Ministry of Food and Agriculture
The Republic of Ghana

No.

The Study on Upper West Integrated Agricultural Development in the Republic of Ghana

Final Report

Part IV
Instruction Manuals for Extension Methods and Tools

March 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

KAIHATSU MANAGEMENT CONSULTING, INC.
CTI ENGINEERING INTERNATIONAL CO., LTD.

GNO
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Abbreviations

AEA(s)	Agriculture Extension Agent/Agents
DAO(s)	District Agricultural Officer/Officers
JICA	Japan International Cooperation Agency
NGO	Non-Governmental Organization
MOFA	Ministry of Food and Agriculture
PAR	Participatory Action Research
PDA(s)	Pilot Development Activity/Activities
PLA	Participatory Learning and Action
PRA	Participatory Rural Appraisal
RAO(s)	Regional Agricultural Officer/Officers
RELC	Research Extension Linkage Committee
RRA	Rapid Rural Appraisal
SARI	Savannah Agriculture Research Institute
TO(s)	Technical Officer/Officers (a field staff of veterinary department)
TOR	Terms of Reference
UWIAD	Upper West Integrated Agriculture Development (name of the Study)
UWR	Upper West Region

Guide for the Use of the Manual

To verify potential agricultural technologies for the Upper West Region, the Pilot Development Activities (PDAs) have been implemented through the JICA's Study on "Upper West Integrated Agricultural Development" in 2008 and 2009. Based on the experience in the implementation of the PDAs, the methods for the dissemination of those agricultural technologies are proposed in this manual.

The intended readers of this manual are mainly DAOs, AEAs of MOFAUWR, and partly leaders and extension volunteers in the communities, who are considered to be the core for disseminating the agricultural technologies. It is important for the users of this manual to further devise ways to apply it practically according to the uniqueness of the people as well as the areas.

This manual is comprised of two chapters and appendices. In Chapter 1, the characteristics of the agricultural technologies as well as the areas are explained by classifying the agricultural technologies into three categories based on the types of activities involved, and the areas into two types based on whether an AEA is stationed or not. It is considered that those classifications need close attention when the technologies are to be disseminated. In Chapter 2, the extension methods are explained according to the classification of the areas.

Useful information for the extension is attached to the appendices, including the outline of general extension methods at various levels, the methods of participatory workshops, and the list of contact and/or resource persons from whom the related materials or information can be obtained. The lists of the agricultural technologies proposed as well as the ones verified through the PDAs are also attached.

Chapter 1 Agricultural Technologies to be Extended

1.1 Classification and Characteristics of the Technologies

The agricultural technologies applied through the PDAs are classified into three categories, i.e., (1) crop production, (2) livestock development, and (3) processing.

The following technologies have been verified effective for either increase of production or income of the community people: (See Appendix E for more details on the agricultural technologies verified through the PDAs conducted during the Study).

[Crop production]
- Integrated farming
- Compost making
- Small-scale irrigation
- Dry season gardening
- Reduction of post-harvest loss

[Livestock development]
- Pig rearing
- Bee keeping
- Rabbit rearing
- Guinea fowl rearing

[Processing]
- Shea butter processing
- Shea soap making
- Groundnuts processing

Some of the above technologies are integrated ones, and therefore have multiple dimensions across the categories. In this manual, those technologies are explained in one of two categories [Crop production] or [Livestock development].

From the next section, the characteristics of each category are explained from the aspects of (1) human/social, (2) materials/preparations, (3) implementation process, and (4) agro-ecological/miscellaneous. These aspects should be taken into account for effectively disseminating the agricultural technologies.

1.1.1 Crop Production

(a) Human/Social aspect

When we introduce any kind of new technologies, it is essential to consider not only technical but also socio-cultural and religious aspects of a community. Due to socio-cultural or religious reason, people may not accept newly introduced technologies including new varieties. For instance, through the Study it was revealed that a high yielding variety of sorghum was introduced to the community people once, but it was not much successful because *TZ* prepared from this variety was not accepted by the people. In some communities, early variety is not preferred because the communities can start harvesting only after performing a ritual for the commencement of the harvest season. The farmers have to wait for harvesting it until such ritual event takes place.

It should also be considered that, by introducing the new technologies, how easy farm will be managed, to what extent farmers can understand the technologies, etc. For example, in the case of an improved variety of cowpea, it was not accepted simply because the community could not handle the extra management practices such as pest control involved in its cultivation.

(b) Materials/Preparations

When a farmer or a group of farmers wants to use one of the technologies, the following materials are prerequisite or required:

* cultivation tools such as hoe, shovel, cutlass, axe, etc.
* improved seeds and/or seedlings
* fence for protecting newly germinated plant and/or transplanted seedlings (especially in case of planting of mango trees).

Agricultural Tools Supplied to the Communities

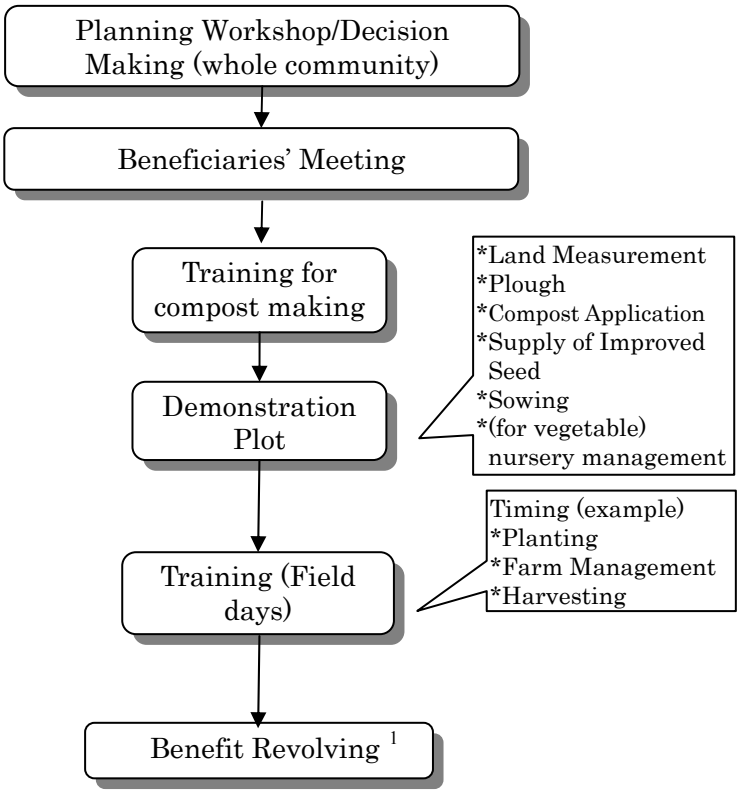
Improved Vegetable Seeds Supplied to the Communities

In some cases, the following preparations are required:

* land excavation for compost making after identifying a suitable place

Regarding the contact persons and/or resource persons from whom the above-mentioned materials can be obtained/purchased, see Appendix C.

Implementation process (Integrated Farming)



[1] Benefit revolving will be applied only when the first beneficiaries are supported by the resources from outside.

(c) Implementation Process

Implementation process of Integrated Farming are shown in the previous page.

It is important to note that the community people should be involved from the beginning of planning process, i.e., planning workshop and decision-making. It is also recommended the whole community be involved in the process once a year.

(d) Agro-ecological Aspect

i) food security crops and cash crops

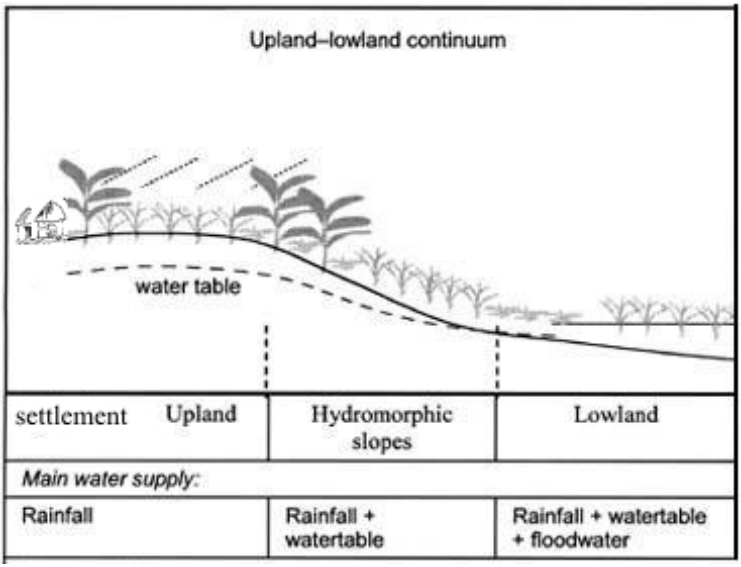
The crops dealt under the PDAs of this category can be divided into two, i.e., food security crops and cash crops. One of major points to be kept in mind are "post harvest" aspect in case of food security crops, and "marketing" aspect in case of cash crops. The reduction of post harvest loss will have an equivalent effect of increasing in yield.

