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Chapter - 1
Potentials of Farmer Organizations to
Agricultural Development: Case of Mezam
Division, Cameroon

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Chapter - 1

Potentials of Farmer Organizations to Agricultural Development: Case of Mezam Division, Cameroon

Kenette Fru Mbangari and Guillaume Hensel Fongang Fouepe

Abstract

The study was carried out under the auspices of the Divisional Technical Unit of the PCP-ACEFA from January 2018 to March 2019 in Mezam Division of the North West Region of Cameroon. The study sought to assess the socio-economic impact of farmers' organizations on farmers in the Region. More specifically, to characterize these FOs and their associated partners; analyze the resources of FOs and those of their associated partners; determine the contribution of FOs at the level of farmers, organization and community, determine the role of FOs to agricultural development of the Division and their sustainability actions on farmers. To attain these objectives, secondary source data were reviewed. Primary source data were obtained directly from the field, seventy (70) FOs were then selected and 280 farmers interviewed using a semi structured questionnaire. Seven leaders were interviewed using an interview guide and direct observations were made. The data obtained were treated and analyzed with "SPSS" software and presented in form of simple tables, curves, bar charts and student (t) parametric test. The analysis of the resources of FOs reveals that since 1995 till date FOs had received aid from SAILD, MINADER, MINEPIA, SOS Faim, EC, American Peace Corps, VSO and ACEFA. SOS Faim and ACEFA had been the best aid donor to FOs. The amount of aid increased with time from 868,000FCFA in 1998 to 216,160,428FCFA in 2010 for the case of aid from SOS Faim and EU. Also, for PCP-ACEFA, the amount of aid received by FOs increased with time from 110, 906,670FCFA in 2013 to 204,764,858FCFA in 2018. Internal resources were mobilized through annual dues, fines, deductions from sales, registration, interests and petty Income Generating Activities (IAGs). Observations from the study showed that FOs contributed positively to beneficiary farmers' well-being and living environment. The contribution on the development of technical and organisational capacities of the farmers was overall positive as farmers had

improved skills in input supply (51%), production (39%) and market access (27%) compared to non-beneficiaries. The contribution on the strengthening of the organisation as a whole was overall positive since it had permitted FOs to respectively employ technical staff (53%) and boosted membership (46%) and improved group input supplies and group sales in the organisation. The contribution on the financial capacities of farmers was overall positive as 49% and 47% of the beneficiary farmers respectively had a statistically significant higher income than non-beneficiaries. The contribution of FOs to agricultural development was overall positive as 44, 54, 41, 44 and 51% of the respondents respectively expressed satisfaction of co-management of projects, involvement in lobbying and advocacy, writing of projects, better follow up, and information and experience sharing to farmers. The contribution of farmers' organizations on the community of farmers and environment was overall positive. Conclusively the contribution of FOs to rural development was overall positive in spite of challenges such as funds not available on time. The study recommends that donors and FOs should provide aid on-time and in accordance with farming calendar. For sustainability, FOs should diversify their activities, put in place an animal feed production unit, and a shop for the supply of agricultural inputs. Farmers should be encouraged to organize themselves into FOs so as to solve farmers' problems with ease.

Keywords: beneficiary, contribution, impact, farmer organisations, Cameroon

1. Introduction

In Cameroon like in many other countries in Sub-Saharan Africa, agriculture is the main-stay of the economy employing about 70% of the population (Food and Agricultural Organisation, FAO, 2012:3). Agricultural development is enhanced when farmers are grouped into FOs to facilitate improved access to inputs like seeds, fertilizers, animals, agro chemicals, farm tools and equipments, capacity building, marketing and access to production credit (African Development Bank, AfDB, 2010:38).

NOWEFOR (2012:15) highlighted that farmers in the North West Region of Cameroon are faced with a number of problems in agriculture, which lead to low production and productivity. Constraints include inadequate access to inputs, low level of agricultural mechanization, small farm sizes per farmer, limited skills in production and marketing, poor storage and marketing facilities. When all of these are coupled with the low literacy levels of the farmers, they remain poor and disadvantaged when farming is their main

source of income. These problems delay the growth and development of farmers.

Meanwhile it is widely believed that FOs play a key role in the development of rural community of farmer through the provision of services such as training, productive resources, access to marketing, credit, and information to farmers thereby facilitating the improvement of their incomes and living conditions. Gouët *et al.* (2009:75) highlighted that FOs contribute in promoting rural development by serving as a framework for sharing information, co-coordinating activities and making collective decisions, and creating opportunities for producers to get more involved in value-added activities such as input supply, credit, processing, marketing and distribution on one hand and create awareness in view of defending farmers interest. **2. Role of FOs in the reinforcement of the capacity's farmers**

a) Contribution at the level of the farmer

Table 1: Distribution of respondents by acquired skills and abilities in farm business

Parameters & characteristics	Category of beneficiaries		
	Beneficiaries (%)	Non-beneficiaries (%)	Total 280 (%)
Input supply skills			
Increased	144 (51.42%)	24 (8.57%)	168 (60.00%)
Constant	8 (2.85%)	96 (34.28%)	104 (37.14%)
Decreased	8 (2.85%)	0 (0%)	8 (2.85%)
Improved production skills			
Increased	108 (38.57%)	32 (11.42%)	140 (50.00%)
Constant	28 (10.00%)	68 (24.28%)	96 (34.28%)
Decreased	24 (8.57%)	20 (7.14%)	44 (15.71%)
Improved marketing skills			
Increased	76 (27.14%)	32 (11.42%)	108 (38.57%)
Constant	28 (10.00%)	64 (22.85%)	92 (32.85%)
Decreased	56 (20.00%)	0 (0%)	56 (20.00%)

As revealed by Table 1, 51% of input supply skills and abilities of the beneficiary farmers increased compared to 9% of the non-beneficiaries.

Table 1 also reveals that 39% of improved production skills and abilities of the beneficiary farmers increased compared to 11% of the non-beneficiary farmers. Twenty eight percent (28%) of improved marketing skills and abilities of the beneficiary farmers increased compared to 11% of the nonbeneficiary farmers. Figure 1 shows a training session conducted by FOs at Mforyah Integrated Farmers Union (MIFU). The farmers were trained on input needs assessments skills, improved production techniques and marketing for viable commodity chains such as market gardening, poultry piggery, ginger, etc. Usually before any training of farmers commenced, a training of trainers' workshop was organized that brought together farmer resources persons, agriculture and livestock officers of the Ministries of Agriculture and that of Livestock and local partner organizations to harmonize the training packages per subsector of production like market gardening, poultry and piggery. The farmers were trained on thematic areas such as joint inputs needs assessments, joint commands and negotiations for bulk inputs, group supplies and distribution as shown in Figure 2.



Fig 1: Training of trainers' workshop at NOWEFOR

The following strategies were used to implement the training at the farmer level in and around Mezam Division. **i) Building farmers capacities**

After more than ten years of collaboration between NOWEFOR and farmers both parties recognized that NOWEFOR had acquired sufficient capacities to assume its organizational responsibilities. In 2008, NOWEFOR put in place a successful system of peer training which has been extended to all unions and farmers. This system consisted of identifying elite farmers and some who have capacities to organize trainings for other peer farmers. These resource persons collaborated with project staff to design training modules and technical slips and implemented the trainings.



Fig 2: Training of farmers in Mforyah on improved techniques on reduced chemical residues tomatoes production

The number of trained farmer resource persons or leaders increased with time from 25 leaders in 2007 to 490 leaders in 2017 as illustrated in Figure 3.

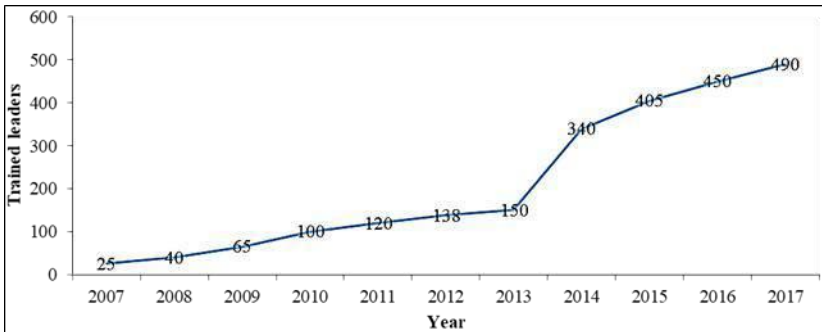


Fig 3: Evolution of trained farmers of NOWEFOR

ii) Evolution of the contribution and targeting

The FOs followed a rolling approach in implementing the trainings. They proceeded from a nucleus of farmers who met up with the performance criteria as follows:

- Have paid annual dues and all other levies in the union.
- Be a registered member in the credit house.
- Not be a delinquent member.
- Be a producer (have a current farm).
- Been saving at least once a month in the credit house.
- Must have been in the union for at least 2 years.

- Must be resident in the Zone.
- Must not be on a permanent salary.

The trainings sessions or workshops started up with more experienced farmers and peer training system was used thus reducing training cost and at the same time built a strong success base for subsequent expansion. New farmers were therefore taken care of when they have also met their minimum performance criteria as it played a big role on material obligations and financial contributions.

iii) Production sector approach

The commodity chain approach was used here to develop crop and livestock production. This entailed working on key areas along the value chain from production to marketing of products. In this approach farmers were organized around the main commodities; market gardening, poultry and pig production. This organization was needed to facilitate training of farmers and exchange of experiences amongst a critical number of farmers involved in a particular production chain.

Once farmers were organized, group input need assessments, group commands and supplies of inputs were easily carried out as illustrated in Figure 4. According to group discussions, to succeed in this approach, local management committees were elected and trained to handle the input supply mechanisms. This approach also facilitated timeliness in farm activities and thus increased the productivity of the agricultural enterprises.



Fig 4: Group input supply of cement and chicks to boost poultry subsector in Bambui

iv) Integration of livestock and crops/promotion of organic manure

Our interviews with farmers and farmer leaders revealed that crop and livestock integration was the principle promoted. These farmers were trained amongst others to manage organic manure from their livestock farms and to integrate this in their gardens.

v) Direct production assistance

Farmers after receiving training on improved production skills per subsector were provided with necessary productive resources to scale up or start up their enterprises. The external input was combined to local dynamics and local contributions to realize the projects. And as such this partnership was needed for the appropriation of the actions. Inputs provided included seeds, piglets, chicks, manure, agrochemicals, etc. as shown in Figure 5. However, farmers were trained to control the use of these products in the expansion of their farms.



Fig 5: Farmers in Mfoyah receiving piglets and feed through FOs to boost pig subsector

vi) Participatory approach

FOs works in a participatory manner in its intervention approach. Our focus group discussions with farmers revealed that the two parties (SOS FAIM and NOWEFOR) saw the need to professionalize a limited number of agricultural speculations amongst which were market gardening, poultry, pig production, ginger, etc. These were chosen according to their economic contribution, the sustainability of the production systems and their contribution to organizational development.

vii) Input capitalization fund

NOWEFOR had put in place a fund that should permit the farmers to continue to have access to productive resources after aid ends. To build this fund, farmers made financial contributions of up to 10-20% of the value of the inputs they received. Without contributions from the farmers, there is a risk of poor appropriation of the project. The approach also enhanced partnership and the development of a self-reliance spirit in the farmers. These findings confirms with those of Shrestha (2015:3) who highlighted that FOs help farmers gain skills, access inputs, form enterprises, process

and market their products more effectively to generate higher incomes. Conclusively the contribution of FOs on the increased on improved input need assessment and supply skills, production skills and marketing skills was overall positive.

b) Contribution at the level of the organization

This section presents the contribution of FOs to group marketing and input supplies, evolution of technical staff and membership.

As revealed by Table 4.5, 28% of improved marketing skills and abilities of the beneficiary farmers increased compared to 11% of the nonbeneficiary farmers. This could be explained by the fact that FOs aims at improving the living condition of farmers. This is usually done primarily by identifying agricultural speculations that are economically viable and facilitating the acquisition of technical and financial assistance to indulge in the production.

Experience of group marketing of tomatoes by market gardening farmers of Mforyah Integrated Farmers Union (MIFU) on the local mastery of the market and organized group marketing i) Background

Farmers in Mforyah affiliated to NOWEFOR identified tomatoes cultivation as an important income generating activity in 2017. The farmers in Mforyah Integrated Farmers Union (MIFU) were organized into a gardening sector and received technical and financial assistance to get involved in the production of tomatoes and other assorted garden crops. The gardening sector mobilized a lot of youth farmers in the Mforyah community. It was therefore an important activity to increase the adhesion of youths to NOWEFOR. Tomatoes cultivation entails the used of agro chemical to combat pests. The farmers in this production subsector were trained to limit application of these chemicals to the minimum levels possible so as to chemical residues in the produce. There organic farming was the method being promoted in this subsector. Fourty (40) young men and women were involved in the sector in 2009.

ii) High supply and low prices for tomatoes

With the technical and financial assistance received from NOWEFOR, the farmers realized increased production. Each farmer moved from 6 buckets of 15 litres of tomatoes per week to between 25 and 40 buckets of 15litres of tomatoes per week. The local markets in Mforyah as well as the nearby Bambui and Bamenda main markets were therefore flooded with tomatoes and this led to a price drop from 4000 F CFA per 15 litres bucket to between 2000F CFA to 2500F CFA. This situation was not comfortable as the farmers were not receiving satisfactory returns for their produce. The farmers in this production subsector reflected on how to make the production subsector more profitable as illustrated in Figure 6. In 2017, 6000 tons of tomatoes were sold at 336 FCFA/Kg at the level of NOWEFOR.



Fig 6: Reflection meetings with farmers on how to make the gardening subsector profitable

Two ideas came up namely how to reduce the supply of tomatoes in the local market and also how to pool the local the farmers produce and look for external market outlets.

The farmers adopted a sequential production so as to limit the supply of tomatoes in the local market. Members of the market gardening subsector were grouped into five groups and planting calendar agreed upon to separate planting dates by weeks intervals among the subgroups. This meant that the farmers harvested at different intervals or times and in this way not all farmers took tomatoes to the local market at the same time.

In search for new market outlets, two market gardening sector members were sent to carry out market research in Douala and Limbe. Two bulk buyers were identified respectively in Douala and Limbe.

iii) Pooling of tomatoes and group sales

The buyer in Douala showed a lot of interest and requested the farmers to send 225kg of tomatoes by mid-December 2009 to be tested for chemical residues. The test on the tomatoes scored 91% while other producers who had also tendered to supply scored respectively 86% and 62%. The bulk buyer (leader price) agreed to buy the produce. The first command or order was placed in December 2009 for the supply of 2.5 tons of tomatoes at 3500FCFA per basket of 20 kg compared to the 2500FCFA at the local market. The contact farmer mobilized the other members of the production subsector and some of them pooled their tomatoes on the agreed date. This was collected and then delivered to the bulk buyer (Leader Price) in Douala.

iv) Negotiating better marketing arrangements

The farmers experienced constraints in transporting the produce to Douala. These constraints were costs and handling of produce. The problem

was presented to the buyer who agreed to take over the transportation aspect. Therefore, a new arrangement was arrived at which entailed farmers to mobilize their produce at the level of the village at the request of the buyer. The buyer then came to the village and paid for the produce and took them to Douala.

