for understanding and dealing with this diversity of agreed views and interests (Checkland and Scholes, 1990). Without consensus on the objective there is confusion. This is the weakness of traditional system engineering methodology and this caused the authors to choose SSM since the multi-criteria decision making problem at hand can be best solved by it.

2.1 MULTI-CRITERIA DECISION MAKING PROBLEM

The need for technique to help human being in making rational judgment from a complex multi- goal or multi-objectives with some multi-criteria consisting of sub-criteria and measurable attributes in a multiple alternatives is what constitutes the multi-criteria decision making problem. There are several multi-criteria analysis (MCA) algorithms or techniques which try to solve multi-criteria decision making problem (Wolfslehner et al., 2005; Sanga, 2010a). It is the best algorithm of choice when: there is a need to structure a complex decision problem, the problem are multi-objective or have multiple criteria to be considered, there are heterogeneous sets of criteria involved, there are conflicting objectives involved, different alternatives are to be compared, there is a need for a more rational, transparent and comprehensive analysis and there are qualitative and quantitative data.

The AHP has been used widely in dealing with multi-criteria decision making problems (Saaty, 1980; Sanga & Venter, 2009). This is the reason why it was chosen to be used in this study. The conventional steps of AHP involve first, structuring the problem into hierarchy; secondly, computing the pairwise comparison matrix to obtain the weight or priority vector and lastly, computing the overall priority vector. In this paper, only the first cycle of SSM which constitutes the ranking of stakeholders using an algorithm called Analytical Hierarchy Process (AHP) will be presented. In order to obtain the priority of stakeholders AHP was used (Sanga & Venter, 2009).

SSM was used in circular fashion as recommended by Checkland and Scholes (1990). KEY: ‘A’ stands for stakeholders’ analysis, ‘B’ stands for inception workshop, ‘C’ stands for baseline survey, ‘D’ stands for data collection and data analysis, and ‘E’ stands for implementation of web- and mobile- based farmers’ advisory systems.

2.2 DATA COLLECTION

As per steps of stakeholders’ analysis, we started with identifying the key stakeholders as per predefined criteria. Then the lists of all possible stakeholders were developed and finally, the stakeholders were ranked according to their priority. Priorities were obtained from their preferences / willingness to participate in research.

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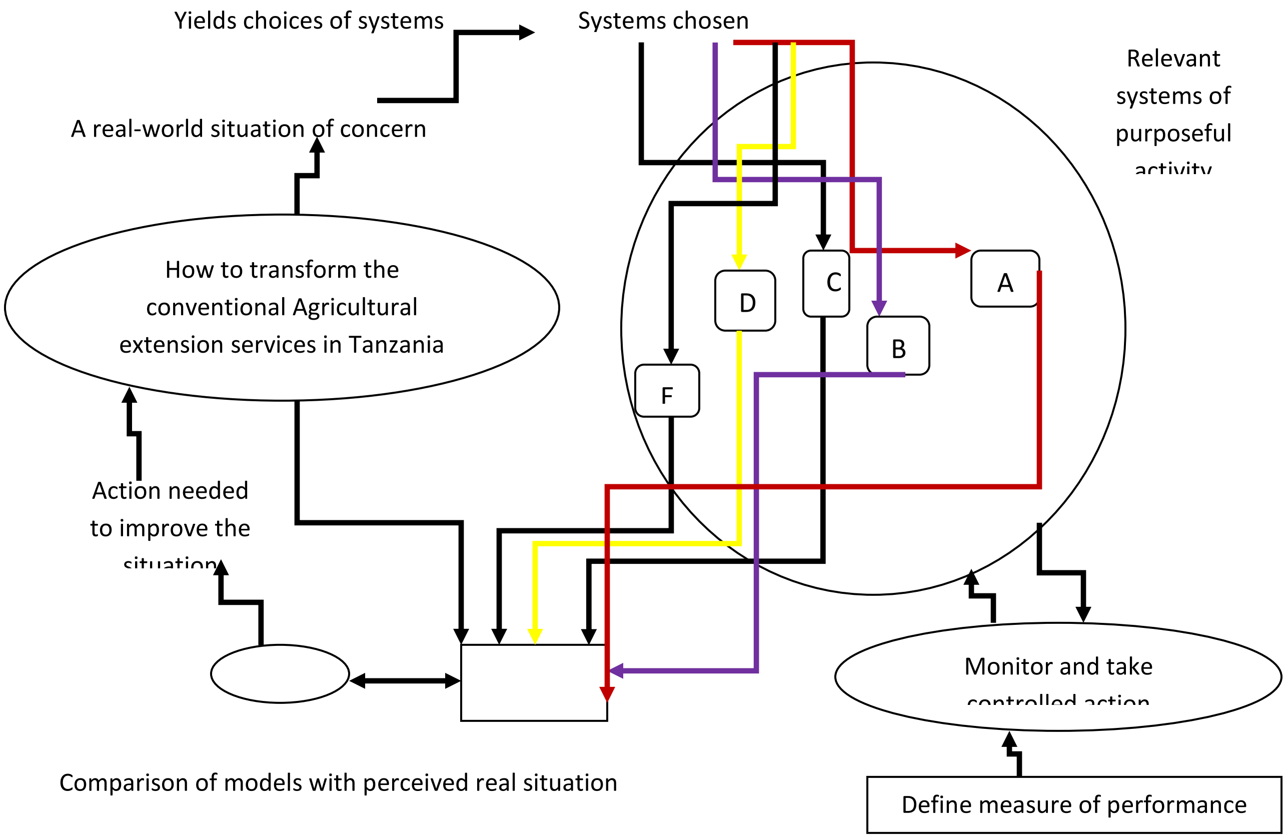
Figure 1: Soft System Methodology