Food security crops	Cash crops
Sorghum, Cowpea	Mango, Groundnut, Vegetable

ii) Soil and topographical condition

Soil and topographical conditions should also be taken into account when disseminating the technologies under this category. The criteria are shown in the following table and figure:

Condition	Crops	Remark
Upland	Sorghum, Groundnuts Cowpea, Vegetable	Sorghum: drought tolerant variety
Hydromorphic	Vegetable, Cowpea Groundnuts	
Lowland	Rice (rainy season), Vegetable (dry season)	



iii) Compost

Compost is effective for both improving soil, especially its physical structure, and increasing the yields of crops. Improvement of the soil by compost however will take long time and laborious. A lot of organic matter is required. It can be said that collection of organic matter is the key for compost making and extensive application to upland crops may not be feasible. Animal dung is a good material for making compost, so it can be combined the activities under both crop production (especially vegetable production) and animal production. Most of the cases, in the UWR, animals are not kept in the run, and therefore the way to collect animal dung should carefully be considered.

1.1.2 Animal Production and Rearing

(a) Human/social aspect

When introducing the technologies under this category, social aspects should be taken into account; for example, pigs are taboo for Muslims, guinea fowls are given to bride family as a ritual gift preferably in some communities, etc.

Though traditionally animals have been reared as a sort of safety nets in the UWR, it is important to keep marketing aspect in mind to commercialize the activities. For effective marketing, it may be good to form groups for the activities. When activities are conducted by a group of farmers, the responsibilities of the members for taking care of the animals must be clearly understood and agreed. The same caution should be taken for the ownership of animals and/or distribution of reproduced animals.

(b) Materials/Preparations

When a farmer or a group of farmers wants to apply one of the technologies under this category, the following preparations are required:

* construction of piggery or hut for animals (guinea fowls or rabbits)
* fabrication of beehives

For the details regarding the dimensions of hut, see the appropriate section of "Instruction Manuals for Agricultural Technologies and Tools".

In addition, farmers must obtain the following materials:

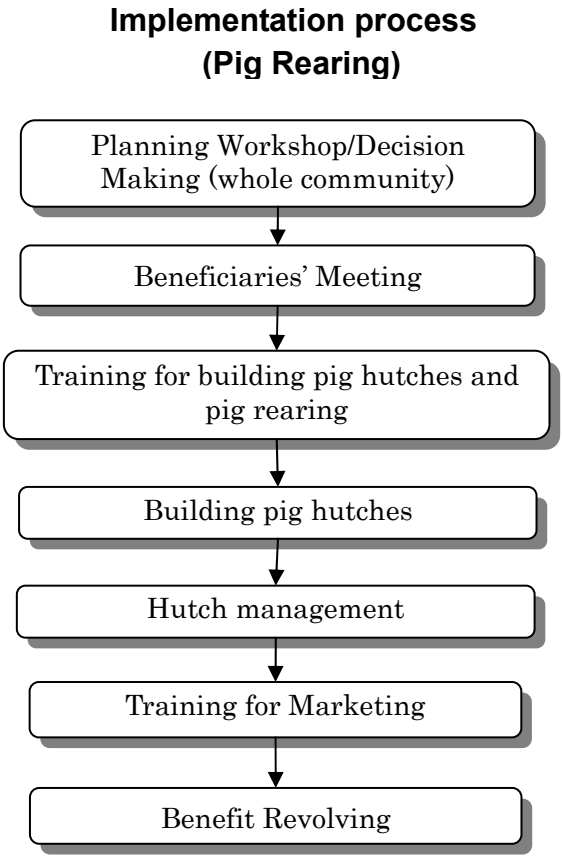
* feeding materials
* beeswax

For the details of the feeding ingredients and its proportion for pig rearing, see the appropriate section of the said Manual.

The contact persons and/or resource persons for purchasing/ preparing material are shown in Appendix C.

(c) Implementation Process

Implementation process of Pig Rearing is shown below. It is important to note that the community people are involved from the beginning of planning as well.



(d) Miscellaneous

* It is important to take care of animal health including regular vaccination. For this purpose, cooperation with Technical Officer (TO) of Veterinary Department is essential. If the community people select the technologies under this category, it is recommended that AEA and TO visit the community once together and TO be introduced to the community people so that the community people can access to veterinary services smoothly;
* Animal dung is a good material for composting;
* Some of the feeding materials can be grown/produced in the farmers' field. If farmers produce such feeding materials at their fields, it may help reduce feeding costs. In any case, however, some of the feeding materials should be purchased from market.
* Marketing aspect of fatten/reproduced livestock should also be kept in mind.

1.1.3 Processing

(a) Human/social aspect

Most of the cases, women folk are involved in processing activities. One of the interesting aspects of the processing is that women folk are enjoying some autonomy in making decisions and do not depend on their husbands for capital to start activities such as agro-processing and *pitoh* brewing, although the communities are basically male-dominant in the UWR.

It is highly recommended to organize a group of beneficiaries (women) when applying the technologies under this category. When the processing activities are conducted by the groups, it is important to train them for effectively managing the organization. Training for book-keeping is also essential so that they can record the balance properly in order to make sure the activities are profitable. From the same point of view, training in marketing aspect is important.

Furthermore, participation of women folk in this practice may help empower the women.

(b) Materials/Preparations

When a group wants to apply one of the technologies under this category, it is required to obtain the following materials and equipments:

[Materials]

* materials for making shea soaps such as shea nuts, palm oil, kaolin powder, caustic soda, colour and perfume
* Groundnuts for extracting oil (and making *kurikuri*)

Regarding the raw materials such as shea nuts and groundnuts, it is preferable to collect or cultivate by beneficiaries themselves as much as possible rather than purchasing all of the required quantities from market to keep the profitability as high as possible[2]. A community where the people can easily collect shea nut within the area and its surroundings is suitable for shea nuts processing.

[Equipments]

* various vessel and equipments (bowls, bucket, aluminum pot, scale etc.) for processing
* crusher for shea nuts

[2] If they purchase materials, it is recommended to purchase them during the cheapest period in a year in order to achieve maximum profit. In case of shea nuts, it is from June to August, and for groundnut it is from October to December.

For these equipments, maintenance is important in order to use them as long as possible.

The contact persons and/or resource persons for purchasing/ preparing material are shown in Appendix C.

(c) Implementation Process

Implementation process of shea soap making is shown in the next page. It is important to involve women from the beginning of planning process. As mentioned above, training for group-dynamics and book-keeping are essential.

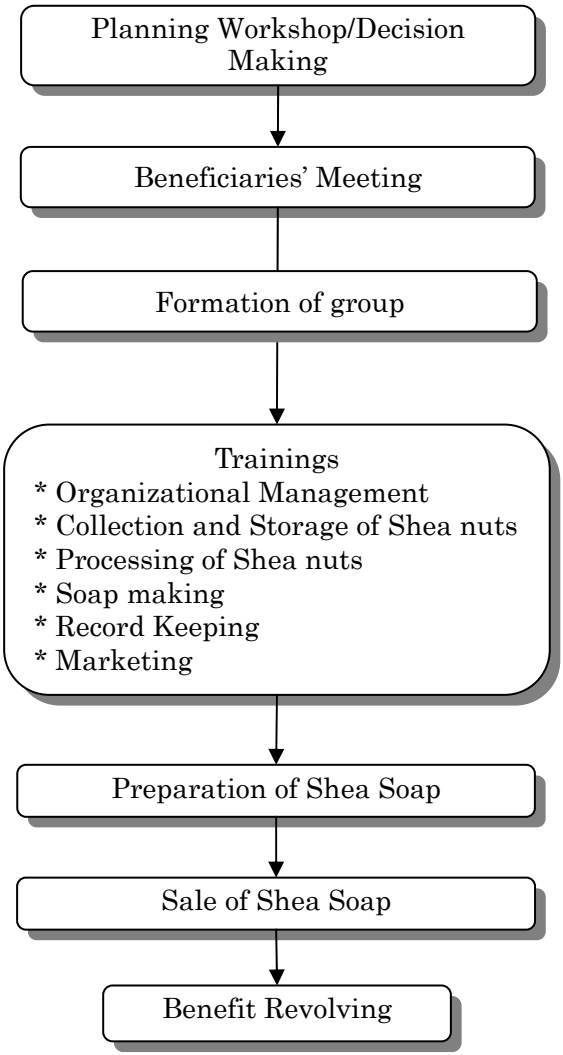
(d) Miscellaneous

It is important to produce quality products to make the activities profitable. From the same point of view, it is also important to know marketing situations around the community.