The farmers also observed that the perishable nature of the tomatoes meant that they should be the ones to determine when the tomatoes were available. This was also discussed and agreed upon with the buyer. New arrangements were made that the buyer gives the quantities needed for a period of six months and this was to be supplied on a weekly basis. Therefore, a contractual agreement was signed between this farmer's organization and the buyer for a six months period on minimum quantities of tomatoes to be supplied monthly. The produce was supplied at a constant rate during the period.

v) Quality concerns

With the first supply of tomatoes to the buyer, 150kg of tomatoes (about 10 buckets of 15 litres) were rejected for poor quality. This prompted the group members to request for training on integrated pest management from NOWEFOR. Improved techniques on limiting agro-chemical applications to the minimum were dwelt upon and the farmers were fully capacitated in this area. The next supply of tomatoes scored 95.5% after the test. Also the supplies in March and April 2010 scored 100%. In April the farmers received a letter of congratulations from Equatorial Guinea and Gabon. The buyer also called on the farmers to maintain the quality with prospects of increasing the buying price in the future given the quality.

vi) Supplies and incomes

Between December 2009 and September 2010, a total of 25.2 tons of tomatoes were supplied to this buyer. This brought a total income of 4, 032, 000FCFA to the market gardening farmers in Mforyah. The massive exportation reduced the abundance of tomatoes in the local market. Farmers producing other varieties for sell in the local market now experience better prices.

vii) Impact of this group marketing of tomatoes in Mforyah zone and NOWEFOR

- There was secured and regular income for farmers' tomatoes.

- The farmers were able to acquire inputs as a group from Douala at low prices.
- Improved qualitative and quantitative production by group members (yields changed from 9tons/Ha to 14tons/Ha).
- The constant good quality of the tomatoes has prompted the buyer to request other produce namely water melon, sweet pepper, etc.
- Most idled youth in the community have found employment in market gardening and increased their commitment (annual due contributions) in NOWEFOR activities. **viii) Challenges and perspectives**

The challenges and perspectives identified in this market gardening subsector were:

- Sometimes the farmers are unable to supply the quantity demanded. There is therefore need to increase production while maintaining the quality.
- This increased in production would there also enable the group contract other buyers to reduce the risk of relying on one buyer,
- Other farmers from the organization have witnessed the regular income from gardening and have expressed the interest to join the gardening subsector. This means that there is need for assistance to train new farmers who become interested in tomatoes cultivation.
- Resources are required to indulge in quality production of other produce being demanded by the buyer
- The Mforyah group marketing experiences has been shared to other communities namely Nchum, Babungo, Batibo, etc. The experienced was first copied from Bambui Union of Sustainable Self-help Groups (BASSUG).
- More 60 youths are now involved in market gardening production in Mforyah.
- Production in the zone had increased and new prices of 4500FCFA per basket have been negotiated with buck buyers.
- Annex business of packaging materials such as baskets is gradually increasing and creating jobs.

In a nutshell, this experience shows that pooling together farmers produce can enable them access special market segments. In this case organic tomatoes are seen to have insatiable demand compared to inorganic. This has also engaged a disadvantaged segment of the population (youths) in agriculture. The challenge faced by farmers now is how to increase production while maintaining the quality as they are a ready market. However, the practices involved in the process are not institutionalized. The farmers brought their tomatoes for group marketing at their free will. Also, the bulk buying of inputs at the level of the Douala was done by viable farmers who put money to pre-finance the purchased.

The contribution of FOs on the organization of group sales is presented in Table 4.6. From 2007 up to 2017 as illustrated in Table 4.6, the increase in pig, assorted gardening crops, and broilers production continued and the problem of marketing was posed. Once these produces were produced, it was bought at low prices by middlemen who in turn sell them in urban towns at a much better price. The challenge was how to increase the producer’s own part of the income from these activities.

Table 2: Group marketing of produce (Gardening, Broilers & Piggery) in NOWEFOR

Period	Speculation	No. of group sales	Quantities sold	Average prices per unit (in FCFA)
2007	Gardening	40	2010 tons	140 per kilogram
	Broilers		50000 birds	3200 per chicken
	Pigs		800 pigs	65000 per average pig
2008	Gardening	76	2600 tons	150 per Kilogram
	Broilers		70000 birds	3500 per chicken
	Pigs		1000 pigs	72000 per average pig
2009	Gardening	114	3500 tons	175 per Kilogram
	Broilers		95000 birds	3700 per chicken
	Pigs		2000 pigs	76000 per average pig
2010	Gardening	225	4700 tons	200 per kilogram
	Broilers		110000 birds	3800 per chicken
	Pigs		2100 pigs	82000 per average pig
2011-2014	Gardening	950	5500 tons	333 per kilogram
	Broilers		150000 birds	4000 per chicken

	Pigs		4000 pigs	85000 per average pig
2015-2017	Gardening	970	6000 tons	366 per kilogram
	Broilers		140000 birds	4000 per chicken
	Pigs		45000 pigs	90000 per average pig

Based on this problem raised, NOWEFOR in bit to address this built the capacities of union leaders on improved marketing and group marketing techniques; put in place a marketing network and a marketing fund that would all facilitate the marketing process. After all the necessary measures were taken to ensure good marketing of farmers produce, the number of groups sales or marketing of pigs, assorted gardening crops and broilers as revealed by Table 2 increased from 40 in 2007 to 225 in 2010 making an overall increase of 82%. This increment could be explained by the fact there was easier access to information and trainings, harmonization of marketing strategies and the existence of marketing network that strived for better prices for farmers produce. As a result of this a large number of new producers joined the NOWEFOR unions, based in Based in Bafut, Mforyah, Nchum, Mundum 1 and Bambui. According to the Community Development Exchange (CDX, 2008) an empowered organization is one which is confident, inclusive, organized, co-operative and influential. It is therefore important to reflect on possibilities of committing members to supply during group marketing as well as participation in bulk buying of inputs.

These results also agrees with NOWEFOR (2017:2) who outlined that farmers organizations also play a vital role in providing training and sharing of experiences on production and marketing techniques; organization of wholesale purchases of inputs and group sales of farm produce; and the implementation of awareness practices that preserve the environment.

This finding agrees Fongang and Forbah (2007:2) who reported that farmers' organization (FOs) in Bambui zone of the North West Region of Cameroon contributes in the facilitation of group marketing of tomatoes products for farmers. They further said between December 2005 and September 2006 a total of 25.2 tons of tomatoes were marketed as a group and this brought in a total income of 4,032,000 FRS to the farmers in the area.

It also agrees with Gruère *et al.* (2009:39) who reported that farmer organizations tin South India play a critical role in the commercialization of underutilized plant species for the benefit of the poor and the conservation of agro-biodiversity.

Furthermore this findings agrees with Fischer and Qaim (2012: 1255), who reported that farmer organizations of small banana holder farmers in Kenya contribute as important catalysts for innovation adoption (trainings, improved varieties, etc.) through promoting efficient information flows.

It stemmed from Table 4 that the 46% of beneficiary FOs membership rose/increased meanwhile only 9% of membership of non-beneficiary increased. Our results from Table 4 reveal that 6% of the beneficiary FOs staff strength increased against 3% of non-beneficiary FOs. This implies that the aid from partners facilitated the increased in membership of FOs, number of trained leaders and the number of technical personnel of the federations.

Table 4: Distribution of respondents by membership strength

Parameters & characteristics	Category of beneficiaries		
	Beneficiaries (%)	Non-beneficiaries (%)	Total 280 (100%)
Membership strength			
Increased	128 (45.71%)	24 (8.57%)	152 (54.28%)
Constant	16 (5.71%)	76 (27.14%)	92 (32.85%)
Decreased	16 (5.71%)	20 (7.14%)	36 (12.85%)
Staff strength			
Increased	148 (52.85%)	8 (2.85%)	156 (55.71%)
Constant	16 (5.71%)	84 (30.00%)	100 (35.71%)
Decreased	8 (2.85%)	4 (1.42%)	12 (4.28%)

The evolution of membership and technical staff of NOWEFOR are illustrated in Figure 7.

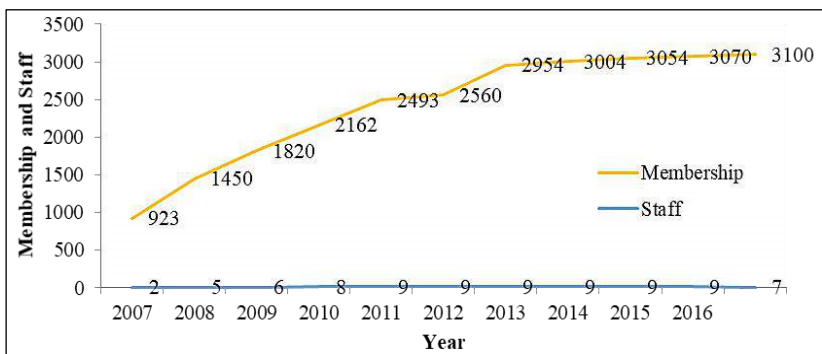


Fig 7: Evolution of membership and staff of NOWEFOR

The data in Figure 7 reveals that, the membership and technical staff of NOWEFOR respectively rose from 923 and 2 in 2007 to 3100 members and 7 technical staff respectively in 2017. It could be concluded from Table 4.8 and Figure 4.9 that, the contribution of FOs was overall positive on the increased in membership and technical personnel of the federation. These results also affirm with those of Fongang and Mbangari (2017:139) who reported that FOs contributes to the promotion membership development and staff strength of organization in the rural community.

3. FOs in the promotion of agricultural development

3.1 Contribution to agricultural development activities

The contribution of FOs to agricultural development activities are illustrated in Table 5. The data in Table 5 shows that both the beneficiaries and non-beneficiaries contribute to agricultural development of the Division. However, the proportion of beneficiaries contributing to agricultural development outweighs those of the non-beneficiaries. However, 40% of the beneficiary FOs interviewed co-managed projects with other development agencies and programs against 6% of non-beneficiaries.

Table 5: Distribution of respondents by agricultural development activities

Parameters & characteristics	Category of responses		
	Yes (%)	No (%)	Total (%)
Co management of projects			
Beneficiaries	112(40.00%)	48(17.14%)	160(57.14%)
Non-Beneficiaries	16(5.71%)	80(28.57%)	96(34.28%)
Lobbying & advocacy			

Beneficiaries	152(54.28%)	8(2.85%)	160(57.14%)
Non-Beneficiaries	32(11.42%)	88(31.42%)	120(42.85%)
Writing of projects			
Beneficiaries	116(41.42%)	44(15.71%)	160(57.14%)
Non-Beneficiaries	24(8.57%)	96(34.28%)	120(42.85%)
Follow up and advisory services			
Beneficiaries	124(44.28%)	36(12.85%)	160(57.14%)
Non-Beneficiaries	24(8.57%)	16(5.71%)	120(42.85%)
Information & experiences sharing			
Beneficiaries	144(51.42%)	16(5.71%)	160(57.14%)
Non-Beneficiaries	24(8.57%)	96(34.28%)	120(42.85%)

This findings are quite in line with those of Ndoum (2005:5) who reported that FOs co-manage activities with development partners by serving as an alley of transmission between the partners and the farmers, thus making them to appear as argents and partners in rural development.

Also, results from Table 5 show that 54% of the beneficiary FOs interviewed carryout lobbying and advocacy for the protection of the interest and well-being of farmers against 11% of non-beneficiaries.

The reasons that brought farmers together to lobby and advocate were that:

- i) Our crops get bad before we reach the markets due to poor farm-to-market roads. Post-harvest losses sometimes reach 50% of total crop production largely because of poor farm to market roads.
- ii) There are no organized markets for livestock such as poultry, rabbits, goats, etc.
- iii) Local council decisions have limited considerations of farmers interest.
- iv) Annual agricultural shows have been hijacked by others in disfavor of farmers.

However, supporting farmers to enhance their participation in local council governance will lead to increased crop and livestock production for food and income security.

Tangible outcomes likely to be derived from effective participation of the farmers in local governance or projects include:

- i) Information and ideas on public issues.
- ii) Public support for planning decisions.
- iii) Avoidance of public conflicts and costly delays.
- iv) Reservoir of good will which can carry over to future decisions.
- v) Spirit of cooperation and trust between the farmers and the public.
- vi) Increased access to productive lands and output markets.
 - vii) Increased revenue, employment and economic growth of council area.

It stems from Table 5 that 41% of the beneficiary FOs interviewed raise internal resources through writing projects for farmers, thus enabling them to raise income and boost production against 9% of non-beneficiaries. This finding is quite in line with Ndoum (2005:5) who reported that FOs facilitate project writing at low cost between the diverse parties (farmers, extensionists, researchers, politicians, NGOs) involved in rural development.

It results from Table 5 that 44% of the beneficiary FOs interviewed carryout proximity advisory follow up and counseling in farmers farms against 9% of non-beneficiaries. Lastly as revealed by Table 5, 51% of the beneficiary FOs interviewed carryout information and experience sharing in farmers farms within and out of the Division against 9% of nonbeneficiaries. This could be explained by the fact that effective farming dynamics requires information, proximity advisory follow up and counseling and experiences sharing amongst farmers for development. These findings tie with those of Tsafack and Degrande (2015: 2) who reported that FOs contributes in the provision of information and extension services to farmers through farmers' field schools, and extension by training-and-visit, as well as community-based extension approaches such as rural resource centers and the farmer-to-farmer extension approach.

3.2 Contribution of FOs in preserving and protecting the environment

The measures put in place by FOs to preserving and protecting the environment vis à vis their activities are illustrated in Figure 8. The information in Figure 4.10 from our survey shows the measures put in place by FOs to preserving and protecting the environment alongside their farming activities in order of importance are: practice of manure pit

development (20.0%), practice of integrated farming (17%), Safety disposal of hazardous waste (16%), use of green manure (14%), safe use & handling of agrochemicals (11%), used of best cultural practices (10.0%) and substituting stakes with sunflower (11%).

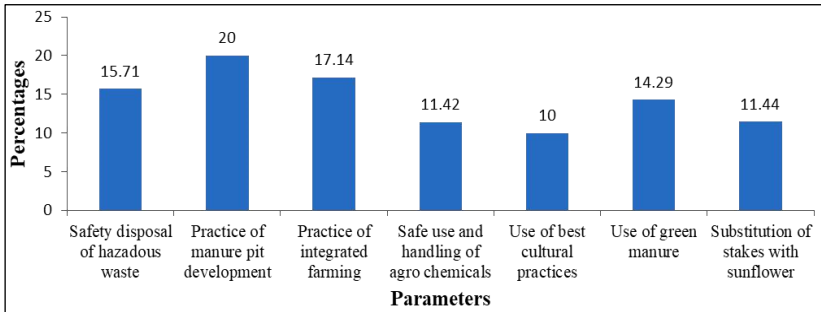


Fig 8: Distribution of respondents by farming practices protecting the living environment

The respondents revealed that FOs have through sensitization and education of farmers stressed on practices to mitigate impacts of Income Generating Activities (IGAs) on the environment and ways to mitigate them like practice of manure pit development, practice of integrated farming, Safety disposal of hazardous waste, use of green manure, safe use & handling of agrochemicals, used of best cultural practices, planting of sunflowers and substituting stakes with sunflower. All this was to ensure that there are no serious environmental or ecological effects from their IGAs on the environment. The following topics and mitigations measures were used during the sensitization and training sessions as follows:

Sensitization and training

The farmers were sensitized and trained on topics or issues such as air pollution, emission of greenhouse gases, soil erosion, fertility loss, soil pollution, loss of soil microorganisms, water pollution from agrochemicals, IGAs waste disposal (liquid and solid) and over usage of agrochemicals on IGAs.

Mitigation measures

The mitigation measures put in place vis a vis IGAs were:

- Avoid farming systems which clearly contributes towards increasing the discharges of carbon dioxide (CO₂) through sensitization and

training of sustainable farming practices like avoiding slash and burnt practices.