2.3 CHOOSING STAKEHOLDERS AS PER PREDEFINED CRITERIA

Before identification of stakeholders the following question was asked by researchers: What are the criteria for identification and inclusion of stakeholders with respect to the project objectives? The choice of stakeholders was based on objective assessment of qualitative information and aggregated measure of the indicators for various quantitative criteria. The criteria which were used in stakeholders' analysis are listed in Table 1 below:

Table 1: criteria for stakeholders' analysis

CRITERIA	EXPLAINATION
Stake in the project	What motivates a stakeholder to participate?
Potential impact on the project	Likely impact if involved (can range from high, medium to low)
What does the project expect the stakeholder to provide?	Stakeholder's contribution in the project
Perceived attitudes and /or risks	How does the stakeholder view the research, will this perception impose some problems or risks?
Stakeholder management strategy	What strategy can be devised to address problems or risks emanating from a stakeholder?
Responsibility	What is his/her role(s)?
Follow up / monitoring compliance	How to ensure that a stakeholder is liable to fulfil his/her obligations?

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Identifying stakeholders: This was done by visiting Kilosa District and interviewed the District Agricultural and Livestock Development Officer (DALDO), coordinator of ICT, coordinator of Kilosa Community Radio, manager of Kilosa Community Radio, researchers from Agriculture Research Institute (ARI - Ilonga) and Ministry of Agriculture Training Institute (MATI - Ilonga), farmers, processors, traders, consumers and policy makers. Thereafter, they were evaluated on how they work with local communities, their influential power, and their expected contribution to the activities in this research.

Develop a list of all possible stakeholders: The output of the first step was the list of stakeholders. The stakeholders identified to be involved in the maize value chain were farmers, processor, microfinance institution, maize producers' association, input suppliers, Non Government Organization (NGO),community based organization (CBO), Local Government Authority, policy makers, middlemen, transporters, international agency, donor, consumers, researchers, community centre, media organizations.

Develop a list of priority stakeholders with expertise: After the output of the first step was obtained then the priority of stakeholders with expertise were identified. These were researchers, donor, NGO, CBO, community centre, microfinance institution, processor and international agency.

2.4 INFORMATION NEEDED FROM STAKEHOLDERS

In order to understand the roles and responsibilities of each stakeholder then it was necessary to get information pertaining to each stakeholder. Since very little secondary information was available to allow researchers to understand the stakeholders, we had to design a methodology to collect the data. Data about each stakeholder was collected using an interview as research method. The data analysis from the collected data leads to the understanding of different actors in the maize value chain at Kilosa. The information relating to DALDO, coordinator of ICT, coordinator of Kilosa Community Radio, manager of Kilosa Community Radio, researchers' from ARI Ilonga and MATI, farmers, processors, traders and consumers, were obtained. The information contained the following criteria: whether the stakeholder has interest in the research; alliances i.e. organizations that collaborate to support or oppose the research /intervention; stakeholder's resource base: the quantity of resources—human, financial, technological, political, and other—available to the stakeholder and his or her ability to mobilize them; stakeholders' power: the ability of the stakeholder to affect the implementation of the research; leadership: the willingness to initiate, convoke, or lead an action for or against the research and management strategy: what strategy can be devised to address problems or risks emanating from a stakeholder?

The above information which was needed to make informed decision about the list of stakeholders' to be involved in selection process was based on qualitative and quantitative measures. Thus, it was important to look for algorithm to help to combine the results (Davison, Deeks and Bruce, 2003; Ananda and Herath, 2003; Mayoux, 2003; Bourne and Walker, 2005; Hermans and Thissen, 2009; Mwesige, 2010; Nichiforel, 2011). AHP was viable and feasible as compared to other methods (Venn diagram, matrix method, stakeholder-circle tool, participatory value chain mapping, stakeholder identification and analysis (SIA), social network analysis, cognitive mapping and conflict analysis) which have no ability to integrated qualitative and quantitative measured criteria.

The stakeholders were ranked as per their total contribution according to the mentioned attributes (Table 1). The stakeholder with higher priority was ranked first. This was used as guide to assess their level of commitment towards achieving the project objectives. After the stakeholders ranking have been done then stakeholders mapping was formulated. Stakeholders mapping is like a web of stakeholders

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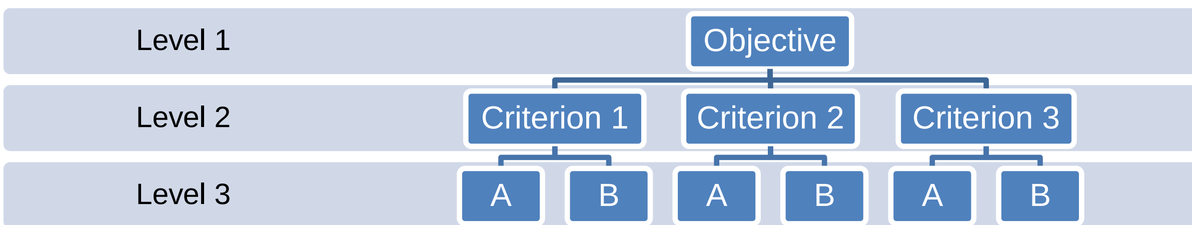
showing the interaction or association between the stakeholders in terms of advocacy, beneficiaries and targets (Mayoux, 2003).

2.5 DATA ANALYSIS

This section presents the concepts on the handling and applying of the AHP in computing priorities. The adopted steps in this paper for AHP are presented in Sanga, 2010b.