The other remarks are:

* for most of the processing technologies, as it is required to heat materials, 'energy sources' such as firewood, charcoal, gas, etc. are needed.
* in order to avoid contamination during boiling process, plenty of clear water is required.

Implementation process (Shea Soap Making)



BOX-1 Benefits of Group Approach

It is recommended to apply "Group Approach" for all the technologies mentioned above. The benefits of group approach are as follows:

* Labour can be shared among the members; for example, cultivation, collection of compost materials, harvesting can be done collaboratively
* Enable better access to various services (training, advices, credit, and information)
* Facilitates group learning and experience sharing
* Motivates others to work better through competition among the group members
* Reduces transaction costs for buying necessary inputs or selling outputs
* Increases farmers' bargaining power with traders
* Facilitate savings and make access to credit easier

1.2 Classification of the Areas

Due to the shortage of staff, there are communities where no AEA is stationed or actually takes care of. The main issue is who should disseminate agricultural technologies to those communities. The areas can therefore be classified into two types depending on whether an AEA is stationed or not.

1.2.1 Areas where AEAs are Stationed

In an operational area where an AEA is stationed, the AEA has a rotational schedule to visit the communities in that operational area. The AEA can visit the communities often based on the rotational schedule although he/she tends to visit the communities more frequently where he/she resides and nearby communities.

The AEA should be well known by the people in such communities, and the AEA himself/herself must have good knowledge about the socio-economic and agro-ecological conditions of those communities. In such case, extension of agricultural technologies can be AEA-led, i.e., extension activities should be taken care by the AEAs.

Nevertheless, it should be noted that further technology transfer among the community people is done by "Farmer to Farmer" extension as mentioned below.

1.2.2 Areas where AEAs are not Stationed

In an operational area where an AEA is NOT stationed, the AEA can seldom visit the communities. Even if an AEA is stationed in an operational area, he/she cannot visit some communities in that area easily because of distance or other reasons. Under such situations, the AEA should expect the community people to disseminate the technologies. It means that the way of extension of agricultural technologies should be farmer-to-farmer or community leader(s)-led extension. If extension volunteers who have been trained through some other projects or NGOs working in the community, those volunteer farmers can assist the AEA. The Agricultural Committee should be organized by the community leaders and extension volunteers to supervise all the related activities.

Chapter 2 Extension Methods

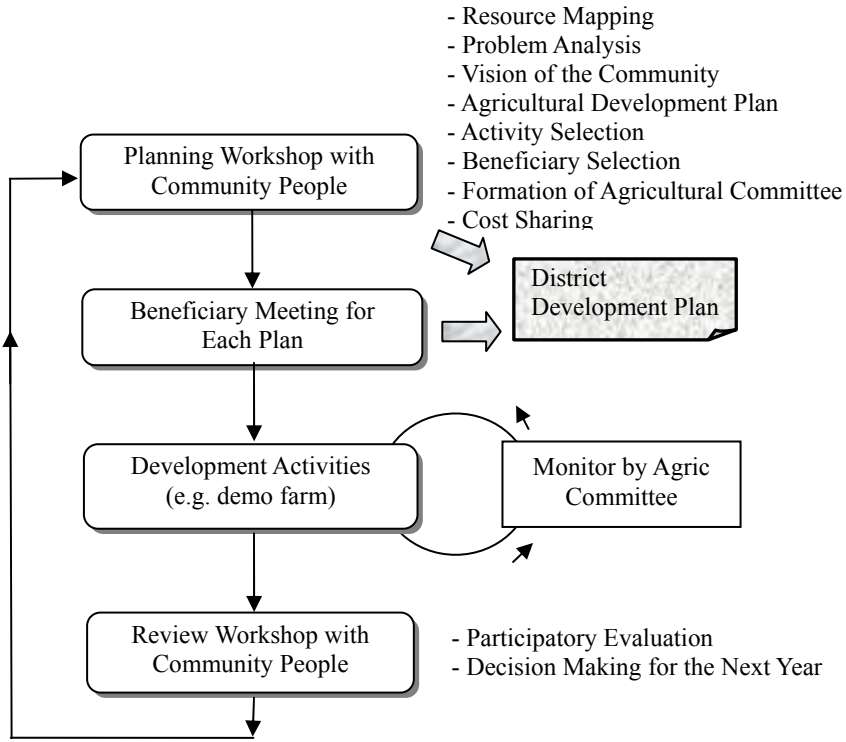
Extension by AEA
- Apply for the communities where an AEA is stationed and the nearby communities.
- The AEA plays a key role.
- Technologies should be transferred intensively by concentrating on targeted communities

Extension by Community Leaders
- Apply for the communities where an AEA is not stationed or an AEA can seldom visit.
- The role of the AEA is minimal, and instead the agricultural committee organized by the community leaders and extension volunteer(s) of the community plays the key role.
- Technology transfer takes place wider than it used to be.

2.1 Extension by AEA

The AEA-led extension approach for disseminating agricultural technologies can be considered for a community where an AEA in-charge is stationed and the nearby communities. Implementation processes for crop production, animal production and processing are shown in the previous chapter, which an AEA should take the lead. Those processes can be broken down as shown in the following chart.

One of the major reasons why we take this approach is to make the activities visible to the community people as much as possible and have them aware that an AEA is assigned for disseminating the technologies that they need. The other reason is that decision can be made by the community people themselves so that they may feel ownership for the implementation of the development activities.



i) Workshop

The process will be started from calling the community people to the planning workshop, through which DAOs and AEA will ask the community people to prepare "resource map", "problem tree" and "objectives tree". These activities allow the community people to identify their own problems and find solutions by themselves. As we are now concerned with only agricultural development of the community, the "core problem" in the problem tree should be closely related to agriculture. Based on the identified "approaches" from the objectives tree, the community people may select one or few of activities that they prefer.

See more details of the participatory workshops in Appendix B.

It is recommended to hold the workshop session during slack season

(i.e., dry season). For coordination with veterinary services, it is a good idea to involve TO(s) in the workshop.

Ideally, at least one person from one household should be involved in this process so that each and every person in the community may know that what activity is taking place. Therefore, inviting as many community people as possible to participate into the workshop is one of the key tasks of the AEA. Before having participatory workshop, the AEA may need to contact some key persons of the community such as chief, traditional leasers, opinion leaders and so on for the invitation of the people and preparation of the workshop. It is important for the AEA to know about social structure, especially leadership structure of the community.

ii) Decision-making

Decision for the selection of the development activities and the participants, who can be called as "Beneficiaries" or "Cooperating Farmers", should be made by the community people rather than only the limited personnel such as chiefs, traditional leaders, etc. The selection of the development activities is done by identifying "approaches" in the objectives tree, while the AEA leads the direction. With the priority, one or a few activities will be selected from the "Menu" by the community people. "Approaches" which are not selected can be included in the 5 year plan of the community. Those discussions and decisions can be brought to the district agricultural offices and incorporated into the District Development Plan.

The "review workshop" is held at the end of the year. In the review workshop, the community people reflect back on the activities done in that year and decide the activities to be done for the next year.

As it may take a few years to get the expected results from the development activities and for the beneficiaries to be able to acquire the related technologies properly, some activities may continue for a few years after reviewing the results of the activities.

iii) Formation of Agricultural Committee

An "Agricultural Committee" is formed in the community where the development activities are to be implemented so that fairness and transparency can be secured and a sense of ownership of the community people can be developed. The role of the committee is mainly to manage the demonstration activities including "field days" with the AEA. The formation of the "Agricultural Committee" should be done through selection or election of the members by the community people. The members of the committee may be the chiefs, traditional leasers, opinion leaders, extension volunteers, school teachers (ex-teachers), ex-agric. officers, voluntary-farmers, and so on. The AEA should respect the results of selection or election by the community people. The AEA plays an important role in the committee as a facilitator/ secretary of the committee.

iv) Beneficiary Meeting

After selection of the development activities and its beneficiaries by community people, a detail discussion and the first training for the selected activities are held with the beneficiary farmers.

v) Demonstration

The process and the methods are the same as what the AEA usually conducts in the communities, i.e., setting up demonstration plots with help of "cooperating farmers". The AEA should regularly visit the demonstration plots.

