CHAPTER 3

THE IRRIGATION SUB-SECTOR IN MALAWI

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This chapter reviews the irrigation sub-sector in Malawi. Following the salient features of the irrigation sub-sector, described are organizations and institutions related to the irrigation development together with the authority of the Department of Irrigation, government policies and donor supports with regard to irrigation development especially centering on smallholder farmers. This chapter also discusses constraints and opportunities in the sub-sector as well as lessons learnt from similar projects.

3.1 Salient Features of the Irrigation Sub-sector

Planned irrigation development in Malawi started in 1949 at Limphasa. In the mid 1950s, two more schemes were developed on the Chilwa and Phalombe plains. In the 1960s and 1970s, emphasis in irrigation development in Malawi was on construction and operation of government schemes. The schemes had been developed on public land in a top-down manner with O&M carried out by the government while the farmers were cultivating the land as tenants. In the 1980s, the government developed self-help schemes on customary land with farmers as the owners and responsible for the O&M. The self-help schemes, however, were designed and constructed by the government with little involvement of the farmers.

Irrigation in Malawi is categorized into two; 1) estate sub-sector and 2) smallholder sub-sector. The latter, smallholder sub-sector, is further divided into; 1) government managed irrigation scheme, 2) farmer managed irrigation scheme (self-help), and 3) co-operative managed irrigation scheme. Despite the considerably large potential irrigable area of over 400,000 ha, the area composed of all the categories currently under irrigation in Malawi is limited to only 56,400 ha.

Out of this 61,107 ha area, 48,135 ha (79%) is under the estate sub-sector and only 12,972 ha (21%) is under the smallholder farmer sub-sector. Estate irrigation schemes produces mainly export crops such as sugar cane, tea and coffee, while most of the smallholder farmers produce maize, the staple food of Malawian, and such vegetables as tomatoes, cabbages, onions, potatoes, etc. for their own consumption and for sale.

Table 3.1.1 Irrigated Area by Category

Category	Hector	Remarks
Estate Sub-sector		
Area under sugarcane	21,685	
Area under tea	21,000	
Area under coffee	5,450	
Sub total	48,135	
Smallholder Sub-sector		
Government managed	3,600	
Farmer managed	8,522	Self-help
Co-operative managed	850	
Sub total	12,972	
Grand total	**56,389**	
Nation-wide irrigation potential area	**Over 400,000**	

Source: Irrigation Sector Programs, 2004

Why irrigation potential is under-utilized is mainly due to over dependence on rain-fed agriculture and lack of exposure to irrigation technologies by many people[1], and thereby little investment was made to the irrigation sector until recent years resulting in low level of irrigation infrastructure. As Malawi is endowed with relatively rich rainfall as compared to other most of the African countries, Malawi has long been putting emphasis on rain-fed agriculture improvement. However, rainfall in the recent years has been erratic and unreliable, and also flood tends to take place more often than ever before due to deforestation in upper catchment areas. Predominance of the current unreliability of rainfall drives Malawi to promoting irrigation development.

3.2 Govenemnt Policy in the Irrigation Sub-sector

The recent erratic climatic condition and its effect on crop production have resulted in increased emphasis on irrigation development. The prospects for development have also fundamentally changed in the context of the process of structural adjustment of the national economy. The government is no longer allowed to stay as the main entity in the decentralized economy. The government is therefore regarded in nowadays context as a facilitator of development in a market oriented economy.

In line with above, there was a need for irrigation policy to reflect the shift from public sector irrigation development towards private sector driven agricultural development. The Ministry of Agriculture has thus established National Irrigation Policy and Development Strategy (NIPADS) in June 2000. Following are the summarized broad policy objectives:

1) Contribute to poverty alleviation by targeting resource poor smallholder farmers for irrigation development to enhance farm income,
2) Increase agriculture production and enhance food security through irrigation, which will ensure some production during droughts and the dry season, and this will supplement rain fed agriculture,
3) Extend cropping opportunities and provide a wider variety of crops in both wet and dry seasons to improve nutritional status, especially of children and women,
4) Create an enabling environment for irrigated agriculture; by facilitating and encouraging the private sector to invest in irrigation development, and encourage rural communities to manage irrigation projects in order to fully utilize irrigable land in Malawi,
5) Optimize government investment in irrigation development by applying the principle of cost sharing and cost recovery,
6) Enhance human capacity for irrigated agriculture in the public, parastatal and private sector in order to facilitate effective research in irrigation technology and marketing of irrigated produce, and
7) Create the spirit of business culture in the small-scale irrigated agriculture sector, to promote and provide competitive financing of irrigation projects and improve the marketing system.

[1] This kind statement can be found in "Irrigation Sector Program, Feb. 2002" and "Agricultural and Livestock Development Strategy and Action Plan". Also often quoted by irrigation engineers in ADDs was "Lack of Irrigation Culture" when asked why irrigation had not been pursued in Malawi in the past.

Broad policy No.4 clearly states that the government should play a role of facilitator and encourage rural communities instead of directly commanding the irrigation development. Also mentioned in broad policy No.5 is a cost sharing and recovery. So far, no cost recovery has been made in Malawi. Cost sharing[2] has not been tried either except for labor contribution from the beneficiaries[3].

However, recent donor funded projects require beneficiaries of a cost recovery in case of pump irrigation scheme. Motorized pump irrigation planned under Smallholder Irrigation Project, funded by ADB, is to be cost-recovered through a NGO newly established for its purpose. Also, in a policy statement with respect to financing, the NIPADS clearly mentions that the overall policy for financing irrigation development is with minimum government subsidy, and the government will optimize its investment in irrigation development by applying the principle of cost sharing and cost recovery.

Following above broad policy objectives, the NIPADS states such broad development strategies as:

1) Identify areas with irrigation potential in order to increase land put under irrigation based on the existing irrigation potential,
2) Enhance technical and administrative capacity in irrigated agriculture in the DOI together with improved technical capacity in the private sector and training institutions,
3) Assist smallholder farmers to develop and manage new and existing irrigation schemes through establishment of local farmer organizations that can assume full ownership of existing irrigation schemes and the new pilot schemes,
4) Transfer ownership of the existing government schemes to the beneficiaries through participatory methods that will enhance farmers' responsibility and obligations towards the management of the schemes,
5) Assist informal irrigation sector through greater presence of the DOI in regional, district and rural communities to prove irrigation technology advice where it is needed most, and
6) Conduct research in irrigation technology in order to promote the use of appropriate advanced and simple technologies in irrigated agriculture with due attention to efficient utilization of water resources.

This Study is well in line with above strategies, and undertakes above all but No.4[4]. Inventory survey for potential smallholder irrigation areas carried out under this Study helps identify the areas quoted in No.1 above. Verification projects carried out during phase 2 contribute to some extent to above No.2, No.3, and No.5, and also irrigation techniques tried out during verification project are to add new ideas for the appropriate and simple technologies in smallholder irrigation.

[2] On Inception Report presentation held January 9, 2003, DOI mentioned that there are three levels of cost sharing: 1) full payment by the Government for major facilities, 2) cost sharing, and 3) cost recovery. A participant also raised that cost recovery may be difficult because what farmers produce are consumed by them.
[3] Under DASP 1, farmers contributed voluntary labor in excavating trench, spillway, compacting embankment, grassing, crashing stones, etc., but no cash sharing was done.
[4] Strategy No.4 is so called IMT, irrigation management transfer. This is undertaken by Smallholder Flood Plain Development Program, IFAD funded. As this Study puts emphasis on self-help type irrigation development, irrigation schemes under IMT program are excluded from scrutinizing but review only.

Pursuing the policy and strategy above, the government of Malawi expects to increase the land put under irrigation based on the existing potential as up to 15% of irrigable land in the next 5 years (until year 2005), and a further 20% in the subsequent 5 years. Also, flood plains and dambos with irrigation potential are expected fully utilized in the next 15 years.

3.3 Authority in Irrigation Development

Government support to irrigation sector came into practice in 1967 when "Irrigation Service" was established under the Ministry of Economic Affairs. The Irrigation Service had operated throughout the intervening period. In late 1980s, the development of irrigated agriculture was mandated to the Department of Irrigation (DOI), the counterpart agency of this Study. DOI has since then been the principal government organization responsible for the planning, development and management of irrigation schemes in the country.

DOI was once under the Ministry of Works and Supplies, and moved to the Ministry of Agriculture and Livestock Development and then in year 1996 to the Ministry of Irrigation and Water Development. With a restructuring of government organization in 1997, DOI again moved to the Ministry of Agriculture and Irrigation (renamed to the Ministry of Agriculture in June 2004). These shifts reflect the changing view of irrigation; namely, it was first considered to be a civil engineering construction service, then to be a supporting service to agriculture with the leading role in planning and development of water resources.

Throughout the changes, DOI has become a small organization involved in planning, designing, constructing, and in government managed systems operating and maintaining irrigation schemes. The underlying principle for DOI operation is that the government will assume the role of a facilitator in irrigation development and that a beneficiary participation approach has to be fully pursued. Irrigation therefore is developed only in those areas with potential and where the farmers are interested in the development.

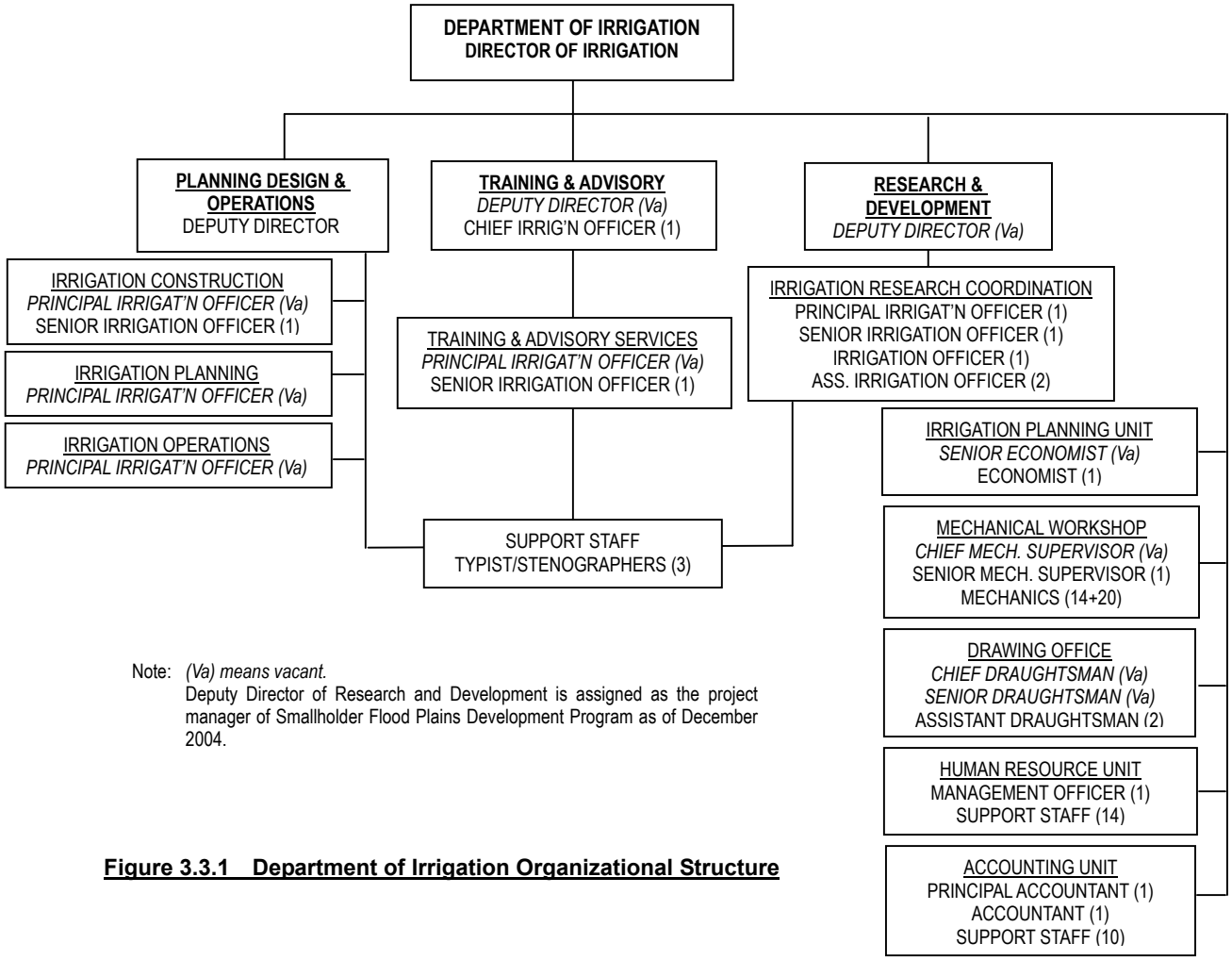
DOI's organizational structure is shown in Figure 3.3.1, composed of such major divisions as 1) Planning Design & Operations, 2) Training & Advisory, and 3) Research & Development aside from supporting units/offices like Irrigation Planning Unit, Mechanical Workshop, Human Resource Unit, Account Unit, etc. Under-staffing has been the prominent weakness for the DOI. An example is that the major three divisions have each deputy director[5] but very few professional subordinate are posted. In summary, the DOI headquarters is equipped with only 9 professional officers including the director of DOI and 2 technical officers as of December 2004. Recruitment to fill the vacancies is underway, but the resource base is very much limited.

In terms of regional level operation, the DOI has no regional/district office[6] so that the operation of irrigation development is actually done through the line of ADD down to RDP

[5] The deputy director of Research and Development Division is assigned as the Project Manager of the Smallholder Flood Plain Development Program.

[6] In most of the Asian countries where irrigation is robust, the department in charge of irrigation has its own line regional offices in region/province, and district/division. This structure makes the irrigation development in a consistent way and easy to pursue cost recovery in the irrigation sector, while the organization tends to be large. In summary, African countries less endowed with irrigation potential may better function with the present organizational structure, smaller one, from the viewpoint of reducing government budgetary burden.

and EPA. ADD has an irrigation section, which is usually furnished with two or three irrigation officers (one is chief/principal and the others are assistance in most cases). RDP has also a section in charge of irrigation development having, in most cases, only one assistant irrigation officer. EPA has no extension officer specialized in irrigation but in general agriculture. When a potential smallholder is found by an AEDO, usually the assistant irrigation officer in the concerned RDP is called up through AEDC. The assistant irrigation officer makes the site visit and gives necessary advice as required, so that the farmers may start their self-help irrigation development.



Note: *(Va) means vacant.*
Deputy Director of Research and Development is assigned as the project manager of Smallholder Flood Plains Development Program as of December 2004.

Figure 3.3.1 Department of Irrigation Organizational Structure

3.4 Ministries and Government Institutions relative to Irrigation Development

There are, aside from Department of Irrigation, government institutions related to irrigation development. These are Ministry of Water Development (MOWD), Ministry of Forestry, Fisheries and Environmental Affairs (MOFFE), Ministry of Lands and Valuation (MOLV), National Irrigation Board (NIB), Water Resources Board (WRB), etc.

Ministry of Water Development incorporates water requirements in national water resources planning and development, and coordinates the establishment of criteria for water allocations and priorities with the Water Resources Board, etc. This ministry is also in charge of improving and updating the water resources database including existing irrigation uses and demand provided by MOA, and protects the vested water right including irrigation

development.

The Department of Environmental under MOFFE is responsible for administering environmental policy and legislation, and in charge of processing and clearance of Environmental Impact Assessment. An Environmental Guideline mentions irrigation project more than 10 ha should basically undergo EIA procedure. The ministry pays attention to irrigated agriculture so that no conflict among interests especially in the potential of irrigated agriculture in forest and game reserves take place.

The MOLV implements land tenure programs for irrigation development in collaboration with MOA and MOWD. Land tenure is revised as necessary to assist the transfer of existing government run irrigation schemes to the beneficiaries, and also revised and updated in the identification of areas with potential for irrigation. The land under most of the potential areas is customary which legal ownership belongs to the state. However, when ownership of an irrigated land is established, the MOLV will process the procedure. As per cultivation right, concerned traditional authority grants the right with certain lease period.

NIB is a coordinating body in irrigation development and management in line with the NIPADS and Irrigation Act, including donor and private sector activities. The board approves standards and guidelines for irrigation development and management, and monitors the progress of irrigation development and management at the national level.

WRB grants water right and also ceases granting additional rights to water extractions in those cases where basins are fully developed or areas where WRB feels that allocations are already exceeded. The board also oversees the pricing of water resources for irrigated agriculture, though pricing on irrigation water has not taken place to date, in order to safeguard against wastage due to underpricing, and at the same time protects farmers against overpricing by the concerned local institutions.

3.5 Training Institutions relative to Irrigation Development

There are two institutes that provide academic and technical courses in irrigation engineering. Bunda College of Agriculture is one of the two. Though there has been a BSc in Agriculture in Bunda College[7], faced with little professional level of staff in irrigation development in Malawi, the college introduced a four-year BSc in Irrigation Engineering program in 1999. The first batch of 15 students graduated in year 2003[8].

At Natural Resource College (NRC), the other institute, there was a 3-year Diploma of Irrigation Technology where technical aspects were emphasized, which was started in 2000. The first 3-year Diploma 8 students[9], which were inevitably also be the last batch in the 3-year program category as it was sifted to 2-year program[10], have successfully completed

[7] There had been BSc in Agriculture only in Bunda College until late 1980s, then introduced were BSc in Agriculture Engineering, Agricultural Economics, etc., but not in Irrigation Engineering.
[8] Five students funded by IFAD, and the rest by the GOM.
[9] Funded by IFAD.
[10] The switch from a 3-year program to a 2-year program was that the former proved expensive and its emphasis was encompassing comprehensive theory and practical, while the latest program will concentrate on the practical aspect of irrigation.

their training and have all joined the Department of Irrigation. In the same line of boosting manpower in DOI, seven Irrigation Officers (PO) were recruited in 2001 in order to improve the capacity of the Department to carry out the irrigation activities in the ADDs.

These two institutions also offer short and long-term irrigation trainings. Trainings, short and long terms, are offered to some members of DOI, ADD, RDP, and EPA. Donors, NGOs and GOM also run training courses on an ad hoc basis. Training courses administered in recent years are Irrigation Design, Water Management and Watershed Management, Environmental Impact on Irrigation, Community Based Natural Resource Management, Gender and HIV/ AIDS in relation to agriculture development, so on so forth.

3.6 Constraints and Opportunities in the Sub-sector

This sub-chapter summarizes the constraints and opportunities in pursuing smallholder irrigation development in Malawi. Those have been identified at a national level workshop carried out right after the presentation of the Inception Report, at ADD level workshops conducted from January to June 2003, and also based on available data, information and interviews.

3.6.1 Stakeholder Analysis at National Level

A national level workshop was held on January 9, 2003 at Lilongwe Hotel after the presentation of the Inception Report. There were thirty five attendants, of which six from the main office of the Ministry of Agriculture, 15 from ADDs of the Ministry, three from projects under the Ministry, three from relevant Ministries and eight from Japanese side. Stakeholders regarding smallholder irrigation schemes were identified at first by all the attendants together, and then Detailed Stakeholder Analysis was done by five sub-groups. The stakeholders identified were as follows:

Group 1: ***Funding Organizations***
Donors, NGOs, and finance institutions

Group 2: ***Service Providers***
Marketing organizations, equipment suppliers, input suppliers, traders, and local artisans

Group 3: ***Facilitators***
MOAI, Irrigation Department, ADD, RDP, extension workers, non-governmental organizations, other departments, health workers and environmental workers / specialists

Group 4: ***Beneficiaries***
Farmers, women groups and youth clubs

Group 5: ***Local Institutions***
District Assemblies, Area Development Committee, TA & other local community leaders, village headmen, counselors, politicians and religious leaders

As per farmers, major beneficiaries in the above group 4, Strengths identified were “willing to work”, “having land”, “socially responsive”, while Weakness were “illiteracy”, “late adaptors of technology”, “over dependency on the hoe”, “generally poor”, “mostly works as an

individual", "culturally bound", "idling during dry season", and "lack of self transportation". Problems for the farmers identified were "frequent illness", "operation not done timely", "low productivity", "narrow food base", "limited access to media", and "poor eating habits".

For the government, Strengths raised were "agro-ecological setting", "strategic location of extension staff", "structure in place", "offices available", "government commitment", "prioritization of activities", and "data available", while Weaknesses were "low staff/farmer ratio (about 1/2,000)", "bureaucratic procedures", "poor institutional memory", "under-provision of financial resources", "poor generation of resources", "limited access to data available", and "poor institutional capacity to build database equipment".

Problems the government is facing were "lack of motivation", "staff attrition", "lack of replacement", "inadequate specialized/trained personnel", "lack of mobility", "inadequate resources", "dwindling resources for implementing programs", "poor quality data", and "unreliable data".

3.6.2 Problem Analysis at ADDs

From January 27 to June 10 of year 2003, total eight workshops for Problem Analysis were held at all the ADDs of Lilongwe, Kasungu, Machinga, Salima, Mzuzu, Karonga, Blantyre and Shire Valley with the attendance of ADD irrigation officers, RDP irrigation officers and AEDCs[11] in EPAs. Summary of the problems identified are shown in Table 3.6.1, and the problem trees are illustrated in Figures 3.6.1 – 3.6.8.

The core problem chosen was "High Malnutritional Diseases of Villagers" at Lilongwe ADD, "Farmers' Low Production" at Kasungu ADD, "Low Crop Production of Villagers" at Machinga ADD, "Poverty of Villagers" at Salima ADD, "Farmers are Facing Low Yield" at Mzuzu ADD, "Low Production of All the Products" at Karonga ADD, and "Low Production" at Blantyre ADD and Shire Valley ADD.

"Low Crop Yield" was observed in all the ADDs. "Declining Soil Fertility", "Low Input", "Low Adoption of Technical Skills", and "Pests and Diseases" are very frequent problems in most of the ADDs. Drought was identified in two ADDs of Mzuzu and Salima. Lack of irrigation facilities were identified in four ADDs of Mzuzu, Lilongwe, Machinga and Shire Valley. Relative to the potential of irrigation development, two ADDs of Karonga and Shire Valley identified inadequate rainfall as problem.

Problem analysis at village levels has also been carried out during the Study. There are several interesting differences between the problems identified at the ADD level and the ones raised at villages. For example, no farmers quoted "Low Adoption of Technical Skill" as their problem at the villages while five out of 8 ADDs mentioned it was problem. Officers especially AEDCs pointed out the problem of use of unimproved seeds, but the farmers, on the other hand, specified that the problem is the difficulty of getting the improved seeds and fertilizer and also the high prices of those inputs. Lack of irrigation facilities was identified

[11] 3 – 5 officers from ADD, 1 – 3 officers from each RDP under the ADD, and about 90% AEDCs of all the EPAs under the ADD had attended. AEDC is the head of EPA, so that 90% attendance could deliver very front line specific issues.

in four ADDs (Muzuzu, Lilongwe, Machinga and Hire Valley), but not in the villages, implying villagers' felt-difficulty may be more with agricultural input than irrigation.