Problem structuring: According to Vila and Beccue (1995), a problem is first decomposed into a number of hierarchical levels. The objective is at the highest level, the decision criteria are at the next level, and sub-criteria and decision alternatives (under each criterion) are at the lowest level of the hierarchy. The following is an example of a hierarchical model of two alternatives A and B with respect to a specific objective to be evaluated (Figure 2). Let's assume the weight of criterion 1 is c1, the weight of criterion 2 is c2 and that of criterion 3 is c3. If the priority of alternatives A and B with respect to criterion 1 is Ac1 and Bc1, similarly the priorities are Ac2 and Bc2 for criterion 2 and Ac3 and Bc3 for criterion 3.

Figure 1: Simple Hierarchical Structure



Assessment of local priorities: This was done by using the pairwise comparison matrix and normalization matrix computations. The pairwise comparisons between elements which are in the same level of hierarchy are done using Saaty scale (Table 1). After that the local priorities weight are computed. In traditional AHP the local priorities weight are obtained by using additive normalization and Eigenvalue methods. The result of this process is the priority vector or normalized Eigen vector. The priority vector shows the relative weighs among the criteria that we compare (Teknomo, 2006). Since it is normalized, the sum of all elements in priority vector is 1.

Table 2: Saaty Scale (Saaty, 1980)

Intensity of importance	Definition
1	Equal importance
3	Moderate importance of one over another
5	Essential or strong importance
7	Very strong or demonstrated importance
9	Absolute importance
2,4,6,8	Intermediate values between adjacent scale values

Computing global priorities: This is the step where by the relative importance of each element within the level (local priorities) is merged/multiplied with the relative importance of each element in the parent level. This is done throughout the hierarchy and it is added for the lowest element in the level. This gives the global priorities for each alternative. For example the mathematical expression for computing priorities for the alternative A and B shown in Figure 1 is:

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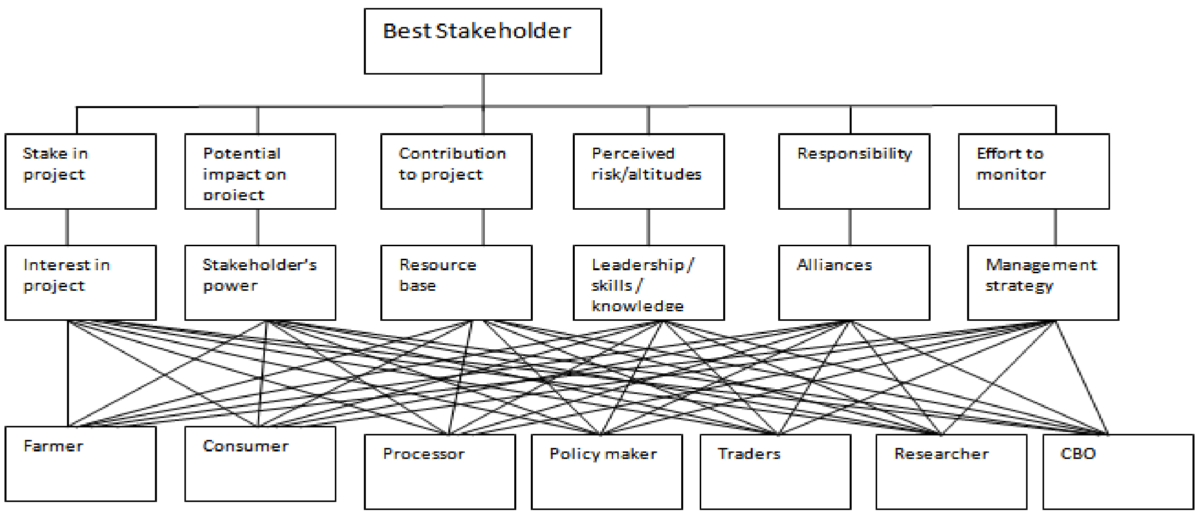
$$\begin{bmatrix} c1 & c2 & c3 \end{bmatrix} \begin{bmatrix} a_{c1} & b_{c1} \\ a_{c2} & b_{c2} \\ a_{c3} & b_{c3} \end{bmatrix} = \begin{bmatrix} P_A & P_B \end{bmatrix} \tag{1}$$

3. RESULTS – HOW AHP WAS USED TO RANK STAKEHOLDERS

Using the steps of AHP, the problem was structured into three levels.

Figure 2: Problem Structured Hierarchical



Level 1 is the goal of the analysis – which was to rank the stakeholders in terms of some criteria. Level 2 is the multi criteria that consist of various criteria. Then level 2 was sub divided into level 3 consisting of several sub - criteria. Further, level 3 was divided into level 3 which contained the alternative choices (i.e. different groups of stakeholders). The lines between different levels indicate their relationship (Figure 3).

3.1 ASSESSMENT OF LOCAL PRIORITIES

The weights of each criteria / attributes in level 2 were of equal importance thus each has 0.167 as its weight. For level 3, seven stakeholders were compared as per their subjective judgments on which criteria he / she is best positioned to contribute most.

Table 3: Pairwise comparison

Interest Project	farmer	consumer	Processor	Policy maker	traders	researcher	CBO
Farmer	1	9	7	5	2	1/3	3
Consumer		1	1/3	4	3	1/7	8

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Processor			1	2	3	1/2	1/5
Policy maker				1	1/4	1/7	1/5
Traders					1	1/6	1/3
Researcher						1	2
CBO							1

To fill the lower triangular matrix, we used the reciprocal values of the upper diagonal. If a_{ij} is the element of row a_i column a_j of the matrix, then the lower diagonal is filled using the following equation (Teknomo, 2006).

$$a_{ji} = \frac{1}{a_{ij}} \qquad (2)$$

Using equation (2), the complete pairwise comparison matrix was obtained.