However, there are slight differences. The contents of the activities might be new for the AEA and therefore he/she should undergo technical training on the topics from RAOs or other experts. Another issue is the monitoring method. As mentioned above, the monitoring is not done only by the AEA or limited individuals alone, but through the Agricultural Committee.

For effective technology transfer to farmers, "field days" are organized, for which as many farmers as possible are invited from the community.

2.2 Extension by Farmer to Farmer

For the communities where an AEA is NOT stationed or an AEA can seldom visit, the extension approach should be "farmer to farmer" or community leader(s)-led. The process of the extension will be almost the same as the extension by an AEA, except for the way to conduct the demonstration. Involvement of DAO/AEA in Planning Workshop, Beneficiary Meeting and Review Workshop is essential. Although the demonstration activities need frequent visits by the AEA, it is difficult for him/her in this case. It should therefore be run/managed by the farmers (beneficiaries such as cooperating farmers) and monitored by the Agricultural Committee. It is still important for the AEA to keep contact with those people in one way and another e.g., via mobile phone.

Whilst the demonstration will be run/managed by farmers and monitored by the Agricultural Committee, cooperating farmers in such communities should be invited to the field days whenever it is held at the nearest demonstration plots by the AEA. Later, these cooperating farmers should conduct their field days in their community by showing whatever they have learnt. For such cooperating farmers, an intensive training on basic agricultural knowledge should be given through the district office before starting the field days.

2.3 Extension with Other Organizations

For communities where any other organization such as NGO is working, the AEA may get help from staff of such organization, especially for entering to the community and for holding the workshops (Planning Workshop and Review Workshop). The extension method in this case should be basically the same as the above-mentioned "Farmer to Farmer extension" .

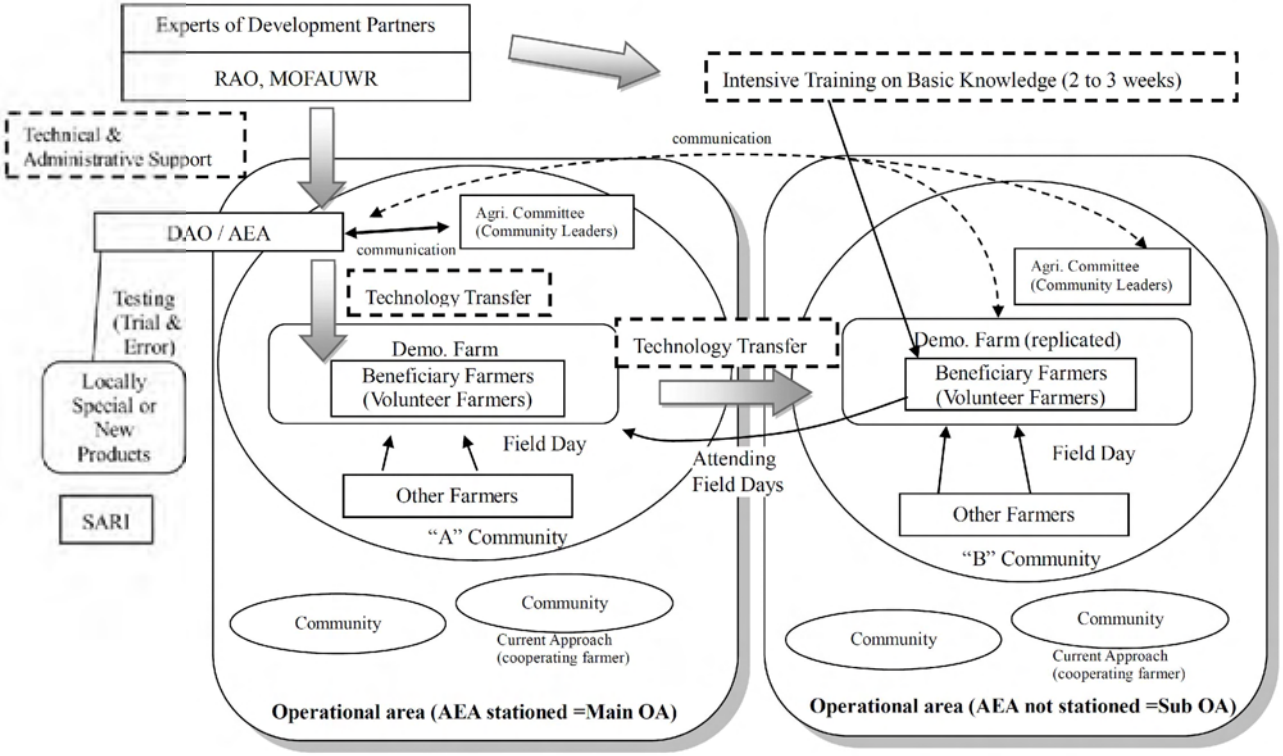
BOX–2. A story of a farmer who is getting onion seeds from his own field.

One day, a horticultural specialist was passing through a community in Lawra district and found a field in which onion was bolting. He was surprised because being a horticultural specialist he knew that under the tropical environment onion never bolts and therefore seed cannot be formed. But that onion was bolting!

According to the farmer of this field, he obtained this technologies from the Upper East Region, while he was working under an onion farmer. He just follows what he has learnt in the Upper East. It is obvious that he has accepted the technologies because he felt that it is useful and beneficial for him. Likewise, farmer-to- farmer extension can be carried out smoothly if we can clearly show the benefits to the fellow farmers.

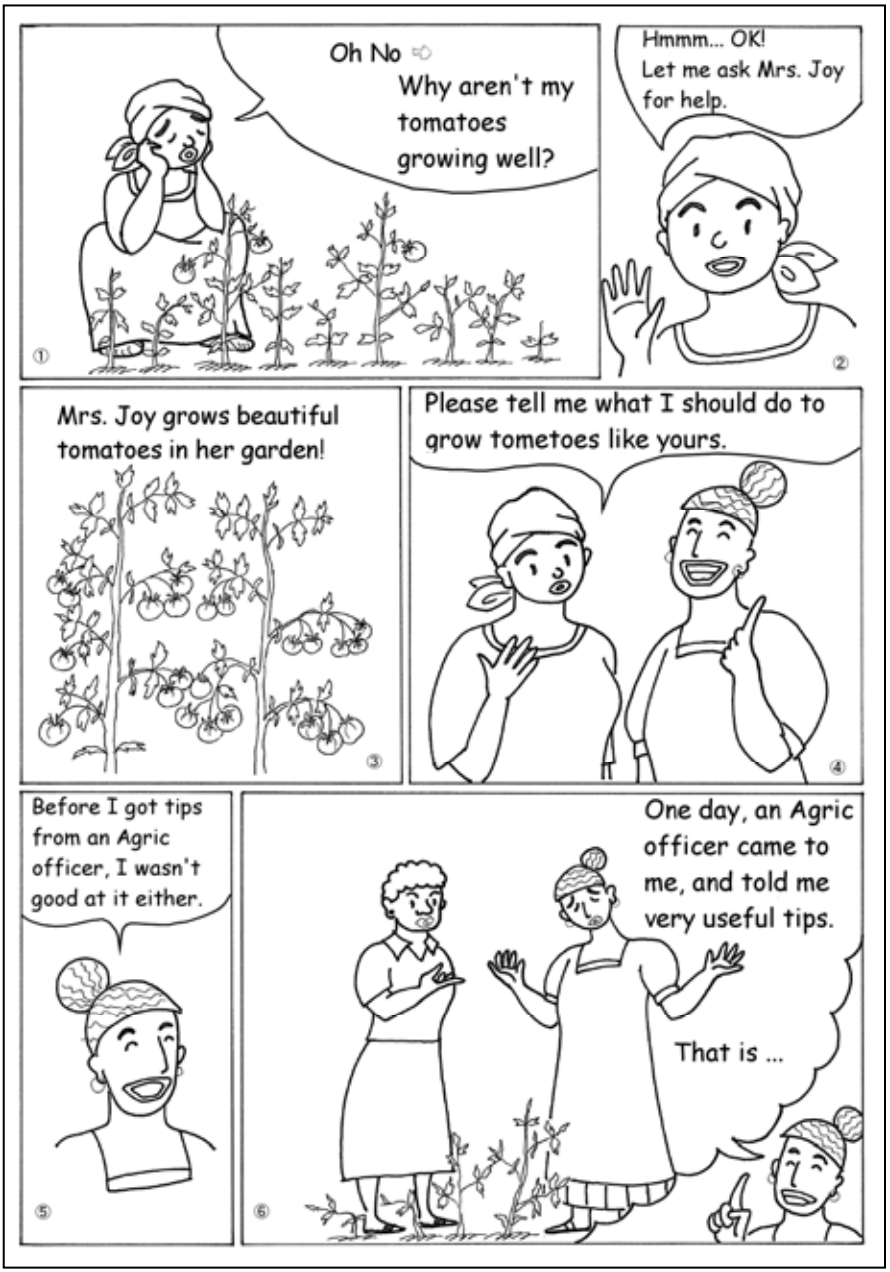
Form this point of view, it is important to find out such products, which can be called as "locally characteristic products", by trial and error. DAOs and AEAs can make this trial and error at the district offices' premises or at cooperating farmer's fields. If a product is found, it can be added to the list of the proposed agricultural technologies (See Appendix A for the detail).