- Erosion control measures such as use of cover crops, developing of contour bonds, terracing farming in slop areas and training of farmers on the safe use of agrochemicals.
- All agrochemicals to be used by beneficiary farmers must comply with the current homologated list by the Ministry Agriculture and Rural Development.
- Training of beneficiary farmers on the production and use of compost manure.
- Waste from poultry and piggery were recycled to be used as manure for the cultivation of vegetables and other crops.
- Avoid burning of plant debris or “Ankara” (allow plant debris to rot).
- Avoid cultivation on very steep slopes as it can lead to erosion and landslides.
- In areas and cases of water shortages in addition to provision of drums, there should be provision of Modern bore-hole wells in the beneficiary’s community.
- Avoid location of piggery and poultry farms near streams/water sources to minimize pollution and related health hazards.
- Livestock infrastructures should be located not too closed to houses and provision of good ventilation in the farm to avoid air tied conditions.
- No dumping of effluent and affluent in streams.

Testimonies of a farmer from Ntangien-Mile 8 Mankon reveals as follows: *...A farmer in Ntangien-Mile 8, Mankon has received training in pig manure management to reduce the odour emitted by his pen. In effect he created a manure pit where he dumps all the waste from the pigsty. His pigsty now does not longer smells and his neighbours are very happy with him. He has sold about 10 bags of manure of 50kg per bag for 15000 FCFA. This 15000FCFA has helped fetch him 5 bags of wheat brand which he had used to compound his animal feed. He now serves as an elite farmer in pit development and solicited by other farmers. He is active member of the Mforyah union...*

These findings abides with those of NOWEFOR (2017:2) who signaled that farmers organizations play a vital role in providing training and sharing of experiences on production and marketing techniques; organization of wholesale purchases of inputs and group sales of farm produce; and the implementation of awareness practices that preserve the environment. **3.3 Contribution of FOs to the development of the rural community**

Figure 9 shows the opinion of members of the community on the changes brought about by aid within the community.

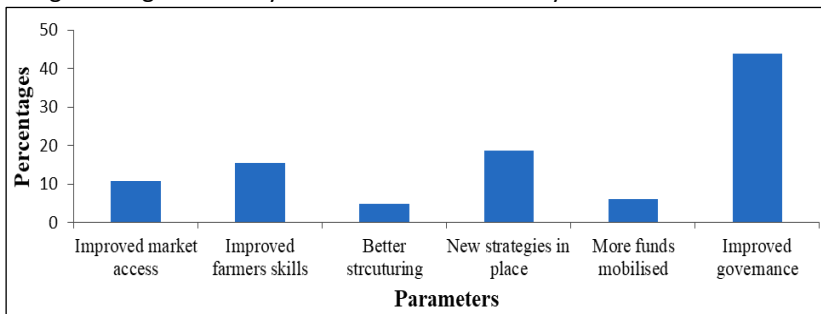


Fig 9: Impact of FOs on the community of members

Figure 9 illustrates that FOs have brought changes within the community in order of relative importance: improved governance (44%), new strategies in place (19%), improved leader’s capacities (16%) and improved market outlet (11%), funds mobilized (6%) and better structuring (5%). In addition, FOs have helped in solving the problem of improve governance, new strategies in place, improved leader’s capacities, improved market outlet, funds mobilized and better structuring in the community as a whole. These findings agree with Fongang and Mbangari (2017:140) who reported that aid had brought changes within the community of farmers affiliated to NOWEFOR such as improved leader’s capacities, funds mobilized, new strategies in place, improved market outlet and improve governance in the zones of interventions of NOWEFOR in the North West Region.

3.4 Contribution of FOs in enhancing financial capacities of famers

This section presents the income evolutionary trends; level of agricultural mechanization, labour utilization and farm income of respondents as follows:

a) Income evolution pattern

The distribution of annual farm income evolution pattern for the last 12 months is presented in Table 9 as follows:

Table 9: Opinion of respondents on their incomes from January-December

Category of beneficiary	Sex	Increased (%)	Constant (%)	Decreased (%)
Beneficiary	Male	76 (27.14%)	8(2.85%)	8 (2.85%)
	Female	60 (21.42%)	8(2.85%)	0 (0%)
	Total	136(48.57%)	16 (5.71)	8 (2.85)
Non-beneficiary	Male	24 (8.57%)	8 (10.00%)	16 (5.71%)
	Female	8 (2.85%)	20(7.14%)	24 (8.57%)
	Total	32 (11.42%)	48(17.14%)	40 (14.28%)

Table 9 indicates that, majority (49%) of the respondents targeted by the external aid in Mezam division have a general increase in farm income. Also majority of the female beneficiaries (21%) have a positive change in their income evolution pattern. The creation of new activities, timely application of fertilizers, good farming season, and aid support from FOs is some of the reasons for the positive change in income. Moreover, 49% of the beneficiaries farm incomes increased as compared to 11% of the nonbeneficiaries whose incomes increased. Testimonies of a farmer from Mforyah help us to have a feel of the impact.

A farmer in Mforyah_Bafut has increased his production from about 10 baskets of tomatoes per week to about 20 each week; he has a turnover of at least 150,000FCFA. He has changed the roofing of his house, all his children go to school and he now employs more than two youth his farms daily. He is active member of the Mforyah union.... These findings also abide with the conclusions of Fongang and Mbangari (2017:132). Who reported that FOs helped farmers to have a positive change in income

b) Contribution to the level of agricultural mechanization

The level of agricultural mechanization in this study was inferred from the different types of equipments used by farmers in their farms are illustrated in Table 10. The results show that both the beneficiaries and nonbeneficiaries have agricultural equipments in their farms. However, the proportion of external aid beneficiaries possessing agricultural equipments in their farms outweighs those of the non-beneficiaries. Also, Table 10 reveals that 19% of the respondents who possessed agricultural equipments

in their farms results from the support of SOS Faim/EC, 17% as a result of MINADER support, 20% as a result of ACEFA support and 44% coming from the farmers own capital.

Table 10: Main equipments possessed by respondents in their farm

Category	Source of aid	Sprayer	Truck	Engine pump	Wheel barrow	incubator	Total
Beneficiaries	SOS Faim/EC	28 (10.0%)	8 (2.8%)	12 (4.2%)	4 (1.4%)	0 (0%)	52 (18.5%)
	MINADER	20 (7.1%)	4 (1.4%)	4 (1.4%)	4 (1.4%)	0 (0%)	28 (10.0%)
	ACEFA	32 (11%)	8 (2.8%)	8 (2.8%)	0 (0%)	4 (1.4 %)	52 (18.5%)
	Own capital	12 (4.2%)	4 (1.4%)	4 (1.4%)	4 (1.4%)	0 (0%)	24 (8.5%)
	Total	92 (32.8%)	24 (8.5%)	28 (10.0%)	12 (4.2%)		160 (57.1%)
Non-Beneficiaries	MINADER	12 (4.2%)	4 (1.4%)	0 (0%)	4 (1.4%)	0 (0%)	20 (7.1%)
	Own capital	84 (30.0%)	12 (4.2)	0 (0%)	4 (1.4%)	0 (0%)	100 (35.7%)
	Total	96 (34.2%)	16 (5.7%)	0 (0%)	8 (2.8%)	0 (0%)	120 (42.8%)

These findings tie with those of Shrestha (2015:3) who reported that farmer organizations assist farmers in accessing farm technologies such as trainings, inputs and farm tools; information; credit and better market access for farm products.

4. Financing of the activities of FOs

4.1 Internal resources of FOs

At the beginning of each year members of these FOs contribute an agreed annual dues or levy for the associative life of the organization. A case study of organizations affiliated to NOWEFOR revealed that at the beginning of each year member unions from all the 12 unions affiliated to NOWEFOR pay a minimum annual due of 100,000 FCFA as participation for the strengthening of its associative life and those unions who do not meet up with their annual contributions are immediately suspended from NOWEFOR services like any field follow up, refinancing or any form of support from

NOWEFOR. An organization that pays more than 100 000FCFA as annual dues reflects its good internal resources mobilization strategies and a sound financial status. From our interview with leaders, NOWEFOR usually realize annually 45 000-50 000 FCFA as income from petty Income Generating Activities (IAGs) such as the sales of plantain plantlets, fines, deductions from sales, registration, and interests. About 200000-300000 FCFA is usually realized annually as income rose from projects writing to other unions, CIGs and farmers in the region. Table 6 illustrates the situation of annual contributed in NOWEFOR for 2010-2014.

4.2 External resources of FOs

Figures 10 and 11 show respectively the yearly amount of financial support granted by SOS Faim and PCP-ACEFA to farmers and farmers’ organization in Mezam Division.

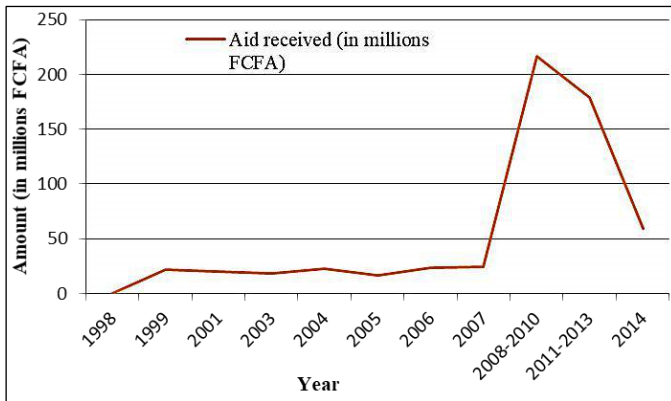


Fig 10: Financial support granted to NOWEFOR by SOS Faim and EC from 1998-2014

From 1998-2014 NOWEFOR, received a total of 543, 862, 670 FCFA as aid mainly from SOS Faim and European Union.

Before the support of SOS Faim and European, NOWEFOR farmers survived on less than 1 dollar per day (NOWEFOR, 2015:9). The fact that they have seen the need to unite under a FOs is a necessary step towards seeking common solutions to their problems.

Table 6: Situation of annual dues contribution from 2010-2018

Unions	Sectors	Annual dues in F CFA								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
Mforyah Integrated Farmers' Union	Poultry, pig, yam, ginger Market gardening	159 000	152000	150000	94000	100000	104000	100000	100000	/
Bafut Union of Farming Groups	Poultry, pig, ginger	143000	121000	124000	85000	100000	100000	100000	40000	/
Bambui Union of Sustainable Self-Help Groups	Poultry, pig, market gardening	172 000	150000	116000	29000	54000	50000		50000	/
Livestock and Crop Farmers' Union kai	Pig, palms	102 000	136000	96000	100000	100000	100000	91000	20000	/
Mundum Farmers' Union	Cassava, Pigs, Market gardening	100 000	100000	100000	100000	69000	80000	10000	41000	/
Nchum Zone Farmers Union	Pigs, ginger	100000	100000	35000	100000	80000	34000	47000	/	/
Nseh Group of Farmers' Organisations	Irish potatoes, Pigs	100 000	100000	100000	41000	100000	100000	18000	/	/

Babungo Farmers Union	Market gardening, Pigs	100 000	100000	104000	110000	100000	128000	122000	150000	50000
Moghamo Union of Farming groups	Pigs, Market gardening	102 000	100000	100000	105500	100000	100000	100000	100000	/

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Union of Momo Farming Groups	Yam, pig	100 000	100000	100000	100000	100000	100000	75000	25000	/
Ibal-Oku Union	Tomatoes, pig	150 000	120000	142000	104000	100000	100000	100000	50000	/
Ngongdzen Farmers Union	Potatoes, Pigs	100 000	100000	100000	100000	100000	120000	100000	8000	/
Din farmers union***					372000	256000	256000	272000	240000	100000
Babanki Farmers Union***	Pig, tomatoes								150000	150000
Total		1,369,500	1, 379,000	1,267,000	1,440,500	1,359,000	1,372,000	1,135,000	934,000	300,000

***Newly registered union

As illustrated in Figure 10, SOS Faim and European Union had been providing aid to NOWEFOR to empower the economic and organization capacities of the farmers in the North West Region of Cameroon.

In spite the provision aid to NOWEFOR by other donors (e.g. the European commission, SAILD, MINADER/MINEPIA, The American Peace and VSO), Figure 10 revealed that since 1998, SOS Faim had been and is still the main donor of NOWEFOR and the amount of aid received by NOWEFOR increased with time. This is in line with Defense and Destrait (2015) who reported that SOS Faim assist thousands of people in Africa to gain their autonomy and not need any more help. ACEFA started supporting farmers in Mzam Division from 2013 and grants were only granted to farmers and FOs as from 2015 because they program usually starts its assistance to would be beneficiary farmers and FOs first with needs assessments, capacity building and project writing. Figure 11 illustrates this.

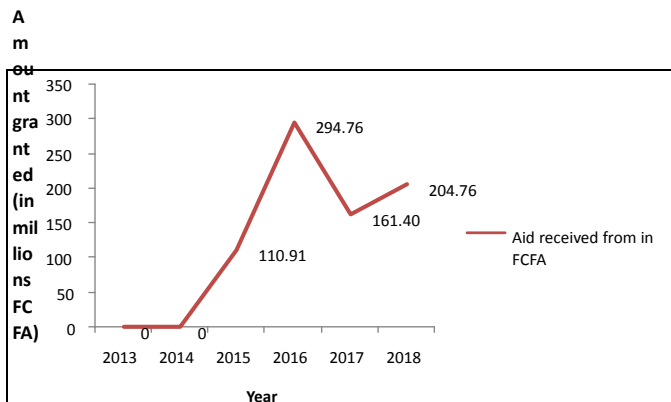


Fig 11: ACEFA’s financial support granted to FOs in Mezam Division (2013-2018)

Data from Figure 11 reveals that, the average amount of grants allocated by ACEFA to assist farmers through FOs in Mezam increased from 110,906,670 FCFA in 2015 to an average amount of 192,958,132.75 FCFA in 2016 to 2018. Our interviews with farmers and farmer leaders revealed that this increase in average amounts of grants was due to the fact that farmers saw the first beneficiaries’ successes and bestowed confidence in the program. Furthermore, it was also due to the increase awareness of the program in the community thanks to the increased number of staff.

4.3 Difficulties faced by FOs in resource mobilisation

- 1) Insufficient revolving fund.

- 2) Low internal mobilization of funds.

5. Risks, challenges and sustainability of FOs FOs

incurred risks such as:

- 1) Marketing risks associated with-non-compliance with purchases; and lower sales prices of products on the market.
- 2) Strategic risks associated with-rising costs of raw materials and unavailability of the raw material, high production cost.
- 3) Technical risks associated with-bad technical practices.

FOs incurred challenges such as:

1. Increase the registration of producers in the FOs.
2. Continue the dynamism in the zones.
3. Obtain the support of local and traditional authorities throughout the whole process.
4. Limit the influence of big buyers in the market.
5. Attain the autonomy of the zones.
6. Adhoc business plans.
7. Poor information management/Poor communication network.
8. Personnel and elected leaders do not always assume their roles.
9. Conflict of interest predominant in decision making spheres.
10. Insufficient trainings, sensitization and education.
11. Many passive members.
12. Low enrollment of youths.
13. Fast aging population in NOWEFOR.

The sustainability strategies of FOs amongst others include:

- i) Internal resource mobilisation is effected through annual dues.
- ii) Fixed assets.
- iii) Project development.
- iv) External assistance.