Table 3.6.1 Summary of Problem Analysis at Eight ADDs

Problem	North		Central			South		
	Karonga ADD	Mzuzu ADD	Kasungu ADD	Salima ADD	Lilongwe ADD	Machinga ADD	Blantyre ADD	Shire Valley ADD
Low Crop **Yield**	*	*	*	*	*	*	*	*
Declining Soil **Fertility**	*	*	*	*		*	*	
Low Input	*		*	*	*		*	*
Low Adoption of Technical **Skill**	*		*	*	*	*		
Pests and Diseases		*	*	*		*	*	
Unimproved **Seeds**		*	*	*		*		
Diseases, HIV/AIDS		*	*		*		*	
Lack of **Irrigation** Facilities		*			*	*		*
Low ha per person			*	*		*	*	
Lack of **Markets** / Low Prices			*	*	*			
Only **One Crop** Per Year			*		*			
Overselling					*	*		
Drought		*		*				
Inadequate Food **Diversification**	*				*			
Inadequate **Rainfall**	*							*
Flood					*		*	
Poor Agricultural Practice							*	*
Land Degradation by **Overgrazing**	*						*	
Land Degradation by **Deforestation**	*						*	
Food Wastage					*			
Lack of **Equipment**							*	
Dambos Not Fully Utilized					*			
Too Much **Drinking** of Farmers	*							
Damage of Crops by **Livestock**						*		
Overdependency of Farmers on handouts								*
Theft						*		
Livestock Diseases		*						

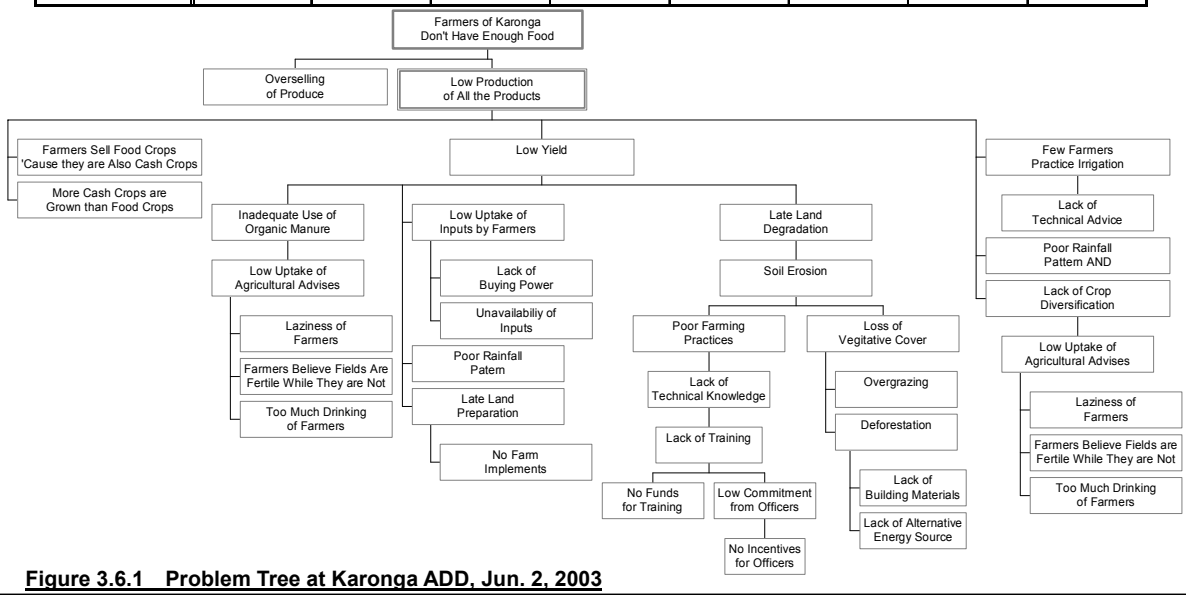


Figure 3.6.1 Problem Tree at Karonga ADD, Jun. 2, 2003

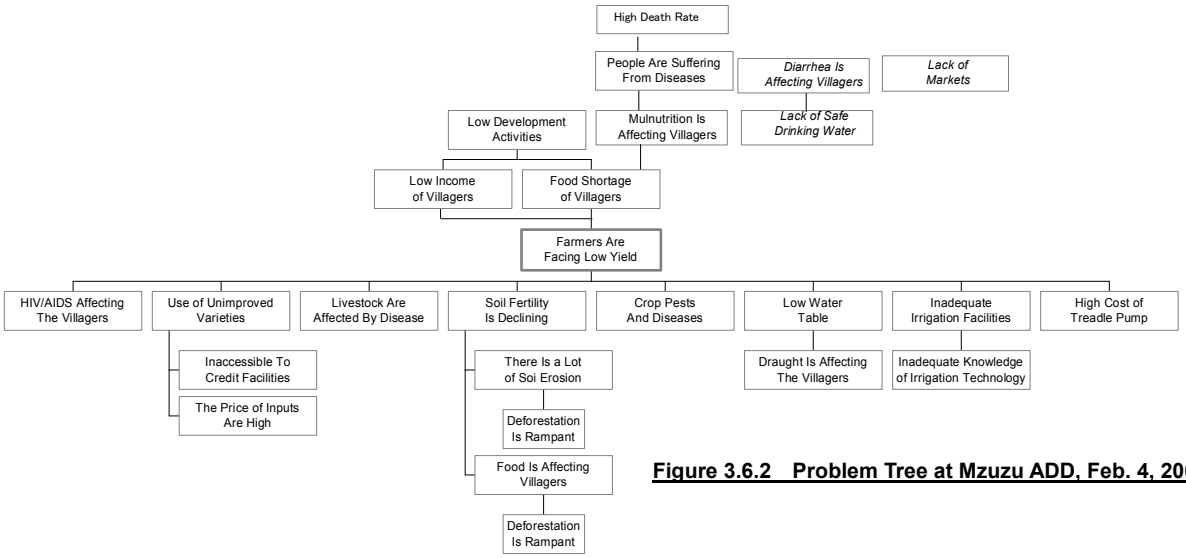


Figure 3.6.2 Problem Tree at Mzuzu ADD, Feb. 4, 2003

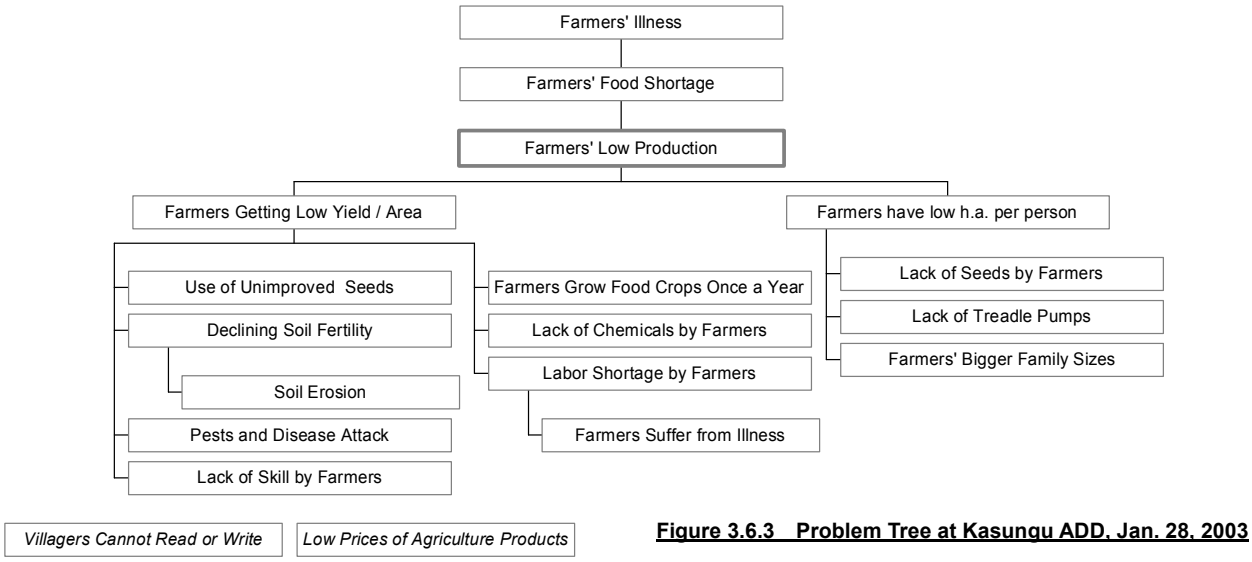


Figure 3.6.3 Problem Tree at Kasungu ADD, Jan. 28, 2003

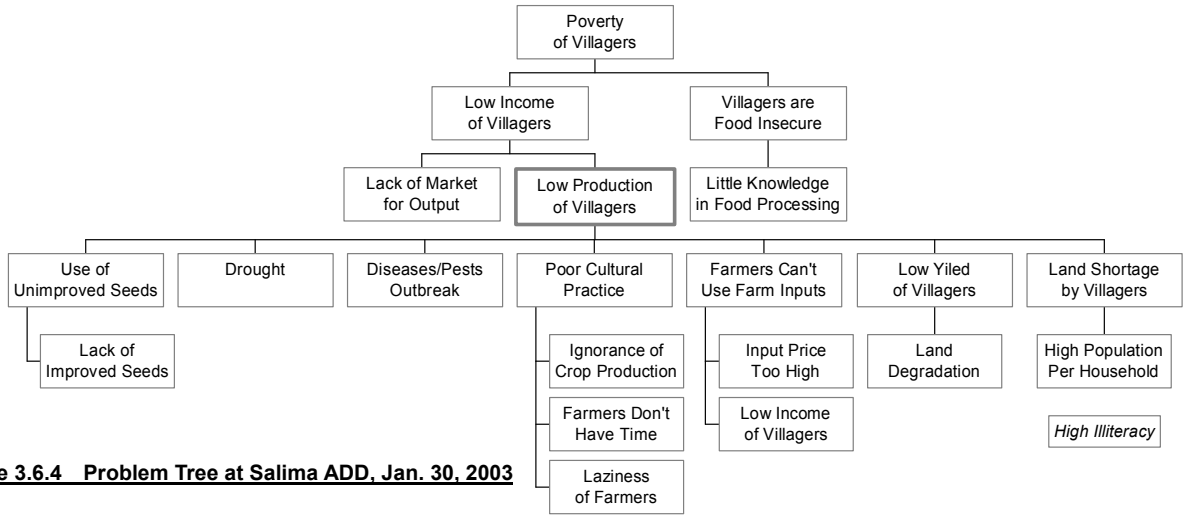


Figure 3.6.4 Problem Tree at Salima ADD, Jan. 30, 2003

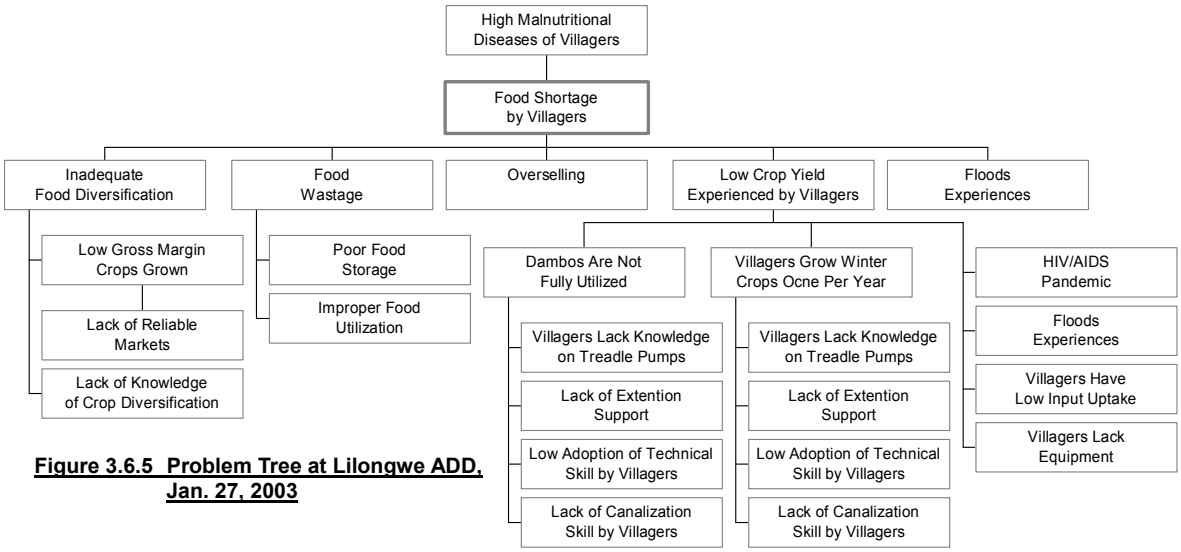


Figure 3.6.5 Problem Tree at Lilongwe ADD, Jan. 27, 2003

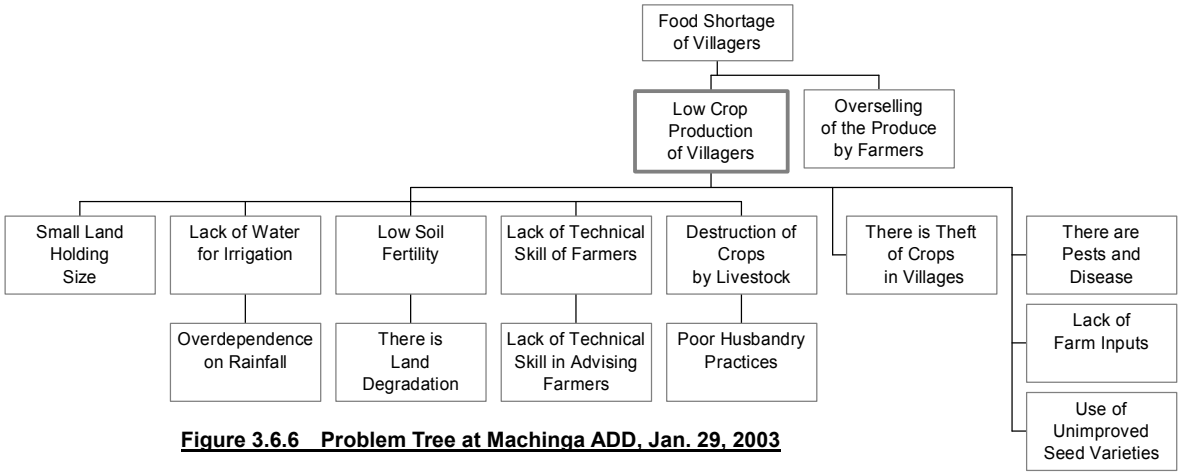


Figure 3.6.6 Problem Tree at Machinga ADD, Jan. 29, 2003

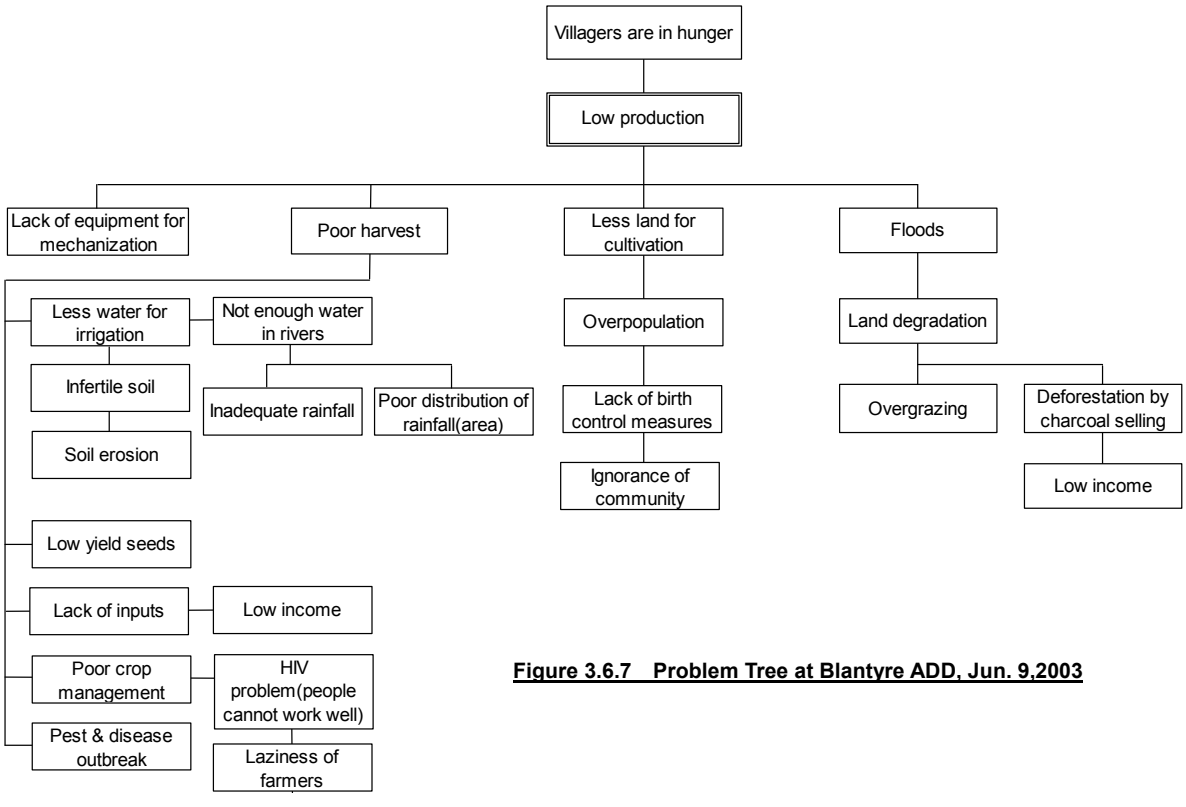


Figure 3.6.7 Problem Tree at Blantyre ADD, Jun. 9,2003

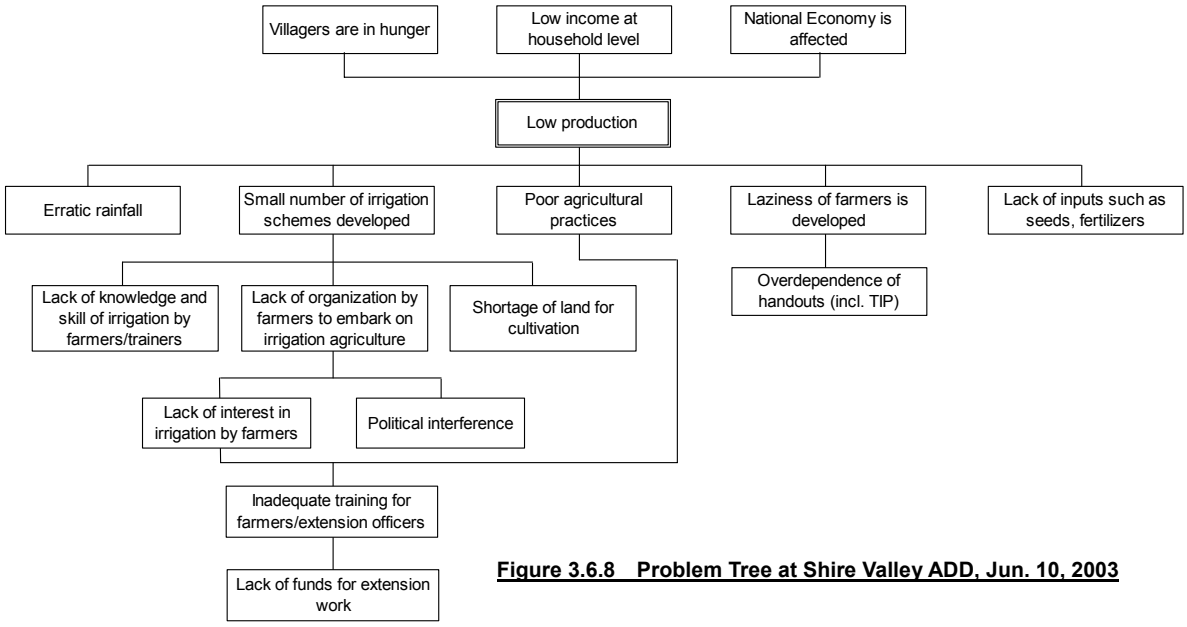


Figure 3.6.8 Problem Tree at Shire Valley ADD, Jun. 10, 2003

3.6.3 Development Constraints

This sub-chapter discusses development constraints, which have been identified from literary review, field observations, and interviews to concerned government officers and farmers.

1) High Cost of Agricultural Input

Effectiveness of chemical fertilizes and high yield of hybrid varieties are well known to Malawian farmers. However, farmers have not been able to access to farm input at a subsidized price since the liberalization of the marketing of farm input. In addition, termination of the MRFC loan disbursement to non-cash crop growers in 1996 caused limited access to farm inputs furthermore. It is extremely difficult for resource-poor family who lives in remote area to mobilize savings to purchase farm inputs.

For past years, the price of farm input, especially chemical fertilizer, has been rising sharply. Average price of major three chemical fertilizers; namely, Urea, CAN and complex (23:21:0:4s), is estimated at MK 717 per 100 kg in 1998, approximately equivalent to covering 1.0 ha farm, while the one in 2002 is MK 2,900 which is almost 4 times higher. Improved seeds, for example maize, had also risen from MK 410 per 20 kg in 1998, approximately equivalent to planting 1.0 ha farmland, to MK 1,460 in 2002 (3.6 times higher).

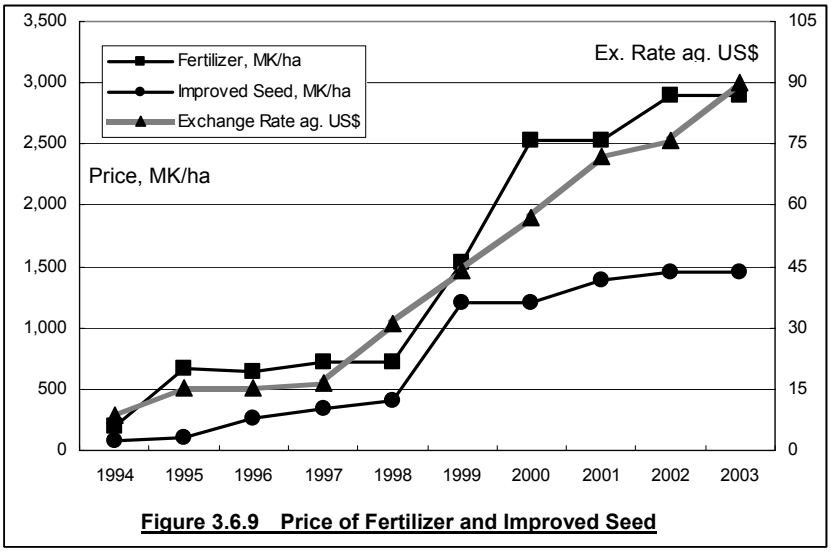


Figure 3.6.9 Price of Fertilizer and Improved Seed

The sharp hike of the input, especially fertilizer, is very much dependent on the depreciation of Malawi Kwacha against dollar. As the fertilizer is 100 % imported in this country, the price of the fertilizer goes up according to the depreciation of Kwacha. Figure 3.6.9 shows a very good correlation between the fertilizer price and exchange rate of Kwacha against dollar (as seed is produced in this country, the hike was not as sharp as the fertilizer did).