In the chart on the next page, the above-mentioned way of extension is shown.


Experts of Development Partners
RAO, MOFAUWR
Intensive Training on Basic Knowledge (2 to 3 weeks)
Technical & Administrative Support
communication
DAO / AEA
Agri. Committee (Community Leaders)
communication
Technology Transfer
Testing (Trial & Error)
Locally Special or New Products
SARI
Demo. Farm
Beneficiary Farmers (Volunteer Farmers)
Field Day
Other Farmers
"A" Community
Technology Transfer
Attending Field Days
Agri. Committee (Community Leaders)
Demo. Farm (replicated)
Beneficiary Farmers (Volunteer Farmers)
Field Day
Other Farmers
"B" Community
Community
Community
Current Approach (cooperating farmer)
Operational area (AEA stationed =Main OA)
Community
Community
Current Approach (cooperating farmer)
Operational area (AEA not stationed =Sub OA)

The cartoon in the next page can be used for explaining the importance of cooperation and learning/teaching each other among farmers, which is the basis of "farmer-to- farmer extension".

Let's learn and help each other!



⑦

nursing,... transplanting,... pruning,... and harvesting at proper timing.

In addition, as my initiative, I started getting seeds by myself

First, take pulps & seeds from well matured tomoto, wait for fermentation, and wash and dry them!

⑧

⑨

Appendix A. Extension Methods in General

A.1 Research and Extension

Extension and research are closely related. As mentioned in BOX-2, it is important to find out a new or locally characteristic product which can bring benefits to farmers so that farmers may willingly accept the production technologies. For finding such product, "research" or "trial and error" is required. In this case, the research is not "paper-oriented", but "extension-oriented". A lot of research is being conducted under SARI, and it is important to coordinate with SARI and receive the valuable and latest information. By adding to it, from the view point of extension and rural development, e.g., empowerment of the communities, there should be "extension-oriented" research to seek something to vitalize the communities by taking full advantage of local resources.

Research conducted by extension agents can be categorized into two types, (i) problem-solving type and (ii) project type.

Firstly, RAOs/DAOs/AEAs should identify the needs of the farmers. For the problem-solving type, the needs rise from the problems which are actually happening in farmers' fields. As it is sometimes urgent, RAOs/DAOs/AEAs have to search the solution. For the project type, the needs come from vision or goals that farmers are dreaming. In the former case, it will be better to tackle the problems with help of experts in a research institute rather than making trial and error alone. In addition, no doubt, the needs of the community people should be considered, but it should be noted that the needs are sometime faint and they do not have any idea what should be introduced as a locally characteristic product.

RAOs/DAOs/AEAs then decide what to conduct. Trial and error will be made for finding a local specialty.

For finding local specialties, “One Village One Product” (OVOP) Movement in Japan is a good example. OVOP Movement is as follows:

1) OVOP is a local specialty development program
2) Started in 1979 by the Governor of Oita Prefecture
3) Aim to revitalize the region by taking advantage of local resources
4) One village/town/city can select more than one product
5) Selected products (OVOP) are registered in Oita Prefecture through the local government

Three Basic Principles of One Village One Product Movement are:

1) Local yet Global
2) Independence & Creativity
3) Human Resources Development

In the following picture, local specialties in Oita Prefecture (equivalent to district) are shown. You may understand that almost each and every sub-district has their own local product.

A.2 Extension at the Field Level

In general, depending on the scale of the targets, extension methods can be divided into three categories, i.e., Mass, Group and Individual. Table A-1 shows the extension methods under each category. Table A-2 describes more details of each extension method.

Table A-1. Mass, Group and Individual Extension Methods

Category	Methods
Mass Media and Audio Visual Aids	Radio Newspapers Print Media and Audio Visual Aids
Group Extension Methods	Demonstrations Field Days Fairs Farm Walks Farmers Rallies Folk Media Group Meetings Motivational Tours Participatory Technology Development Training Days Farmer Field School
Individual Extension Methods	Individual Farm Visit

Source: Department of Agricultural Extension, Government of Bangladesh (1999)

Table A-2. Description of Extension Methods

a) Mass Media and Audio Visual Aids

Extension Methods	Key Points
Radio	This method has the potential for large audiences. Use of the radio can be enhanced through the establishment of Radio Listening Groups and linking with Local Radio Station through the regional office.
Newspapers	This method has the potential for large audiences. (Don't forget there might be illiterate farmers in villages.) Use of this method can be enhanced through Newspaper Reading Groups with literate farmers. Articles can be submitted to local newspapers about: 1) successful technologies in the region. 2) actions that should be taken in the event of emergency situations.

b) Group Extension Methods

Extension Methods	Key Points
Print Media and Audio Visual Aids	This method helps to make extension events more interesting. Scope for reusing resources particularly if a Resource Centre with a stock of flip charts, slide sets, real objects and displays, flash cards, posters and other materials is developed. Materials can also be shared with other organizations.
Demonstrations	There are numerous types of demonstrations, which can be used to show farmers a new technology or the benefits of modifying existing practice.

Field Days	The method enables groups of farmers to meet together to show firsthand demonstration sites, encourages farmers to participate and allows the host farmer to act as the resource person.
Fairs	Fair has potential to reach large number of farmers. Show a variety of technologies and innovations and encourage partnership with other extension agents. Requires significant planning and funding.
Farm Walks	This method has a variety of uses. For example, they can be used to show farmers a new technology, can help farmers analyze farm problems, or help groups plan further activities. They can also be used to stimulate permanent and temporary farmer groups.
Farmers Rallies	Use a combination of methods (e.g. song, drama, presentations, banners, prize giving) to introduce and / or reinforce a technology to a large number of farmers. Working with partner agencies increases cost effectiveness and interest.
Folk Media	Effective when linked to other extension activities such as fairs or rallies. Simple messages are used to relay important information in an informal way. Examples include, puppet shows, drama and songs.
Group Meetings	Many people use this method because they are cost effective. For example, radio listening groups or as a way of enabling farmers to discuss problems, develop plans, plan extension events, and explore new ideas. It can be made more effective if visual aids are used to stimulate discussion e.g. flash cards, posters, or real objects.
Motivational Tours	Motivational tours are like farm walks but are conducted further away from the farmers' homes, e.g. visits to research stations.

Participatory Technology Development	A low cost method, which encourages farmers to try new technologies on their farm as an experiment, rather than a demonstration. Farmers are able to select technologies according to their needs, resources, and local environment. Support and advice are provided by experts but inputs are obtained by the farmers themselves.
Formal Training Days	This method is used to train groups of farmers for a particular technology. It can last one day and can be held at any level, either village or district. It is more effective if supported by audio / visual aids. Training materials require significant planning and preparation.
Farmer Field School	Enables groups of farmers to be trained over an extended period (e.g. a cropping season) using regular classroom and field activities. Emphasizes participatory, action based and problem solving learning.

c) Individual Extension Methods

Extension Method	Key Points
Individual Farm Visit	Enables field staff to identify and analyze the main problems facing an individual farmer or household and provide advice on possible solutions. Individual visits also provide opportunities for extension staff to learn about an area or innovative farm practices. As it is a potentially expensive extension method, it requires careful planning. Working with groups of farmers is preferable wherever possible.