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Chapter - 2
**Synthesis of Culture and Learning for Successful
Extension Service**

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Chapter - 2

Synthesis of Culture and Learning for Successful Extension Service

Agholor Isaac

Abstract

This chapter has been designed appropriately with agricultural development in mind. Broadly focused, nurtured and conceived out of the need to assist the teeming population of extension practitioners, subject matter specialist, educators, students and farmers to contend with numerous problems associated with extension and culture of the community. The chapter is prepared to guide users through the intricacies in extension and culture. The entire chapter captures exhaustively the social and cultural factors in agricultural extension, social structures, changes in culture, barriers to change, adult learning, adult learning principles, barriers to learning, concept of learning, learning experiences, learning characteristics, essentials of learning situation and their features, and general principles of learning. Finally, the chapter reflected comprehensive on the key areas of groups, and group dynamics in agricultural extension cascading to conflict management in agricultural extension.

Keywords: synthesis of culture, change in culture, adult learning, learning experiences, learning situations, motivation, agricultural extension, successful, group dynamics, conflict management

1. Introduction

In agricultural extension, it is important to understand the community where the extension officers operate. This chapter deals with the differentiation and changes in the society by exploring social and cultural changes, common groupings and group dynamics. It further, orientate extension practitioners with social structure, changes in culture, factors promoting change, barriers to change and development and the challenges of rural communities. Learning principles were extensively discussed. These salient areas highlighted above are either neglected or ignored but remain

the most important factors in agricultural extension and development. Extension embodies social capital, ramifying values emanating from social networks, which allow individuals to achieve things they couldn't on their own. Social interactions can benefit communities through information sharing, provision of assistance and establishing trust.

2. Social and cultural factors in agricultural extension

Society refers to a collection of individuals with similar social norms. However, society could be variously organised, with cultural identity. Culture encompasses societal patterns of doing things which has resonated from within the group ^[1].

2.1 Social structure

The patterns of administration and relationship embodied in a social group is referred to as social structure. The understanding of social structure allows the instructor to manage information within a social group ^[2].

The factors causing the division of people into groups and societies are as follows:

- Gender differentiation.
- Beliefs.
- Division based on age.
- Kinship/Kinship groups.
- Grouping on the basis of common residence.

2.2 Gender differentiation

The males and females exhibit exceptional bond in a society. In some societies, there are strong affirmation and discrimination on gender. Sometimes males are considered superior to the females and oftentimes the females are excluded from participating in community affairs on the pretext that females are secondary citizens.

2.3 Religious and ceremonial groups

Most known culture includes a sophisticated and diverse cultural and ceremonial grouping. Most religious group exhibit shared loyalties and values.

These loyalties and values influences instructors' performance.

2.4 Division based on age

The typology of farmers on the basis of age may be helpful in bringing change. The instructor should potentially recognise age to be able to perform adequately with farmers ^[2].

2.5 Kinship

Kinship is referred to as the “hub” or structure in the society. The pattern of kinship indicate father as the primary unit, mother and children bonded together with similar group behaviour and intimacy.

2.6 Grouping on the basis of common residence

In any community, mutual residence is made up of smaller unit referred to as family. The elements which that characterize communal groupings are their similarities in occupation or livelihoods.

3. Changes in culture and barriers

Culture is dynamic and open to changes. Changes may manifest from the advent of innovation and new types of technology, relationship adjustment and modernization ^[2]. The factors associated with cultural changes are as follow: innovators, affinity with other culture, media and other factor. The following are the barriers to change.

3.1 Culture based barriers

Confidence associated with own culture: Most communities are of the view that their way of doing things remain the best. Resistance to change is exhibited because of the social cost inherent in change in culture.

Superiority and poise: Individuals may have a feeling of superiority towards their culture and thus resist possible changes. Society may be poise to resist new way of thinking or innovation.

Norms: Communities may value a known taste, appearance or recognised peculiarities in a society. Societal norms poses a constrain to change.

Unpredicted difficulties: The fear and suspicious of risk associated in change be discouraging. **3.2 Social barriers to change**

Responsibilities of the individual: Individuals within a society have their own responsibilities which they are expected to carry out.

Communal ceremonies: Weddings, funerals, etc. could be a factor that will take up so much of the farmer's time that he cannot work on his farm to optimum.

Social structure: Extension practitioners should understand the structure of the society in which they work to be able to recognize and seek the intercession of influential people to persuade the society to accept changes. This is an underlying assumption that religion, culture and other states of the human soul cannot be radically changed without a redistribution of area of power, property and structure ^[3].

3.3 Psychological barriers to change

Attitude toward government personnel: People sometimes regard government personnel as tax collectors or law enforcers. Extension workers should not be involved in the collection of money, taxes or repayment of loans, or in prosecuting people who break the law. The extension worker's job is to help the people to help themselves with a view to improving their quality of life. Attitude toward gifts - People often think of gifts as things of little or no value. They think that a gift is given with the purpose of gaining something in return ^[4].

3.4 Rural community development

Rural community development includes a range of methods and activities that aim at improving the welfare and livelihoods of people living in rural areas. This range of methods recognises social issues particularly the organisation of community.

4.1 The challenges of rural communities

There are many challenges faced by rural communities. Some of these challenges are considered in the following dimensions:

a) Personal characteristics

- Age and ratio of males to females
- Education and training • Limited local organisations

b) Socio-economic issues

- Leadership problem
- Land tenure system and land fragmentation
- Absence of labour

- Health and nutrition
- Water supplies
- Fuel
- Rural youth (Agriculture has a poor image and unattractive)
- Low farm income
- Poverty
- Food security

c) Socio-psychological issues

- Managerial competence
- Conflict in decision making
- Aspiration and motivation
- Perception and image • Absence of basic needs

d) Resource pressure and environmental degradation

- Soil erosion
- Deforestation
- Leaching
- Soil and natural resources conservation problems

5. Adult learning principles

Andragogy is the science of helping adult learners to learn (adult centred) while pedagogy is the learner centred method of learning. Adults has some peculiarities associated with learning and clarification of expectation must be established by the instructor in the mind of the learner ^[5].

5.1 Motivating an adult learner

Motivation of adult learner is important in the teaching learning process. Adults learn better in an environment where they are at liberty to learn. For example, a farmer concerned about how the mastitis (a disease of dairy animals) affecting dairy production might be motivated to learn about the disease ^[1].

5.2 Experience

The recognition of prior learning or previous knowledge of farmer can assist the instructor to accomplish a given task. Previous experiences may impact or bias the farmers' perceived ideas about how learning will occur.

However, previous knowledge is recognised and guided by the Extension officer, can assist the adult to connect the current learning experience to something learned in the past.

5.3 Level of engagement and self-directed

Adults are usually inclined to decide on what they prefer to learn. The have predetermined objectives in mind and these are not satisfied during the teaching process, they become bored and inattentive. Appropriate timing of instructions must be borne in mind when facilitating the learning process ^[6].

5.4 Applying the learning skill

As skills and knowledge are acquired, it is paramount to include ‘return demonstrations’ by the learner. The primary purpose is to verify the ability of the patient to perform the skill. Return demonstrations enable the teacher to view, and the learner to experience, the progress in their understanding and application of the education. Seeing progress and realizing a tangible movement forward in the learning process may increase the farmers’ motivation to learn even more. Information that goes into the learner's memory will likely be remembered if the Extension officer or the teacher provides opportunities in the session for activities such as application exercises and discussions. **5.5 Learning styles**

Most adult learners develop a preference for learning that is based on childhood learning patterns. Several approaches to learning styles have been proposed, one being based on the senses that are involved in processing information. An assessment of the adult/farmers’ learning style is a fundamental step prior to beginning any educational activity. Determining the adult learning style will help identify the preferred conditions under which instruction is likely to be most effective. The most frequently used method of delineating learning styles is in describing visual, auditory and kinesthetic learners ^[7].

Visual learners prefer seeing what they are learning. Pictures and images help them understand ideas and information better than explanations ^[8]. A phrase you may hear these learners use is "The way I see it is." The teacher needs to create a mental image for the visual learner as this will assist in the ease of holding onto the information. If a visual learner is to master a skill, written instructions must be provided. Visual learners will read and follow the directions as they work and will appreciate it even more when diagrams are included.

Auditory learners prefer to hear the message or instruction being given. These adults prefer to have someone talk them through a process, rather than reading about it first. A phrase they may use is "I hear what you are saying." Some of these learners may even talk themselves through a task and should be given the freedom to do so when possible. Adults with this learning style remember verbal instructions well and prefer someone else read the directions to them while they do the physical work or task.

Kinesthetic learners want to sense the position and movement of skill or task. These learners generally do not like lecture or discussion classes, but prefer those things or situation that allow them to "do something". These type adults do well in learning physical skill resources for hands-on practice are available.

6. Barriers to learning

The adult learner has many responsibilities that must be balanced against the demands of learning. Owing to these responsibilities, adults may have barriers against participating in learning. Some of these barriers include a) Lack of time.

- b) Lack of confidence.
- c) Lack of information about opportunities to learn.
- d) Scheduling problems.
- e) Lack of motivation.
- f) Red tape.

If the learner does not see the need for the change in behaviour, a barrier exists. Furthermore, if the learner cannot apply what he/she has learnt to his/her past experience or situations then barrier is also created. This then, remains a barrier for extension officer to overcome. Extension practitioner, need to find ways to motivate farmers and enhance their purpose for learning and decrease barriers if possible. A successful strategy includes showing the adult learner the relationship between the knowledge/skill and the expected positive outcome.

The Extension officer must be aware of possible environmental and emotional barriers to farmers' education. Adults are more sensitive to discomfort so the physical setting, room temperature, lighting, and noise level should be as comfortable as possible. Providing an ambient room temperature is very important for older adults who may chill more easily. If

the learner has hearing or vision impairments, this can impact the educational process and possibly make the him appear insecure or unable to comprehend information. If not corrected, eventually the learner may become less willing to participate in the learning experience. Emotional connection to the learner is perhaps the most elusive barrier to overcome between instructor and learner/farmer. Any instructor who can make a learner believe that he/she is capable of learning a skill/knowledge has already met an important goal of the teaching/learning experience ^[9].

6.1 Types of learning activities

A learning activity is defined as an approach that is used to teach programmes content and ensure that learning takes place.

The following are categorised as learning activities:

- Case study
- Role play
- Group discussion
- Demonstration
- Syndicate discussion exercise
- Individual exercise
- Pairs exercise
- Trainer presentation
- Reading and exercise
- Question and answer
- Ice breakers and games, etcetera

6.2 Learning characteristics

- **Learning encompass change:** A change in behaviour may be decent or bad, wanted or undesirable.
- **A change must be relatively enduring or consistently permanent:** Any momentary changes in behaviour may only be impulsive and fails to epitomize any learning. For instances, any change induced by alcohol, drugs, and sickness is not regarded as a change. therefore, learning has not taken place in such circumstances.
- **Change must be as a result of experiences:** It means that for a change to occur and translate into learning, it may be deliberate or

unintentional, nice or bad. For any change to be regarded as learning, it must be brought about by experience. The experience here, translates to the interaction of an individual with his or her immediate environment. An effective learning experience is one that results in optimum desirable change in behaviour on the part of the learner. Learning experience is what a learner does or perform in the learning situation.

Box #1: Learning defined:

- A way of gradual behavioural adaptation ^[10].
- A means by which a person becomes transformed in his behaviour via self-activity ^[11].
- The method whereby knowledge is created through the transformation of experience ^[12].
- The acquisition or improvement of one's ability to perform in a behavioural pattern through experience and practice ^[13].
- Any relatively permanent change in behaviour that occurs as a result of experiences or practice ^[14].
- Learning is a relatively permanent change in behaviour that results from practice ^[15].
- Learning therefore, can be defined as the cleaning of the mind, the entire body and inner-self for adaption to the society through experiences (authors' definition).

6.3 Essentials of learning situation and their features

Proper learning experience can only be undertaken in a well-prepared situation. One of the core function of extension officer is to prepare and manage learning situation through which learners (farmers) can acquire effective learning experience.

6.4 The features of learning situation

There are 5 primary elements of learning situations as follows:

1. Learner

A learner (farmer) is an individual who needs to acquire knowledge through learning. In any learning situation, a learner is central and all efforts are focused towards him/her.

Learners should:

- i) Be ready and able to learn. ii) Be interested in the subject. iii) Information offered relevant to needs of the learner.
- iv) Good usability of information once gathered.

2. Teacher

The extension officer who gives training and inspires the learner is a teacher. The extension personnel must be knowledgeable in the subject content and how to release it.

Extension personnel must:

- i) Have a well-defined objective.
- ii) Knowledgeable in the content of materials. iii) Be able to apply and use teaching resources.
- iv) Ensure equal participation of clients.

3. Knowledge content

Understanding the knowledge content which is:

- i) Relevant to the learner's desires.
- ii) Appropriate to their real-life situations.
- iii) Well organised and presented logically and clearly.
- iv) In agreement with the overall objectives.

4. Teaching resources

The resources for teaching must be:

- i) Appropriate and allied to the subject matter.
- ii) Sufficient in quantity. iii) Relevant.

5. Physical environment

The environment must be:

- i) Well ventilated (airy).
- ii) Fire extinguisher available.

iii) Two door access (exit and out) easily accessible. iv) Toilets (male and female) facilities.

v) Spacious seating arrangement and lighted.

6.5 General principles of learning

In agricultural extension, some elements are isolated for effective teaching of farmers. These are as follows: **i) Elements of association**

Learning is continuous and usually associated with previous knowledge and experiences. Past experiences and learning usually prepares the stage for further or subsequent learning. For instance, if a farmer is able to reduce the mortality rate of his broilers chicken to about 10% by using Lasota or Gumboro vaccine, then the farmer may be motivated to use other vaccines in the course of production. The implication here, is that: Learning starts from what the learner/farmer already know, progressively to unknown concepts, to the simple ones, to complex issues, then from complex to abstract where the learner can now think critically and apply what is learnt to various situation

[16].

Box #2: Elements of association in learning.

Known: The learner/farmer has idea of real-world situation which he/she can exhibit in any setting. His must be recognised by the extension practitioner.

Unknown: The farmer at this stage is prepared to grasp new ideas, having recognised what he/she already know.

Simple: The elementary basis is expressed to allow learner/farmer build self-efficacy.

Complex: The learner/farmer is exposed to higher instructional task.

Abstract: The thinking faculty is tasked and knowledge learnt is now applied in other settings or situations.

Known → Unknown → Simple → Complex → Abstract **ii)**

Elements of objectives

The objectives set out for learning must be clear and focus

iii) Elements of self-activity

Learners/farmers learn by doing. Some well-coordinated activities expose the potentials of the learner. The three domain of learning which is the cognitive, affective and psychomotor are usually tasked for performance when practical activities are given at intervals. Which is why workshops are being preferable to seminars, conferences and other extension teaching methods. **iv) Elements of motivation**

Motivation may be described as enhanced behaviour directed at achieving some goals which may have arisen from the needs of a person at a specific situation. The desire to learn must be uppermost in the heart of the learner/farmer. Efforts and enthusiasm are exerted when the need to learn is visible. Therefore, the extension practitioner must motivate farmers to make learning more challenging and admirable. Achievements in the course of learning should be recognise appropriately.

v) Elements of practice

Learners/farmer must be given the ample chance to practice what they have been taught. Practice assist in building confidence and creates perfection. All teaching content must be practice oriented. **vi) Elements of disassociation**

Learning is influenced by inner feelings. To remove undesirable response, an instructor must provide an alternative or substitute that may be satisfying than the initial one. For instance, running a trial project or farm will certainly showcase differences whereby plot A can be evaluated against plot B. This decrease doubt and apathy and thus increase good emotions.

vii) Elements principle of attitude

The attitude displayed by a farmer is central to his preparedness to learn. **viii) Elements of reinforcement**

An accepted behaviour must be positively rewarded and encouraged while behaviour which is undesirable should be negatively rewarded.

ix) Elements of transference

What is learnt in one setting should be transferable to another setting. However, transference is mostly to occur when what is taught or information gathered is original, effective, similar to the new settings and can be associated.

x) Elements of feedback

The progress of learning must be disseminated to the learner/farmer. This help to motivate the learner to do further task.

xi) Elements of abilities

Individual differences during the course of instructions must be recognised in the teaching and learning process. Abilities varies extensively among persons.