Though the input price has risen sharply for the past years, farmers' maize selling price, equivalent to farm-gate price, has also risen accordingly. Figure 3.6.10 shows the ADMARC purchase price of maize together with input price composed of fertilizer and improved seed (unit is converted into per hectare by using 2.1 ton yield per ha for maize, 20 kg improved seed and 100 kg fertilizer. 2.1 ton yield per ha is the nation wide average of hybrid maize from 1991 to 2002).

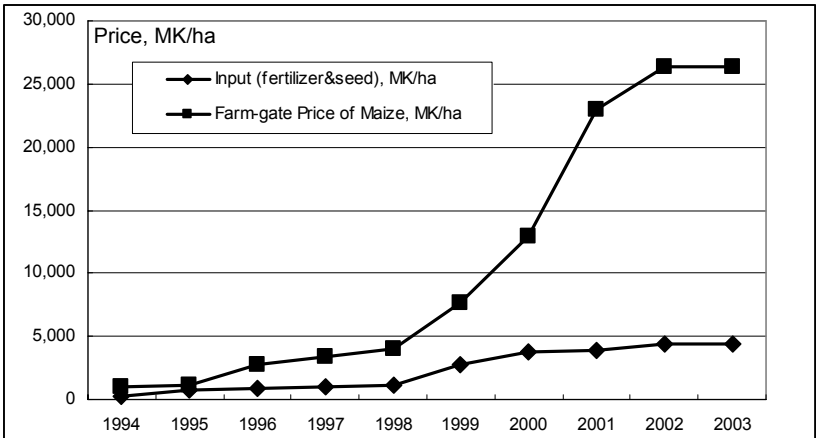


Figure 3.6.10 Input and Maize farm-gate Price

The hike of maize farm-gate price is bigger than the hike of input. The input consisted of about 30 % of maize farm-gate price until year 2000, but now consists of about 17%. This theoretically means maize growers can nowadays get more benefit than ever before. However, the actual situation is that maize is staple food so that more than 90% of rain-fed maize is just for home consumption. Home consumption means no benefit from the increased maize farm-gate price but the farmers are just suffering from the hike of the input. Increased price of input makes farmers difficult to access.

Diesel cost is not an exception of the high cost inputs. One litter diesel costs MK102, equivalent to almost 1 US$, as of December 2004. Topographic condition, especially in the floor of Rift Valley, very often requires irrigation system to be equipped with lifting mean. Diesel operation cost ranges by crop according to the water requirement. The table below summarizes the diesel operation cost together with electricity cost as a reference. As most smallholder farmers have no access to the main power grid, they have to depend on diesel when they intend to introduce pumping irrigation.

Table 3.6.2 Diesel and Electricity Cost by Crop

Crops	Diesel Cost, $/ha	Electricity, $/ha	W. Requirement, cum/ha
Maize	553	194	4,500
Beans	367	129	3,000
Onion	614	215	5,000
Rice	1,597	560	13,000
Tomatoes	676	237	5,500
Cabbage	613	215	5,000

Source: Socio-economic Aspects of Irrigation Technologies in Malawi, March 2002.

As indicated in the aforementioned Figure 3.6.10, the farm-gate price of maize is about MK 26,000, equivalent to about 260$, which is only half of the diesel cost required for irrigating 1 ha maize field. Most smallholder farmers cannot afford to manage input with reasonable price, and furthermore the diesel cost would make them unable to operate their irrigation dependent on diesel unless they grow profitable cash crops. Subsistence farmers usually have to grow maize for their food security. With the high price of diesel, they cannot afford to operate on diesel irrigation.

2) Limited Number of Irrigation Officers

As Malawi has long been over-dependent on rain-fed agriculture, irrigation development is still a new momentum. Accordingly, officers specialized in irrigation are very few. An example is the staff in the DOI headquarters where there are only 9 professional officers specialized in irrigation. Each ADD has an Irrigation Department, which has usually only two irrigation officers each. At RDP level, there is usually an irrigation technical officer[12]. There are 30 RDPs (being converted to district office which has a total number of 27), and accordingly there are about 30 or more irrigation technical officers throughout the country. However, they do not necessary have the educational background in irrigation. They have in most cases received only technical training course in irrigation.

EPA extension workers, so called AEDOs, are not specialized in irrigation but in general agriculture. Though most of them have received some technical training courses including agriculture engineering, the courses are short and they usually do not focus on irrigation development unless they are given a specific instruction relative to irrigation from the DOI through ADD and RDP. Once they are informed to identify irrigation potential areas, they are the ones who know the area best, thus they can identify. However, to realize the irrigation development even if it is small-scale, they need a technical advice/assistance from the irrigation technical officer in the RDP.

DOI is recruiting graduates from NRC and Bunda College. In year 2002, 8 irrigation technical officers were recruited. They are now engaged in irrigation projects such as Smallholder Floodplain Development Program (two of them engaged in this Study as of December 2004). Though direct recruitment of school leavers for on-job-training and re-employment of retired officers are tried, staff attrition rate due to annual retirement, movement to greener pastures, etc. still undermines the efforts. Staff shortage is the major constraints in pursuing nationwide irrigation development.

3) Limited Operation Budget

General extension activities, except project basis, depend on other recurrent transaction (ORT) budget. The ORT is very limited, and sometimes not delivered to RDP and therefore to EPA as planned. The ORT per RDP in most cases ranges between MK100,000 to MK250,000 per month including management. This amount has to be divided among sections in the RDP such as crop section, animal husbandry, agriculture extension services, land resources conservation and irrigation for the technical, and human resources, financial and planning section for the management, and inclusive of fuel allocation.

[12] Most of the technical officers have certificate only. Only very few have Diplomas.

Upon allocating the ORT among the sections in a RDP, available budget per technical section becomes only around MK10,000 – 20,000[13]. This budget has to cover technical officers transportation (so called T&T) and meal allowance/lodging, etc. At worse, faced with the country's overall financial difficulty, the ORT does not sometimes come as scheduled. Kasungu ADD could not deliver the ORT for three months out of 7 months since the beginning (July) of fiscal year 2002/03 to January 2003. Salima ADD did the same thing, no ORT for three months for the same period[14]. With this situation, extension activities cannot be well pursued unless otherwise there is a project basis budget.

4) Limited Transportation

RDP is usually equipped with one – two pickups or four-wheel drive vehicles, in some RDPs one lorry, and one government motorbike (plus several number of motorbikes under ownership program[15]). EPA usually has only one motorbike for the AEDC[16], usually under ownership program, and all the AEDOs do not have motorbike but are given bicycle[17]. All RDPs, which the Study Team contacted, indicated they do not have reliable motor vehicles at both management and frontline levels. Where these are available, they are mostly aged, for example more than ten years, thus not be effectively and efficiently in service. Often they are off the road and maintenance costs are very high and unbearable with the limited ORT.

Limited ORT also edges technical officer's mileage. A government regulation limits the technical officer's reimbursable mileage to 250 km (300 km for AEDC) per month. With the only 250 – 300 km reimbursable mileage per month, efficient extension cannot be done. A technical officer in a RDP located far away from his ADD consumes the reimbursable mileage by just visiting the ADD once a month. This situation implies that extension activities that require technical advices from RDP technical staff cannot be done unless otherwise there is a project basis budget.

5) Communicaiton between RDP and EPA, and within EPA

ADD has two to three telephone lines plus facsimile line including the direct line for the program manager. Some technical departments such as irrigation sometimes have their own telephone line. RDP has at least one telephone line, and also facsimile though the facsimile is often out of order. Communication among the ministry's headquarters, ADD and RDP therefore is not difficult, and urgent notice can be delivered in time.

However, EPA has no telephone line. Communication to EPA has to be delivered by RDP staff person to person directly. Notice to EPA does take a bit time, especially during rainy season when road condition becomes worse. This Study requested AEDCs to gather at their ADDs to administer an inventory survey. A three-day advance arrangement with the ADDs

[13] ORT allocated to the Irrigation Section in Ntchisi RDP of Kasungu ADD in January 2003 was MK9,700.
[14] Mzuzu ADD did not deliver the ORT for December of 2002/03, for the same period.
[15] Under the program, a motorbike is bought with MK 253,812 KW (year 2000 price). He/she is supposed to pay 25% (MK38,000) to the government for 72 months (6 yrs). After the installment completed, the bike becomes his/her property. This system implants ownership to the officer so that he/she well maintains the bike.
[16] About 10% of AEDCs do not have motorbikes. Some of the assistant AEDCs have motorbikes, thus some EPAs have two motorbikes but this case is very limited. The mileage is reimbursed with MK9.8 per kilometer.
[17] They are given MK130 per month for the maintenance.

did not enable all the AEDCs to come to their ADDs[18]. According to RDP staff, there should be one-week advance notice to well deliver message to the respective EPAs.

EPA locates their extension staff, called AEDOs, in their areas called station. The AEDOs have to report to their respective EPA once every two weeks. Communication from their head, AEDC, to AEDOs can therefore be done at least once every two weeks. However, as there is in most cases only one motorbike, which is usually owned by the AEDC, and AEDOs are given only bicycle, there is a difficulty to communicate among them without any delay unless enough time is given.

6) Overdependency on Rainfed Agriculture

While Malawi is endowed with relatively high rainfall as compared with other parts of African continent, this has led the country to over-dependence on rain-fed agriculture. Consequently, irrigation development has not much been focused up until very recent date. A quote from an irrigation officer is that major constraint for promoting irrigation to the farmers is lack of irrigation culture since irrigation is very new for the majority farmers.

In years 2000/01 and 2001/02, the country had experienced devastating food shortage due to erratic rainfall. The food shortage drove the farmers to exploring irrigation development either with technical assistance from concerned RDP and EPA or by their own self-effort. Though no accurate data is available how many self-help irrigations have been driven due to the last two years devastating hunger, about one out of every 5 existing schemes that the Team has visited during the phase 1 study was commenced by their own initiative, and there are many sites which started on a simple technical advice from the concerned RDP irrigation officers.

Faced with recent erratic rainfall, not only farmers but also government officers have become aware of the role of irrigation. However, long-lasted over-dependence on rain-fed agriculture still limits the available irrigation experiences and practices. Due to few existence of the irrigation schemes in the country, farmers who reside near a stream having potential of gravity irrigation development may not recognize the potential, hence still suffering from food shortage.

7) Targeted Input Program (TIP)

There is a program for subsistence farmers; called Targeted Input Program (TIP). TIP program started in year 1998/99 with the intention of supplying 0.1ha worth of improved maize seed, grain legume seed, and chemical fertilizer, to all rural families with land in Malawi. The program now provides a starter pack containing 2 kg of maize seeds, 2 kg of beans or groundnuts seeds, and 10 kg of inorganic fertilizer (5 kg of 23:21:0-4S and 5 kg of Urea) to the smallholder farmers. The target beneficiaries of the starter pack have been changing since 1998/1999 as below[19]:

[18] About 10% of AEDCs were not able to receive the notice from the ADDs through respective RDPs within the three-day.

[19] Source: Department of Planning, Ministry of Agriculture, November 2004

1998/1999	2.86 million farm households
1999/2000	2.86 million farm households
2000/2001	1.5 million farm households
2001/2002	1.0 million farm households (150,000-200,000 for winter TIP)
2002/2003	2.0 million farm households (450,000 for winter TIP)
2003/04	2.0 million farm households (Nil for winter TIP)

For the first two years, the target was actually set for all the smallholder farming households[20]. Then, the target figure was reduced to 1.5 and 1.0 million in 2000/2001 and 2001/2002 respectively and it was donor driven. In 2002/2003, due to the last two years serious food shortage, donors including DFID and NORAD and MOA decided to increase the target to 2.0 million. The Government also decided to add winter TIP.

The Figure 3.6.11 shows the estimated total improved seeds in Malawi and the one distributed by TIP. The graph shows that TIP program has purchased about half to two-thirds of the estimated total improved seeds in Malawi[21]. It implies, in turn, more than half of improved seeds have been distributed to the farmers free of charge. If this continues, though TIP is targeted for the subsistence farmers, farmers might think improved seeds are given by the GOM free or otherwise continue depending on just local seed.

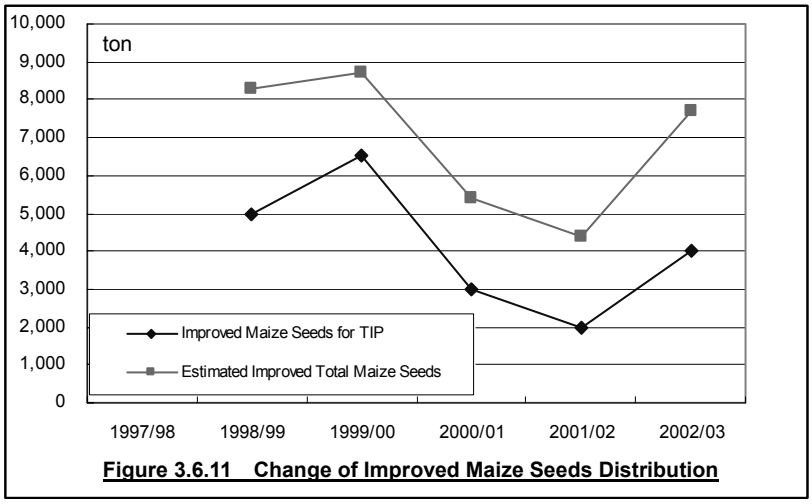


Figure 3.6.11 Change of Improved Maize Seeds Distribution

The same graph also shows that depending on the seed amount purchased by TIP, the total seed production in Malawi changes accordingly. If TIP targets many farmers like over 2 million farmers, the seed production may mark high amount, or otherwise may remain at lower production. By market force, as far as there is demand, seed companies try to supply the seed to meet the demand. However, should farmers think that improved seeds come in a form of grant, the demand might not increase even sometime after the TIP stops operating.

The Figure 3.6.12 shows the maize planted area and the maize production[22]. Though the maize planted area has not changed so much, the productions of years 2000/01 and 01/02 have declined dramatically, during which distribution of TIP has also been dramatically reduced. Figure 3.6.12 shows dramatic production decline in years of 91/92, 93/94, and 96/97 as well, which were mainly caused by drought. Therefore the reduction in years of

[20] According to census of 1998, total number of smallholder farm household is 2.39 million, accounting to 90% of total farm households. However, MOA relied on the number of 3.1 million farm households given by EPAs, which surpasses the number of census.
[21] The information of seeds was provided by TIP office and Monsanto, a seed producer in Malawi.
[22] Source: Ministry of Agriculture, Agriculture Economic Survey Office

2000/01 and 01/02 may be attributed to the erratic rainfall (late and heavy rainfall, but not drought) in those years as reported by many farmers interviewed.

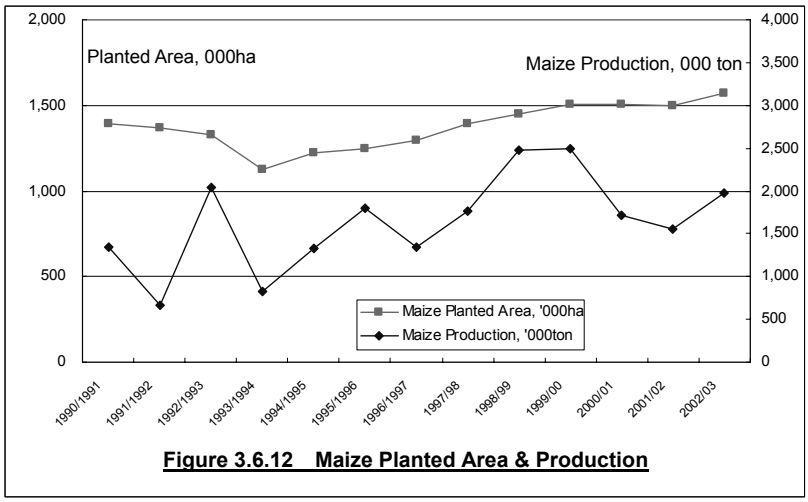


Figure 3.6.12 Maize Planted Area & Production

However, Figures 3.6.13 and 3.6.14 may still imply that the reduction of TIP has contributed to the production decline. Planted area with improved seed was boosted in years of 98/99 and 99/2000 as shown in Figure 3.6.13[23]. Then according to the reduction of TIP seed, the total planted area with improved seed has declined in years of 2000/01 and 01/02. Figure 3.6.14 shows the production by variety. The production of hybrid maize in years of 98/99 and 99/2000 was boosted thanks to the increased planted area of improved seed which in turn was thanks to the distribution of TIP. Though planted area with improved seed has been always less than that of local seed, the production of the hybrid maize much surpassed the local one in years of 98/99 and 99/2000, boosting total production of the maize in these years.

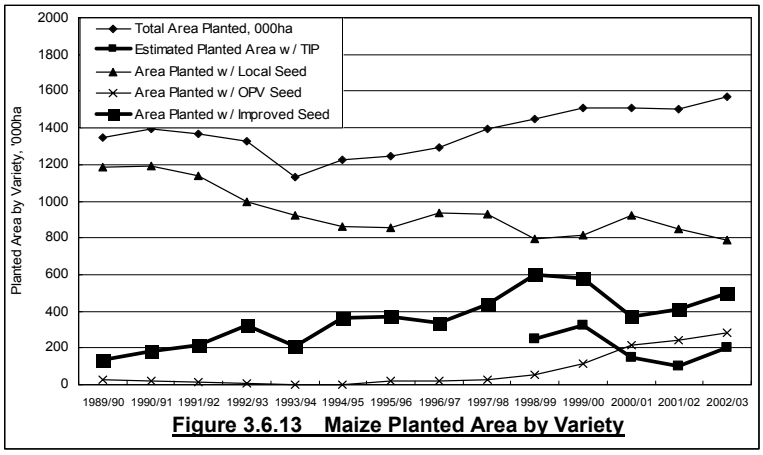


Figure 3.6.13 Maize Planted Area by Variety

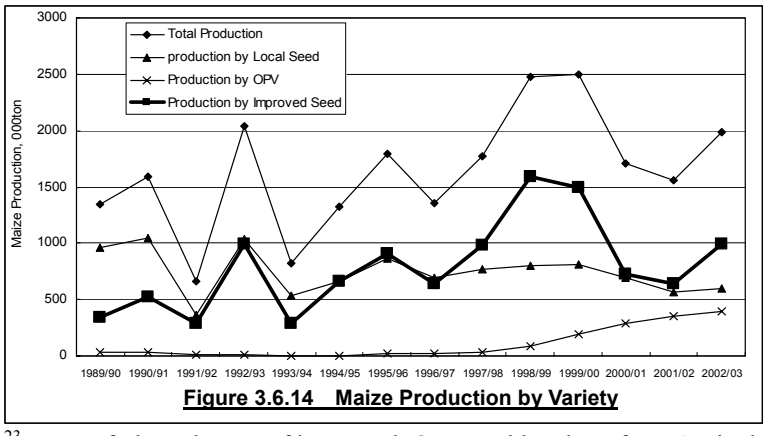


Figure 3.6.14 Maize Production by Variety

Attention is drawn on the planted area and production of local maize in year 2000/01. While the planted area increased from the previous year, the production declined a little. This implies damage by natural cause of erratic rainfall. Same production decline in year 2000/01 for hybrid maize is also on the Figure 3.6.14, however the decline is quite remarkable which was affected by the reduced planted area as shown in Figure 3.6.13, which has probably originated in the deduction of the TIP distribution. The impact of TIP in terms of improving the farmers food security is tangible, however on the other hand it may have side

[23] Data of planted areas of improved, OPV, and local are from Agriculture Economic Survey Officer, MOA, and the planted area with TIP was estimated by 0.1ha with 2kg of seeds provided by TIP.

effects in: 1) distorting market demand on improved seeds, 2) discouraging farmers to purchase improved seed thereby dependent still on local seed, and 3) diminishing self-sustainability of agriculture, and 4) affecting the nation wide maize production thereby un-stabilizing the food security, etc.

8) Way-forward taking into account Development Constraints

Those development constraints discussed above give this Study a direction of: 1) stabilizing the farming in their locality at first especially taking into account high and therefore inaccessible inputs and existence of TIP, 2) facilitating smallholder irrigation development by a series of groups, called cluster approach, in view of limited staff, budget as well as transportation, 3) promoting farmer-to-farmer extension taking into account limited human resources of the government in the dissemination of smallholder irrigation schemes, 4) promoting study tour to proceeding sites that will motivate prospective farmers who have long been dependent on rain-fed agriculture, and 5) on top of these self-effort by the farmers should be pursued to the largest extent specially faced with government budgetary constraints.

3.6.4 Development Opportunities

There are development opportunities/strengths while DOI and regional offices such as ADD, RDP and EPAs are facing aforementioned development constraints. These are well-established structures starting with ADD down to EPAs, presence of a rural financial institution, relatively coherent rural society at village level, nation-wide radio program (Agriculture Communication Branch), etc.

1) Established Structure in Place

As identified in the national level stakeholder analysis on January 9, 2003, established structure, expressed as “strategic location of extension staff”, “structure in place”, and “offices available”, is one of the strengths that the MOAI has. There are 8 ADDs throughout the country, under which there are 30 RDPs (now under restructuring to be merged to 27) and also 186 EPAs. One EPA office covers about 50,000 ha in average (22km x 22km) which can be within one-day accessible distance by a motorbike.

EPA is further divided into blocks, to each of which an AEDO is assigned. Though there are as many as about 800 vacancies in AEDOs, there are still about 1,500 AEDOs throughout the country. One AEDO, as the average, covers 6,500 ha (8km x 8km). This area coverage is not so easy to handle with a bicycle if it is in very remote area and also especially during rainy season. However, villagers that the Team contacted during phase 1 study have all said they see their AEDO every two weeks or at least every month something like that.

Reporting system from the ground, EPA, to RDP and ADD, and then the Ministry is also in place. AEDOs prepare forth-nightly report about crop production during rainy season. Besides, they prepare subject matter reports monthly, quarterly, half a year and yearly. These reports include general extension, crop production, horticulture, seed multiplication, livestock, land resources, and irrigation. These reports are compiled/consolidated at RDP level, ADD level, and then national level.