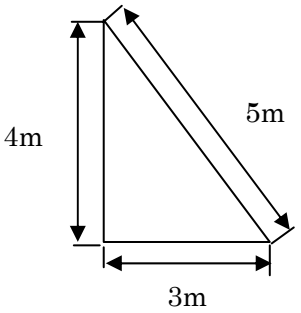
Source: Department of Agricultural Extension, Government of Bangladesh (1999) (modified by the Study Team)

A.3 Setting Up a Demonstration Farm

The procedure for setting up a demonstration farm is as follows:

1) A cooperating framer(s), who can voluntarily offer land and labor for the year for setting up a demonstration farm, need to be identified. It is important to know about social set-up of the community regarding decision-making on land ownership as well as land utilization. Most of the cases, the landlords and lineage heads have the control over community lands both for practical and spiritual purposes, and they have authority for decision-making on land and the imposition of sanctions on abominable acts regarding land use.
2) It may be better if the demonstration farm can be set up at the place where many people can easily recognize. One of the options is at roadside. To put a sign board to indicate that it is the demonstration farm is worth consideration.
3) From the viewpoint of equity, a cooperating farmer(s) should be altered year by year.
4) It is worth doing to set up "control" plot in which the conventional farming method in the area to be applied, so that we can see the difference between conventional method and a technology to be demonstrated.
5) For proper comparison, it is important to measure the yield when harvesting.
6) with regard to 4) and 5), it is recommended to select the place where it is flat and has enough space to secure the areas for both demonstration and control properly in rectangle shape. See the following box (BOX-3) for making corners at right angles.
7) It is important to organize "field days", in which the farmers in the community should be invited as many as possible in order to demonstrate and transfer new technologies. In the field days, farmers from other communities can also be invited.

BOX–3. How to make corners at right angles



It can be done by using the famous Pythagorean triangle shown in the figure on the right side. The typical combination of figures is 3 - 4 - 5. The way to prepare the demonstration plot is as follows:

1) Select a place and decide the dimension where demonstration plot is to be set up.
2) Define the long side of the rectangle by using a tape-measure. (e.g., 20m)
3) Put pegs at the both ends as well as at the center. (e.g., at 0m, 10m and 20m)
4) Put a string between these pegs.
5) Rewind the tape-measure.
6) With help of three persons, let them grab the three point of the tape-measure at 0m, 5m and 9m.
7) The person who grabs 0m should move to the point of 12m. He/she will grab both 0m and 12m.
8) The three persons should gently strain the tape-measure each other with the unique strength. Now you can see the Pythagorean triangle.

9) The person who grabs at 9m should move to the corner and the person who grabs at 5m should move on the string which was put in the step (4). Place the triangle along the string.
10) Extend the tape-measure beyond 12m up to the desired length of the short side. (e.g., up to 22m. It means the length of the short side is 10m) Place the tape on the ground, while taking care to make the part of the tape between 9m - 12m and the part beyond 12m be straight line.
11) Put a peg at the end of the short side and then put a string between 2 pegs.
12) Repeat the same (5 to 11) on the other end of the long side.
13) Measure the distance between the two ends of short sides and confirm the length is the same as the other long side. Put a peg at the center of the side and connect 2 center pegs. You can have two equivalent plots.

Appendix B. Participatory Workshops

B.1 General Modules of the Workshop

A number of participatory approaches with various terminologies, such as Participatory Action Research (PAR), Participatory Learning and Action (PLA), Participatory Rural Appraisal (PRA), Rapid Rural Appraisal (RRA), etc., have come into practice over a period of time. The participatory methods related to the problems analysis, objectives analysis and the resource map are explained hereafter.

1) Problems Analysis[3]

The Problems Analysis sorts out the existing problems in the target area by applying the relationship of "**Causes and Effects**," It visualizes the problems by developing a **Problem Tree** for easily understanding the relationship. It starts by identifying the **Core Problem**, and the Tree is developed both upward and downward by considering the Causes and Effects of the Core Problem.

2) Objectives Analysis[4]

The Objectives Analysis, like the Problems Analysis, is to develop an analytical tree by clarifying the relationship between the desired situations to be realized by solving the problems and the means that lead to the situations in the form of "**Means and Ends**" relation.

Whereas the Problems Analysis is to clarify the "existing situations," the Objectives Analysis aims to find all possible solutions. This will be the basis for the implementation plans.

3) Resource Map[5]

The resource map is one of the most commonly used tools in the PRA method. The resource map focuses on the natural resources in the locality and depicts land, hills, rivers, fields, vegetation, etc. The resource map may cover habitation as well.

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[3] FASID (2008)

[4] FASID (2008)

[5] Kumar, Somesh (2002)

The resource map in the PRA is not drawn to scale. It is not done by experts, but by the local people. The local people are considered to have an in-depth knowledge of the surroundings where they have resided for a long time. Hence, the resource map drawn by the local people is considered to have a lot of useful information.

The resource maps have been found specially useful because they provide a focused spatial structure for discussion and analysis. They help to create a common understanding amongst the participants as well as a baseline for monitoring and evaluation. The process of creating the recourse map is full of joy and it instills self-confidence amongst the participants. The resource map is useful also for the analysis of the problems, solutions and planning for action. The resource map is used to facilitate discussions among the participants about natural resources, their entitlement and utilization, problems related to deforestation and soil-erosion, etc. The focus should gradually shift from the identification and prioritization of the problems to the planning of the future actions.

B.2 Facilitation Methods

The steps for performing the above-mentioned Problems Analysis, Objectives Analysis and Resource Map are explained here.

1) Problems Analysis

The methods/steps for conducting the Problems Analysis are as follows:

1. Select the core problem (focal problem).
2. Identify the direct causes of the core problem.
3. Develop the problems tree downwards (add causes).
4. Identify the direct effects of the core problem.
5. Develop the problems tree upwards (add effects).
6. Ensure that “cause-effect” relationships are maintained in the problems tree.

Tips for Writing Problem Cards

1. Write existing problems only.
2. Write only one problem per card.
3. Describe the problem in a sentence.
4. Do not include both cause and effect of a problem on one card
5. Try to avoid expressions such as "No resource is available." (Instead, describe the conditions resulting from the lack or absence of the particular resources.)

2) Objectives Analysis

The methods/steps for conducting the Objectives Analysis are as follows:

1. Identify the core objective.
2. Write the direct means for the Core Objective.
3. Develop the objectives tree downwards (add means).
4. Identify the direct ends of the Core Objective.
5. Develop the objectives tree upwards.
6. Ensure that "cause-effect" relationships have changed into "means-ends" relationships.

Tips for Writing Objective Cards

1. Describe desirable situations on the cards.
2. Confirm the statement whether it is realistic or not.
3. Confirm the statement whether it is feasible or not.
4. Add new cards if necessary.
5. You may not have to rewrite all the problem cards.
6. Do not become an automatic "translation machine."

While conducting the workshops, the following House Rules are applied commonly both for the Problems Analysis and the Objectives Analysis:

Workshop - House Rules

1. Write your own idea on a card.
2. Write only one idea on a card.
3. Describe in a clear and brief sentence.
4. Stick to the facts, and avoid abstractions and generalizations.
5. Write your ideas on the cards before beginning discussion.
6. Obtain a consensus when removing cards from the board.

In addition, some "Traffic Sign Cards" may be used, if discussion goes round and round on a single subject without any progress in the workshop. Cards indicating "doubt", "lack of information", "disagree, conflict or controversy" and "no more discussion or analysis is required" are being used.

After the Objectives Analysis, the "Project Selection" should be conducted by the following way:

Project Selection Procedure

1. Circle approaches on the Objectives Tree.
2. Name each approach to make its objective clear.
3. Confirm the key points of each approach.
4. Make selection criteria for prioritizing the approaches for the implementation.
5. Compare and examine the approaches in light of the selection criteria.
6. Select one approach to be developed into a project.