Group and group dynamics in agricultural extension

The nature of extension work necessitates the formation of groups or typology of farmers. Essentially groups are persons who interact socially towards the achievement of common goals or objectives. Groups are important and useful because it allows the combination of various talents to provide solutions to complex problems. Farmers' cooperatives, animal breeding groups and study groups are good examples of groups.

Hints on how to start a group

- Identify the purpose of the group.
- State the specific goals or objective of the group.
- Identify specific techniques/strategy to use.
- State the cost of group formation.
- State the criteria for admission/dismissal (inclusion/exclusion).
- State the number of people that will participate in the group.

Group dynamics

The behaviour of the group and the characteristics exhibited within the group is referred to as group dynamics. When a particular group work together, a dynamic interaction is bound to happen. Group dynamic entails the ways groups behave, do things with one another. Group dynamic is defined as the study of patterns of interactions among members of the group as they develop to achieve specified goals ^[17].

Groups are governed by group norms or rules. The groups' rules determine which behaviour is acceptable or unacceptable to the group.

There are five major stages that a group goes through:

- Forming
- Storming

- Norming
- Performing
- The fifth stage is the Adjourning

The time required for participants to move from one stage to another depends on the amount of time spent together and the task they have to perform. The extension officers' role is to manage the process by noticing the stage of development and the roles of the participants.

Conflict management

Groups are made up different types of people with different character traits. Owing to diversity among groups, conflict is bound to arise anytime between members of the group or sub-groups. Conflicts are often the result of poor communication between members on matters such as:

- Needs
- Values
- Perceptions
- Objectives
- Experiences
- Failures
- Disappointments etc. **Types of conflict**
- Destructive conflict: It occurs when no common solution to a perceived problem can be found thereby resulting to: diverting energy away from important task; produces barriers to cooperation and team work; decreases productivity; destroys moral; produces irresponsible behaviour and separates groups and allow the use of the term 'them-versus-us'.
- Constructive conflict: occurs when the issues at hand are open for discussion leading to problem solving; building group; enhancing creativity' understanding each other; preparing group or individual to grow; improves communication amongst among group ^[18].

Dealing with conflict among groups/conflict management

In conflict resolution, it is pertinent to avoid damaging strategies that could destroy relationship. It is also important to note that individuals perceived issues differently and this also affects the way they view conflicting matters.

The productive strategies of conflict management are as follows:

- Fight the conflict actively.
- Talk.
- Empathise.
- Facilitate open expression and don't use 'silencers' technique.
- No need to gunnysack but focus on the present.
- Recognise strategic manipulation and avoid it.
- Fight only above the belt.

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Chapter - 3

History of Reforms in Agricultural Marketing

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Chapter - 3

History of Reforms in Agricultural Marketing

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Abstract

According to report of the National Commission on Agriculture (XII Report), agricultural marketing is an integrated process which is initiated with a will to produce a saleable farm commodity, and it involves all the fundamental aspects of market system, both functional and institutional, based on technical and economic considerations, and includes pre-and postharvest operations, assembling, grading, storage, transportation and distribution. There are various problems in agricultural marketing like malpractices in marketing, forced sales, presence of middlemen, inadequate market information, and inadequate credit facilities, improper warehouses etc. So, there is need of reforms in agricultural marketing for empowering producers with knowledge, information & capability to undertake marketdriven production, provide multiple choice and competitive marketing channels to farmers, and attract large scale investments needed for building Post-Harvest infrastructure and National Goal helps in achieving the national goal of doubling farmer's income by 2022. Agricultural marketing reforms can be classified into two parts agricultural marketing policies and agricultural price policies. Journey of agricultural marketing started back from 1806 when first regulated market was established. In 1912, first cooperative marketing society was established. NAFED (1958), APMC (control) act (1966), MPEDA (1972), APEDA (1986) TRIFED and NIAM (1987), WTO (AoA) (2000) was established give a new direction to agricultural marketing. Major agricultural marketing reforms since independence in India are APMC (control) act (1966), Model APMC act (2003), e-NAM (2016) and new farmers acts (2020)-The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act 2020, The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act 2020 and The Essential Commodities (Amendment) Act 2020. APMC (control) act (1966) give incentives to farmer's to adopt new technology and make investment in modern inputs and make competitive

environment. Model APMC act (2003) give incentives for development of efficient marketing system & promotion of agri-exports, agri-processing for marketing of agri product, imposition of unit point levy of on the sales of notified agricultural commodities and purchase of Farmers' produce through market yards of private players. But various drawbacks in this model like inadequate private investment for commercialization and diversification of agricultural sector, fragmented and uncoordinated marketing system. New models emerged from physical marketing to online marketing. Building on the success of e-mandi, Karnataka introduced a unified market platform in 2014. All APMCs in the state are brought under a single trading platform. Vision of unified and single national agricultural market through electronic platform (e-NAM) unveiled in 2016 intended to be a market-based mechanism for efficient price discovery. In first phase, the scheme aimed at establishing a common e-platform in 585 specified regulated wholesale markets across 16 states and 2 Union Territories.

In a study, NIAM (2015) revealed that e-NAM helped in increasing integration of market and in improving infrastructural, social and technological efficiency of markets. The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill, 2020, permits farmers to sell their produce outside the notified Agricultural Produce Market Committee (APMC) mandis without any obligation of paying any State taxes or fees. The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020, facilitates farming on contract basis and direct marketing of produce. The Essential Commodities (Amendment) Act, 2020, deregulates the storage, movement, production and sale of several major foodstuffs, including cereals, edible oils, pulses and onion, except in the case of unforeseen contingencies. The government is hoping that the new laws will provide farmers with more choice, with free competition leading to remunerative prices, as well as initiation of private investment in agricultural marketing related processing industries and infrastructure. Agricultural Price Policy is an effective tool to impact the price of agricultural product, regulate demand and supply, changing the behavior of middlemen, administered prices and creation of infrastructural facilities are forms of government intervention to influence positively the agricultural prices. Major Price stabilization tools are MSPSP, ceiling price, procurement price, issue price, levy price, fair & remunerative prices etc. The plan on paper will not operationalise perfectly in real life, this leads to unsuccessful of most of policies. Institutions and infrastructure are two building blocks for successful

execution of any government programme. Both are like complementary goods which are always required in pair.

Keywords: infrastructure, middleman, agricultural produce market committee, e-NAM

Introduction

Agriculture is one of most important sector in contributing more revenue to the Economy of nation. The performance of this sector has a significant impact on the growth of economy. The agriculture and allied sector contributed 16.1 percent to the gross value added (GVA at current prices), 43.1 percent to employment and Rs. 2.7 lakh crore to national exports in 2018-2019 (Gol, 2019-2020). With the greater importance agriculturist should have good marketing facilities as economy adopt new policies. In recent years there is a great importance to the efficiency of marketing of agriculture produces in India. It is believed that poor linkages in the marketing channels and poor marketing infrastructure are leading to high and fluctuating consumer prices, and to only a small proportion of the consumer rupee reaching the farmers. There is also substantial wastage, deterioration in quality, and frequent mismatch between demand and supply spatially and over time. Agricultural trade is an important ingredient for economic development. Marketing infrastructure and strategies serves as the wheels for carrying economic activities. Market infrastructure and effective strategy is important not only for the performance of marketing functions and the expansion of the size of the market. Infrastructure facilities lead to reduction in marketing cost, which is crucial for increasing the income of farmers and reducing cost to the consumers. The sound market infrastructure and strategies provides support to production activity, income generation and positive effect on income distribution. Improved agricultural marketing infrastructure is a primary driving force under every condition for commercialization. So, there is a need of reforms in agricultural marketing.

Major problems and challenges in agricultural marketing

According to the National Commission on Agriculture (XII Report), agricultural marketing is a process which starts with a decision to produce a saleable farm commodity, and it involves all the aspects of market structure or system, both functional and institutional, based on technical and economic considerations, and includes pre and post-harvest operations,

assembling, grading, storage, transportation and distribution. There are various problems in agricultural marketing.

1. Lack of finance

Finance in agricultural sector is mainly through informal sources i.e. moneylenders which forces farmers into vicious cycles of debt and poverty.

2. Large number of middleman

The long and unbreakable chain of middlemen consume a large proportion of consumer's rupee.

3. Transportation and storage facilities

There is high demand for transportation and storage facilities in the peak harvest seasons, in order to protect the perishable produce from deterioration in quality. Production process in agriculture is seasonal while consumption is regular. So, to fill this gap adequate transportation and storage facilities are must.

4. Grading and standardization

Grading and standardization is very essential for fetching good prices. But it is very tedious and time consuming to grade and standardize the products, as there are many agricultural goods and one produce has many qualities.

5. Branding

Agricultural products do not create demand. Advertising is not possible due to the limited resources of agriculturists. As there are many qualities branding is also not an easy job.

6. Price fluctuation

There is price fluctuation in agricultural products due to the lag in supply and demand.

7. Lack of market information

In India most of the farmers are illiterate and ignorant of the accurate prevailing prices in the markets. They rely on irrelevant reports of village merchants who always hide correct price.

8. Highly fragmented markets

It is experienced both at national and state level and seriously impeding efficiency of marketing.

9. High incidence of market fee/charges

Market Committee is authorized to collect market fees ranging 0.30% to 2.0%, from the buyers/traders on the sale of notified agricultural produce. In addition, commission charges are to be paid to commission agents which varies from 0.5% to 4.5% in food grains, and 3.0% to 7.0% in case of fruit and vegetables. In addition to these, other charges, such as, various types of development cess, entry tax, purchase tax, weightment charges and hamal charges, etc. are also required to be paid resulting in to higher transaction cost and low-price realization by the farmers in a regulated market.

10. High post-harvest wastage

Study by ICAR (2015), revealed that the range of post-harvest losses of various agricultural commodities varies from 4.65-5.99% for cereals, 6.368.41% for pulses, 3.08-9.96 for oilseeds, 6.7-15.88% for fruits, 4.8-12.44% for vegetables, 0.92% for milk, 7.19% for eggs and 6.74% for poultry meat. The total post-harvest losses of agriculture commodities have been estimated at about Rs 92,651 crores at average prices value of 2014.

Need of policy reforms in agricultural marketing

There is great need of policy reforms in agricultural marketing. Empowerment of producers with knowledge, information and capability to undertake market-driven production and by empowering the farmers there exploitation can be checked. Provide multiple choices and competitive marketing channels to farmers so that they get better price of their produce. Policy reforms can help in attracting large scale investments that is needed for building post-harvest infrastructure. Better agricultural marketing policies can help in achieving the national goal of doubling farmer's income by 2022.

Agricultural marketing reforms can be classified in two parts 1)

Agricultural Marketing Policies.

2) Agricultural Price Policies .

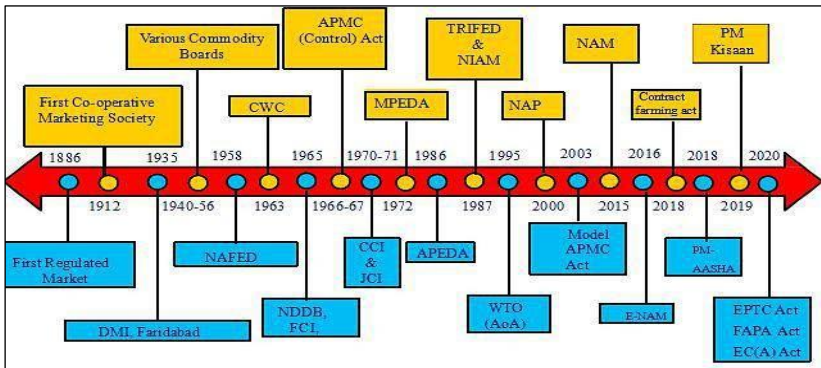


Fig 1: Journey of Agricultural marketing in India

Before independence, the major objective of the Government policy with respect to agricultural marketing was to keep the prices of food for the consumers and agro-raw materials for the industry below a these hold. However, after independence, the need to safeguards the basic interest of farmers and to provide them remunerative prices to increase the production of agricultural commodities was also felt. History of agriculture produce market regulation programme in India has its roots in British period as raw cotton was the first agriculture produce to attract the attention of the Government due to anxiety of British rulers to make available the yarn of pure cotton at reasonable prices to the textile mills of Manchester (UK). For that purpose, first regulated market (Karanja) under Hyderabad Residency Order was set up in 1886 in the Country and the first legislation related to this was the Berar Cotton and Grain Market Act of 1887, which empowered British Resident to declare any place in the prescribed district a market for sale and purchase of agricultural produce and a committee was constituted to supervise the regulated markets. This Act became the model for enforcement in other parts of the country. Then in 1912, first co-operative marketing society was the Kumbakonam Agricultural Society, which supplied quality seeds, manures and fertilizer's, implements and arrangements of sale of agricultural produce. In year 1935, Directorate of Marketing and Inspection, Faridabad an Office which is attached with the Department of Agriculture, Cooperation and Farmers Welfare under separate Ministry of Agriculture & Farmers Welfare, was established to implement the agricultural marketing policies and programmes for the continuous development of marketing of agricultural and other allied produce in the country with a view to provide level battle field for farmers as well as the

consumers. It maintains a close linkage between the Central and the Governments of states. Various Commodity Boards were established during the period of 1940-56 to promote exports of the respective commodities and for giving advice and recommendation to the government on policy matters, like Coffee board in 1942, Rubber Board in 1947, Central silk Board in 1949, All India handicraft Board and All India Hand loom Board, Tea Board in 1955, Cardamom Board in 1965, etc. Further National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED) was set up in 1958. NAFED is registered under the act of Multi State Co-operative Societies. NAFED was setup with the aim to promote Co-operative form of marketing of agricultural produce in order to benefit the farmers. Agricultural farmers are themselves the main members of NAFED, who are provided with the authority to say in the form of members of the General Body in NAFED meeting.

Central Warehousing Corporation was established in 1963 to acquire and build godowns and warehouses at suitable places in India. In year 1965, two milestone establishments NDDDB and FCI, National Dairy Development Board to plan, promote and organize programmes for the purpose of development of dairy and other agriculture based and allied industries and biological and Food Corporation of India to provide farmers remunerative prices and to make food grains available at reasonable prices, particularly to vulnerable section of society. Agricultural Produce Marketing (control) act in 1967 to give incentives to farmer's to adopt new technology and provide freedom to Producers to choose market and buyers for their produces. Cotton Corporation of India and Jute Corporation of India in year of 1960 and 1961 respectively. In 1972, Marine Products Export Development Authority (MPEDA) was established for promotion of Indian marine products in foreign markets, collection and dissemination of trade information and provide facilities for seafood export trade. Agricultural and Processed Food Products Export Development Authority (APEDA) was established in 1986 functions for promotion of export-oriented production and development of scheduled products. Setting the standards and requirements for the scheduled products and also improving the packaging and marketing. In year 1987, Tribal Cooperative Marketing Development Federation of India (TRIFED) with the objective is to promote marketing development for the tribal people and National Institute of Agricultural Marketing (NIAM) availability of quality managers through its mandate were established.