Therefore, DOI headquarters can follow-up monthly basis progress of nation wide irrigation activities, and indeed produces monthly progress report, quarterly progress, etc. Though some data from the ground sometimes get missed on the course of forwarding and accuracy is also sometimes in question[24], this structure already in place is a very good strength in pursuing nation wide smallholder irrigation development.

2) Cohesive Rural Society and Norm in Place

The rural society is now undergoing changes. During the interviews with village headmen/women and other villagers, it was often mentioned that since democratization and the onset of the multi-party system, people started behaving differently and that traditional governance and social norms, which once were absolute, started being violated. Other factors contributing to the change of rural society are: a transitory socio-economy from the subsistent farming to the monetary livelihood; substantial flows of resources to villages through NGOs and other aid organizations; etc.

Although rural societies are undergoing above changes, traditional leaders like TA chief, group village headman, and village headman still play an important role and their positions are still intact in the official administrative system. No project will be successfully planned and implemented in the rural area without the traditional leaders' positive involvement and support.

All the villages the Study Team has visited during phase 1 study have strong traditional headmanship with clan and are very cohesive. There are even some villages in Ntchisi RDP of Kasungu ADD that practice ostracism[25]. A person who has offended social norm prevalent in the village several times is ultimately given ostracism. The person becomes no longer able to stay in the village until he/she abides by the norm and the village headman forgives.

Another example of strong norm was found in a committee established under DASPS. The committee, Kamalambo Dam Committee, has general membership of 90 households and the service area is about 50 ha covering 7 villages. There is discipline committee aside from others such as main committee (irrigation), credit committee, crop inspection committee, etc. The discipline committee was established by villagers themselves, since some members did not attend the construction work. If a farmer did not attend the construction work, he had to explain the reason for the failing. If the reason was found not acceptable, he had to pay MK 15, and actually about 30 farmers had paid by then.

The Kamalambo Dam Committee has a revolving fund. In year 2002, 35 members borrowed money from the revolving fund, and 6 defaulted to pay back in time. When default takes place, the discipline committee goes to the defaulter and takes his/her property such as ox cart, cattle, goats, bicycle, etc. until the defaulter settles the due. For example, in

[24] A spot-checking for canal length done in Lilongwe ADD in November 2003 revealed that only 58% of the reported figures was actually excavated. Source: Progress Report for November 2002, DOI, MOAI

[25] According to the assistant irrigation officer in Ntchisi RDP. Ostracism is also a part of Japanese culture, and it was executed on the family (not just only on the personnel). Though the present Japanese society no longer practices ostracism, the sense still remains for most of the Japanese rural population, functioning binding force among the villagers.

year 2002 the committee took 7 ox carts from 7 farmers, one cattle from one farmer, 2 sowing machine, radio, etc. Grace period is one month, during which the defaulters of course try to settle the due, and in fact as of February 2003 all the defaulters had settled their dues.

With those strong norms including ostracism, discipline could well be established that is required to a certain extent wherever group activity is required. Also, with the still prevalent social cohesiveness under strong village headmanship, land tenure and membership or by-laws of clubs and irrigation schemes could be expected to be clear, thus few conflicts are expected especially for land tenure and water right.

3) Appropriate Agriculture Technology already in Place

As seen in many fields, most of the Malawian farmers already practice contour ridging. Though remote areas still do not practice the ridging, one can say in relatively populated areas such as Lilongwe and Kasungu ADDs that practically all the farmers do the contour ridging. Many farmers also know how to use A-frame, simple equipment, which leads the ridge according to the topographic contour; an example is that about 4 out of every 5 farmers of villages under Ntchisi RDP know how to use the A-frame.

Faced with the high cost of fertilizer, extension officers are now promoting compost manure. One can see pits for compost and also heaps of compost manure in many fields. Lilongwe ADD targeted 3 million heaps of compost manure in year 2001/02, and achieved 2.2 million heaps. Though the data does not show how many farmers out of the total 630,000 farmer households had practiced the compost manure, the heaps of over 2 million compost manures must be a good achievement. These appropriate agriculture technology already in place to the front line extension is a good opportunity in pursuing irrigated agriculture.

4) Rural Financial Institution (Malawi Rural Financial Company Ltd.)

Malawi Rural Financial Company Ltd. (MRFC) has 8 branch offices, 27 satellite offices and 163 field offices throughout the country[26]. The branch offices are situated in ADDs (one branch office in each ADD), and satellite offices in RDPs and field offices in EPAs. There are 186 EPAs throughout the country, out of which 163 EPAs are furnished with MRFC's field office. Also, field staffs are equipped with motorbikes to enable them to provide the banking services to the villages.

In general, rural population are hardly accessible to any commercial banking institutions since most of them tend to operate only in and around populous areas in order to acquire as many customers as they can with lesser operating cost. Commuting to a bank in urban area from a rural area costs farmers unexpected transportation expenses[27], resulting in difficulty of keeping the bank account. With this situation, most farmer organizations face difficulty to open a bank account, and even if they once open, may of them fail to operate the account.

[26] MRFC 2001 Annual Report & Account

[27] Kamalambo dam committee, organized under DASPS I, has a bank account in Kasungu Branch Office of a commercial bank. Transportation from Jenda to Kasungu is MK 240 for mini bus and MK 200 for big bus. Three signatories are required to withdraw money, so that about MK 600 to 700 is required for going to and coming back from the bank. To reduce the transportation cost, they usually go to the bank only once a year.

Given as many as 163 field offices equipped with motorbike, there is a great possibility that farmer organization can operate on a loan or on an account in a form of revolving fund. Borrowers, in case of club or group, are supposed to make upfront deposit of 15% of the loan to be granted but not required to submit any collateral, enabling smallholder farmers to access the loan. The annual interest on the loan is, however, about 30%[28], which is very high. Farmers or farmer organization may face difficulty to pay back, becoming defaulter. Defaulting is actually a big problem for the MRFC. About 20% of the borrowers become defaulter, meaning one out of every 5 borrowers has a possibility of becoming defaulter.

Though the high interest rate may not attract farmers or even become a development constraint, they can at least open a saving account, which is easily accessible. MRFC offers joint account in addition to individual accounts, which are mostly used by farmer organization. Saving account also earns about 25% interest per annum depending on commercial competitiveness. With this situation, farmers could well keep the account and even operate a revolving fund on the account if they are trained in financial management.

5) Nationwide Radio Program

MOA has Agriculture Communication Branch (ACB) office. This office prepares certain agricultural programs, which is a mode of extension, and those programs are broadcast through Malawi Broadcasting Cooperation (MBC) everyday except Saturday with 5 to 50 minutes each. For example, information on when to plant and cultivate certain varieties, what and how much inputs to be prescribed, what and how much pesticide to be applied can be known nation-wide through the programs. Also, if a research station has found a new variety that is suitable for certain area or can withstand against certain pest, the research station together with ACB goes to the MBC to spread over the information.

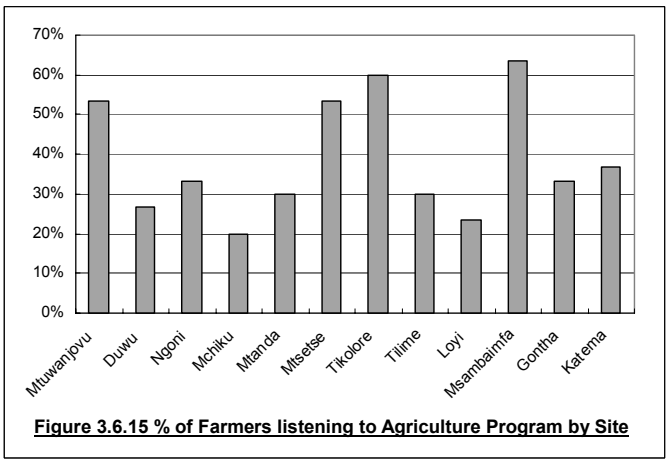


Figure 3.6.15 % of Farmers listening to Agriculture Program by Site

Most of the farmers nowadays have radios as seen in the field they are listening to radio programs while farming. According to a baseline survey carried out under this Study at 12 sites, 43% of the 360 sample farmers own radio, and by site 20% to as high as 60% of the farmers answered that they listen to the agriculture program as shown in the Figure 3.6.15. The average frequency to listen to the program was around 3 times a week.

Given this situation even in rural area, the ACB program can easily deliver messages to the farmers in a form of extension. Renewing battery for radio may be a constraint for some farmers to keep in touch with the program all year round. However at least village headman and some better-off farmers must be able to renew the battery, so that messages can still be delivered to a certain extent in a village.

[28] For the first time borrower, the interest is 33% per annum, 32% for repeater and 30% for prime customer as of December 2004 (it was 49% per annum, 48% for repeater, and 46% for prime customer as of February 2003).

DOI has an intention to promote such simple techniques as treadle pump, canalization, impounding water by gunny sack, stream diversion by simple structure like brush dam, etc. The nationwide radio program could motivate the farmers who are interested in irrigation, and even ask the farmers to visit nearby EPAs to have a technical assistance instead of AEDOs visiting each and every village. The program can also tell an example of self-effort irrigation of how the farmers have developed the schemes with what kind of tools, materials, etc. Letting farmers know such example of self-effort scheme would have a possibility of motivating them to embark on same self-help type irrigation activities.

6) Trained Staff in Irrigation and Participatory Development

There are training courses relative to irrigation and also participatory development. An example of the courses that an assistant irrigation officer in a RDP of Lilongwe ADD had gone through from year 2000 to 2002 is: 1) Irrigation Design (1 week), 2) Irrigation and Watershed Planning (2 weeks), 3) Environmental Impact on Irrigation (2 weeks), and 4) Community Based Natural Resources Management (2 weeks). Since irrigation in this country is getting momentum, better training opportunity is available for irrigation sector.

Another example is a 14-day PRA training course that was given to 160 extension workers (20 each from eight ADDs) in 2000. After the training, they were sent to the site right away and put PRA into practice. They are already equipped with participatory development and facilitation skills. Those skilled front line staff with participatory method could be a great asset for implementing community-based development projects.

Though training opportunity has been available not only for irrigation related issues but also for participatory development as mentioned above, there is also a limitation in this field. Above irrigation related training No.1 was funded by FAO, No.2 & No.3 funded by DANIDA, and No.4 by CARE International. Also, the 14-day PRA training was funded by DANIDA, thus donors funded most of the training courses. Therefore, without external fund assistance, training course may face budgetary constraint to continue.

7) Association of Smallholder Seed Multiplication Action Group (ASMAG)

Malawi has long been dependent on local seed (recycled seeds) and on hybrid seed in part. Private companies produce hybrid seeds under isolated environment. Though unit yield of hybrid seed is high such as about 2.2 ton/ha in average as compared to 0.8 ton/ha only of local variety, the supply of hybrid seed may look affected by TIP program. Also, poor accessibility to rural areas makes seed distributors reluctant to go there.

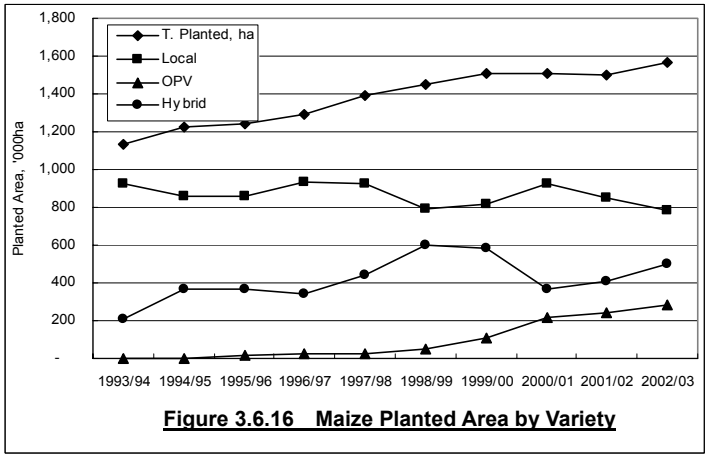


Figure 3.6.16 Maize Planted Area by Variety

Faced with the difficulty of getting hybrid seed in the rural areas, the MOA has introduced open pollinated variety program. Under the program, there is a farmer organization called ASMAG.

ASMAG is composed of farmer's associations throughout the country who produce open pollinated seed crop varieties (OPV can be recycled for three seasons). The farmers are encouraged by the MOA to stand on themselves and take farming as a local business. OPV planted area has been increasing since 1998/99 (see Figure 3.6.16). The amount of Maize-OPV produced by ASMAG in 2002/2003 is about 2,000 ton and is already more than half of the estimated production of the formal seed sector[29].

Department of Agricultural Research and Technical Services of MOA says local suppliers of seed just like primary school or local clinic are necessary in Malawi for sustainable supply of seed, and ASMAG is a test for that purpose. With the irrigation, local seed production of open pollinated variety can be done easily than during rainy season since possibility of cross-pollination is greatly reduced during dry season.

8) Way-forward viewed from Development Opportunities

Development opportunities discussed above give suggestions how this Study should move forward in promoting smallholder irrigation development. These suggestions are: 1) present ADD-RDP-EPA structure supported by trained staff together with nationwide radio program should be utilized in order to carry out effective nation wide dissemination of smallholder irrigation development, 2) revolving fund or credit scheme may well work unlikely as experienced in other developing countries taking into account the existence of MRFC throughout the country and still cohesive rural society and norm in place, and 3) there is an opportunity to stabilize their farming in their locality by promoting OPV in their vicinity.

3.7 Lessons Learnt from Experiences

This sub-chapter discusses lessons learnt from similar projects supported mostly by donors, and picks up issues that have to be due considered in planning the smallholder irrigation development in this Study, then summaries the direction as way-forward.

3.7.1 Experiences in Similar Projects

Table 3.7.1 summaries similar projects/studies which have been carried out together with the brief hard components, lessons and relevance to this JICA Study. All the projects and studies can be said that they are dependent on outside physical intervention or even in case having the term of self-effort such as "Self-effort Communities by EC" there are provisions for foreign materials like cement, reinforcing bar, etc. As summarized in the table, dependence on outside interventions needs much longer lead-time, well-informed consensus prior to the commencement of projects. Also pointed out is that the more project brings foreign (outside) materials, the more difficulty the farmers face in operating and maintaining the projects, thereby less project sustainability.

On the contrary, the idea of "pursuing farmer's self-effort as much as possible rather than expecting government intervention in terms of physical investment" is the key for this JICA Study. For example, designing of irrigation system envisaged in this Study shall be done in such way of not engaging any heavy equipment nor engaging local contractor in the

[29] Estimated seed yield is 2,554 ton for Monsanto, 447 ton for Pannar Malawi and 333 ton for Seed-Co and the total is 3,334 ton.

construction. Likewise, the facilities in this JICA Study are those that can be established by using locally available materials only, which is quite different from the past experiences.

Table 3.7.1 Summary of Similar Projects in comparison with JICA Study

Project(completion)	Lessons	Relevance to the JICA Study
Self-help Irrigation Communities (Oct. 1992), EC 1. Identification of self-help irrigation communities 2. Design for 17 self-help schemes	The study had been successfully completed with an output of three volumes of reports. However, EC has not committed the implementation. Though some schemes have been rehabilitated/ upgraded by the GOM's own effort, no lessons have been documented.	Concept of self-effort is very similar to the JICA study. However, still cement, reinforcing bar, ballast, etc. are designed to be used in rehabilitating/ upgrading the self-effort type irrigation systems. Those materials are designed to be provided by the project and all the labors by the farmers voluntarily. This JICA study aims at realizing irrigation system by using only locally available materials, which is quite different from the project above.
Bwanje Valley Project (Dec. 1999), JAPAN 1. Construction of headwork 2. Opening of 800 ha for paddy field	The leveling of 752ha for rice field was left on the GOM. The leveling was at first planned to be done by the beneficiary farmers manually. However the manual land leveling was too hard to manage for the farmers, requiring heavy equipment such as bulldozer and scraper. The cost for the equipment was not timely available by the GOM. Over- reliance on the GOM's own budget resulted in delaying project completion, thereby suspending the benefit accrued from the project.	The headwork, main canal, feeder canals, etc. had been constructed by the GOM funded from Japan. All the construction works had engaged a Japanese general contractor, which is a conventional irrigation development. Therefore, the Bwanje valley project is different from the irrigation schemes undertaken by this JICA study, which is to be constructed by the farmers' self-effort as its core.
DASPS I (Feb. 2000), DANIDA 1. 16 dams rehabilitation planed but only 2 completed.	Rehabilitation of earth dams can hardly be done by farmers' self-effort due mainly to: 1) very little intensives since the rehabilitation would not usually enlarge the irrigation area, 2) heavy siltation of the reservoir which can hardly been de-silted since most of the dams do not have drain conduit (dry work impossible), 3) long duration to be required which is usually more than 1-year (hardly attracts smallholder farmers), etc.	Since rehabilitation of earth dam can hardly attract farmers' attention as well as nor can be done by farmers' self-effort only due to the reasons in left column, the JICA study does not put high priority on the dam rehabilitation but on the gravity irrigation system, which is the simplest irrigation system.
AICAF Pilot Project (Mar. 2001), AICAF, JAPAN 1. Small scale irrigation development 2. Post harvesting facilities	About two-thirds of the members in five farmers' associations organized by the project did not continue the activities after the project had been completed. Also, most members of an association had gone back to their native livelihood, which is fishing, after they had realized agriculture was very much erratic corresponding to climate while fishery was stable in earning.	One of the reasons why they are not functioning now is insufficient lead-time and insufficient informed consent procedure. Farmers said, "A technical team came and did the project. We participated to it." In this JICA study, unless farmers agree to embark on the project by their own, JICA Team would rather go to neighboring sites rather than sticking to the site.
Small Scale Irrigation Development Study (mid 2003), ADB 1. Identification of potential areas 2. F/S for selected 40 sites 3. D/D & bidding document preparation for selected 15 sites	As this study was completed in late 2003, no physical construction commenced, thereby yet no lessons.	Final product from the study is the detail design report together with the bidding document. This means that the project to be undertaken is to engage contractor, which is different from the self-effort irrigation schemes targeted in this JICA study.

Table 3.7.1 Summary of Similar Projects in comparison with JICA Study (con'd)

Project(completion)	Lessons	Relevance to the JICA Study
Smallholder Flood Plain Development Program (to be 2005), IFAD 1. Construc'n of model schemes (206 ha) 2. Rehab. of existing schemes (1,528 ha) 3. Rehab. of self-help schemes (302 ha)	The program has faced an increased lead-time to get participatory agreement on track. The program says that leading times of three to four years are required for more organized irrigation schemes as opposed to much shorter preparation periods for small-scale technologies such as treadle pump.	Irrigation projects this JICA Study undertakes are small in size most probably less than one-tenth scale of those in the program, so that much less lead-time could be enough to succeed. Also, most of the projects undertaken in the program are so called on IMT program; first rehabilitate the government scheme and then transfer the schemes to the farmers.
Smallholder Irrigation Project, ADB (to be 2005) 1. Treadle pump (1,008 ha) 2. Motorized pump (3,265 ha) 3. Gravity irrigation (95 ha) 4. Sprinkler (284 ha) 5. Earth dam rehabilitation (6 dams)	This project was declared effective on February 1, 2000. The development stage is now to establish micro finance credit system. Therefore, no physical progress has been made except for equipment procurement as of end of 2004.	Gravity irrigation undertaken in the project is similar to the JICA study. However, the emphasis in the project is more or less on the treadle pump, motorized pump, and sprinkler. With regard to the equipment, this project intends to establish a credit system, through which the beneficiaries purchase the irrigation equipment. JICA study centers on very simple techniques, for which irrigation facilities should be constructed by using locally available materials only, not requiring such credit system.
Horticulture and Food Crops Development Project (to be 2005), ADB 1. Treadle pump (1,693) 2. Motorized pumps (1,260 ha) 3. Canal & lifting pumps (1,590ha) 4. Rehab. of earth dams (25 Nr.) 5. Sprinkler irrigation system (15ha)	Procurement process had taken longer period than originally scheduled. Therefore, the project is still at the beginning stage as of end of 2004 in terms of physical intervention. No concrete lessons have yet been gained.	As the JICA study centers on farmers' self-effort, motorized pump and rehabilitation of earth dams have less priority. The motorized scheme requires much operation cost that most subsistence farmers cannot afford, and the rehabilitation of earth dams cannot be carried out without certain amount of government interventions such as provision of equipment.
Small Farms Irrigation Project (to be 2005), BADEA 1. Development of two 800ha pumping irrigation schemes	As of end of 2004, project staff, accounting system, procurement have been done but not yet physical construction started.	The project is a medium pumping irrigation schemes. The planed irrigable area is 800 ha each, which is to accommodate 2,000 farmer members (0.4ha per each farmer). The design of the project is quite different from this JICA study that is not seeking much outside assistance to realize the system.

3.7.2 Issues due Considered

There have been self-effort irrigation developments and also donor funded projects. These, especially for the later, are well documented. This sub-chapter carries out literary review and also incorporates the Team's field investigation and interview results, from which lessons are gained as below:

1) Land Tenure

The land tenure in Malawi is categorized into three; namely, Customary Land, Private Land, and Public Land. It is estimated that 6.6 million ha are under customary land, 1.25 million ha under private and 0.6 million ha under public land. Customary land is vested in the President who, under the Chiefs Act, delegates power to allocate land to traditional Chiefs for use by smallholder farmers. In summary, the smallholder farmers have a right to cultivate. The right to cultivate is granted by their respective local authorities such as village headman, group village headman and traditional authority.

The concerned authority would usually willingly provide land for an irrigation scheme to a group of farmers upon receiving the farmers' request. Irrigation facilities are then constructed, and start the operation. Irrigation yields some benefit, which aside from the beneficiaries attract the local authorities or original land cultivators. When a headman realized the irrigation facilities yield some benefit, there were happenings that he demanded the land back or the original landowners started charging the land rent[30]. This creates social tensions between the irrigation users and the local authority, and the original landowners.

Lesson says that when irrigation is introduced in a new area that needs local authority to grant the right to cultivate, the grant should be in a written form[31] witnessed by local government officers such as AEDC or AEDO responsible for the area. Also, there may be original cultivator even if the prospective irrigable land looks idle. It should be confirmed if there has been original cultivators in the prospective area. In case that original cultivator is found, he/she should be fully informed of the irrigation development, and the land issue has to be agreed before irrigation is introduced by way of renting the land, involving the original cultivator as a member, etc.

2) Farmers' Pace

Dilemma between target and disbursement driven activities and progress at the farmers' pace became to be one of the most over-riding problems during the pilot project under DASPS I. This was mainly because the rehabilitation plan was based on conventional government-led rehabilitation experience. The DASPS I however applied farmers participation approach, which required much longer time than the expected under government-led-approach (supply led approach).