Table 4: Local priority with respect to interest to project

Interest Project	Farmer	consumer	Processor	Policy maker	traders	researcher	CBO	weights (eigen vector)
Farmer	1	9	7	5	2	0.333333	3	0.286371
consumer	0.111111	1	0.333333	4	3	0.142857	8	0.138491
Processor	0.142857	3	1	2	3	0.5	0.2	0.0920284
Policy maker	0.2	0.25	0.5	1	0.25	0.142857	0.2	0.0242382
traders	0.5	0.333333	0.333333	4	1	0.166667	0.333333	0.0456479
researcher	3	7	2	7	6	1	2	0.302334
CBO	0.333333	0.125	5	5	3	0.5	1	0.110889

C.I.= 0.476263, Maximum EigenValue =9.85758

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3.2 COMPUTING GLOBAL PRIORITIES

The global priorities were computed using the following formula

$$[\boldsymbol{IP} \quad \dots \quad \boldsymbol{MS}]\begin{bmatrix} \boldsymbol{F} & \cdots & \boldsymbol{CBO} \\ \vdots & \ddots & \vdots \\ & \cdots & \end{bmatrix} = [\boldsymbol{P_1} \quad \boldsymbol{P_2} \quad \boldsymbol{P_3}\ \boldsymbol{P_4} \quad \boldsymbol{P_5} \quad \boldsymbol{P_6}\ \boldsymbol{P_7}\,]$$

Table 3: Local priorities of all criteria

Interest Project (IP)	Stakeholder's power (SP)	Resource base (RB)	Leadership / skills / knowledge (L)	Alliances (A)	Management strategy (MS)
0.1667	0.1667	0.1667	0.1667	0.1667	0.1667

This was multiplied with the priority weight vector matrix of the actors

Table 4: Priorities weight for the actors

Farmer (F)	Consumer (C)	Processor (P)	Policy maker (PM)	Traders (T)	Researcher (R)	Community based organization (CBO)
0.2864	0.1385	0.0920	0.0242	0.0456	0.3023	0.1109
0.2325	0.0554	0.0433	0.0808	0.0920	0.2036	0.2923
0.0313	0.0717	0.1351	0.4001	0.0645	0.1129	0.1845
0.0268	0.1651	0.1244	0.2933	0.0304	0.2433	0.1166
0.2864	0.1385	0.0920	0.0242	0.0456	0.3023	0.1109
0.0211	0.0353	0.0668	0.3319	0.0687	0.3453	0.1310

and the resultant priority vector was

Farmer (P_1)	Consumer (P_2)	Processor (P_3)	Policy maker (P_4)	Traders (P_5)	Researcher (P_6)	CBO (P_7)
0.1474	0.1008	0.0923	0.1924	0.0578	0.2516	0.1577

This gave the priorities (P_1, P_2, P_3, P_4, P_5, P_6, P_7) of each actor which helped the researchers in ranking actors in a value chain.

Table 5: Ranking Actors

Actor	Priority weight	Ranking
Farmer (P_1)	0.1474	4
Consumer (P_2)	0.1008	5
Processor (P_3)	0.0923	6
Policy maker (P_4)	0.1924	2
Traders (P_5)	0.0578	7
Researcher (P_6)	0.2516	1
CBO (P_7)	0.1577	3

The ranking result provided the initial information about which stakeholders / value chain nodes / value chain actors to promote. The following is the preference list for promoting the research project. Its ranking priority list was researcher, policy maker, community based organization, farmer, consumer, processor and traders.

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The second step in value chain analysis (VCA) was about mapping value chain. The criterion for mapping was the assessing of the characteristics of actors and their linkages. A VCA is the technique used to evaluate the value contribution by the stakeholder (Changwony, 2012). Quantification of the actors was based on the characteristics of the value chain actors which were done through interview and focus group. The following were the output of the actor characterization of the maize value chain actors in Kilosa.

The problems identified by farmers group are: low production, low price especially for maize product, lack of reliable market, high cost of production and farm inputs (e.g. fertilizers, seeds and pesticides), shortage of agricultural extension services in rural areas, shortage of arable land; large portion of land are owned by private organization (e.g. sisal farms) and the prevailing climate change. Climate change make hard for farmers to predict the onset of the raining season. The challenges identified by farmers group are inability of most farmers to posses mobile phones, lack of reliable source of power (electricity) especially in rural areas, limited coverage of mobile phones network, high cost to buy and operate mobile phones, limited coverage of radio frequency (especially for Kilosa community radio) and most farmers do not posses radio.

The problem identified by extension officers are: shortage of facilities for transport, production and processing; high cost of production and farm inputs especially in maize production, lack of reliable market and lack of reliable information and communication infrastructures. The challenges identified by extension officers are adverse of climate change, farmers do not receive subsidized farm inputs on time, shortage of demonstration facilities (e.g. transport, storage and production facilities), increase in forged as well as poor quality (i.e. counterfeit) farm inputs lead to poor quality of products, and lack of reliable infrastructures for Information and Communication Technology (ICT).

Researchers group identified the following problems: inability to buy and operate mobile phones to some stakeholders who can’t own and service mobile phones, mobile phone network coverage problems; some areas are not covered by mobile phone network, and wrong information provided by some stakeholders during data collection. Researchers group identified the following challenges: lack of source of power in some areas especially rural areas, ICT cannot solve some problems especially real time evaluation and monitoring of the research activities in the field, some farms are located far away such that they cost researchers (i.e. time, money, resources) and lack of actively participation of Agro-dealers and law agency in business related to agricultural.

Communication group identified the following problems: high operation cost for mobile phones and Internet access, unreliable source of power, limited time for advertisement through Radio, most agriculture stakeholders are not interested to access/listen announcements or agriculture training session which are advertized through radio or uploaded on the Internet and lack of knowledge to some agriculture stakeholders on how to use the ICT tools. The challenges identified by communication group are: unreliable network connectivity and shortage of reliable source of power.