The WTO Agriculture Agreement provides a framework for a long-term reform of agricultural trade and domestic policies, in order to provide fair

competition and export competition in 1995. The government came out with a National Agricultural Policy in 2000 which will help in creating growth in employment in rural areas and secure a fair standard of living for farmers and their families. In 2003, Model APMC Act came into force and a new chapter on 'contract farming' has been added to promote contract farming. Development of efficient marketing system & promotion of agri-exports, agro-processing for marketing.

Aim of unified national agricultural market through online trading platform (e-NAM) unveiled in 2016 intended to be a market-based mechanism for efficient price discovery. In first phase, the scheme's main objective is to set up a common e-platform in around 580 selected wholesale regulated markets across 16 states and 2 Union Territories. Model Agriculture Produce and Livestock Contract Farming and Services (Promotion & Facilitation) Act, 2018 came into force with a main objective to integrate farmers with wholesale purchasers including exporters, agro-processing industries etc. for better realization of price through mitigation and shifting of market and price risks of the farmers along with assuring smooth and regular supply of raw material to the agro industries. Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA) was launched by the Government of India during 2018-19 and comprises:

- 1) **Price support scheme (PSS):** Physical procurement of pulses, oilseeds and copra will be done by Central Nodal Agencies with proactive role of state governments.
- 2) **Price deficiency payment scheme:** Under this direct payment of the shortfall between the amount of MSP and the modal price will be made to pre-registered farmers selling their produce in the prescribed market yard through a transparent auction process.
- 3) **Private procurement and stockiest scheme (PPSS):** For oilseeds, states have the option to roll out PPSS on pilot basis in selected district/APMC(s) of district involving the participation of private stockiest.

In 2019, Pradhan Mantri Kisan Samman Nidhi is an initiative by Govt in which all the beneficiaries will get up to Rs. 6000 per year as minimum income support.

In 2020, three acts, The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020 allows farmers and traders to sell and buy farm produce outside mandis notified under State Agricultural Produce

Marketing legislations. This can make inter-State and intra-State trade of agri-produce smoother. The trade can happen at farm-gate, warehouses, cold storage or processing units, letting farmers save cost and effort including on transportation. The Bill also allows for an electronic platform through which agritech firms can purchase produce from farmers without intermediaries. The Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Services Act, 2020 provides for contract farming. The prices are to be fixed before the crop is sown, with the firms providing farmers with inputs and technology support. The Essential Commodities (Amendment) Act removes upper stock limits on cereals, oilseeds, potatoes, pulses, onions stored by agribusiness firms. The limits will be imposed only under extraordinary circumstances such as natural calamities and famines, but even then, they will not be applicable to processors or value chain participants or any exporters (up to their export commitments).

Major policy reforms since independence

- 1) APMC(Control) Act, 1967.
- 2) Model APMC Act, 2003.
- 3) E-NAM, 2016.
- 4) Model Contract Farming Act, 2018.
- 5) PM-AASHA, 2018.
- 6) New Farm Acts, 2020.

APMC (Control) Act, 1967 Salient

features

- To give incentives to farmer's to adopt new technology and make investment in modern inputs.
- Reduction in malpractices like unregulated auctioning.
- To create competitive environment.
- Freedom to Producer to choose markets and buyers for their produce.

Drawbacks

- Failed in major commodity coverage.
- Wider variation in composition and functioning of agricultural market boards.
- Area served per market yard is high, so high transportation cost.

- Rural periodic market not developed and regulated.
- Election of APMC managerial bodies not held properly.
- Multiple tax regimes and problem in multi-licensing.
- Strong Organization of market functionaries was barrier to new functionaries.

Model APMC ACT, 2003

Salient features

- Development of efficient marketing system and promotion of agriexports, agri-processing for marketing of agri-products.
- Legal persons, growers allowed establishing new markets.
- No compulsion to route the produce via APMC.
- ‘Special Markets’ for special different commodities.
- Ensuring transparency in pricing system and payment on the same day.
- Public private partnership mode and contract farming in the management of agricultural markets.
- Provision of appointment of chief executive officer in market committee.
- Imposition of single point levy of market fee on the sales of notified agricultural commodities
- Purchase of agricultural produce through private market yards.

Drawbacks

- Inadequate private investment for commercialization and diversification of agricultural sectors.
- Fragmented and uncoordinated marketing system.
- Insufficient and poorly managed network of market in most of the states.

- Limited market support service.

S. No.	STATES & UT	PVT	DM	CF	FM	ET	SLV	SLN	(On 08/12/2018)
1.	Gujarat								Complete Adoption
2.	Goa								
3.	Himachal Pradesh								
4.	Karnataka								
5.	Mizoram								
6.	Rajasthan								
7.	Sikkim								
8.	Jharkhand								
9.	Andhra Pradesh							Adoption	
10.	Maharashtra								
11.	Nagaland							YES	
12.	Uttarakhand							NO	
13.	Madhya Pradesh								
14.	Arunachal Pradesh								
15.	Assam								
16.	Chattisgarh								
17.	Tripura								
18.	Punjab								
19.	Haryana								
20.	Chandigarh								
21.	Orissa								
22.	West Bengal								
23.	Uttar Pradesh								

PVT: Private Market; DM: Direct Marketing; CF: Contract Farming; FM: Farmers Market; ET: e-Trading; SLV: Single Point Levy; SLN: Single License

Fig 2: Status of Marketing Reforms in different States

States like Gujarat, Goa, Himachal Pradesh, Karnataka, Mizoram, Rajasthan, Sikkim, Jharkhand completely adopt the new reforms like private market, direct marketing, contract farming, farmers market, e-trading etc. Uttarakhand, Madhya Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Tripura, Punjab, Haryana adopted private market, direct market, contract farming, farmers market.

Chandigarh, Orissa, West Bengal, Uttar Pradesh only adopted private market, farmers market and direct market respectively due to their infrastructural and structural reasons.

From e-MANDI to e-NAM, 2016

Building on the success of e-mandi, Karnataka introduced a unified market platform in 2014. All APMCs in the state are brought under a single trading platform. Traders are issued the unified market licence. They can bid for the produce online from any part of state or outside the state, resulted in improved competition and in better price discovery. Vision of unified national agricultural market through electronic trading platform (e-NAM) unveiled in 2016 Intended to be a market-based mechanism for efficient price discovery. In first phase, the scheme main focus is on setting up of a

common e-platform in 585 selected wholesale regulated markets across sixteen states and 2 Union Territories. States needed to amend their respective APMC Acts to put in place three prerequisites for the success of this programme-a single licence across the State, a unique point levy of the market fee and electronic auctioning in all the markets.

State	No. of APMC	Mandis doing online trade
ANDHRA PRADESH	53	18
CHANDIGARH	1	1
CHATTISGARH	14	11
GUJARAT	142	28
HARYANA	81	60
HIMACHAL PRADESH	35	22
JAMMU & KASHMIR	2	2
JHARKHAND	40	2
KARNATAKA	2	0
KERALA	16	0
MADHYA PRADESH	96	27
MAHARASHTRA	118	51
ODISHA	53	32
PUNJAB	47	34
RAJASTHAN	144	102
TAMIL NADU	73	29
TELANGANA	77	31
TOTAL	1000	431

Fig 3: No. of mandis doing Online Trading

S.No. APMC	S.No. APMC	S.No. APMC	S.No. APMC	S.No. APMC	S.No. APMC	S.No. APMC
1. Adampur	13. Dabwali	25. Hodal	37. Kanina	49. Nigdhu	61. Puhana	73. Stwani
2. Ambala	14. Dhand	26. Indri	38. Kamal	50. Nilokheri	62. Raipur rani	74. Sonapat
3. Ambala cantt.	15. Ellanabad	27. Ismailabad	39. Kosli	51. Nissing	63. Rania	75. Tarori
4. Asandh	16. Faridabad	28. Israna APMC	40. Ladwa	52. Nuh APMC	64. Ratia	76. Tauru
5. Ateli APMC	17. Fatehabad	29. Jagadhari	41. Madlauda	53. Pat APMC	65. Rewari	77. Thanesar
6. Barwala Hisar	18. Ferozpur Jhirka APMC	30. Jakhai	42. Meham	54. Palwal	66. Rohtak	78. Tohana
7. Barwala Panchkula	19. Gansur	31. Jhajar	43. Mohindergarh	55. Panchkula	67. Sadhaura	79. Uchana
8. Bhattu Kalan	20. Gharaunda	32. Jind	44. Mulana	56. Panipat	68. Safidon	80. Uklana APMC
9. Bhiwani	21. Gohana	33. Julana	45. Naraingarh	57. Pehowa	69. Samalkha	81. Yamuna nagar APMC
10. Ch Dadri	22. Gurgaon	34. Kaithal	46. Namaul	58. Pillukhera	70. Shahbad	
11. Cheeka	23. Hansi	35. Kalanwali	47. Namaund	59. Pipli	71. Shahzadpur	
12. Chhachhrauli	24. Hisar APMC	36. Kalayat	48. Narwana	60. Pundri	72. Sirsa	

Fig 4: APMCs in HARYANA on e-NAM Platform Objectives of

e-NAM

- To integrate agricultural markets across the nation through a common e-market platform and to facilitate trade in agricultural commodities.
- To simplify marketing procedures and make them uniform across nation to promote efficient and well-functioning of the markets.
- To provide online access to farmers for better marketing facilities.
- To provide for efficient quality assurance and quality detecting system to encourage informed bidding
- To provide stable prices along with quality produce to consumers.

List of all commodities which are traded on e-NAM

List of Commodities Traded on eNAM					
5 No Commodities Traded	5 No Commodities Traded	5 No Commodities Traded	5 No Commodities Traded	5 No Commodities Traded	5 No Commodities Traded
01. Ahar	26. Gal Seed	51. Pineapple	76. Sweet Corn	101. Ribhite	126. Ahar Dal Split
02. Maang whole	27. Cotton Seed	52. Onion	77. Capsicum	102. Bamboe	127. Safed Peaha
03. Masoor whole	28. Pongam seeds	53. Potato	78. Jirikand (Kuran)	103. Cotton	128. Ber
04. Urad whole	29. Linseed	54. Tomato	79. Hygurd	104. Raw Cashewnut	129. Black Pepper Whole
05. Wheat	30. Apple	55. Pea	80. Colecacia vegetable	105. Betel leaves	130. Maang Dal Split
06. Maize	31. Pear	56. Bomb gourd	81. Pumpkin	106. Yeagal	131. Chana Dal Split
07. Chana whole	32. Orange	57. Bitter gourd	82. Fenugreek leaves	107. Mahua Seed	132. Urd Dal Split
08. Bajra	33. Sapota	58. Cucumber	83. Drumstick	108. Palasa	133. Kabuli Chana Whole
09. Barley	34. Musk melon	59. Brinjaj	84. Pointed gourd	109. Saffron	134. Tinda
10. Inwar	35. Grapes	60. Cabbage	85. Cumin	110. Kari Jute	135. Jamin
11. Paddy	36. Lichi	61. Cauliflower	86. Red chili	111. Tender coconut	136. Cardamom Whole
12. Rajma	37. Pomegranate	62. Green chilies	87. Turmeric	112. Area nut (betel nut)	137. Cloves Whole
13. Raji	38. Banana	63. Carrots	88. Ajwain	113. Tuberosa	138. Nutmeg Whole
14. Lobia	39. Plum	64. Sweet potato	89. Coriander whole	114. Matigali	139. Coconut With Husk
15. Basmati rice	40. Peach	65. Spinach	90. Dried Raw Mango Slices	115. Buck Wheat	140. Oats Raw
16. White Peas	41. Mango	66. Mustard leaf	91. Large zantam	116. Snake Gourd	141. Cherry Red / Black
17. Moth	42. Sweet orange	67. Coriander leaves	92. Fenell seed	117. Strawberries	142. Banana Raw
18. Castor seed	43. Custard apple	68. Garlic	93. Fenugreek seed	118. Amla	143. Papaya Raw
19. Mustard seed	44. Watermelon	69. Bhindi/Dokra	94. Tajpota	119. Horse Gram	144. Niam Seeds
20. Soyabean	45. Lemon	70. Ginger	95. Guar seed	120. Dry Ginger	145. Jute Seed
21. Peanut kernel	46. Guava	71. Berroot	96. Mahua flower	121. Lubia Pods	146. Tapioca
22. Sunflower seed	47. Jackfruit	72. Ribbed colery	97. Tamarind	122. SEM	147. Base Cut Flower
23. Cucum seed	48. Kinnow	73. Cluster beans	98. Jaggoty	123. Carnation	148. Chhappan Kaddu
24. Sesame seed	49. Raw Mango (or pickles)	74. Ridge Gourd	99. Groundnut with peah	124. Gladiolus	149. Preshimom
25. Niger Seed	50. Papaya	75. Reddish	100. Coconut	125. APRICOT	150. Walnuts Inshell
					151. Chrysanthemum
					152. Garbara
					153. Anthurium
					154. Tulip
					155. Spray Chrysanthemum
					156. Lily
					157. Chaihua Or Black Rice
					158. Mase Whole
					159. Pappi Seed
					160. Chiraji
					161. Safed Maali
					162. Spange Gourd
					163. Passion Fruit
					164. Broccoli/Caladrese
					165. Sugar Snap Peas
					166. Aloe Vera
					167. Oyster Mushroom
					168. Button Mushroom
					169. Chonaji
					170. Grapefruit
					171. Rapeseed
					172. Jiba
					173. Mint Leaves
					174. Curry Leaves
					175. Spring Onion

National performance of e-NAM till May 2020

175 Commodities are listed on e-NAM platform. Out of 175 commodities 26 are food grains, 14 are oilseeds, 31 are fruits, 50 are vegetables, 16 are spices and 38 are miscellaneous. About 785 markets are integrated all over the country.

There are many users on e-NAM platform, 1.66 Cr farmers, 1.30 Lakh traders, 0.71 Lakh commission agents on e-NAM. Around 1005 FPOs, are users on e-NAM. Trade volume of e-NAM is 3.43 Cr MT out which 37.93 lakh Coconut, Bamboe, Betel Leaves traded. Rs. 1,00,164 Cr is total value of Trade on e-NAM.

PM-AASHA, 2018

To protect farmer income by way of robust procurement mechanism in coordination with the state governments, the Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA) has been launched by the Government during 2018-19 and comprises:

- Price Support Scheme (PSS).
- Price Deficiency Payment Scheme (PDP).
- Private Procurement and Stockist Scheme (PPSS).

Price Support Scheme (PSS)

Physical procurement of pulses, oilseeds and copra will be done by Central Nodal Agencies with proactive role of state governments. NAFED and FCI will take up PSS operations in states/districts. The procurement expenditure and losses due to procurement will be borne by the central government as per norms.

Price deficiency payment scheme (PDP)

This component covers all oilseeds for which MSP is notified. Under this scheme, the direct payment of the shortfall between the amount of MSP and the selling/modal price may be made to pre-registered farmers selling produce in the notified market yard through an open and transparent process of auctioning. All payment will be done directly into the registered bank account of the farmer (by direct bank transfer or DBT mode).

Private procurement and stockist scheme (PPSS)

For oilseeds, states have the option to roll out PPSS on pilot basis in selected district/APMC(s) of district involving the participation of private stockist.