Project completion report of DASPS I, February 2000, mentions that when pressures to meet perceived physical targets were put on the ADDs, there was only limited attempt to pursue the farmers' pace in terms of the pilot project objectives. Many of the DOI staff were unwilling to accept the farmers' rate of progress. Conventional approach tells that once plans and designs for development have been laid down, the physical progress would follow, which is

[30] This case took place in Chimwaza irrigation scheme, about 3 ha in Lilongwe ADD, and Chikumbutso Kadziwamwini irrigation scheme, about 1 ha, in Salima ADD. Source: Socio-economic Aspects of Irrigation Technologies in Malawi, March 2002. Another example is that an original landowner in AICAF pilot project area in Salima ADD once allowed the irrigation canal to pass through his land, but after the project team left, he refused the beneficiaries to use the canal water.

[31] According to the Malawi Land Act of 1971, smallholder farmers can apply for registering of customary land, to which they hold usufruct rights by authority of the village headman, as leasehold.

quite against participatory approach.

Participatory approach proceeds with farmers' pace, but this does not necessary mean that all can be thrown upon the farmers. At sites, where continuity in technical support is not well provided, physical progress tends to halt. DASPS I had planned 16 dams rehabilitation but actually completed two only due partly to discontinued assistance. In these occasions, even the rationale behind participatory approach was forgotten; the pace of development be governed by the speed of farmers.

At those sites where the participatory approach was well followed up and supported by timely intervention from the technical staff, good physical progress has also been achieved (for example, Kamalambo Dam in Champhira EPA, Mzimba RDP, Mzuzu ADD). Rushed intervention should be avoided in participatory approach and farmers' pace should always be pursued with timely technical assistance and support.

3) Consistency in Project/Program Operation

From the interviews with the beneficiaries of DASPS I in two villages in Lilongwe ADD, some confusion or misunderstanding was found. For the rehabilitation of a dam, villagers contributed labor for about one month. Two to three persons per family from 15 villages participated twice in the month. Villagers contributed labor from around 6AM to 10AM without food. It was July-August 1999.

Villagers said that the project was to provide material and wheel burrows, etc., but the project did not provide them except cement and one builder (paid for one and half months) and transportation for sand (a pickup) for one month. There was actually confusion even among the project staff about whether equipment for the project was free or not. Farmers in most cases tend to think government provides everything for free. Local politics may also have made the situation worse. A consistency in providing materials and equipment should be established before the commencement of the project firstly among the project staff and then between the project and the farmers.

The farmers also complained about the account they opened. At first a consultant came and told them that it was revolving fund. Later, a project staff came and told them to repay with interest to the bank account. Any revolving fund, of course, needs payback with an interest, which is mostly lower than commercial interest. However, villagers may have not understood the concept of revolving fund and just thought of revolving the capital without any interest. Revolving fund needs well-systematized mechanism including installment, interest rate, penalty against defaulter, etc. Though all the project staff may have been aware of the operation of revolving fund, the explanation to the farmers should have been more concrete.

4) Informed Consent with Enough Lead-Time

In case of a pilot project in Bandawe Village in Tembwe EPA of Salima RDP[32], which had tried to promote agricultural development in the area, about two-thirds of members in five

[32] Carried out by Association for International Cooperation of Agriculture and Forestry (AICAF) from 1999 to 2001.

farmers' associations organized by the project did not continue the activities after the project had been completed. Also, most members of an association had gone back to their native livelihood, which is fishing, after they had realized agriculture was very much erratic corresponding to climate while fishery was stable in earning.

One of the reasons why they are not functioning now is insufficient lead-time and insufficient informed consent procedure. Regulation of association committee was prescribed in a meeting held by the project, but actually most of farmers didn't understand the contents. Consequently, the regulation is not working. Since their project period was limited, there was not enough lead-time and thereby they could not have enough time for informed consent. Farmers said, "A technical team came and did the project. We participated to it."

To establish sustainability of a project, it is essential to build up farmers' self-consciousness of being an owner of the project. Especially, in cases of irrigation projects initiated by outsiders, after finishing the project, responsibility of operation and maintenance of the irrigation facilities is transferred to the concerned farmers' organization. The success of post project is dependent on sense of ownership of the farmers' organization. It is often demonstrated that small-scale irrigation systems initiated and constructed by farmers are well managed by themselves while middle-large scale irrigation systems constructed by project often fail.

Establishment of farmers' self-consciousness of the ownership can be brought by sufficient lead-time and informed consent procedures. Even in a project, which is initiated by outsider, a series of meetings between the outsiders and the villagers should be held until achieving the consensus of direction, methods, and responsibility of the project, thereby generating a kind of farmers' ownership. It follows from this that sustainability of a project cannot be established without sufficient lead-time and informed consent in case outsiders initiate the project.

5) Over-reliance on Government Funding

Bwanji Valley Project, promoting rice cultivation in a floodplain under Lilongwe ADD, had been constructed from December 1997 to December 1999. The project was handed over to the GOM on March 17, 2000. The total cost of the project is made up of US$ 14 million provided by GOJ, and the GOM among other contributions provided compensation costs of the order of MK5 million for the crops that had to be destroyed during the construction[33].

The project had covered construction of the irrigation system, and leveled a pilot area of 48ha for demonstration of rice cultivation out of the planned irrigable area of 800 ha (existing 230 ha + new development of 570 ha). The leveling for the remaining area of 752 ha[34] was left to the GOM, and only 36ha was leveled by September 2002. Most of the area was left unleveled long time after the handing over, giving a difficulty to well cultivating rice[35]. Leveling requires bulldozer and scraper, which high cost may not be timely available by the

[33] National Irrigation Task Force, Report on the Meeting held at Kambiri Hotel, 12 – 13 April 2000.
[34] Existing 230 ha was not considered to require land leveling at first, however information from the site raised the need of leveling even for the existing area.
[35] Salima ADD reported that a maximum of 600 ha was planted with rice in 2000 depending on the irrigation system together with rainfall, but other information gives about half area at maximum.

GOM faced with a financial difficulty. Over-reliance on the GOM's own budget may result in a case of delaying project completion, thereby holding up the benefit accrued from the project for some time.

3.7.3 Way-forward from the Lessons

Above lessons leads this Study to consider that: 1) land tenure for the irrigable area should be clarified with local authorities before proceeding to the implementation of irrigation project, 2) farmer's pace be considered and come first even if it is very slow as compared to conventional blue-print type procedure, 3) consensus among the farmers as well as project officers be reached in line with the farmer's pace, and 4) pursuing farmer's self effort as much as possible rather than expecting government intervention in terms of physical investment.

The last idea of "pursuing farmer's self-effort as much as possible rather than expecting government intervention in terms of physical investment" is the key for this Study. For example, designing of irrigation system envisaged in this Study shall be done in such way of not engaging any heavy equipment nor engaging local contractor in the construction.

CHAPTER 4

SMALLHOLDER IRRIGATION POTENTIAL AREAS

CHAPTER 4 IRRIGATION POTENTIAL AREAS

This chapter explores how much irrigation potential this country is endowed. Glanced are nation-wide topography and climate, based on which one can see which part of Malawi is rich in water. Following the glancing, irrigation potential by drainage area that an ADB funded study, Small Scale Development Irrigation Study, has estimated is summarized so that the potential based on low flow can be known. Further presented is an inventory survey result carried out under this Study. The inventory was carried out in collaboration with frontline officers aiming at mostly gravity stream diversion.

4.1 Topography

Malawi is divided into five landform areas such as: 1) the plains, 2) the hill areas, 3) the plateaus, 4) the rift valley scarp, and 5) the rift valley floor [1]. Topography varies widely dependent on the location but mostly could be generalized in the above 5 landform areas. The highest point in Malawi is Sapitwa Mountain, on Mulanje, which has an altitude of 3,048 m. The lowest is south of Nsanje, where the altitude is only 60 m.

Of the 5 landform areas, irrigation potential areas can be more found in those areas of the plains, the hill areas, and the rift valley floor. The plateaus are endowed with much rainfall, but due to the steepness of the slopes and high altitude, less potential in terms of irrigation development is found. The three landform areas, which have relatively high irrigation potential, are summarized as below:

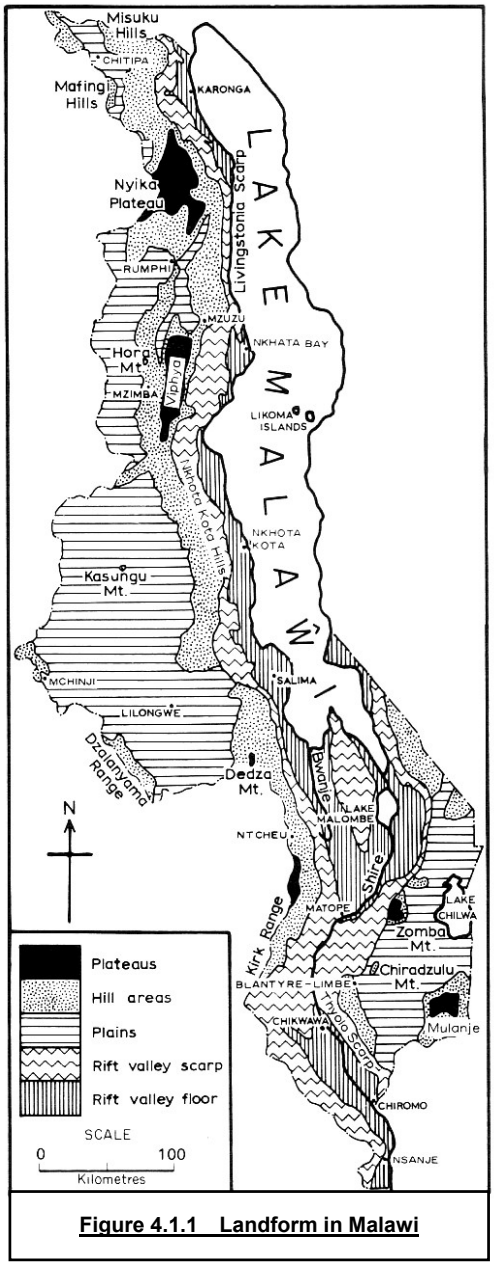


Figure 4.1.1 Landform in Malawi

- Plains are large areas of flat or gently sloping land. The valleys on the plains are wide, and this landform often has dambos. The largest plain covers most of Lilongwe and Kasungu ADDs, and has an altitude of about 1,200 m. This is very rich in agriculture development, and many agriculture-related projects have so far been implemented.

- Hill areas rise above the plains to higher altitudes. Most of them are characterized with steep slopes, so that irrigation potential area can mostly be found at almost foot or outskirt areas of those. Along the slopes of hills, also found are stream diversion type irrigation potential.

[1] Source: Third Edition, A geography of Malawi inclusive of Figure 4.1.1 Landform in Malawi, A. and D.M. Young.

- Part of the rift valley is filled by Lake Malawi. Along the shore of the lake there area narrow plains. These have been made of soils carried down by the rivers. The lakeshore areas are at altitude of 470 – 550 m. The Sire River flows through the southern part of the rift valley floor. The rift valley floor is another rich farming area but at the same time prone to floods and gravity diversion to farmlands is found difficult in most cases.

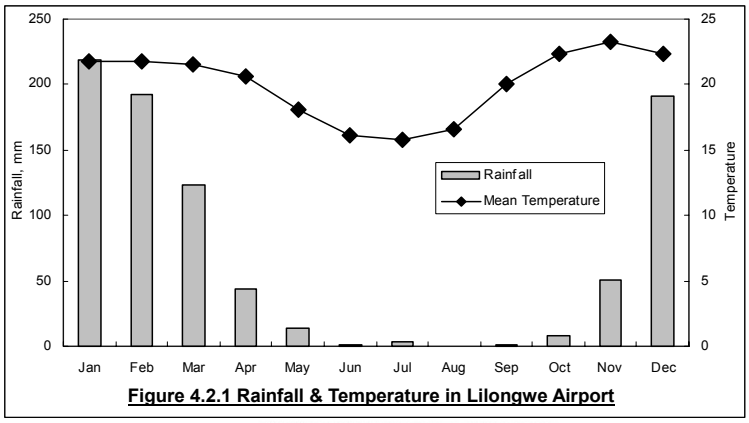


Figure 4.2.1 Rainfall & Temperature in Lilongwe Airport

4.2 Climate

Malawi falls under a warm tropical climate region. In general, temperature ranges in most areas between 17 and 22 ^{0} C with exceptions of very lower and higher areas. Minimum temperature occurs in July, while maximum temperature in October and November. Most of the country receives between 800 and 1,200 mm annual rainfall with same exceptions of very lower and higher areas. Most of the rain in Malawi falls in five months from November to March. From May to October, dry winds blow across Malawi, and there is little rainfall (see Figure 4.2.1, 30 years average at Lilongwe Airport).

Landform greatly affects such climate as temperature and rainfall. The coldest regions of Malawi are the high plateaus. Temperature there is about 20ºC in November, and in June falls below 10°C (sometimes frost occurs). The plains have temperature of about 15 ^{0} C in the cool season, and around 25 ^{0} C in November and December. The rift valley floor has the lowest altitude and is therefore very hot. The temperature goes up over 35°C in November, and even in June it is usually over 20°C.

The wind which blows from the south-east is called the trade winds. Many winds that bring rain come from the south and east. The landform gives effect on the rainfall. Where these winds blow across high land, they are moved upward, making the winds cool and then causing rainfall in general. Where the winds descends on the other side of the high land, the wind gets warm and thus there is little rain (see Figure 4.2.2).

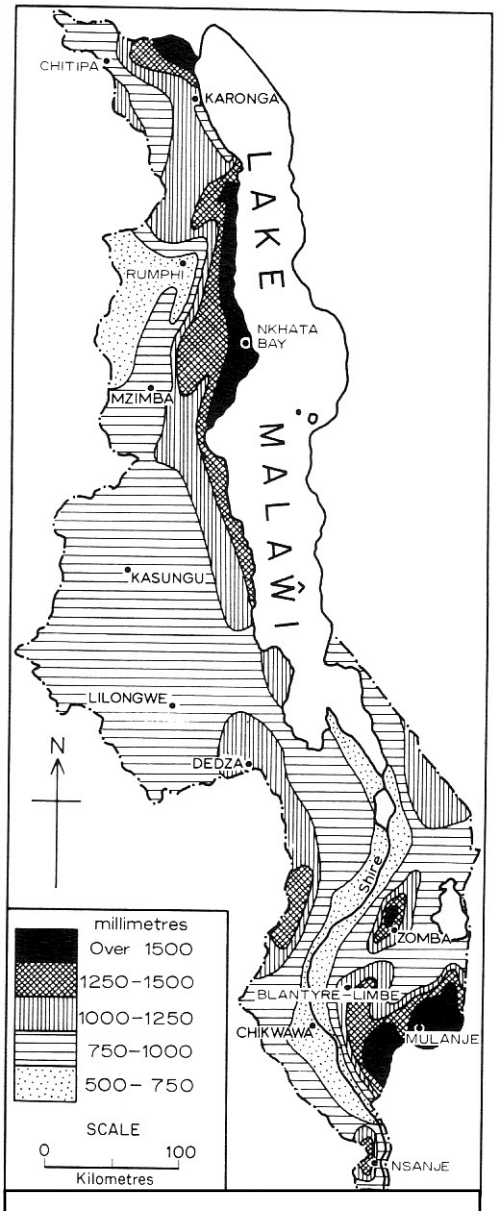


Figure 4.2.2 Annual Rainfall in Malawi

Plenty of annual rainfall in Malawi is found at Nkhata Bay area, northern tip of Karonga ADD, and high mountain areas such as Mulanje and Zomba. Near Nkhata Bay, winds from south-east are moved up over high ground, producing plenty rain with a total of over 1,500 mm. The plateaus and the hill areas are rich in rainfall usually over 1,000 mm because they are at around higher altitudes. Over most of the plains, the annual rainfall is between 750 and 1,000 mm. The Shire Valley is in a rain shadow area, and it has about 650 mm annual rainfall only[2].

Following table summarizes mean annual temperature and annual rainfall by ADD. As aforementioned, mean annual temperature falls in a rage of 17 to about 25°C throughout the country, and as goes to the floor of the rift valley and Shire Valley, the temperature goes up as high as 25°C to more than 35°C. Annual rainfall ranges in most of the country from 700 – 12,00 mm, and northern part of the country is endowed a little more rain than the southern part although it is very much locally affected by landform.

Table 4.2.1 Summary of Temperature and Rainfall by ADD[3]

ADD	Mean Annual Temperature	Annual Rainfall
Karonga	23 – 25°C in the lakeshore, and 12 – 15°C on Nyika Plateau	Mostly 900 – 1,300 mm, but about 800 mm in Nyika plateau, and more than 2,000 mm north of Kaporo.
Muzuzu	22 – 25°C around Nkhata Bay area to 12 – 15°C on the Nyika Plateau, but mostly 17 – 20°C	Mostly 700 – 900 mm, but 600 mm in Rumphi and Mzimba to more than 1,600 mm on the Nyika plateau. More than 2,000 mm in Nkhata Bay.
Kasungu	17 – 20°C mostly, and the lowest area is Mchinji mountains.	700 – 1,300 mm (no metrological station in this ADD)
Salima	22 – 25°C along lakeshore plain, and lowers to about 20°C toward escarpment.	800 mm around Bwanje and Liwawadi valleys, and about 2,000 mm in Chia Lagoon area.
Lilongwe	17 – 23°C mostly, but increase as goes down to lakeshore to about 25°C	800 – 1,000 mm in most areas, and about 1,000 mm on the escarpment.
Machinga	17 – 23°C, coldest area is Zomba mountain and hottest is Upper Shire Valley area.	Mostly in a range of 800 – 1,200 mm, but less than 700 mm in the Upper Shire Valley, and more than 2,000 mm in Zomba mountain.
Blantyre	Mostly 20 – 23°C, but Varies widely; 13 – 24°C depending on the location from Middle Shire Valley to Mulanje mountain.	Varies widely; 700 – 800 mm in the low lands and 1,000 – 1,300 mm in the Shire Highland and Thyolo escarpment.
Shire Valley	24 – 26°C, hottest area among 8 ADDs. Highest temperature is about 37°C.	700 – 1,000 mm in the lowlands, and over 1,400 mm in hilly areas.

4.3 Drainage Area and Potential Irrigation Area based on Low Flow

Figure 4.3.1 shows major rivers in Malawi[4]. In northern and central Malawi, the rivers flow into Lake Malawi. Where these rivers cross the plains, their courses are gentle. They flow slowly in shallow valleys, creating many dambos. Most of the rivers flow in meandering. Where the rivers cross the rift valley escarpment, their courses become steep, and flows become fast. They flow in deep and narrow valleys.

The largest river in Malawi is the Shire River, which starts at Lake Malawi and through Lake Malombe flows down into the Zambezi River. The Shire River flows almost constantly throughout year, but others have a great seasonal fluctuation of flow. Those rivers are full of

[2] Third Edition, A Geography of Malawi including Figure 4.1.3, A. and D.M. Young
[3] Agro-climatic Inventories, Eschweiler and Nanthambwe, 1990. Land Resources Appraisal of Each ADDs, 1991. Small Scale Irrigation Development Study, Phase 1 Report, GIBB Eastern Africa.
[4] Third Edition, A Geography of Malawi, p10, including Figure 4.1.4, A. and D.M. Young

water during rainy season, but the flows become less during dry season. Most of small rivers dry up before November, and again start flowing as rain starts falling from November. The rivers, which start at the Nyika, Viphya and Mulange, do not usually dry up thanks to the higher amount of rainfall on these plateaus.

National Water Resources Master Plan (NWRMP), published in 1986, evaluated water resources in whole Malawi. The NWRMP divided the country into 17 water resources areas according to the main river basin such as Dwangwa, Bua, Shire, etc., and summarized the relationship between catchment area, rainfall, and runoff. The overall runoff is shown below, and the runoff ratio as percentage against rainfall is 19%, which is relatively high as compared to other part of African countries.

- Total land area: 94,276 sqkm
- Mean annual rainfall (mm): 1,037 mm
- Total runoff (mm): 196 mm
- Total runoff (cum/s): 588 cum/s
- Annual runoff volume: 19 BCM
- Runoff ratio: 19 %

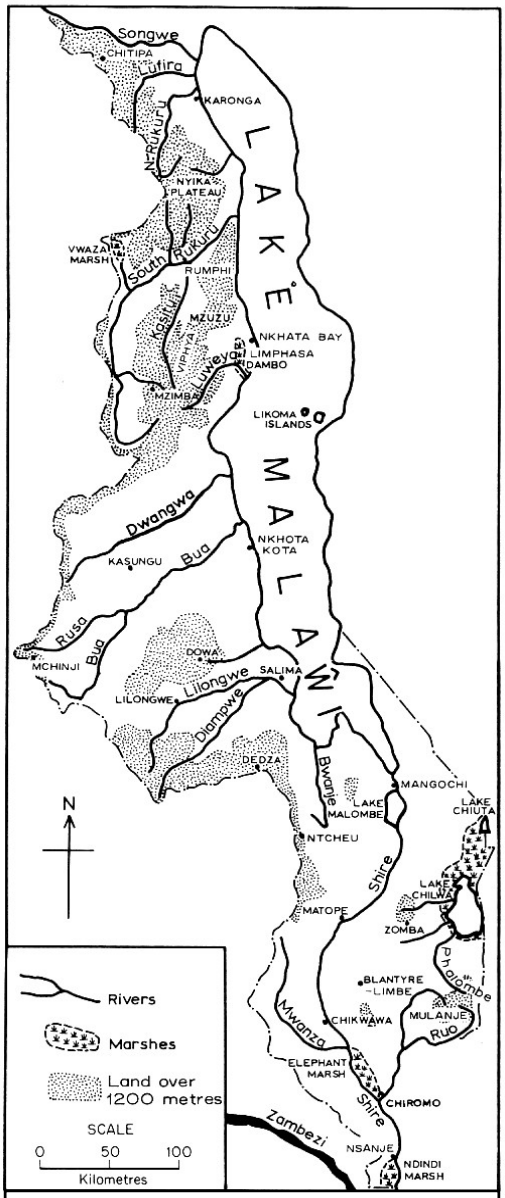


Figure 4.3.1 Major Rivers in Malawi

With the same 17 water resources areas over the country, Small Scale Irrigation Development Study has estimated dependable flows in the Phase 1 report published in December 2001. The study considered national domestic and industrial consumption, unregulated rivers available for irrigation, and Lake Malawi as dependable water for irrigation.

The assessment showed that flow available for nation-wide irrigation was 207.3 cum/s with a reliability of 10-day 75% excess. Given a rough irrigation duty of 1 l/s//ha, it is now estimated that maximum nationwide potential irrigable area is about 210,000 ha (see Table. 4.3.1). The study further estimated irrigation water availability by district, showing high dependable irrigation flows in such districts as Nsanje, Chikawawa, Nkhata Bay, Karonga, etc (see Table 4.3.2).