Trainers group identified the following problems: insufficient budget allocated to train stakeholders and improve information and communication services, poor communication between trainers and agriculture stakeholders and wrong information from some stakeholders. Trainers group identified the following challenges: insufficient ICT facilities to be used by a large number of students available in colleges, high cost required to buy and run ICT facilities like mobile phones, rapid change of ICT and related facilities, and lack of interest to most Tanzanians to use their mobile phones to search agriculture related information. Agro-processing group identified the following problems: low quality of raw materials produced, shortage of reliable infrastructures like roads and source of power and shortage of specialists who can make labels and containers for packaging processed agricultural produce.

Agro-processing group identified the following challenges: shortage of quality packages, shortage of processing facilities and skilled manpower in packaging and agro-processing, industry and poor quality of available processing facilities. Policy makers identified the following problems: most researcher leave their findings in documents, they are not implemented to help the intended group like agriculture stakeholders in Kilosa and other districts, lack of decision support systems, evaluation and monitoring

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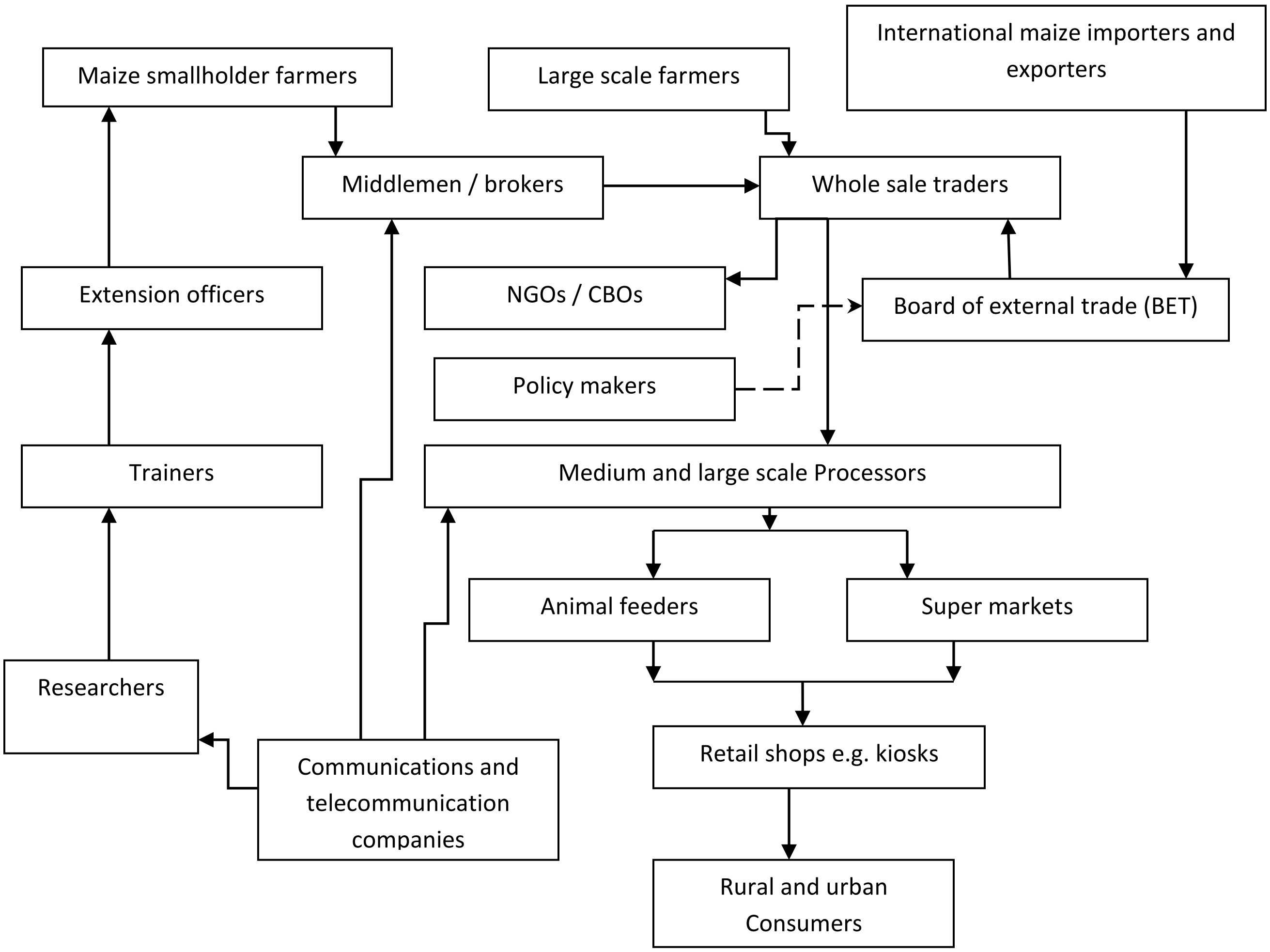
Volume 1 Issue 2, June - September 2013 (85 - 104)

tools for agricultural projects, and lack of good communication and linkage between policy maker and other agriculture stakeholders. The following challenges were identified by the policy maker group: lack of reliable source of power (electricity) especially in rural areas hinders the information and communication services, unstable marketing and poor quality of products produced make difficult in price synchronization. After the value chain actors have been characterized then the result of the mapping value chain was as follows (Figure 4).

Figure 3: Mapping of Value Chain



After the mapping of actors in the maize value chain in Tanzania has been done then analysis of different activities and their respective information systems that can support different actors in the value chain were identified (Figure 5).