Public procurement, deficiency payments and private procurement were the main planks of this programme. However, only public procurement was carried out in a meaningful way. Deficiency payments were only implemented on a pilot basis in Madhya Pradesh and surprisingly initiation of private procurement was not reported, even on a pilot basis, in any State. However, the initial budgetary outlay was not sufficient as compare to the level of ambition of the programme. An outlay of only Rs. 4721 crore was made in 2018-19. A study by the Institute of Economic Growth concluded that the programme needed a much larger outlay to provide comprehensive

coverage. The initial outlay further dwindled to Rs.321 crore in 2019-2020 and only Rs. 500 crore have been earmarked in 2020-2021.

The new farm acts, 2020 The farmers' produce trade and commerce (promotion and facilitation) act 2020

- Seeks to completely open up the sale of produce outside the Agricultural Produce Market Committees, or the APMCs.
- The trade can happen at farm-gate, warehouses, cold storage or processing units.
- Also allows for an electronic platform through which agritech firms can purchase produce from farmers.
- Every trader who transacts with farmers shall make payment for the traded scheduled farmers' produce on the same day or within the maximum three working days.
- In case of any dispute arising out of a transaction under section 4, the parties may seek a mutually acceptable solution through conciliation by filing an application to the Sub-Divisional Magistrate who shall refer such dispute to a Conciliation Board to be appointed by him for facilitating the binding settlement of the dispute.

Pros

- Open more choices for farmers and help them get better prices.
- This can make inter-State and intra-State trade of agri produce smoother.
- Letting farmers save cost and effort including on transportation.
- Farmers will be able to sell their produce without inclusion of intermediaries. **Cons**
- State will lose revenue if farmers will sell produce outside APMC market.
- Commission agents will be impacted adversely if the entire trade of agricultural commodities will go out of mandis.
- Hardly any regulation outside the mandis and no redressal mechanism yet.
- Farmers cannot get assured or minimum price.

Marketing scenario in India

In India, as per the Shanta Kumar committee report, 94% of farmers in India are dependent on the markets. Only 6% of the farming community in the country are able to sell at the guaranteed Minimum Support Price (MSP). Studies have also revealed that only some 36% of farm produce was sold in the mandi (APMC yards) and the remaining was sold outside to private trade. The question that crops up is, if the markets were so well functioning and efficient, agriculture sector of India shouldn't have been in the grip of a severe agrarian crisis. In other words, markets failed to prop up farm incomes.

The farmers agreement on price assurance and farm services act 2020

- Gives farmers the right to enter into contract with Agribusiness firms, wholesaler, processor, exporter and retailer for future sale of their produce.
- A farmer has to deal with a written farming agreement as far as his produce is concerned and agreement may include for
 - a) The terms and other requirements for supply of such produce, including the time of supply, quality, grade, standards, price and such other matters.
 - b) The terms related to supply of farm services.
- The prices are to be fixed before the crop is sown.
- The Firms providing farmers with inputs and technology support.
- The minimum period of the farming agreement shall be for one crop season or one production cycle of livestock, as the case may be, and the maximum period shall be five years.

Pros

- Promotes contract farming and marketing.
- Get technological aid from large companies like better quality of seeds and cost saving technologies and which gives better yield and income to farmers. **Cons**
- Big corporate may dominate the Indian food and agriculture business.
- Farmers don't have adequate knowledge to negotiate the best term with a private company.

- Lack of bargaining power with big companies.
- More chances of farmers exploitation due to less knowledge and competence of farmers and dominating nature of companies.

Present scenario of contract farming in India

- Contract farming in India is done by MNCs, domestic corporates in many areas. Tomato cultivation in Punjab, Haryana and Chandigarh, Mushrooms in Haryana, Sunflower cultivation in Andhra Pradesh and Karnataka, Fruits and vegetables in Tamil Nadu, Maharashtra and Andhra Pradesh can be given as prominent examples of contract farming. (Singh, 2007)
- Few exceptional success stories which entirely contradict the definition of contract farming would be Amul & NDDB for milk procurement, the Sugarcane cooperatives in Maharashtra, green leaf satellite out growers to the South Indian tea manufacturing industry, the prawn aquaculture farmers of AP & the rapid spread of poultry projects in West Bengal, Tamil Nadu, Maharashtra, Andhra Pradesh and Punjab. (Sinha, PM. 2001).
- The contracting firms generally end up worsening the natural resource crisis as most of the contracts are short term (one or two crop cycles). The firms tend to look out for new growers and lands after squeezing out the fertility of the local resources, particularly land and water. The firms have major objective of earning profits and they do not bother about rising costs having effects like overexploitation of groundwater, salination of soils. Effects like soil fertility decline and pollution are externalized so far as the agriculture sector is concerned. (Swain *et al.*, 2012).
- Contract farming increases the income of participating farmers due to improved access to market, better use of resources and better management of technology. Contract farming benefits rural employment by providing additional employment opportunities through processing.
- Contract farming helps in improving farmer's production through the provision of appropriate technology and through the creation of structured, efficient farming operations. Agribusiness firms enable the farmers to reduce their price risk through

predetermined prices, production risk through provision of technology, extension services and diversification of farm activities.

- Some negative side of contract farming like agribusinesses corporations mostly prefer to deal the contracts with large farmer groups because they have lower average costs and are more reliable and regular suppliers with respect to both quantity and quality. Most of the schemes related to contract farming occur only in the regions where, commercial agriculture is already established and offering reliable infrastructure and access to markets.
- Due to unequal power in terms of bargaining, negotiating, or contract enforcement contracts between agribusiness firms and farmers tend to be unfair and lead to exploitation. **The essential commodities (amendment) act 2020**
- Takes away cereals, potatoes, oilseeds, pulses, onion and edible oils from the list of essential commodities.
- These commodities are now free of the Essential Commodities Act restrictions and stand deregulated.
- The central government has exclusive right to regulate them under extraordinary circumstances, such as in case of a war, famine, natural calamity and impose stock limits if there is a steep rise in prices. **Pros**
- Free to stock large quantities of commodities like cereals, potatoes, oilseeds, pulses, onion and edible oils from list of essential commodity act.
- No imposition of stock holding limits on such items.

Cons

- Big companies will have freedom to stock commodities.
- This result in helping the big companies dictates terms to farmers.
- More chances of farmers exploitation.

1. Agricultural price policy

Agricultural Price Policy is a tool of government to influence the price of agricultural product. At time of Independence the aim was to increase agricultural production and increase supply of grains to consumers at reasonable prices. Up to mid-sixties various forms of price controls mainly imports of foodgrains and their distribution at the prices below the market

rate were followed. With introduction of green revolution in 1960s, price policy was assigned a positive role to increase the domestic agricultural production. Agricultural price commission (APC) was set up in January 1965 with a broad framework of price policies. It was renamed as Commission for Agricultural Costs and Prices (CACAP) in the year 1985.

Objectives of price policy

- To provide incentives to the producers for crop production,
- To provide price stability in the agricultural product,
- To provide the consumer food grains at reasonable price.
- To maintain favorable agricultural Terms of Trade (ToT),
- To increase the production and exports of agricultural product.
- To maintain balance between food and non-food crops,
- To promote adoption of latest technologies of production
- To safeguard farmers' interest and giving necessary incentives to augment the agricultural production.
- To maintain appropriate relationship among the competing crops.

Form of government interventions to influence agricultural prices

- Influencing Demand and supply of Agricultural Commodity.
- Influencing Behaviour of Market Middlemen.
- Administered Prices of Agricultural Commodities.
- Creation of Infrastructural Facility.



Administered prices



Procurement price: It is the price at which the Government procures commodities from farmers/processors to feed the buffer stocks. However, the Government through the policy instrument of procurement prices is imposing an element of compulsion on the farmers to sell part of their produce to the Government at the announced procurement price.

Levy price: The levy price applies to both traders and farmers. It can be imposed depending on the market situation on both the farmers and traders. It is a procurement system, which makes it obligatory for the farmers and traders to sell a special quantity to Government at procurement price. After this procedure of retention of this much quantity, rest part can be allowed for open sale.

Issue price: The Price at which the products through fair price shops are issued or made available to the consumers. Issue price are always higher than the procurement price.

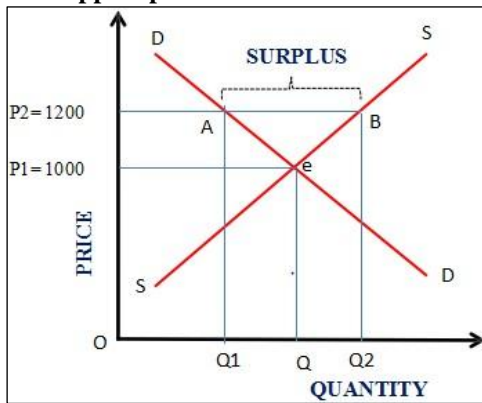
Fair and remunerative prices: It is the minimum price at which rate sugarcane is to be purchased by sugar mills from the farmers. It prevents the exploitation of the farmers from the owners of sugar mills and give farmers assured price for their produce.

Ceiling price: Ceiling price is an upper price level of commodity fixed by the Government to protect the consumers from unwanted price rise. It protects consumers' rights. By fixing ceiling price Governments checks the

traders in charging a higher price than the maximum price. It does not apply to farmers. Farmers are free from ceiling price.

Minimum support price (MSP): It is fixed based on average cost of production. This mainly aimed at protecting the farmers against the price fall during surplus production or market glut conditions. MSP is announced by the cabinet committee on economic affairs before sowing of crop every year. The minimum support price is the price at which the Government of India makes a commitment to purchase all the quantities offered by the farmers. But in reality, MSP is always low in magnitude than prevailing market price for food grains, also it's not mandatory for the farmers to sell their produce to the Government.

Effect of minimum support price



- Producer will get higher income,
- Consumers will pay more prices.
- Tax payers have to pay more tax.
- Stock of food grains with increases, as production is large so its management is difficult.
- Problem of storage arises, more production and less storage facilities.
- How to dispose of these produce will be a major problem with Government.
- Ensure food security.
- Farmers get assured price for their produce as committed before the sowing of crop.

Conclusion

The plan on paper will not operationalise perfectly in real life, this leads to unsuccessful of most of policies. Institutions and infrastructure are two building blocks for successful execution of any government programme. Both are like complementary goods which are always required in pair.

The states/union territories where APMC acts are non-functional or adopted on partial scales should allow for some administrative reforms and appropriate amendments in their respective APMC Act to make provision for e-NAM for benefiting targeted farmers. States which do not have APMC act are required to establish it as soon as possible so that farmers might tap potential benefit of MSP through APMC's. To solve the problem of inadequacy of skilled human resources for carrying out of electronic trading, skilled individuals can be hired from the agricultural universities situated nearby on internship basis.

Only giving farmers the freedom to sell their produce by avoiding role of middlemen will not solve the purpose. To make the policy more impactful adequate infrastructure in terms of linking roads to markets, cold storage facilities should be made available with considerable level of reliability. The CACP who recommends MSP along with the Cabinet ministries and State Governments itself does not enjoy any statutory body status as it is not set up by the Parliament. It is only a government policy that is part of administrative decision-making. There is no legal implication of declaration of MSP by the government.

There is no binding on government to procure all produce at the MSPs but it purchase the amount it need to feed for PDS system only thus the system of MSP will remain and government procurement will continue, this fear had to be clarified even further and farmers should be guided well in this regard.

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Chapter - 4
**Cyber Extension: A Breakthrough in Agriculture
and Rural Development**

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Chapter - 4

Cyber Extension: A Breakthrough in Agriculture and Rural Development

Namami Gohain, Rohit Dhankhar and Amita Yadav

Abstract

Over the past few decades, agriculture has emerged as one of the promising sectors with increased production and productivity of crops which shifted the self-sustainable profession to a commercial business encompassing higher profitability. This is made possible by advancements in technology with respect to agricultural crop production coupled with highly efficient extension services transferring these innovations to the ultimate farmers to be implemented and adopted following suitability of such techniques in real field situations. Cyber extension has evolved as one such breakthrough in extension services facilitating quick and easy transfer of technology from lab to land. Cyber extension is a form of Information Communication Technology (ICT) which can be referred to as a collaboration of information technology in agriculture and extension services. Its main objective is to provide quick and continuous information to the farmers relating to agricultural crop production, marketing of their produce, price of inputs and outputs, post-harvest management and technology, livestock management systems etc. During the process of information dissemination, cyber extension methods employ various tools such as e-mail, World Wide Web, Telnet, FTP etc. which are discussed in details in the chapter. The use of this advanced form of extension service saves time, energy and efforts of extension specialists, is economic and involves active participation of the farming community at large. However, it should be borne in mind that effective application requires the farmers to be literate so far as networking is concerned and innumerable information may also lead to farmer's confusion. However, such shortcomings can be overcome by appropriate management of cyber extension services.

Keywords: cyber extension, information dissemination, information communication technology

Introduction

Introduction of agriculture in the civilization process was one of the historical leaps made by mankind till date which has not only paved the way of producing foods for consumption but has also led to the evolution of the sector on a commercial basis. Development of this specific sector has been fueled differently owing to different climatic conditions, varied cultures, different soil and topographical conditions, management of livestock, floriculture as well as marketing aspects of the same. Although agriculture in its initial years was confined to the farm family solely on a sustainable basis, yet with peer population pressure combined with several other factors such as rapid urbanization, high advancement of the medical sector and the like, the sector has emerged as one of the most potential commercial sectors of any economy. This resulted in widespread research in agriculture which finally made way for various inventions and innovations in the sector targeting the increase in output from the sector. It is to be mentioned here that transfer of those innovations in agricultural practices from lab to land has been facilitated through agricultural extension services. Agricultural extension is a dynamic process which may be subjected to change as per the needs of the farming community.

Recent days advancements in agricultural technologies are highly correlated with Information Communication Technology (ICT). Various technologies in agriculture are classified into two types namely, Material based Technology and Knowledge based Technology. Information technology in agriculture collaborated with extension services led to the development of the concept of Cyber Extension. The use of networking and computer communication combined with interactive digital multi-media for assisting the distribution of lab innovated technologies is termed as cyber extension. Wijekoon (2003) defined cyber extension as “an agricultural information exchange mechanism over cyber space, the imaginary space behind the interconnected computer networks through telecommunication means”. In agricultural sector, cyber extension structure encompasses efficient exercise of ICT, various information networks, internet and professional computer personals to revolutionize the availability and accessibility of information related to agriculture to farmers, extension workers, subject matter specialists, research scholars, scientists, universities and the like (Wijekoon, 2011). **Development of cyber extension**

With respect to cyber extension in agriculture, the very first landmark in the world was achieved in the year 1995, by Agricultural Knowledge

Management Unit (AKMU) previously known as Agricultural Research Information Systems (ARIS). In Sri Lanka before 2004, the agricultural extension system collapsed entirely due to a series of events. Few notable among them are trade liberalization post 1977, exclusion of extension personnel from various extension related activities, delegation of authority to regional councils, Civil Wars from 1983 to 1989 and twenty long years of hydra headed terrorism (Jones, 1997). Hence the need of a system to revive the deserted and frail connectivity among various agencies comprising of research specialists, extension personnel and farmers was greatly felt during this period of turbulence in the country. Accordingly in the year 2004, Sri Lanka witnessed the commencement of the first cyber extension program in the field of agriculture launched by the department of agriculture (DOA) in the country. The project at its initial stage (2004-06) started its operations by setting up a total of 45 Cyber Extension Units (CEU) at 45 Agrarian Service Centres commonly known as Govijana Kendra offices.