Aside from the above nationwide potential irrigable area of 210,000 ha, the GOM intends to develop the lakeshore areas of Lake Malawi. The irrigation development is done by trenching canal from the Lake to the inland areas and lifting up the water by motorized pump or treadle pump onto the farmland spreading along the trench. With this potential irrigation

area along the lakeshore, the nation wide irrigation potential area is now estimated at over 400,000 ha[5].

Table 4.3.1 Dependable Flows for Malawi Water resource Areas

No	Basin	Catchment (sqkm)	Q75 (10) % of ADF	Q75 (10) cum/s	Maximum Irrigable Area, ha	Yied l/s/sqkm
1	Shire	18,945	2.09	2.10	2,100	0.11
2	Lake Chilwa	4,981	4.08	1.40	1,400	0.28
3	SW Lakeshore	4,968	6.80	1.30	1,300	0.26
4	Linthipe	8,651	5.39	2.60	2,600	0.30
5	Bua	10,658	3.51	2.10	2,100	0.20
6	Dwanga	7,768	5.05	1.80	1,800	0.23
7	S. Rukuru & N. Rumphi	12,705	15.30	8.50	8,500	0.67
8	N. Rukuru	2,091	20.14	1.60	1,600	0.77
9	Lufira & Songwe	3,680	7.02	4.40	4,400	1.20
10	SE Lakeshore	1,540	4.62	0.20	200	0.13
11	Lake Chitua	2,460	1.85	0.40	400	0.16
12	Likoma island			0.00	0	
13	Chisusumulu iland			0.00	0	
14	Ruo	3,494	21.27	8.40	8,400	2.40
15	Nkhotakota Lakeshore	4,949	11.62	9.60	9,600	1.94
16	Nkhatabay Lakeshore	5,458	27.68	24.10	24,100	4.42
17	Karonga Lakeshore	1,928	28.23	3.80	3,800	1.97
		94,276		72.30	72,300	0.77
Less national domestic and industrial consumption				-4.00	-4,000	
Total from unregulated rivers available for irrigation				68.30	68,300	0.72
Plus Lake Malawi dependable outflow for irrigation				142.00	142,000	1.51
National available water resource for irrigation				210.30	210,300	2.23

Source: Small Scale Irrigation Development Study, Phase 1 Report, December 2001

Table 4.3.2 Irrigation Water Availability by District

District	Area, sqkm	Q75 (10) except Shire, cum/s	Flow from the Lake, cum/s	Total Dependable Flow, cum/s	Q75 (10) except Shire Yield, l/s/sqkm	Total Yield, l/s/sqkm
Nsanje	1,970	0.86	30.50	31.36	0.44	15.92
Chikwawa	4,885	0.53	34.30	34.83	0.11	7.13
Thyolo	1,669	2.68	0.00	2.68	1.61	1.61
Mulanje	1,896	9.16	0.00	9.16	4.83	4.83
Phalombe	1,550	1.72	0.00	1.72	1.11	1.11
Zomba	3,172	1.64	6.10	7.74	0.52	2.44
Chiradzulu	747	0.39	0.00	0.39	0.52	0.52
Blantyre	2,016	0.32	13.30	13.62	0.16	6.76
Mwanza	2,326	0.66	13.30	13.96	0.28	6.00
Balaka	2,155	0.15	16.40	16.55	0.07	7.68
Machinga	3,860	1.09	10.30	11.39	0.28	2.95
Mangochi	6,427	1.16	17.90	19.06	0.18	2.97
Ntcheu	3,246	1.43	0.00	1.43	0.44	0.44
Dedza	3,777	2.21	0.00	2.21	0.59	0.59
Salima	2,118	3.83	0.00	3.83	1.81	1.81
Lilongwe	6,155	1.98	0.00	1.98	0.32	0.32
Dowa	2,868	0.47	0.00	0.47	0.16	0.16
Ntchisi	1,937	2.06	0.00	2.06	1.06	1.06
Nkhotakota	4,321	15.48	0.00	15.48	3.58	3.58
Mchinji	3,446	1.24	0.00	1.24	0.36	0.36
Kasungu	8,066	0.50	0.00	0.50	0.06	0.06
Mzimba	10,476	3.65	0.00	3.65	0.35	0.35
Nkhata Bay	4,355	35.72	0.00	35.72	8.20	8.20
Rumpi	4,584	14.75	0.00	14.75	3.22	3.22
Karonga	3,441	21.52	0.00	21.52	6.25	6.25
Chitipa	4,251	15.81	0.00	15.81	3.72	3.72

Source: Small Scale Irrigation Development Study, Phase 1 Report, December 2001

[5] Irrigation Sector Programs, February 2002.

4.4 Potential Area by JICA Inventory Survey

During the first and second field surveys, an inventory survey for the self-help smallholder irrigation scheme was conducted at all the eight ADDs. Inventory survey involved 178 EPA offices that are broken down into 15 EPAs for Karonga, 31 EPAs for Mzuzu, 23 EPAs for Kasungu, 8 EPAs for Salima, 36 EPAs for Lilongwe, 31 EPAs for Machinga, 23 EPAs for Blantyre and 11 EPAs for Shire Valley. According to the inventory survey, total 883 potential sites were identified, of which 230 sites were existing schemes and 653 were proposed (new) schemes.

The total potential area amounts to 11,260 ha as summarized in the table below. Area per site therefore arrives at 12.8ha (11,260/883), which looks very big according to the experiences from the verification (pilot) project done under this Study. In fact, the inventory result does not necessary mean that all the potential areas could be irrigated because the areas were identified from the viewpoint of topographic condition only. These sites can be considered as potential ones for the self-help smallholder irrigation schemes, but actual irrigable area per site according to the available flow may be much smaller as evidenced by the verification project.

Average area per site irrigated by the verification project was only 1.2 ha. However, on the other hand it became apparent that many more sites which had not been identified by the inventory survey were developed under the verification project. Though as many as 264 sites were implemented as verification project in 2004, only 34 sites had been identified before the implementation (about 13%). Therefore, though irrigable area per site may result in much smaller than the inventory, number of sites developed is expected to be much more, suggesting that overall area may be in a range of around 10,000ha.

Table 4.4.1 Number of Inventory Survey Sites and Potential Area

ADD	Existing Scheme		New Scheme		Total	
	No of sites	Area (ha)	No of Sites	Area (ha)	No of Sites	Area (ha)
Karonga ADD	16	230	36	360	52	590
Mzuzu ADD	22	270	144	1,660	166	1,930
Kasungu ADD	64	900	87	1,210	151	2,110
Salima ADD	6	650	37	290	43	940
Lilongwe ADD	59	800	133	1,320	192	2,120
Machinga ADD	21	400	125	1,790	146	2,190
Blantyre ADD	34	170	50	320	84	490
Shire Valley ADD	8	170	41	720	49	890
Total	**230**	**3,590**	**653**	**7,670**	**883**	**11,260**

4.4.1 Categorization of Potential Irrigation Sites

The type of irrigation schemes identified in the inventory survey is mostly the surface (gravity river diversion) irrigation system as it was so arranged to identify potential sites suitable for self-help smallholder farmers. The potential sites for the self-help small-scale irrigation scheme can be categorized by different types of irrigation technology as referred to the existing system in Malawi. As a result, majority of the potential sites falls in “Stream/River” in terms of water source followed by impounding dam, “Gravity” for water abstraction method followed by treadle pump and “Open Canal” as water delivery method.

Out of the total 883 sites, stream/ river as water source counts for 691 sites or 78% of the total

sites, followed by impounding dam with 108 sites or 12% of the total sites. In terms of water abstraction type, 791 sites or 90 % of the total sites are for gravity irrigation, followed by treadle pump with 63 sites or 7% of the total sites. As for water delivery type, open canal system is applied in 813 sites or 92 % of the total sites, followed by pressurized pipe system with 61 sites or 7 % of the total sites (See Table 4.4.2 below).

Table 4.4.2 Number of Potential Irrigation Sites by Irrigation Technology

Water Source		Water Abstraction		Water Delivery	
Type	**Site**	**Type**	**Site**	**Type**	**Site**
1. Stream / river	691	1. Gravity	791	1. Open canal	813
2. Impounding dam	108	2. Treadle pump	63	2. Pressure pipe(sprinkler)	61
3. Spring	49	3. Motorized pump	26	3. Manpower carry	9
4. Shallow well (dug well)	28	4. Watering cans/ buckets	3		
5. Deep well (tube well)	0				
6. Lake	7				

Table 4.4.3 Summary of the Inventory by EPA, RDP, ADD (1/3)

Region	ADD	RDP	EPA		No. of sites			Serial No.
					Total	Existing	New	
North	Karonga	Chitipa	1	Kameme	1	0	1	KR 1
			2	Lufita	3	2	1	KR 2 - KR 4
			3	Misuku	5	4	1	KR 5 - KR 9
			4	Kavukuku	3	0	3	KR 10 - KR 12
			5	Chisenga	5	2	3	KR 13 - KR 17
			6	Mwamkumbwa	6	0	6	KR 18 - KR 23
		Karonga	7	Vinthukutu	2	0	2	KR 24 - KR 25
			8	Karonga	1	1	0	KR 26
			9	Karonga south	2	2	0	KR 27 - KR 28
			10	Karonga north	1	1	0	KR 29
			11	Kaporo	1	1	0	KR 30
			12	Kaporo north	6	2	4	KR 31 - KR 36
			13	Mpata	5	1	4	KR 37 - KR 41
			14	Kaporo south	5	0	5	KR 42 - KR 46
			15	Lupembe	6	0	6	KR 47 - KR 52
		Total of Karonga			**52**	**16**	**36**	
	Mzuzu	Nkhata Bay	1	Chikwina	5	0	5	MZ 1 - MZ 5
			2	Mzenga	8	0	8	MZ 6 - MZ 13
			3	Mpamba	5	1	4	MZ 14 - MZ 18
			4	Chinthechi	5	2	3	MZ 19 - MZ 23
			5	Nkhata Bay	5	0	5	MZ 24 - MZ 28
			6	Tukombo	5	0	5	MZ 29 - MZ 33
			7	Chitheka	5	0	5	MZ 161 - MZ 165
		Rumphi/N.Mzimba	8	Mphonpha	5	0	5	MZ 34 - MZ 38
			9	Chiweta	5	2	3	MZ 39 - MZ 42, 166
			10	Mhuju	5	1	4	MZ 43 - MZ 47
			11	Ntchenachena	5	0	5	MZ 48 - MZ 52
			12	Katowo	6	2	4	MZ 155 - MZ 160
		Central Mzimba	13	Mpherembe	5	0	5	MZ 53 - MZ 57
			14	Malidade	5	0	5	MZ 58 - MZ 62
			15	Emsizini	5	2	3	MZ 63 - MZ 65, 95, 96
			16	Zombwe	5	1	4	MZ 66 - MZ 70
			17	Bulala	5	0	5	MZ 71 - MZ 75
			18	Emfeni	4	0	4	MZ 76 - MZ 79
			19	Njuyu	5	2	3	MZ 80 - MZ 84
			20	Champhila	8	1	7	MZ 85 - MZ 92
			21	Khosolo	5	0	5	MZ 93, 94, 97 - MZ 99
			22	Luwerezi	5	0	5	MZ 100 - MZ 104
			23	Manyamula	8	1	7	MZ 105 - MZ 112
			24	Bwengu	5	1	4	MZ 113 - MZ 117
			25	Mjinga	4	0	4	MZ 118 - MZ 121
			26	Eswazini	5	0	5	MZ 122 - MZ 126
			27	Kazombo	5	0	5	MZ 127 - MZ 131
			28	Euthine	5	4	1	MZ 132 - MZ 136
			29	Mbalachanda	5	2	3	MZ 137 - MZ 141
			30	Mbawa	6	0	6	MZ 142 - MZ 147
			31	Vibangalala	7	0	7	MZ 148 - MZ 154
		Total of Mzuzu			**166**	**22**	**144**	

Table 4.4.3 Summary of the Inventory by EPA, RDP, ADD (2/3, con'd)

Region	ADD	RDP	EPA		No. of sites			Serial No.
					Total	Existing	New	
Central	Kasungu	Kasungu	1	Chamama	7	7	0	KU 1 - KU 7
			2	Lisasadzi	6	0	6	KU 8 - KU 13
			3	Chipala	8	2	6	KU 14 - KU 21
			4	Santhe	4	4	0	KU 22 - KU 25
			5	Kaluluma	6	0	6	KU 26 - KU 31
			6	Bowe	6	1	5	KU 32 - KU 37
		Ntchisi	7	Chipuka	9	9	0	KU 38 - KU 46
			8	Chikwatula	6	5	1	KU 47 - KU 52
			9	Malomo	6	6	0	KU 53 - KU 58
			10	Kalira	8	4	4	KU 59 - KU 66
		Dowa	11	Mvera	9	9	0	KU 67 - KU 75
			12	Nachisaka	8	2	6	KU 76 - KU 83
			13	Modolera	6	2	4	KU 84 - KU 89
			14	Madisi	4	0	4	KU 90 - KU 93
			15	Chisepo	6	0	6	KU 94 - KU 99
			16	Mponela	8	1	7	KU 100 - KU 107
			17	Chivala	8	0	8	KU 108 - KU 115
		Mchinji	18	Mlonyeni	5	2	3	KU 116 - KU 120
			19	Chioshya	9	4	5	KU 121 - KU 129
			20	Kalulu	5	3	2	KU 130 - KU 134
			21	Msitu	3	0	3	KU 135 - KU 137
			22	Mikundi	6	0	6	KU 138 - KU 143
			23	Mkanda	8	3	5	KU 144 - KU 151
		Total of Kasungu			**151**	**64**	**87**	
	Salima	Nkhotakota	1	Mwansambo	6	0	6	SA 1 - SA 6
			2	Linga	5	0	5	SA 7 - SA 11
			3	Zidyana	7	0	7	SA 12 - SA 18
			4	Nkhunga	4	0	4	SA 19 - SA 22
		Salima	5	Khombedza	6	2	4	SA 23 - SA 28
			6	Chinguluwe	5	0	5	SA 29 - SA 33
			7	Chipoka	5	2	3	SA 34 - SA 38
			8	Tembwe	5	2	3	SA 39 - SA 43
		Total of Salima			**43**	**6**	**37**	
	Lilongwe	Lilongwe West	1	Demera	8	0	8	LL 1 - LL 8
			2	Ukwe	6	1	5	LL 9 - LL 14
			3	Ming'ong'o	5	2	3	LL 15 - LL 19
			4	Mpingu	5	2	3	LL 20 - LL 24
			5	Thawale	5	2	3	LL 25 - LL 29
			6	Malingunde	5	0	5	LL 30 - LL 34
			7	Mitundu	5	0	5	LL 35 - LL 39
			8	Chileka	5	3	2	LL 40 - LL 44
			9	Chilaza	5	0	5	LL 45 - LL 49
			10	Mlombwa	5	0	5	LL 50 - LL 54
			11	Mwala-Nthondo	5	1	4	LL 55 - LL 59
			12	Mngwangwa	9	0	9	LL 60 - LL 68
		Lilongwe East	13	Chiwamba	5	2	3	LL 69 - LL 73
			14	Chitekwere	9	4	5	LL 74 - LL 82
			15	Chigonthi	3	0	3	LL 83 - LL 85
			16	Chitsime	5	3	2	LL 86 - LL 90
			17	Nyanja	5	1	4	LL 91 - LL 94, 191
			18	Mkwinda	5	0	5	LL 95 - LL 99
			19	Mpenu	5	4	1	LL 100 - LL 104
		Dedza West (Thiwi-Lifidzi)	20	Lobi	5	0	5	LL 105 - LL 109
			21	Chafumbwa	5	0	5	LL 110 - LL 114
			22	Kabwazi	5	2	3	LL 115 - LL 119
			23	Linthipe	5	1	4	LL 120 - LL 124
		Dedza East (Dedza Hills)	24	Kaphuka	5	2	3	LL 125 - LL 129
			25	Mayani	6	1	5	LL 130 - LL 135
			26	Mtakataka	5	0	5	LL 136 - LL 140
			27	Kanyama	6	2	4	LL 141 - LL 145, 192
			28	Golomoti	5	3	2	LL 146 - LL 150
			29	Bembeke	5	4	1	LL 151 - LL 155
		Ntcheu	30	Nsipe	6	6	0	LL 156 - LL 161
			31	Manjawira	4	1	3	LL 162 - LL 165
			32	Bilira	5	0	5	LL 166 - LL 170
			33	Njolomole	5	0	5	LL 171 - LL 175
			34	Tsangano	5	5	0	LL 176 - LL 180
			35	Kandeu	5	4	1	LL 181 - LL 185
			36	Shapevale	5	3	2	LL 186 - LL 190
		Total of Lilongwe			**192**	**59**	**133**	

Table 4.4.3 Summary of the Inventory by EPA, RDP, ADD (3/3, con'd)

Region	ADD	RDP	EPA		No. of sites			Serial No.
					Total	Existing	New	
South	Machinga	Mangochi	1	Mpilipili	6	0	6	MHG 1 - MHG 6
			2	Nasenga	5	0	5	MHG 7 - MHG 11
			3	Lungwenya	5	1	4	MHG 12 - MHG 16
			4	Nankumba	5	2	3	MHG 17 - MHG 21
			5	Masuku	6	1	5	MHG 22 - MHG 27
			6	Chilipa	5	0	5	MHG 28 - MHG 32
			7	Mthilmanja	4	1	3	MHG 33 - MHG 36
			8	Katuli	3	0	3	MHG 37 - MHG 39
			9	Ntiya	4	0	4	MHG 40 - MHG 43
			10	Mbwadzulu	5	0	5	MHG 44 - MHG 48
		Balaka	11	Utale	5	0	5	MHG 49 - MHG 53
			12	Phalula	1	0	1	MHG 54
			13	Bazale	5	0	5	MHG 55 - MHG 59
			14	Ulongwe	5	0	5	MHG 60 - MHG 64
			15	Rivirivi	5	0	5	MHG 65 - MHG 69
			16	Mpilisi	5	0	5	MHG 70 - MHG 74
		Machinga	17	Nsanama	4	2	2	MHG 75 - MHG 78
			18	Nampeya	5	2	3	MHG 79 - MHG 83
			19	Mbonekera	3	1	2	MHG 84 - MHG 86
			20	Nyambi	6	0	6	MHG 87 - MHG 92
			21	Mtubwi	6	1	5	MHG 93 - MHG 98
			22	Nanyumu	4	4	0	MHG 99 - MHG 102
			23	Chuweq	3	0	3	MHG 103 - MHG 105
			24	Ngwelero	5	0	5	MHG 106 - MHG 110
		Zomba	25	Thondwe	5	4	1	MHG 111 - MHG 115
			26	Chingale	5	0	5	MHG 116 - MHG 120
			27	Mpokwa	5	0	5	MHG 121 - MHG 125
			28	Nsondole	4	0	4	MHG 126 - MHG 129
			29	Likangala	7	0	7	MHG 130 - MHG 136
			30	Dzaone	5	2	3	MHG 137 - MHG 141
			31	Malosa	5	0	5	MHG 142 - MHG 146
		Total of Machinga			**146**	**21**	**125**	
	Blantyre	Neno	1	Neno	4	4	0	BLT 1 - BLT 4
			2	Lisungwi	2	1	1	BLT 16 - BLT 17
		Mwanza	3	Mwanza	5	3	2	BLT 6 - BLT 10
			4	Thambani	5	3	2	BLT 11 - BLT 15
		Blantyre	5	Lirangwe	1	0	1	BLT 19
			6	Chipande	4	4	0	BLT 20 - BLT 23
			7	Ntonda	5	0	5	BLT 24 - BLT 28
			8	Kunthembwe	5	1	4	BLT 29 - BLT 32, 18
		Phalombe	9	Nkhulambe	3	0	3	BLT 33 - BLT 35
			10	Kasongo	1	0	1	BLT 36
		Chiradzulu	11	Mombezi	1	0	1	BLT 37
			12	Mbulumbuzi	1	0	1	BLT 38
			13	Thumbwe	6	6	0	BLT 39 - BLT 44
		Mulanje	14	Milonde	4	1	3	BLT 45 - BLT 48
			15	Mulanje Boma	2	0	2	BLT 49 - BLT 50
			16	Thuchila	6	0	6	BLT 51 - BLT 56
			17	Kamwendo	5	3	2	BLT 57 - BLT 61
		Thyolo	18	Masambanjati	4	3	1	BLT 62 - BLT 65
			19	Thekelani	4	0	4	BLT 66 - BLT 69
			20	Thyolo centre	3	0	3	BLT 70 - BLT 72
			21	Dwale	7	0	7	BLT 73 - BLT 79
			22	Khonjeni	2	1	1	BLT 80 - BLT 81
			23	Matapwata	4	4	0	BLT 82 - BLT 85
		Total of Blantyre			**84**	**34**	**50**	
	Shire Valley	Chikwawa	1	Dolo	5	0	5	SHV 1 - SHV 5
			2	Kalambo	10	0	10	SHV 6 - SHV 15
			3	Mitole	4	1	3	SHV 16 - SHV 18, 51
			4	Livunzu	4	0	4	SHV 19 - SHV 22
			5	Mbewe	5	3	2	SHV 23 - SHV 27
			6	Mikalango	4	2	2	SHV 28 - SHV 31
		Nsanje	7	Zunde	5	0	5	SHV 32 - SHV 36
			8	Nyachilenda	2	0	2	SHV 39 - SHV 40
			9	Makhanga	5	1	4	SHV 41 - SHV 45
			10	Mpatsa	3	0	3	SHV 46 - SHV 48
			11	Magoti	2	1	1	SHV 49 - SHV 50
		Total of Shire Valley			**49**	**8**	**41**	
Grand total					**883**	**230**	**653**	

4.4.2 Willingness, Needs, Affordability, etc.

The inventory survey has asked concerned farmer representative(s) of; 1) self-help works they have undertaken in the past, 2) why they have not constructed the irrigation system by themselves and what they need to construct the irrigation system, 3) willingness to provide voluntary labors, 4) willingness to bear cash contribution and how much, 5) needs to start irrigation upon completion of the irrigation scheme, 6) lunch offer to the GOM officers engaged, and 7) how much percentage the government should undertake as a whole, etc. Following are the summary:

1) Self-help Works

So far, almost all the villages have carried out some sort of their own self-help works, except for Blantyre ADD, where around 30% of the villages have no significant experiences of self-help works. These are village road construction/ rehabilitation, molding bricks in most of the cases, and in some cases canalization and building schools. Food for work and other works under provision of tool and materials have not so often been done; only about 0 to 20% community have experienced.