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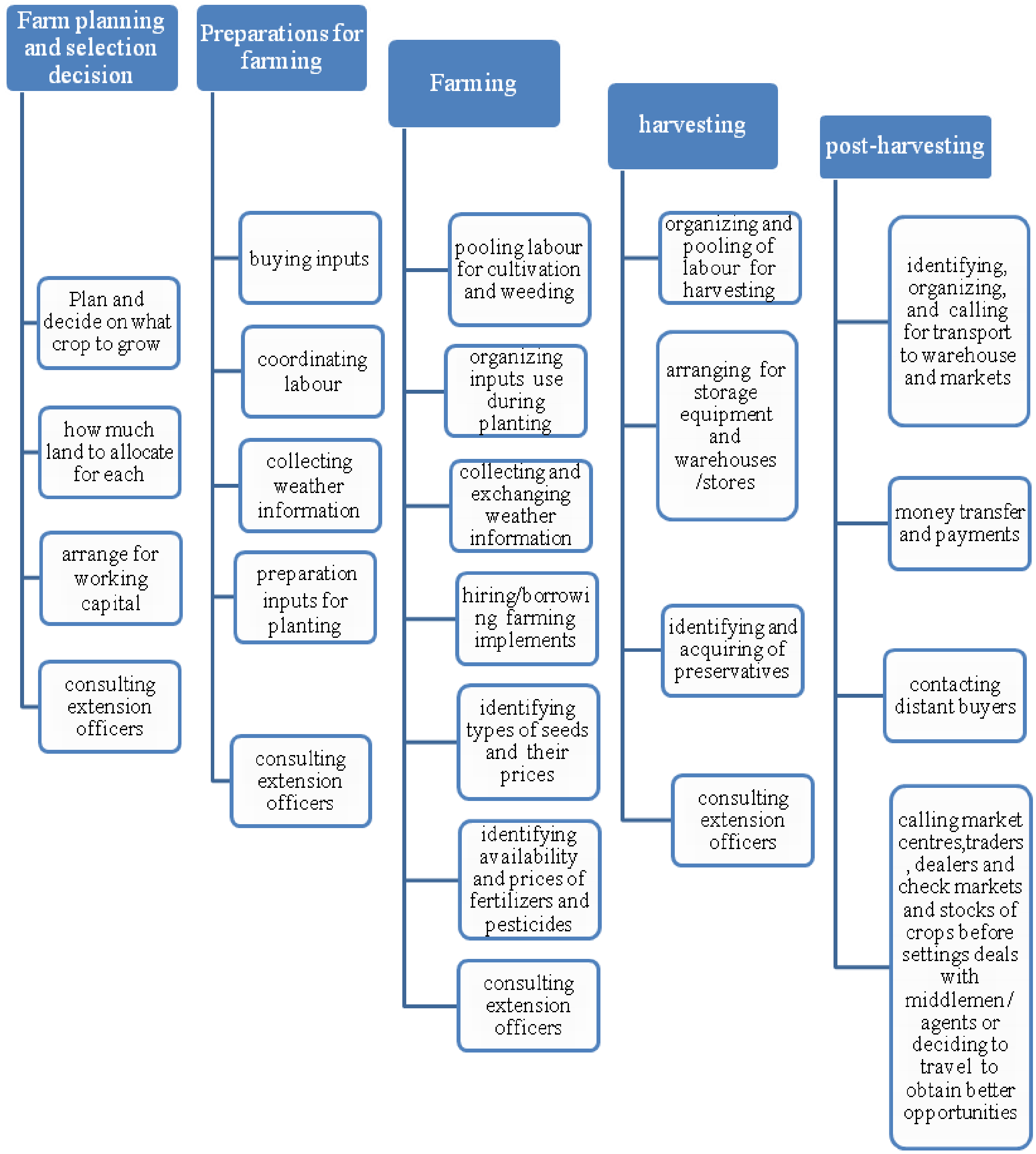
Volume 1 Issue 2, June - September 2013 (85 - 104)

Figure 5: Possible activities which can be done by actors in a given agricultural value chains



4 INFORMATION SYSTEMS IN AGRICULTURAL VALUE CHAINS

We analysed the information systems which have already been implemented to support agricultural value chains in Tanzania. The analysis was based to Parikh, Patel, and Schwartzman (2007) who mentioned four types of information systems which need to be integrated to enhance the information flow in any agricultural value chains. These systems are (i) Marketing information systems (ii) Agricultural extension systems (iii) Procurement and traceability systems and (iv) Inspection and certification systems.