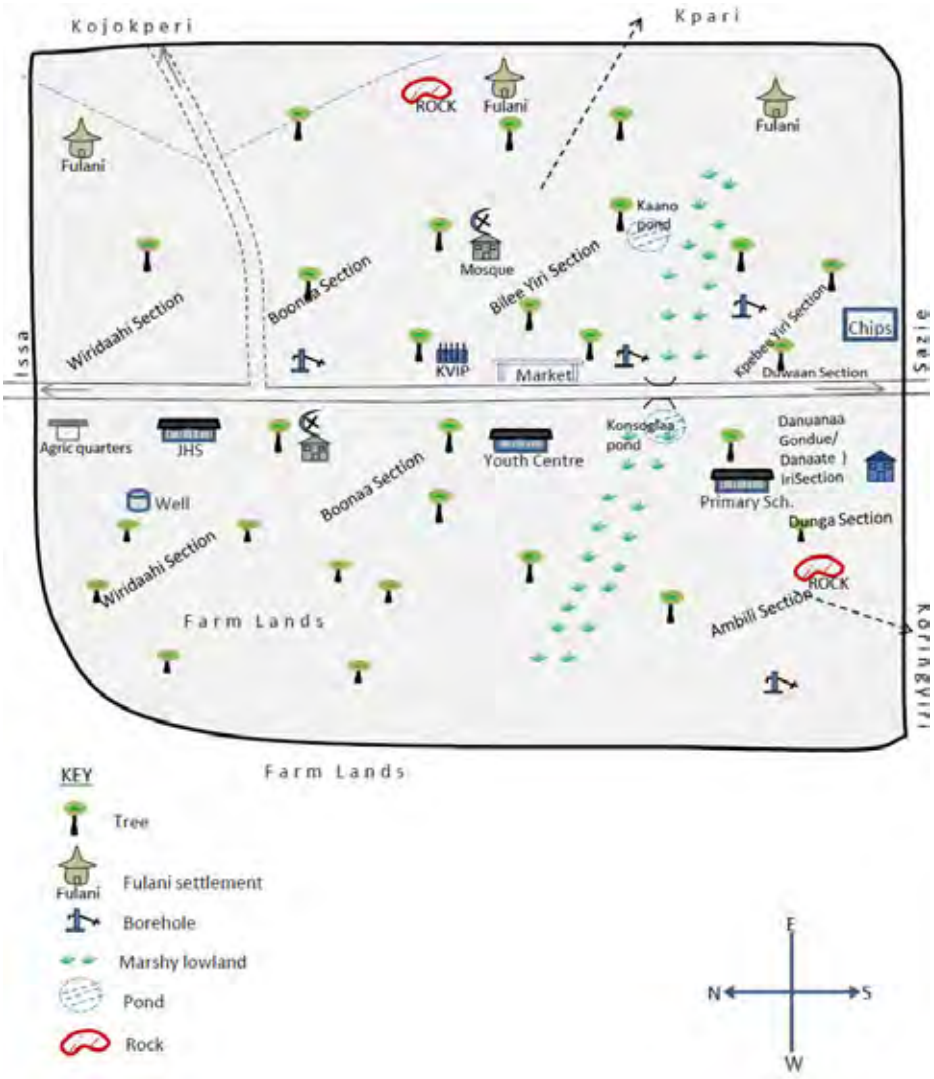
3) Resource Map

The main steps of the Resource Map are as follows:

- Select a proper place for preparing a resource map of the area in consultation with the local people. Fix the time and invite people from different sections of the society. Ensure that the marginalized groups and women participate.
- Start the exercise at the fixed time. First explain the purpose of the exercise.

- Ask them to start showing the major resources. Encourage them to use locally available materials in a creative way and to make the map as representative as possible.
- Do not interfere. Allow them to do it on their own. In case they get stuck, help them out.
- Listen carefully to the discussions they have, while preparing the map. Take note the relevant points.
- In case the participants are not representing the aspects you are interested in, be patient. Wait till the mapping process comes to an end. Ask them un-intrusive questions without disturbing the process. Some helpful questions include:
  + What about . . . ?
  + Can you show me . . . in the map?
- Ask them to explain the map including the various symbols, visuals and colours used.
- Ask them to depict and discuss the problems and opportunities, keeping the objectives of the resource map in mind.
- At the end, ask them whether anybody would like to make any modifications or additions.
- Keep eyes on who was actively involved and who was marginalized. Try to involve the marginalized groups and women in the process.
- Interview them on the map. It provides you with valuable insights into the status of natural resources. It helps you to clarify your doubts and know what you are interested in. The key questions can include:
  + Can you tell me more about . . .?
  + This looks very interesting. Can you explain it to me in more detail?
- Copy the map onto a large sheet of paper with all details including legends. Also, make a small-sized copy for the report and photocopies.
- Triangulate (crosscheck) what is on the map. One way is to go for a transect. The other way is to talk about the map with key persons in the community and get their feedback.
- Thank the participants for their active participation.

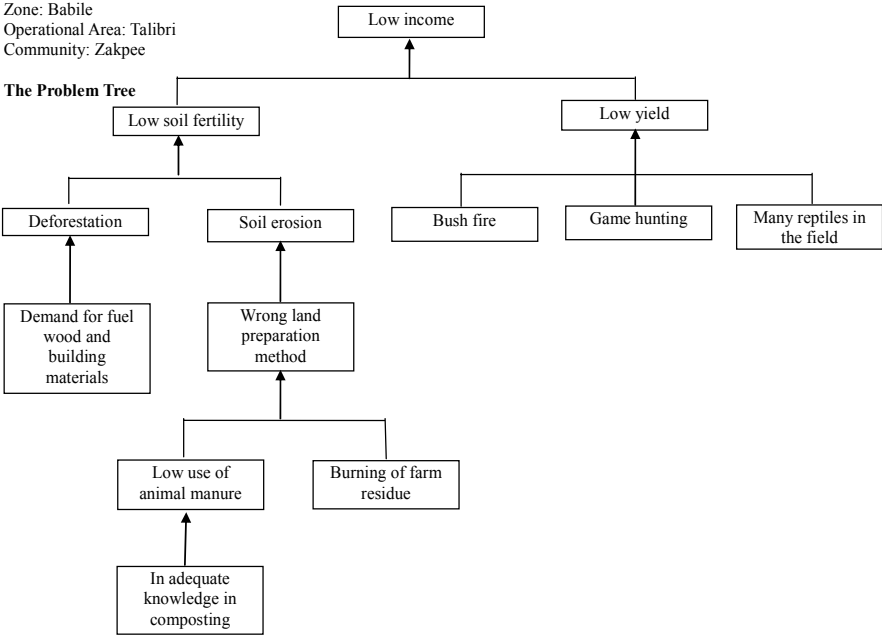
B.3 Outputs
(Example of Resource Map)



(Example of the Problems Analysis)

District: Lawra
Zone: Babile
Operational Area: Talibri
Community: Zakpee

The Problem Tree



Other problems raised

- Low price for farm produce
- High post harvest loss
- Theft of livestock
- Wrong cultural practice
- High mortality of livestock
- Inadequate use of early maturing variety
- Inadequate water source for watering animals and irrigation
- Inadequate knowledge in food processing and utilization
- Erratic rainfall

Problems and Solutions

Problem

Soil erosion

Solutions

- Ridging across sloping lands
- Stone lining / contour bands
- Non-burning of farm produce
- Making the use of compost and animal dung
- Planting of vertiva grass across the slopes

Bush fire

Solutions

- Formation of fire volunteers and their training
- Enact bye-laws against bush burning
- Create fire bells around community lands
- Communicating in writing to neighboring communities

The Problem Tree (Zakpee)

Appendix C Contacts

The following table shows a list of contacts (resource persons/organizations/ institutions).

Name of Item	Name of Person and place	Contact No.
[Agric Inputs]		
Certified Seeds/Pesticides/ Agricultural Tools (Agric Inputs in General)	Seyan Enterprise, P.O. Box 21, Wa, UWR (Mr. Osman Bazaara)	0756-22525 Mobile: 0244-958935
Mango Seedlings	Integrated Tamale Fruit Company Ltd. (ITFC), P.O. Box 763, Tamale, Northern Region	071-23223 Fax: 071-22375
Piglet/pig for breeding Feed for Pigs	Mr. Peter Kwasi Sarpoy, Farm Manager, Babile Pig Farm, Lawra District, UWR	Mobile: 020-8392616
[Other Materials]		
Beehives	Mr. Gaeten Beru St. Augustine's Modern Furniture Worlds P.O.Box 374, Wa, UWR, Ghana	0756-22639 0209-115873
Bee Wax	Naa Bob Loggah	Mobile: 0244-210608 0208-072290
Roaster for groundnuts	Gratis Foundation, P.O.Box 226, Wa, UWR Mr. Harruna, Manager Mr. Bede, Fabricator	0756-22211
Material for Shea soap	It's cheaper in Techiman (Contact RAO (WIAD) for the detail)	0277-864923 (Ms. Kutina)