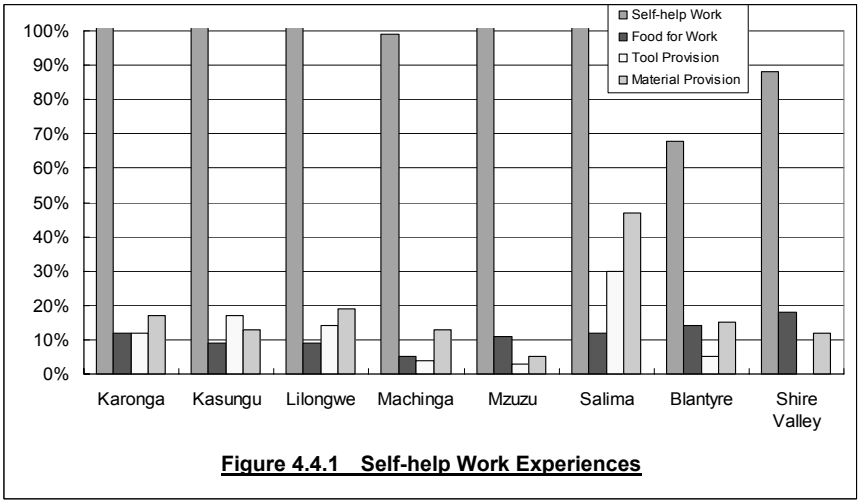


Figure 4.4.1 Self-help Work Experiences

2) Causes of not Starting Irrigation

Despite the irrigation potential in the vicinity of them, why they have not yet started the irrigation to date are: do not know how to use the water for irrigation with about 30% to as much as 50%; lack of initiative is about 30% to 40%; lack of technical services and/ or tools and materials are most commonly cited as about 50% to more than 90%. Of tools and materials they lack, most often cited were wheelbarrow, shovels, and cement.

3) Willingness to Provide Voluntary Work

About 75% to 90% by ADD have replied that they are ready to provide all the voluntary work

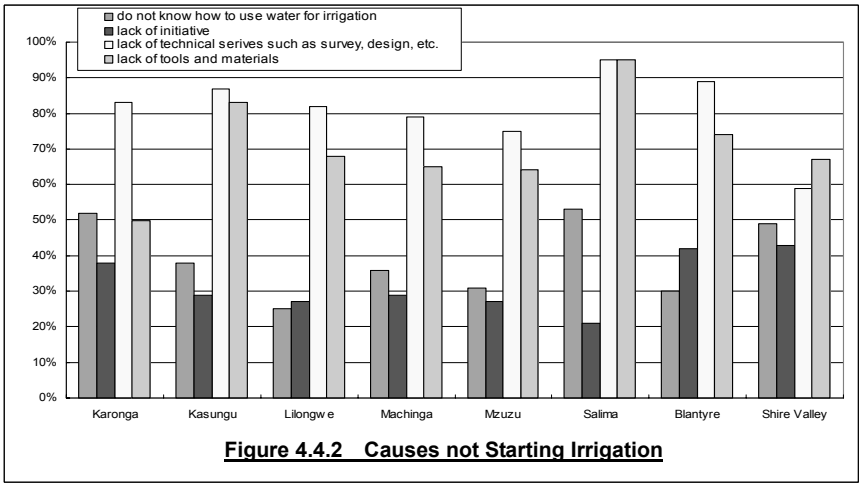


Figure 4.4.2 Causes not Starting Irrigation

required for the construction work (voluntary means no provision of food, etc.). The working hour would be limited to 3 to 4 hours a day since they do not take enough food, making them difficult to work over noon. While, the reason why about 10% village cannot provide the labor is mostly food shortage or busy for getting the food.

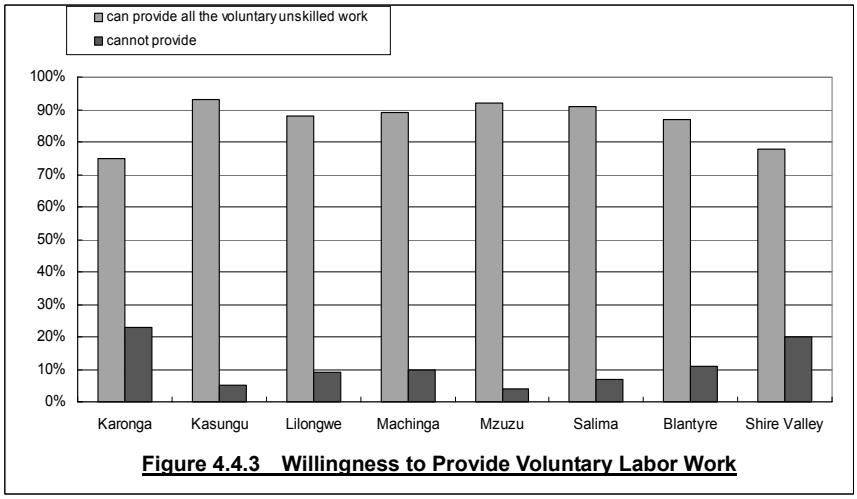


Figure 4.4.3 Willingness to Provide Voluntary Labor Work

4) Willingness for Cash Contribution

Irrigation system may require some foreign materials such as cements, wire, etc. In this case, cash contribution from the community may be needed. The amount how much they willingly contribute in cash to procuring the foreign materials is; less than MK 50 per household with about 10% to 25%, MK 50 – 100 per household with 30 to 40% which is the majority, and more than MK 100 becomes less in percentage.

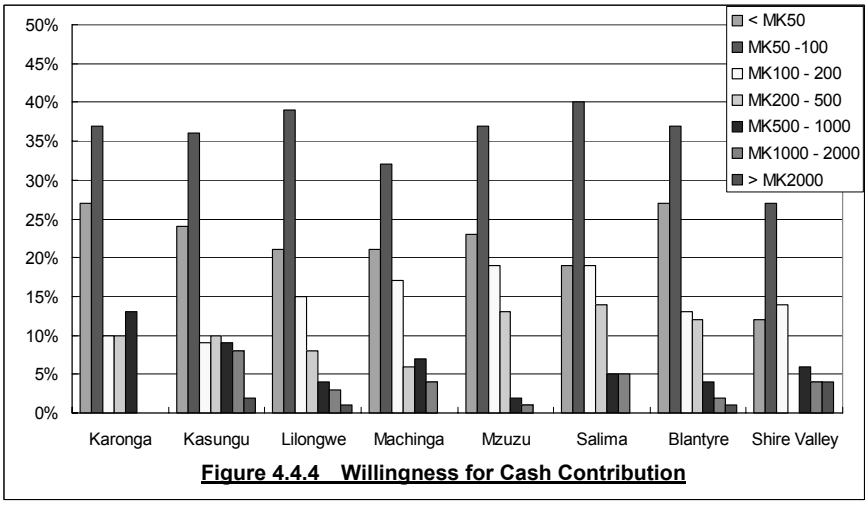


Figure 4.4.4 Willingness for Cash Contribution

5) Readiness to Start Irrigation upon Work Completion

About 60% responded they would start irrigation upon completion of the construction work. However, about 20% to 30% responded that they would still need some technical assistance such as training of water management. This

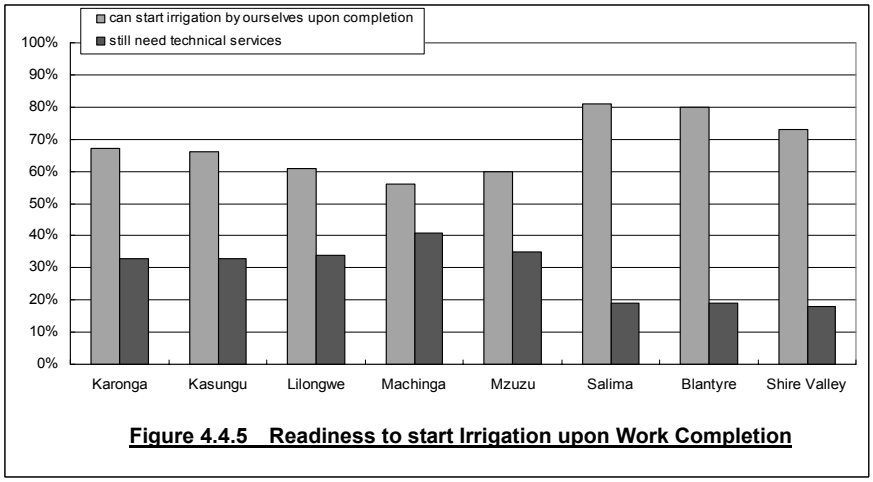


Figure 4.4.5 Readiness to start Irrigation upon Work Completion

tendency is less in southern part of the country. One unique thing is that more than half of the 30% responded they need seed and fertilizer otherwise they may not start irrigation. Seed and fertilizer are presently provided under a program called TIP, and this may have led the villagers to have that mind.

6) Lunch Offer to the Government Officers

During the construction work, the government officers have to attend the site. A question was given if the villagers are ready to offer lunch for the government officers. More than 80% responded, except Machinga and Blantyre, that they could provide local lunch. The reasons for the respondents who say that they cannot provide lunch are simply shortage of food in the village or fund to arrange the food. Machinga falls in a poorer region, so that the answer may have reflected the situation.

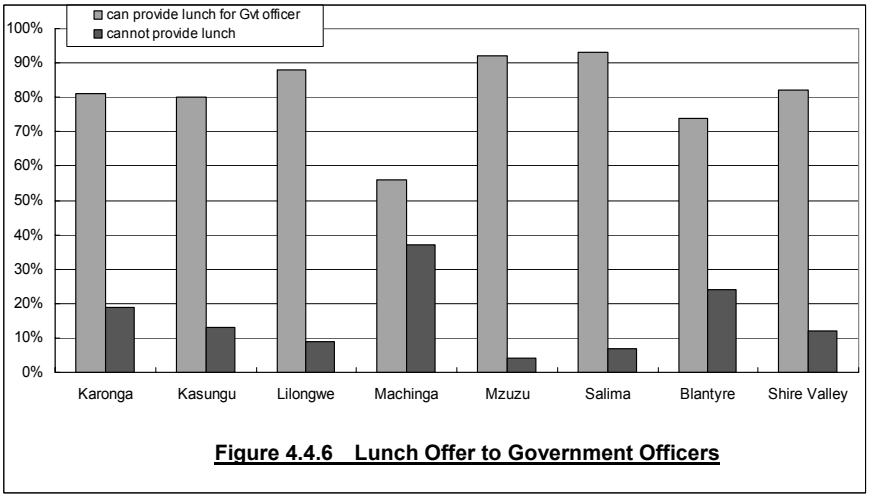


Figure 4.4.6 Lunch Offer to Government Officers

7) Government Contribution to the Project

As a whole, how much percentage do you want your government to undertake the construction/ rehabilitation work of the irrigation system was a question. The majority, about one every 3 villages, responded the government should bear about 40 to 60% of the whole construction requirement, meaning half-half sharing between the two.

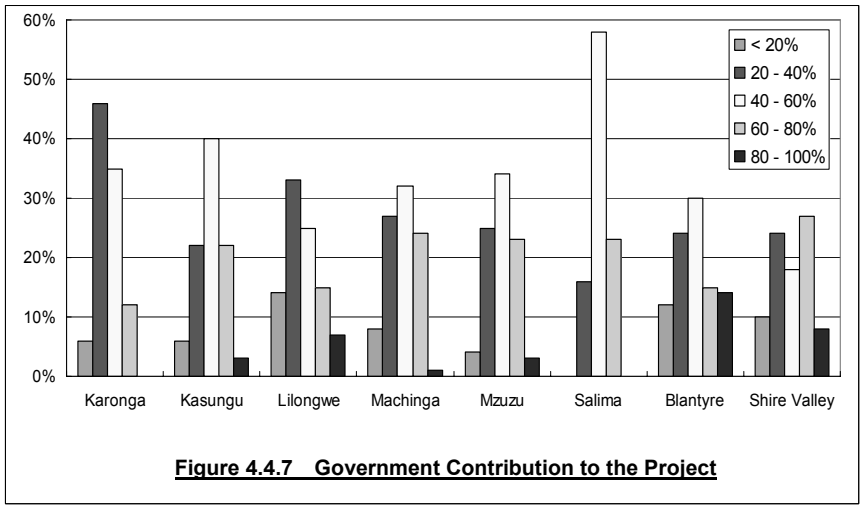


Figure 4.4.7 Government Contribution to the Project

4.4.3 Prioritization of Potential Areas

According to the result of the inventory survey, potential of smallholders irrigation development is rated in each level of EPA, RDP and ADD. The potential of EPA was ranked among the EPAs under the same super-ordinate RDP, likewise the potential of RDP, which is the sum of potentials of its subordinate EPAs, was ranked among the RDPs belonging to the

same ADD. Finally the potential of ADD was ranked among them.

The ranking was conducted from the viewpoints of physical condition, degree of self-effort of villagers, and the observation of concerned AEDOs on strength of the community. These points (indicators) were individually evaluated. Each indicator was scored as following explanations in Table 4.4.4 below and the result of the ranking is shown in Table 4.4.5.

Table 4.4.4 Indicators of EPA, RDP and ADD for Ranking

Indicator		Way of Scoring
1. Physical condition		The number of potential sites modified by the river flow condition is used. If the river flow of a site is perennial, score 1 is given and if it is seasonal, the score is 0. If the river flow of the site is seasonal, it is not included in the potential site.
2. Self-effort of villagers	2.1 Labor contribution	In each site, village leader was asked if they were willing to contribute labor. If the answer is yes, it is scored 1, otherwise 2. Average of the score of all the sites in an EPA is compared to that of other EPAs belonging to the same RDP. The lower the score is, the higher the EPA is ranked.
	2.2 Cash contribution	In each site, village leader was asked how much they could contribute to irrigation development. The score was given 1 to the answer of "less than 50MK", 2 to 50 – 100MK", 3 to "100 – 200MK", 4 to "200 – 500MK", 5 to "500 – 1000MK", 6 to "1000 – 2000MK", and to 7 to "more than 2000MK". Average of the score of all the sites in an EPA is compared to that of other EPAs belonging to the same RDP. The higher the score is, the higher the EPA is ranked.
	2.3 Expectation to Government	In each site, village leader was asked how much they thought the government should subsidize to irrigation development. The score was given 1 to the answer of "less than 20%", 2 to "20 – 40%", 3 to "40 – 60%", 4 to "60 – 80%", 5 to "more than 80%". Average of the score of all the sites in an EPA is compared to that of other EPAs belonging to the same RDP. The lower the score is, the higher the EPA is ranked.
3. Community strength (AEDO observation)		AEDO assessed the communities from the viewpoints of 1) Leadership, 2) Coherence, and 3) Dependency with 1 to "very strong", 2 to "strong", 3 to "medium", 4 to "weak" and 5 to "very weak" for each point. The score is aggregated by the form of 1)×2) / 3). The higher the score is, the higher the EPA is ranked.

Table 4.4.5 Ranking of EPA, RDP and ADD on Smallholders Irrigation Development (1/3)

ADD	RDP	EPA	Physical Condition	Labor Contribution	Cash Contribution	Less Expectation to Gvt	Community Strength
Lilongwe	Lilongwe West	Mpingu	1	1	5	9	11
		Thawale	2	1	5	1	8
		Mlombwa	3	8	10	3	5
		Mitundu	4	1	7	2	1
		Mngwangwa	5	12	7	10	6
		Demera	6	11	2	7	8
		Ukwe	7	8	1		
		Chileka	8	1	3	4	7
		Ming'ong'o	9	1	7	5	1
		Malingunde	10	1	12	7	4
		Mwala-Nthondo	11	1	3		10
		Chilaza	12	8	11	5	1
	RDP Total(Average)		1	3	5	2	1
	Lilongwe East	Chitekwere	1	1	4	7	3
		Nyanja	2	1	5	4	5
		Mkwinda	3	1	6	1	5
		Chiwamba	4	1		2	2
		Chitsime	5	1	3	6	1
		Chigonthi	6	1	2	5	4
		Mpenu	7	1	1	3	
	RDP Total(Average)		2	1	2	3	3
	Ntcheu	Kandeu	1	1	1		6
		Tsangano	2	7	3	2	5
		Shapevale	3	1	6	2	6
		Njolomole	4	1	4	4	2
		Nsipe	5	6	2	5	3
		Bilira	6	1	6	1	1
		Manjawira	7	1	5		4
	RDP Total(Average)		3	3	1	4	5
	Dedza East (Dedza Hills)	Kanyama	1	1	3	5	4
		Mayani	2	1		3	
		Mtakataka	3	1	1	1	1
		Kaphuka	4	1	2	6	2
		Golomoti	5	1	4	2	5
		Bembeke	6	1	4	4	3
	RDP Total(Average)		4	1	2	1	3
	Dedza West (Thiwi-Lifidzi)	Chafumbwa	1	1	1	1	1
		Linthipe	2	4	2	4	
		Lobi	3	1	2	3	1
		Kabwazi	4	1	2	1	3
	RDP Total(Average)		5	3	4	4	2
ADD Total(Average)			1	2	4	2	6
Mzuzu	Central Mzimba	Champhila	1	1	2	10	16
		Manyamula	2	1	7	4	8
		Emsizini	3				
		Luwerezi	4	1	18	11	6
		Kazombo	5	1	10	2	3
		Khosolo	6	1	3	4	8
		Bwengu	7	17	9	18	17
		Mbawa	8	1	16	11	8
		Eswazini	9	1	5	1	3
		Malidade	10	1	7	8	13
		Zombwe	11	1	6	4	13
		Mjinga	12	1	10	7	11
		Emfeni	13	1	4	3	11
		Mpherembe	14	18	16	17	18
		Mbalachanda	15	1	10	15	2
		Njuyu	16	1	10	11	6
		Vibangalala	17	1	15	14	5
		Euthine	18	1	10	15	15
		Bulala	19	1	1	8	1
	RDP Total(Average)		1	1	2	1	3
	Nkhata Bay	Mzenga	1	1	2	1	2
		Chitheka	2	1	5	5	3
		Mpamba	3	1	2	3	6
		Chinthechi	4	1	7	2	1
		Tukombo	5	7	1	6	3
		Nkhata Bay	6	1	6	6	5
		Chikwina	7	1	4	4	7
	RDP Total(Average)		2	1	1	2	1
	Rumphi/N.Mzimba	Katowo	1	1	1	5	3
		Mphonpha	2	4	2	3	1
		Mhuju	3	4	5	4	
		Ntchenachena	4	1	3	1	4
		Chiweta	5	1	3	1	2
	RDP Total(Average)		3	3	2	3	1
ADD Total(Average)			2	2	7	6	1

Table 4.4.5 Ranking of EPA, RDP and ADD on Smallholders Irrigation Development (2/3) Con'd

ADD	RDP	EPA	Physical Priority	Labor Contribution	Cash Contribution	Less Expectation to	Community Strength
Kasungu	Dowa	Mvera	1	1	3	5	7
		Nachisaka	2	7	2	4	5
		Chivala	3	1	5	2	2
		Chisepo	4	1	3	1	6
		Madisi	5	1	1	6	4
		Mponela	6	1	7	3	1
		Modolera	7	1	6	7	3
	RDP Total(Average)		1	1	4	3	1
	Ntchisi	Chipuka	1	1	2	3	3
		Kalira	2	4	3	4	1
		Chikwatula	3	1	4	1	4
		Malomo	4	1	1	2	2
	RDP Total(Average)		2	3	2	1	2
	Mchinji	Mkanda	1	1	2	2	3
		Mlonyeni	2	1	6	3	1
		Chioshya	3	1	5	1	2
		Kalulu	4	6	3	4	4
		Msitu	5	1	3	5	4
		Mikundi	6	1	1	5	6
	RDP Total(Average)		3	1	3	4	4
	Kasungu	Chipala	1	5	3	4	4
		Chamama	2	1	2	6	2
		Santhe	3	6	1	2	3
		Lisasadzi	4	1	6	3	1
		Bowe	5	1	4	5	5
		Kaluluma	6	1	5	1	6
	RDP Total(Average)		4	3	1	2	3
ADD Total(Average)			3	1	4	4	5
Machinga	Mangochi	Mpilipili	1	1	5	4	8
		Masuku	2	1	4	3	5
		Nankumba	3	1	2	4	
		Lungwenya	4	10	1	10	
		Mthilmanja	5	1	7	8	1
		Ntiya	6	1	7	1	6
		Chilipa	7	1	9	9	6
		Katuli	8	1	6	4	3
		Nasenga	9	1	10	7	4
		Mbwadzulu	10	1	3	1	2
	RDP Total(Average)		1	1	3	3	1
	Zomba	Thondwe	1	1	6	6	
		Malosa	2	1	5	3	1
		Mpokwa	3	1	2	2	2
		Likangala	4	7	4	4	4
		Dzaone	5	1	3	7	
		Chingale	6	1	1	1	5
		Nsondole	7	1		5	2
	RDP Total(Average)		2	1	4	1	4
	Balaka	Ulongwe	1	1	5	1	1
		Utale	2	5	1	5	1
		Mpilisi	3	1	3	4	
		Rivirivi	4	1	5	3	
		Bazale	5	1	3	1	
		Phalula	6	5	2	6	1
	RDP Total(Average)		3	4	2	2	3
	Machinga	Mtubwi	1	7	5	6	8
		Nyambi	2	1	2	5	5
		Mbonekera	3	1	4	8	2
		Nsanama	4	1	3	4	4
		Nampeya	5	1	1	1	6
		Ngwelero	6	6	7	7	7
		Nanyumu	7	1	6	2	1
		Chuweo	8	7		3	3
	RDP Total(Average)		4	3	1	3	2
ADD Total(Average)			4	2	2	3	4

Table 4.4.5 Ranking of EPA, RDP and ADD on Smallholders Irrigation Development (3/3) Con'd

ADD	RDP	EPA	Physical Priority	Labor Contribution	Cash Contribution	Less Expectation to Gvt	Community Strength
Blantyre	Thyolo	Dwale	1	1	3	2	4
		Masambanjati	2	1	2	4	1
		Thekelani	3	1	5	3	3
		Thyolo centre	4	1	6	1	2
		Khonjeni	5	1	4	5	
		Matapwata	6	6	1	6	4
	RDP Total(Average)		1	1	3	1	1
	Mulanje	Thuchila	1	3	1	1	2
		Kamwendo	2				
		Milonde	3	1	2	3	2
		Mulanje Boma	4	1	2	2	1
	RDP Total(Average)		2	5	7	4	4
	Blantyre	Kunthembwe	1	3	3	2	4
		Ntonda	2	2	2	3	2
		Chipande	3	1	1	1	3
		Lirangwe	4	4		4	1
	RDP Total(Average)		3	7	2	2	3
	Mwanza	Thambani	1	1	2	2	1
		Mwanza	2	1	1	1	2
	RDP Total(Average)		4	1	5	3	5
	Neno	Neno	1	1	1	1	2
		Lisungwi	2	2	2	2	1
	RDP Total(Average)		5	6	1	6	7
	Chiradzulu	Thumbwe	1	1	3	1	2
		Mbulumbuzi	2	1	1	3	3
		Mombezi	3	1	1	2	1
	RDP Total(Average)		6	1	6	4	2
	Phalombe	Nkhulambe	1	1	2	2	1
		Kasongo	2	1	1	1	1
	RDP Total(Average)		7	1	4	7	6
ADD Total(Average)			5	2	7	8	2
Shire	Chikwawa	Kalambo	1	5	3	5	5
		Livunzu	2	1	4	4	1
		Mikalango	3	1		3	3
		Mitole	4	1	4	1	4
		Dolo	5	6	1	6	2
		Mbewe	6	1	2	1	
	RDP Total(Average)		1	1	1	1	1
	Nsanje	Makhanga	1				
		Zunde	2	1	3	2	
		Nyachilenda	3	4		1	1
		Magoti	4	1	2	3	
		Mpatsa	5	1	1	3	1
	RDP Total(Average)		2	1	2	2	2
ADD Total(Average)			6	2	1	4	6
Karonga	Karonga	Kaporo north	1	8	1	6	3
		Kaporo south	2	9	8	8	1
		Mpata	3	1	3	5	6
		Karonga south	4	1	2	2	4
		Vinthukutu	5	1	4	2	4
		Karonga	6	1	4	2	7
		Kaporo	7	1	9	9	9
		Karonga north	8	1	4	7	2
		Lupembe	9	1	7	1	8
	RDP Total(Average)		1	2	2	1	2
	Chitipa	Chisenga	1	1	6	4	5
		Lufita	2	1	3	3	2
		Kavukuku	3	1	1	1	3
		Mwamkumbwa	4	5	4	4	6
		Misuku	5	5	2	2	4
		Kameme	6	1	4	6	1
	RDP Total(Average)		2	1	1	2	1
ADD Total(Average)			7	2	4	1	2
Salima	Nkhotakota	Zidyana	1	1	3	1	3
		Linga	2	1	4	1	
		Nkhunga	3	1	1	4	1
		Mwansambo	4	4	2	3	2
	RDP Total(Average)		1	1	2	2	1
	Salima	Tembwe	1	4	1	2	4
		Chipoka	2	1	4	4	1
		Khombedza	3	3	2	2	2
		Chinguluwe	4	1	3	1	3
	RDP Total(Average)		2	2	1	1	1
ADD Total(Average)			8	8	2	7	6

CHAPTER 5

SMALLHOLDER IRRIGATION DEVELOPMENT PACKAGE

CHAPTER 5 SMALLHOLDER IRRIGATION DEVELOPMENT PACKAGE

This chapter describes "Smallholder Irrigation Development Package", which a set of dissemination materials. The package at first consisted of "comprehensive guideline" and "technical manual", and then posters, leaflet and picture stories were added on the course of the implementation, which were meant to serve wide-range of dissemination. The package was once drafted prior to the commencement of the verification projects and through the verification projects it was modified and refined. The package is presented separately from this Main Report, and therefore only brief explanation is made hereunder.