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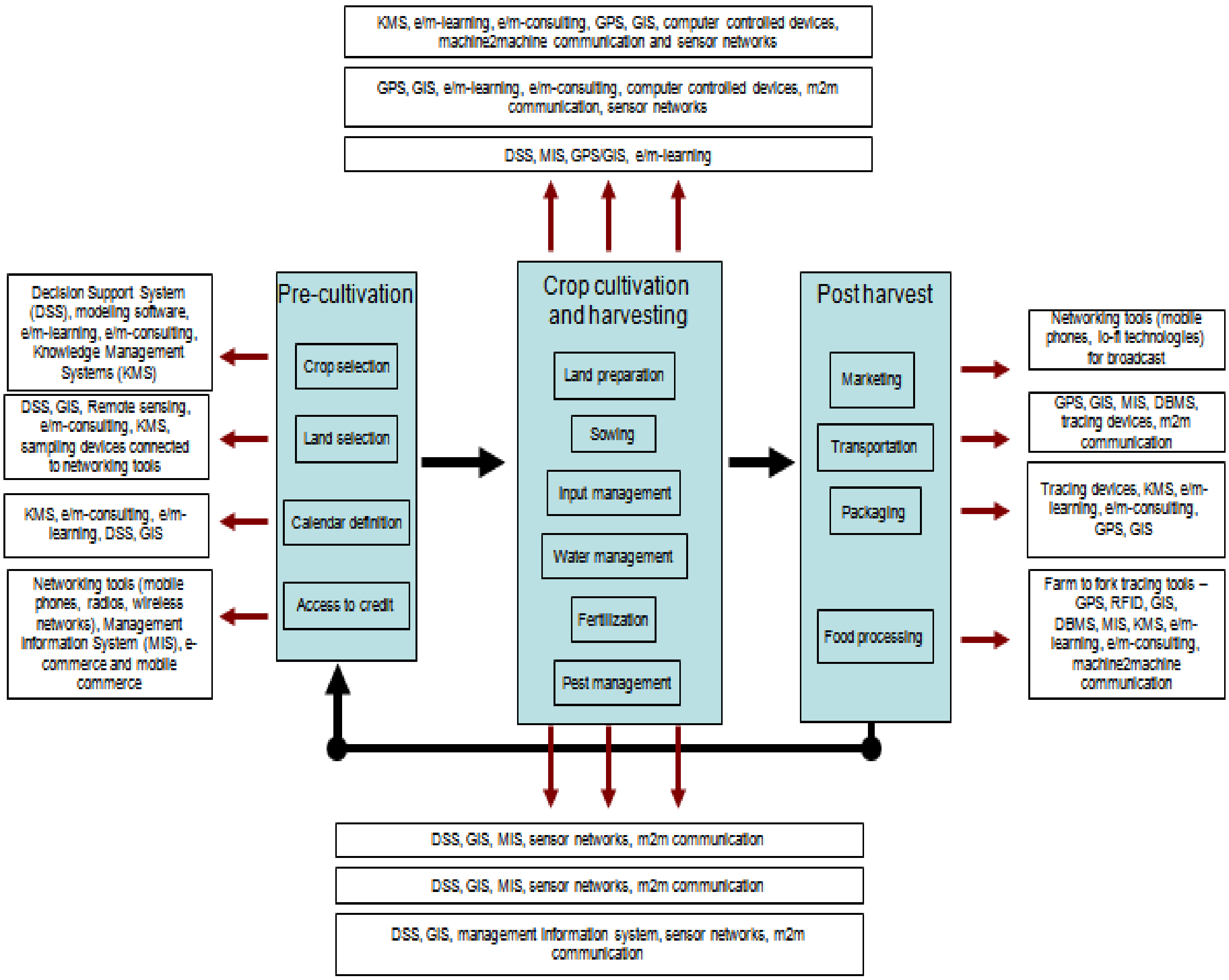
Interdisciplinary Studies on Information Technology and Business (ISITB)
Volume 1 Issue 2, June - September 2013 (85 - 104)

In addition, the analysis of information systems in the agricultural value chain was based on looking into GFAR (2012) framework. GFAR (2012) developed the following framework which shows different information systems to support information flow in any agricultural value chain.

Figure 6: ICTs needed in different phases in agriculture (GFAR, 2012)



Since the main objective of our research was on improving the agricultural extension services using ICT and in particular, the mobile phones thus it was important to assess different ICT systems which have already been implemented in Tanzania. The following are some of the examples of ICT tools which have been used in provision of agricultural extension and advisory services in Tanzania:

a. Farmers use mobile phones to get price information of agricultural produce from different market places using the local language (Kiswahili).
b. Under the Agricultural Marketing Systems Development Programme (AMSDP) (2002 – 2009) farmers have been trained on how to search market information using SMS. Also, Vodacom has started offering service on market information using SMS.
c. The use of SMS for market prices, weather and extension through eSoko platform (http://www.esoko.com/about/clients.php).
d. Provision of livestock marketing information through Livestock Information Network and Knowledge System (LINKS) portal (http://www.lmistz.net/Pages/Public/Home.aspx)
e. Development of market chains and exchange experiences through Linking Local Learners (LLL)

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platform; the First Mile project and the use of Internet (emails & website); mobile phones (call & SMS-Bulletins) and community radio stations.

f. Use of the mobile phones and Internet through Agricultural Sector Development Programme (ASDP).
g. Dissemination and sharing of agricultural information (market prices) using the: (i) Family Alliance for Development and Cooperation (FADECO) and Kilosa Community Radio (ii) radio broadcasting and community tele-centres
h. Sharing best agricultural practices through (i) the AFRRI in collaboration with 3 Radio stations: Sibuku, TBC, and Radio Maria. (ii) Farmer Voice Radio (FVR) project (iii) Use of SMS alerting to an upcoming programme. (iv) Use of calls and SMS during the questions and answers radio program
i. Sharing modern agricultural methods through radio and audio visual programme e.g. Ministry of Agriculture Food Security and Cooperatives offers “Ukulima wa Kisasa” through TBC and Radio Free Africa: “Inuka” for farmers & livestock keepers
j. Sharing knowledge and access agricultural information through tele-centres e.g. (i) use of television in shop selling farm inputs and the use of price information board, training farmers and youth e.g. at Kilosa Rural Services and Electronic Communication (KIRSEC) (ii)Use of SMS by farmers (iii) Depositing and withdrawing money through mobile money (e.g. M-Pesa, TigoPesa, Z-pesa) (iv) use of Internet forselling and buyingtheir products
k. Provision of meteorological information through the radio, TV stations, e.g. the FarmSMS launched by SUA and TMA for farmers in Same and Lushoto

From these analyses, what is missing is an integrated system for ICT, in particular mobile phone applications for different agricultural value chains in Tanzania as per stakeholders’ preferences deduced from stakeholder analysis (Figure 5 and Figure 6).