Appendix D Proposed Agricultural Technologies

Agricultural Technologies	Description of the Technologies
Introduction of drought-tolerant varieties and farming methods	Production and dissemination of drought-tolerant varieties of sorghum and cowpea, and introduction of early-maturing varieties such as Dorado and Kapaala for sorghum, and Songotra and Apagbaala for cowpea
	Improvement of mix-cropping of late- and short-maturing varieties (mixture of improved and local varieties) to reduce the risk of being negatively affected by climate change
	Improvement of farming method by adopting ridge till method and increasing the cultivation density at available lands
Introduction of alley cropping	Cultivatation of food crops and legumes between mango and cashewnut trees by broadening the distance between the trees to allow alley cropping, and mix-cropping of legumes and early-maturing food crops or rotational cropping of groundnuts and soybeans.
	Mix-crop of pigeon peas and food crops/legumes by planting pigeon peas every few meters and other food crops between pegion peas.
Introduction of water harvesting method	Introduction of stone band technologies for sloping ground (adopt and improve the method introduced by DANIDA at Yagha area in Lawra-Jirapa western route)
	Restore of vegetation at degraded land by adopting "STONE MULCH", by applying it for fodder trees such as *Cajanus cajan, Leucaena leucocephala, Pithecellobium dulce,* and *Gmerina arborea*
	Introduction of water harvesting method at degraded land by making mound in a half circle- or v-shape to catch rain water
Measurement for soil erosion	Prevention of soil erosion by applying anti-erosion measures such as agroforestry

Agricultural Technologies	Description of the Technologies
Improvement of post harvest technologies for food crop	Improvement of threshing and drying technologies, by not doing it directly on the ground but on tarpaulin to maintain the quality of crops and to reduce loss.
	Improvement of crop storage technologies, including construction methods of storage facilities

Agricultural Technologies	Description of the Technologies
Improvement of marketing skills	Improvement of marketing skills of the farmers on negotiation skills, joint marketing and other basic marketing skills such as access methods to useful market information
Collection and use of livestock dung	Collection of animal dung efficiently by keeping animals in a run to apply it for furrow at vegetable fields, and also to cultivate vegetables at the run.
Introduction of compost making and use	Compost making by utilizing existing resources, including collection and use of dead leaves and animal dung
	Effective and efficient use of compost, by concentrating it at the area around the trunk of fruit trees and the furrow at vegetable fields.

Agricultural Technologies	Description of the Technologies
Expansion of small scale irrigation	Dissemination of vegetable cultivation such as tomatoes, onions, okra, and cow peas with small scale irrigation at flood-prone areas
	Introduction of small-scale-irrigation using manual pump along the rivers
Livestock development	Introduction of commercial pig farming technologies, with Babile Pig Breeding Station to be responsible for the provision of technical training and arrangement of feedstuff
	Promotion of exotic guinea fowl breed
	Dissemination of rabbit farming technologies
	Improvement of efficient goat/sheep rearing technologies
	Introduction of livestock processing technologies such as salting, drying and smoking
	Dissemination of cultivation technologies of pasture grass around wells/boreholes where drain water can be used

Agricultural Technologies	Description of the Technologies
Introduction of bee keeping technologies	Introduction of bee keeping technologies, including the skills of making bee keeping box and processing honey
Improvement of Agro-processing technologies	Dissemination of processing technologies for soybeans, groundnuts, and fruits, by using grinder and roaster for soybeans and groundnuts and using hygienic drying equipments for fruits
	Dissemination of cashew nut processing technologies, including simple frying method
	Improvement of shea nuts processing and soap production technologies of women groups, including packaging and marketing skills
	Improvement of dawadawa processing technologies by introducing the concept of sanitation and hygenic environment for production
	Dissemination of drying vegetable technologies

Appendix E Agricultural Technologies Verified through the PDAs

District	Community	Project Title	Project Contents	Agricultural Technologies Verified through the PDAs	Crops or Livestock Included in the PDAs*
Lawra	Puffien	Integrated Farming	Compost making, Demonstration plots for crop production, Improved breeds of small ruminants, Improved animal housing	Introduction of drought-tolerant varieties and farming methods, Introduction of compost making and use, Livestock development	sorghum and cowpea, sheep and goats
		Mango tree planting	Supply and planting of mango seedlings	Measurement for soil erosion	mango
	Tome-Kokodour	Integrated Farming	Compost making, Demonstration plots for crop production, Improved breeds of small ruminants, Improved animal housing	Introduction of drought-tolerant varieties and farming methods, Introduction of compost making and use, Livestock development	sorghum and cowpea, sheep and goats
		Dry season gardening	Digging of boreholes with concrete rings, Training on production methods	Expansion of small scale irrigation	**tomato**, **cabbage**, eggplant, onion
		Mango tree planting	Supply and planting of mango seedlings	Measurement for soil erosion	mango
	Zakpee	Integrated Farming	Compost making, Demonstration plots for crop production, Improved breeds of pigs, Improved animal housing	Introduction of drought-tolerant varieties and farming methods, Introduction of compost making and use, Livestock development	cowpea, upland rice, groundnuts, soybean, pigs
		Soya bean processing	Training on soybean processing and nutrition	Improvement of agro-processing technologies	soybean
		Pig rearing	Training on group management, improved breeds of pigs, improved piggery, community-based pig rearing, marketing	Livestock development	pigs
		Bee keeping	Training, supply of beehives and related items, marketing	Introduction of bee keeping technologies	bees

*Note: Vegetables underlined are monitored crops in the PDAs.

District	Community	Project Title	Project Contents	Agricultural Technologies Verified through the PDAs	Crops or Livestock Included in the PDAs*
Jirapa-Lambussie	Naawuie	Pig rearing and compost making	Compost making, improved piggeries, pig rearing, marketing	Introduction of drought-tolerant varieties and farming methods, Introduction of compost making and use, Livestock development	sorghum and cowpea, pigs
		Improvement in post-harvest technology	Training, supply of drying and storage materials	Improvement of post harvest technologies for food crop	sorghum and cowpea
		Bee keeping	Training, supply of beehives and related items	Introduction of bee keeping technologies	bees
	Kogri	Pig rearing and compost making	Compost making, improved piggeries, pig rearing, marketing	Introduction of drought-tolerant varieties and farming methods, Introduction of compost making and use, Livestock development	sorghum and cowpea, pigs
		Improvement in post-harvest technology	Training, supply of drying and storage materials	Improvement of post harvest technologies for food crop	sorghum and cowpea
		Bee keeping	Training, supply of beehives and related items	Introduction of bee keeping technologies	bees
	Nyani	Improvement in post-harvest technology	Training, supply of drying and storage materials	Improvement of post harvest technologies for food crop	sorghum and cowpea
		Integrated Farming	compost making, training	Introduction of drought-tolerant varieties and farming methods, Introduction of compost making and use	sorghum and cowpea
		Agro-forestry	Central nursery at the district office, supply of seedlings	Measurement for soil erosion	mango, cajanus, leucaena, lebbek tree
		Shea butter processing	Training on group management, supply of raw materials, marketing	-	-
		Rabbit ad pig rearing	Supply of rabbits and improved breeds of pigs, improved housing, marketing	Livestock development	rabbits, pigs

*Note: Vegetables underlined are monitored crops in the PDAs.

District	Community	Project Title	Project Contents	Agricultural Technologies Verified through the PDAs	Crops or Livestock Included in the PDAs*
Nadowli	Daffiama	Small scale irrigation for paddy and vegetables	Demonstration plots for crop production, marketing	Expansion of small scale irrigation	paddy, **tomato**, okra, cabbage, pepper
		Groundnuts processing	Training on group management, supply of raw materials, marketing	Improvement of agro-processing technologies	groundnuts
	Tabiesi	Guinea fowl and rabbit rearing	Supply of rabbits and improved breeds of guinea fowls, improved housing, marketing	Livestock development	guinea fowls, rabbits
		Dry season gardening with use of compost	Compost making, training on production methods	Introduction of compost making and use, Expansion of small scale irrigation	tomato, **okra**, pepper, cabbage
		Shea soap making	Training on group management, supply of raw materials, marketing	Improvement of agro-processing technologies	-
	Nanvilli	Guinea fowl and pig rearing	Supply of improved breeds of pigs and guinea fowls, improved housing, marketing	Livestock development	guinea fowls, pigs
		Dry season gardening with use of compost	Compost making, training on production methods	Introduction of compost making and use, Expansion of small scale irrigation	tomato, onion, **pepper**, cabbage

*Note: Vegetables underlined are monitored crops in the PDAs.

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