5.1 Cascading of the Package

As one of the objectives of this Study is to establish a package of methodologies for self-help smallholder irrigation development, this Study aims at producing a comprehensive guideline with several dissemination materials which themselves together consist of the package. The package is now composed of: 1) a comprehensive guideline, 2) technical manual, 3) leaflets, 4) posters, and 5) picture stories, which are cascaded with reference to the existing MOA's organizational structure. The MOA is stratified at ADD, RDP and then EPA in order to well disseminate agriculture related extensions, thereby the package should also be stratified.

The comprehensive guideline is mainly for DOI irrigation officers, ADD irrigation officers and RDP irrigation officers, technical manual mainly for RDP irrigation officers and the frontline extension officers called AEDOs, and leaflets chiefly for the AEDOs and farmers. Posters will be posted in relevant government offices such as EPA, RDP, ADD and local government offices in order to widely disseminate the smallholder irrigation development in a campaign style. Picture stories can be used during kick-off workshop which invites potential farmers, aiming at getting the farmers interested in embarking on the irrigation development.

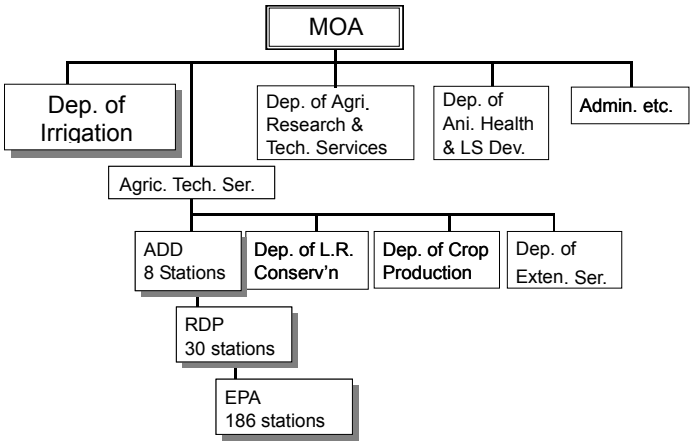


Figure 5.1.1 Technical Line of the Ministry

Table 5.1.1 Cascaded Dissemination Materials

Material	Prime Users	Remarks
Comprehensive Guideline	DOI, ADD, RDP irrigation officers	One copy should be furnished to EPA
Technical Manual	RDP irrigation officers, EPA AEDOs/AEDCs	
Leaflets	EPA AEDOs, farmers	
Posters	Relevant offices	Including local government offices
Picture Stories	EPA AEDOs, farmers	Prepared by AEDOs during AEDO training course

5.2 Comprehensive Guideline

This guideline comes first for the cascaded dissemination materials and the prime users are officers of DOI, ADD, and RDP. It deals with broad framework of smallholder irrigation

development, general implementation arrangement and procedural flow, participatory planning, organizing process of farmer irrigators club and the organizational internal set-up, overall irrigation facilities & construction, monitoring and evaluation at national level, public equity in conjunction with irrigation development, and appropriate agriculture technologies that have to be incorporated in the irrigation development. This guideline gives an overall direction in pursuing smallholder irrigation development to and facilitates comprehensive understandings for the users.

The comprehensive guideline was firstly drafted in the Interim Report presented in May 2003, and had been used through the implementation of the 1st generation verification projects during 2003 dry season. First revised version was produced in November 2003 incorporating the lessons learnt from the 1st generation verification projects, and then distributed to all the 8 ADDs and 4 RDPs of Ntchisi, Dowa, Lilongwe East and Dedza Hills. The guideline was also distributed to the 26 EPAs under the 4 RDPs, which participated in the 1st AEDO training in May/June 2004, then referred to in promoting 2nd generation verification projects tried in 2004 dry season. The guideline has thus been tested through 2-year of implementation of the verification projects, and finalized with the following modules:

MODULE 1 Development Objectives, Strategy and Procedures
MODULE 2 Participatory Planning
MODULE 3 Identification of the Project Sites
MODULE 4 Organizing Farmers Club
MODULE 5 Design of Irrigation Facilities
MODULE 6 Construction
MODULE 7 Operation and Maintenance
MODULE 8 Appropriate Farming in Irrigated Agriculture
MODULE 9 Participatory Monitoring and Evaluation
MODULE 10 Providing Sustainable System
MODULE 11 Gender and Development

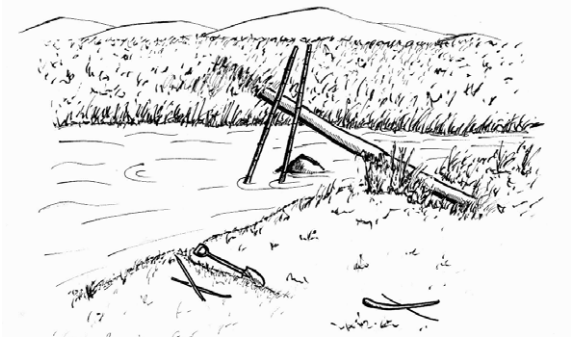
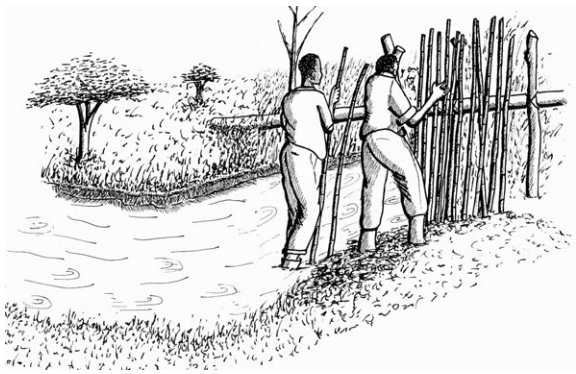
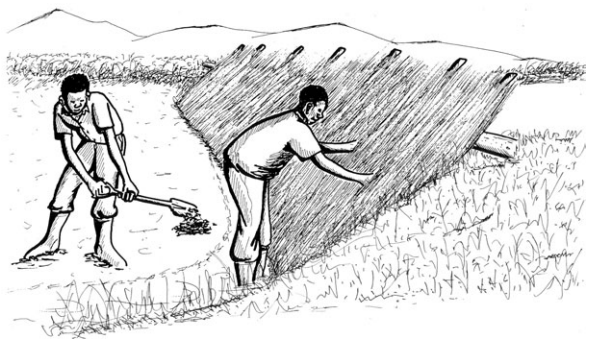
5.3 Technical Manual

The technical manual shows how to construct different types of weirs together with necessary materials and tools, align canal, construct ancillary facilities such as canal bridge, irrigation methods, etc., and in most cases is referred to by frontline officers and RDP irrigation officer. This manual also incorporates agriculture component such as compost manure making, botanical pesticide, liquid fertilizer, improved grain storage, etc. PD method[1] developed in

[1] The word of "PD method" comes from "Process Description method". This is a JICA technology transfer method of producing both an operation manual and (audio) visual aids using photos or illustrations, which are portrayed by superposing on the photos, of a series of actual activities of a work. This method is applicable not only for describing operation processes but also explaining all the field operation activities for a specific work. The process description is made by: 1) taking a series of photos of a work, and 2) describing the activities in the photos by step mostly by counterpart, through which the counterpart will acquire the skill and knowledge necessary for the work and also the manual will be produced simultaneously. Source: Hideyuki KANAMORI (1994): Effective Technology Transfer by PD Method (in Japanese), Journal of the Japanese Society of Irrigation, Drainage and Reclamation Engineering, Vol.62, No.12, pp.7-12

IFIC, JICA was employed in producing this manual, with which a step-wise detailed explanation is made together with illustrations following what to do step by step to, for example as shown below, construct an inclined standard weir.

Table 5.3.1 An Example of Technical Manual: Construction of Inclined Weir

Process	*Description*
	*Put a horizontal supporting log at the diversion point across the stream. It is advisable that the horizontal log is put on a place where there are tree stump/rock for support of a log. If there are no objects for support, put something such as stone to keep the log from moving by water pressure and weight of the brush dam itself.*
	*The vertical members composed of bamboo/twigs are put in front of the horizontal supporting log. To put grasses and soil easily, the vertical members should be put as closely as possible. These vertical members are placed into the foundation which is replaced by clay soil at the bottom and again connected to horizontal support log at the top using materials such as runner.*
	*Grasses are placed or fixed in front of the vertical members. Grasses are at first piled horizontally, and then vertical standing grasses should be placed in the front. To prevent the grasses from swelling out, the grasses are bound by horizontal members such as bamboo and tied together with the vertical members.*
	*The clay soil is patched on the grasses to prevent seepage from the brush weir. The clay soil is collected from around the weir. To prevent water leakage, the clay soil is patched tightly on the grasses. The clay soil is put not only on grasses as a part of dam but also on the stream banks in contact with the weir to prevent seepage going around the weir.*

The manual has been prepared through the experiences of 1st generation verification projects,

and the first draft was presented to all the 8 ADDs and the 4 RDPs in November 2003. The manual was also the major material used during the 1st AEDO training, and given to all the participants. The AEDOs have referred to the manual during the development of smallholder irrigation schemes and made feedbacks to the Study Team. Given recommendations and comments by the AEDOs, the manual was refined and is now presented with this Final Report for the following 17 works:

IRRIGATION FACILITIES;

1. Construction of Brush Dam: Inclined Wall Type (Type-A)
2. Construction of Brush Dam: Vertical Wall Type (Type-B)
3. Construction of Brush Dam Supported by Trigonal Prop (Type-C)
4. Construction of Brush Dam having Double Lines (Type-D)
5. Construction of Diversion Weir made of Rock & Clay (Type-E)
6. Construction of Canal Bridge
7. Canal Alignment using Line-level
8. Rock Breaking
9. Irrigation Method (Section 1; Furrow Irrigation, Section 2; Basin Irrigation)
10. Discharge Measurement (Section 1; by V-notch, Section 2; Float Method)
11. Problems and Measures on Construction of Irrigation Facilities

AGRICULTURE COMPONENTS;

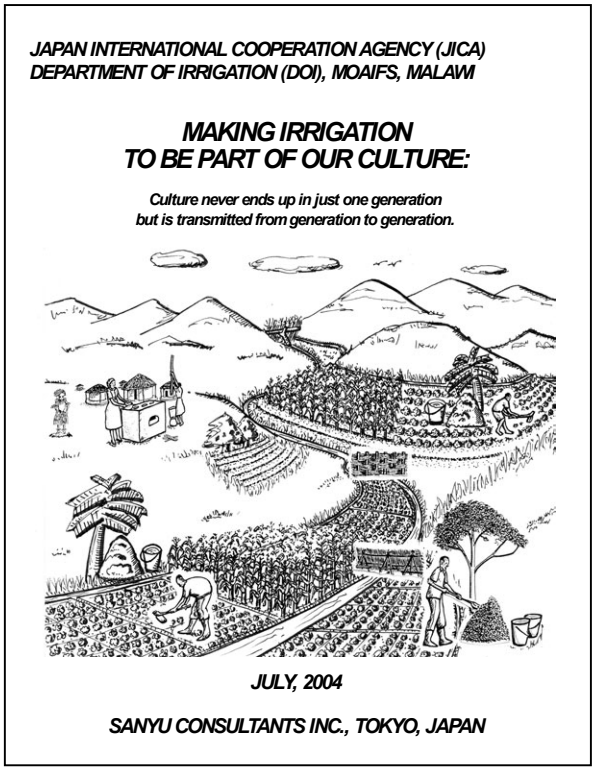
12. Bocashi, a Type of Quick Making Compost Manure
13. Chinese Compost Manure
14. Liquid Fertilizer
15. Botanical Natural Pesticide
16. Improved Grain Storage
17. Construction of an Energy Saving Stove (Kamado)

5.4 Leaflet

Leaflet is meant to serve wide range of dissemination and to be used by frontline extension officers and farmers. Leaflet briefly shows all the steps to develop smallholder irrigation schemes together with simple illustrations. The first version was produced in November 2003, and distributed to all the 8 ADDs and the 4 RDPs. The first version of the leaflet explained irrigation development only, and now the final version is reproduced inclusive of Bocashi manure: a type of quick compost manure[2]. Irrigation usually demands two times usage of same land, exploiting further the soil fertility and resulting in unproductive soil unless the soil is well taken care of. From the viewpoint of both physical improvement of and supplementing nutrition to the soils, the final version has incorporated the Bocashi and has been produced in both English and Chichewa versions (10 pages for English version and 14 pages for Chichewa version). The cover, which shows how rural life with irrigation looks nice, and contents of the leaflet are as follows:

[2] Conventional compost requires 2 to 3 months to be matured, while the Bocashi needs only 2 to 3 weeks to be ready to use. Bocashi incorporates virgin soils which are abundant with microorganisms which facilitate decomposition process.

1. Attitude to promote irrigation culture
2. Identify potential diversion site
3. Construct diversion structure
4. Align canal and start digging
5. Layout the plot and do the irrigation
6. Issues and concerns
7. A quick making compost manure: Bocashi



5.5 Posters

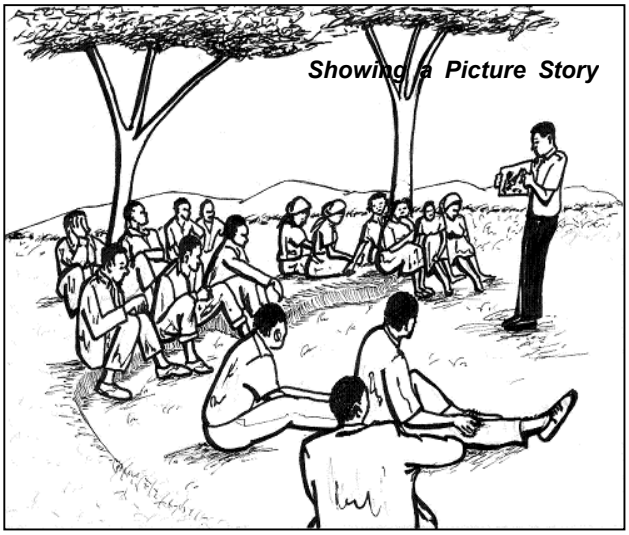
To disseminate smallholder irrigation development further widely, posters have been produced. The posters are composed of five A-2 sheets, making altogether a story from showing a rural life engaging irrigation to cooking products from the irrigation. Poster No.1 shows overview of a rural life how people can live around the irrigation. Posters No.2 & No.3 directly deal with the main irrigation facility; that is diversion weir. Weirs shown in Poster No.2 are very simple ones such as standard inclined weir and standard vertical weir. Weirs in Poster No.3 are advanced ones like double-line weir and trigonal stand structure supported one. Poster No.4 disseminates Bocashi compost manure, a quick making compost.

Poster No.5 shows a modern cooking stove on which the irrigator farmers are solicited to cook their harvest. The modern cooking stove, though made out of locally available materials only, can save firewood at least half to as much as two thirds, which implies conservation of catchment area. Catchment area produces irrigation water so that the Poster No.5 is meant to raise sustainability of irrigation schemes as well as serve environmental conservation. The head-messages of the 5 posters are as follows:

1. What the irrigation life is like ! How people live around the irrigation !
2. Construct simple weirs for diverting the water to your farmlands !
3. Use upgraded weirs in needs of reducing leakage, traversing wide stream, etc. !
4. Apply a new type of compost manure to raise the irrigated plants well ! The compost, called BOCASHI, can be ready in 2-3 weeks, and very nutritious !
5. Cook the products of irrigation on an energy efficient stove, called KAMADO ! This stove can save firewood by at least half, thus conserving the catchment area !

These posters, except No.1, can also be used as picture stories as they show how to construct, for example, weirs by step. If an extension officer needs to know detail construction procedure, he/she should refer to the technical annual. However, if he/she needs to show farmers how a weir can be constructed or how Bocashi compost manure made, the extension officer can, while explaining, show the posters to the farmers. The posters will be of great help for the extension officers to let the farmers well understand and get them motivated

especially during kick-off meeting.

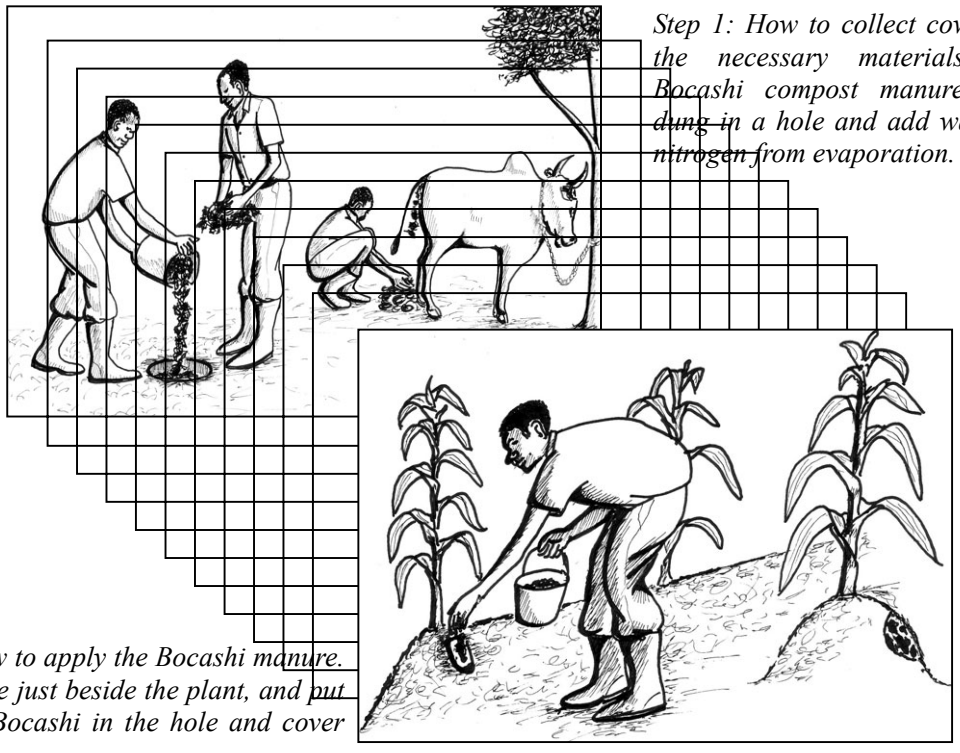


5.6 Picture Stories

Picture story is a series of pictures which together explains visually all the necessary steps of a work such as how to construct standard inclined weir, how to construct standard vertical weir, how to align canal, how to irrigate farmland, etc. The picture story is structurally very similar to the technical manual made by PD method, and actually most of the illustrations were picked up from the ones employed in the manual. Illustrations picked up were zoomed up to A-3 size, and the black and white copies were given to the AEDOs who participated in the 1st AEDO training. They had colored the illustrations with color pencils and pasted on A-3 thick papers together with technical notes on the back.

The picture stories are now kept by all the 26 EPAs under the 4 RDPs of Ntchisi, Dowa, Lilongwe East and Dedza Hills. The stories can be used during kick-off meeting to get the potential irrigator farmers motivated onto the smallholder irrigation development. Likewise, the stories can be shown just before a specific work such as how to construct a weir, how to align canal, how to irrigate the farms, etc, by which the farmers can well know how to proceed to the work. In this case, these picture stories can work as posters do but more detailed step is available.

Figure 5.6.1 An Example of Picture Story



Step 1: How to collect cow dung, one of the necessary materials of making Bocashi compost manure. Collect the dung in a hole and add water to prevent nitrogen from evaporation. Then, ……..

Step n: How to apply the Bocashi manure. Make a hole just beside the plant, and put a handful Bocashi in the hole and cover it with soil.