5 INTERPRETATION OF RESEARCH FINDINGS

Doing research in the agricultural sector in form of value chain (rather than looking at problem facing each actor separately in a value chain) has been the trend now, because of its importance in addressing problems facing the sector as whole rather than dealing with constituent parts (Bolo et al., 2011). From the above principle, this research is in progress and the results are promising. The ranking of actors/stakeholders were obtained after the collected data about different actors in maize value chain were superimposed on AHP algorithm to support multi-criteria evaluation. The findings shows those who have direct interest in the research project to be implement, those who could affect its implementation (i.e. stakeholder’s power), those who are expecting to benefit from it, their resource base, leadership / skills / knowledge they have, alliances they have and their management strategy.

The actor titled ‘researcher’ ranked higher because of their importance to attain the objective of the research. They are the ones to develop the web- and mobile- based farmers’ advisory system. Also their roles was to make sure the agricultural research results from different universities and colleges in Tanzania are disseminated to intended stakeholders efficiently and effectively. The second ranked actor was policy maker because of their importance to enhance the enabling environment by aligning different policies related to agricultural extension services. In the third position of the ranking was the community based organization (e.g. KIRSEC owned by private sector). This attained that position because of what they have been doing to communicate and disseminate agricultural information and knowledge as well as training the farmers and youth groups. The fourth ranked actor was smallholder farmer. Even though this group need to be at the epicenter but the challenges which they face in terms of possessing, utilization and maintaining ICTs (which can help them to access and use agricultural information) make them to be last when it comes to adoption of ICTs dealing with provision of agricultural advisory services. In future research, the aim will be to empower this group through developing different systems related to ICT and training the farmers so that there is uptake and adoption of technology. The actor in fifth position was

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consumer who is part and parcel of the whole value chain. They are the recipient of the benefit to be realized by this research. Those ranked in sixth position was the processors who deal with branding, packaging and processing. This is the field which is not fully exploited. Few citizens engage in these activities. Traders were lastly ranked because they normally engage in activities which benefit them directly. They are profit oriented and thus in the absence of direct benefits from the research they tend to shy away. Also they assume that the researchers aim at empowering farmers in turn this will eliminate some of the middlemen in the value chain. Thus traders benefit much from the ignorance of farmers.

After the stakeholders have been ranked the next steps was for the researchers to make use of it when designing and performing other research project activities (e.g. inception workshop and data collection for baseline survey). Thus, researchers planed to interview the low ranked stakeholders/ actors identified to gain more information and problems which have either contributed or affected their positions, interests, and ability. According to literature review, this is important so that the actors with low priority can be empowered (VeneKlasen and Miller, 2002) through different ICT ecosystems identified in Figure 5 and Figure 6. Otherwise the poor farmers, marginalized and vulnerable group of actors / stakeholders tends to be ignored by many researchers in research dealing with agricultural value chains.

6 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The principle finding from this research is that the study has confirmed "stakeholders' analysis as a tool for management and decision making" in research. Under this, we have shown that the tool can be used as aid in the process of planning and managing a research project development intervention in an effectively, efficiency and ethically way (i.e. 3E). The outcome of the analysis helps the researcher to visualize easily the problem. Also in future activities of the research project the stakeholders will be given different roles as per their interest, power, resource base, willingness, alliances and management skills they have. Thus all this information helps the researcher and other stakeholders / actors to have an informed decision about their participation and how they will contribute positively towards the research objective. In other words, the project intervention is done to the right actors who need the assistance most. This concurs with Zimmerman and Maennling (2007) who stressed the importance of understanding the stakeholders participating in a joint task so that the intended results are attained.

The finding answers the research question posed early "How stakeholders' analysis can be done in agricultural value chain?". This was done by identifying the criteria and how the criteria will be measured in order to rank the actors. It complements other study done early by Varvasovszky and Brugha (2000), who just stressed the importance of using qualitative and quantitative data in analysis of stakeholders. Even though they gave just a good narrative how stakeholders' analysis can be done without showing the practicality of their approach, our study fill the gap identified from Varvasovszky and Brugha's study.

The weakness of the research study which was of concern to the researchers is the biasness contributed from the stakeholders' involvement in providing their opinions. The opinions from different stakeholders were analyzed to get their preferences, which in later stage was compared and ranked. The ranking of the stakeholders which were obtained from the views given by different stakeholders do contain biasness and uncertainties. This concurs to the caution given by Varvasovszky and Brugha (2000) while doing stakeholders analysis. In order to minimize the biasness, the researchers in our study did the consistency checking for each decision made by stakeholder. Consistency checking is a step contained in AHP algorithm (Sanga, 2010b).

The implications for theory and wider knowledge body of research from our results is that since the environment, the context of the analysis, stakeholder interests, positions (i.e. power) and influence changes with time thus there is a need of doing the stakeholders analysis in circular fashion over some specified period of the research project life time. This is the reason Soft System Methodology (SSM) was proposed as research methodology. It also answers some of the open question raised by Msanjila (2013) in his paper "Analyzing inter-organizational trust with multi-model view". The technique presented in this

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Volume 1 Issue 2, June - September 2013 (85 - 104)

study can be used to rank the trust between different stakeholders within the organization (i.e. intra-organization) and also between different stakeholders in different organizations (i.e. inter-organization).

The implication of this study for application and practice is in area of the developments of multi-criteria decision support system (Belaid and Razmak, 2013) for stakeholders' analysis in any value chain.

A suggestion for further research study is on developing the algorithms such as Fuzzy AHP or Fuzzy ANP which handles uncertainty associated with different criteria in stakeholders' analysis. Another avenue for future studies is on analyzing the interconnection, linkages and relationship between different criteria and actors in different levels of hierarchy using analytic network process (ANP). Furthermore, the comparison between AHP and AHP or Fuzzy AHP and Fuzzy ANP can be done in future study (Sipahi and Timor, 2010; Wolfslehner et al., 2005).

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