Objectives of cyber extension

The inclusion of cyber extension in the field of agriculture for promoting the transfer of technology to the farmers has certain basic objectives in its backdrop which are outlined as under-

1. Generating consciousness/awareness amongst various extension functionaries.
2. Familiarizing extension personnel and specialists on the utility of information technology and computer networking in achieving their targets.
3. Estimating the efficacy of cyber extension as ICT media in accomplishing the set goals.
4. Conferring and understanding the value of various tools of cyber extension viz., E-mail, video conferencing, Telnet etc.

Assessing the importance of cyber extension to farmers

The previous discussion on cyber extension clarified the fact that timely and required information dissemination to the farmers is the prime objective of ICT in agriculture. The type of information provided can be common agriculture related news, latest innovations and technologies in agriculture, weather forecasting, prior caution on incidence of pests and disease attack, post-harvest management techniques, information on market availability and prices of inputs, knowledge of various subsidies and

developmental programs in rural areas. Cyber extension is entrusted with the responsibility of offering fastest and most unswerving information related to crop production, horticulture and landscaping, post-harvest management and value addition, export related information, marketing practices, contract farming and extension related services. Farmers as receivers will be most benefited in the process which will aid in evolving agriculture as one of the most remunerative and profitable professions thereby improving the standards of living. By way of providing multiple interfaces between audios and visuals, cyber extension has by far emerged as the most efficient extension methods of information dissemination (Gujarathi and Patil, 2009).

Tools of cyber extension

The various tools used for making cyber extension an efficient information dissemination method is stated as below:

- 1) E-mail
- 2) Telnet
- 3) FTP
- 4) Gopher, Archie, Veronica
- 5) World Wide Web

I. E-mail

Electronic mail (E-mail) is probably the most widely used tool in cyber extension. This tool enables receipt and transfer of electronic messages between two users. Various tools are used for the process of reading or sending an e-mail, notable among them are web browsers such as Internet explorer, Eudora, Netscape and the like. To send an e-mail one has to know the e-mail address of the receiver.

II. Telnet

Telnet stands for Terminal Network. It is an application which provides service to its users by developing a general client-server program which permits logging on to a remote computer system thereby acting like a terminal emulation programme. Telnet sessions were much in popularity prior to the introduction of the World Wide Web (WWW).

III. FTP (File transfer protocol)

This network protocol is basically used for transfer of data from one computer to the other or on internet. It is responsible for copying and transferring copies of data files to other systems and servers. FTP users can validate themselves by use of a sign-in protocol usually in the form of userID and password or through use of anonymous connections if permitted by the server.

IV. Gopher, Archie, veronica

Gopher is a server which was the first attempt made to make information access on the internet easier. It makes use of text-based menus to obtain access to various FTP sites, files, documents and directories. It was developed in the University of Minnesota, designed by a number of computer specialists. Although Gopher sites achieved the objective of managing the FTP sites quite well, yet within a very short span after its initiation, Gopher sites became unmanageable. Hence development of other sites such as Archie, Veronica, Jughead etc., was the need of the hour which assisted locating the right Gopher site. However, with the availability of a large number of search engines now-a-days, Gopher and its derivatives became outdated.

V. Usenet newsgroups

Newsgroups provide a platform for users to know about the opinions and sent entries to be posted regarding any post. They are basically discussion groups not meant for publishing news. Before the introduction of the World Wide Web, Usenet Newsgroups were in esteem among the common masses and have managed to keep hold of their non-commercial nature in contrast to the ad-laden Web.

VI. World wide web

In recent days, World Wide Web emerged as the most vital tool of cyber extension thereby substituting all the other potential internet tools. The Web is potentially worldwide comprising of hypertext documents including animations, texts, images, videos, interactive programs and so on. Searching for websites can be done with the help of various search engines available now-a-days, however the best way is by knowing the address technically referred to as URL which stands for Uniform Resource Locator.

Advantages of cyber extension

In general parlance, it is to be borne in mind that use of cyber extension in agriculture and allied sectors cannot and will not purge all the shortcomings of our conventional extension system. It can however harmonize the traditional extension system thereby providing correct and dependable information to the farmers. The advantages of cyber extension over conventional extension methods are outlined as under:

1. Economic aspect

Cyber extension can be referred to as the most avant-garde method of information transfer which aims at reducing cost, time and exertions.

Research findings by specialists will be prepared in the form of electronic messages by the scientists themselves which do not need the help of print media to be distributed to the rural masses. These messages will be uploaded online for easy access by the farmers which in turn save time.

2. Reduce dependency

Cyber extension by virtue of its conveniences can diminish dependency of farmers on diverse government and non-government personnel for obtaining information. It is a common phenomenon that farmers fail to acquire adequate and complete information at the needed time. In that case cyber extension comes to the rescue wherein information is posted online by specialists thereby shortening the extension process.

3. Accessibility of information

Cyber extension has assisted in propagating information on any innovation or technology in any part of the world to the rural farmers in a very short period of time. Information can reach the rural masses located in geographically secluded areas such as hills, deserts, and riverside localities etc., where extension personnel hesitate to reside and serve. This instills a confidence among the rural communities that they are well connected with the rest of the world.

4. Amplify farmers' participation

Cyber extension by its virtues has traced a long path in making the farmers gain knowledge on operating websites for the purpose of searching information. This enables them to obtain some basic knowledge of computer operation. Owing to free accessibility of information provided by

cyber extension, farmers' participation in extension activities is augmented to a greater extent.

5. Provides prior information on weather forecasting

Advanced and current data availability on the part of cyber extension systems enable farmers to predict weather conditions during most crucial crop stages thereby equipping them to take steps accordingly to mitigate losses arising from the unforeseen weather circumstances. Prior warnings on weather hazards can aid advance vigilance, resulting in lessening the risk to life and possessions, and guarantee suitable rehabilitation. Cyber extension can also help the farmers to anticipate their harvest and market trend thereby shielding themselves against price fluctuations, black marketing, unscrupulous market practices and the like.

6. Participation of rural youth

Technological breakthrough in agricultural production disseminated through advance networking has gone a long way in arousing the interests of young generation in agriculture. Hence cyber extension has increased the involvement and participation of rural youth in agriculture.

7. All time availability

An online information system is available throughout the year for 365 days which is one of its distinctly significant features. This feature enables one to have access to information at any point of time provided one has uninterrupted internet connectivity.

Limitations of cyber extension 1. Limited availability

In a developing economy like India, cyber extension facilities are not in existence in all the villages of the country. Such situations compel farmers to travel long distances to obtain accessibility to online information systems provided by cyber extension. This is likely to develop an attitude of reluctance on part of the farmers towards this highly advanced method of extension.

2. Information overload

Agriculture being a dynamic sector is subjected to change every now and then. The changes occurring in this sector can be with respect to technology, conventional package of practices, marketing systems and the like, which can arise distrust in the minds of the farmers regarding the utility of cyber extension in enhancing the profitability from agriculture. Moreover,

illiteracy of the rural community poses a serious hindrance in utilizing the online information sources.

3. Quality degradation

Availability of information free of cost at any point of time poses a serious threat to the quality of cyber extension services. Moreover, reliability of information available on various online forums is questionable and is a serious peril to not only agricultural activities but also for general awareness. This will further lead to doubts in.

4. Generalized information

It is to be borne in mind that the information that is made available by cyber extension services is not region specific. Hence adopting any particular technology by any farmer may not yield appropriate results owing to unsuitability of that technology in the targeted region. Moreover, information provided may not be in the local language and some resources which make up foreign cyber extension networks are not obtainable in India.

5. System malfunctions

In event of any malfunctions in the cyber system, there is always a fear of losing data encrypted in the cyber extension system. Hence, all the efforts that goes into collecting and uploading of these data in the cyber extension system goes in vain which calls for a back-up system for the system.

6. Lengthy process of information acquiring

Although cyber extension systems claim their information accessibility to be free yet, it calls for sign-ups or registrations for obtaining access to some important information. This might create a kind of hindrance for the farmers in the process of information gather.

Milestones achieved by cyber extension

In the year 1995, Agricultural Research Information Centre (ARIS) came into existence with the objective providing recent data and agriculture related information to students, researchers and farmers after which Government of India established ARISNET in 1997. The commencement of NATP (National Agricultural Technology Project), during 1999 called for establishment of ATIC (Agricultural Technology Information Transfer). MANAGE (Hyderabad), through its website made available various agriculture related information to be used by farmers as well as researchers and under the purview of NATP has achieved success in establishing

network connectivity in seven states of the country namely Andhra Pradesh, Bihar, Himachal Pradesh, Jharkhand, Maharashtra, Odisha and Punjab. After that, various efforts were made in the field, notable among them are stated as under:

A) Information village project

Swaminathan Research Foundation laid the foundation stone of this project on 30th of December, 1999 which did the job of installing connectivity in ten different villages near Pondicherry with computer systems. This revolutionary step empowered rural masses with knowledge and opportunity to participate in various extension activities. The information provided under this project was region and language specific and was related to input and output prices, export potentiality, market availability, accessibility of medical and paramedical facilities in nearby hospitals, animal husbandry practices, transportation facilities and so on.

B) Warna wired village project

This project was launched by the Indian government in collaboration with National Informatics Centre, Govt. of Maharashtra and Warna Cooperative society in April 1998. The main objective behind implementation of the project was to provide first-hand information to the farmers on package of practices of major crops, plant protection aspects of crops, marketing and processing related information etc.

C) E-Choupal

E-Choupal was initiated in Madhya Pradesh by Indian Tobacco Company in the year 2004. The main motive behind its formation was to liberate the potential of Indian farmers by way of informing and empowering them to produce quality agricultural goods capable of enhancing competitiveness in world market. This would ultimately track down to improving the standards of living of the people with better management strategies to mitigate risk.

D) Kisan call centre

Kisan Call Centers were launched nationwide during 2004 by the Department of Agriculture & Cooperation, Ministry of Agriculture, GOI. The main objective of establishing these call centres was to extensively utilize the nation's telecom sector in providing extension services to the rural farmers. A Kisan Call Center is an amalgamation of telecommunication networking, computer system and human resources structured to provide solutions to inquiries raised by farmers.

Conclusion

Through this chapter an attempt has been made to understand the concept of cyber extension and its role in agriculture. The subject matter of cyber extension is very vast which encompasses various tools and techniques that make up this advanced method of extension service. The role of cyber extension in agriculture is manifold varying from information dissemination to taking follow up of extension activities. Marketing of agricultural commodities encompasses several shortcomings with respect to prices as well as exploitation by intermediaries. Creating a sense of awareness on the existence and utility of cyber extension can go a long way in reducing these limitations thereby complementing conventional extension methods of information transfer.

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Chapter - 5
Agricultural Pesticides Usage and Safety
Precautions

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Chapter - 5

Agricultural Pesticides Usage and Safety Precautions

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Abstract

This book chapter succinctly examined the concepts of pesticides, historical perspective of pesticides, classification of pesticides such as systemic pesticides, contact pesticides, ingested pesticides, herbicides, organic pesticides, insecticides soap etc. The chapter also explored the benefits of pesticides, effects of pesticides on human health and the environment, precautionary measures to employ when applying pesticides and Safety Practices to Employ when Applying Pesticides.

Keywords: agricultural, pesticides, usage, safety, precautions

Introduction

The global population is projected to be 9 billion by year 2050, and food availability and people's access to the food are matters that are increasingly important. Pesticides can help reduce the yield losses caused by the pests (e.g. insect pests, pathogens, weeds), and to feed the increasing world's population (Verger and Boobis, 2013). Agriculture is one of the most dangerous occupations although it is the second largest sector in the world as a source of work force. A large number of agricultural workers and farmers suffer from work accidents and diseases every year (ILO, 2010). Each and all individuals are faced with some types of pesticide exposure, but farmers and farming workers are particularly at high risk of pesticide exposure due to added risk of occupational exposure (Hashemi *et al.*, 2012a). Crop protection products particularly the use of pesticides against pests is one of several factors that are contributing to the huge growth in agricultural production. Pesticides are major inputs of the modern agricultural production, and due to their high capability and trustworthiness for crop protection against pests and warranty of high crop yields (Ahmed *et al.*, 2011; Cooper and Dobson, 2007; Damalas, 2009; Fan *et al.*, 2015). To protect human health against vector-borne diseases, for example, malaria,

dengue, Zika fever, Chikungunya fever (Cuervo-Parra *et al.*, 2016; WHO, 2009; Wilson and Tisdell, 2001) and to protect home sites, storages, lawns from weeds, pathogens and both insect and mammal pests pesticides are also used (Nayak *et al.*, 2015; Sarwar, 2016; Spliid *et al.*, 2004).

Pesticides are chemicals usually synthetic sometime biologically used to kill or contain the activities of pests (Wikipedia, 2014). Crop damage from pest infestation often result in serious consequences, warranting the need to use pesticide. However, despites their benefits, pesticide are potentially hazardous to man and the environment when inappropriately handled (Larson, 2003). Factors such as balanced use, optimum dosing, correct application method and timing helps in ensuring improved agricultural productivity (Bhan, 2014). Use of agrochemicals has led to increased food production. However, exposure to other organisms during their application including human, is poorly controlled (Damalas, 2017). Their use has significantly increased the concentration of toxic materials in food and the environment, with negative effects on plant and animal health. (Anderson, 2016) The world health organization (WHO) has estimated that more than three million farmers in developing countries are poisoned by agrochemicals each year (WHO, 1992; Larson, 2003).

In Nigeria, agricultural sector is the major supplier of food, raw materials and 70% of Nigeria's population largely depend on this sector for survival (Olakunle, 2016). Due to the country's drive to increase agricultural production and the upsurge of different species of pest that damage and ravage agricultural products` in field and storage, farmers have resorted to the use of agrochemicals as an important control strategy (Ajibola, 2015). An estimated 125,500, 130,000 metric tons of pesticides are used annually (Asogwa, 2013). According to Rahman and Chime (2013), 7% of rice and yam farmers apply pesticides, and 41% of farmers apply pesticides to at least one food crop in Nigeria. The application of pesticides is often imprecise, with unintended worker exposures. Ogwa and Dongo (2013) on problems associated with pesticide usage and application in cocoa production in southern Nigeria found the use of pesticides for insect pest control has generated public health problems and environmental pollution in Nigeria.

Exposure to insecticides is one of the most important occupational risks among farmers in developing countries. In some situation exposure to insecticides can occur from accidental spills of chemical leakages of faulty spraying equipment (Ateya, 2016). The exposure of farmers increases in the case of not paying attention to the instructions on how to use the

insecticides and particularly when they ignore basic safety equipment (Ajayi, 2018).

Despite the fact that several pesticides are banned and restricted or unregistered in many countries despite them been listed as hazardous by the World Health Organization (WHO, 2012); Fagewonyomi (2015), Stated that many of them are still widely promoted and applied especially in developing countries where weak controls and dangerous work condition make their impact even more devastating. In view of the adverse environmental effects from the usage of insecticide, lack of awareness of health consequences by some farmers, it therefore becomes imperative to identify farmers and pest management practices in their farming activities by investigating farmer's awareness and perception about the effect of pesticides used in the environment.

Concepts of pesticides

The word pesticide is a general term used to describe a substance or mixture that kills a pest, or prevent or reduces the damage a pest may cause. A pest may be insects, mice, other animals, unwanted plants (weeds), fungi, bacteria, or viruses (WHO, 2013). Pesticides are chemical compounds that are used to kill pests or contain it (Wikipedia, 2014). Pesticides could also be defined as a substances used for destroying insects or other organisms harmful to cultivated plants or to animals. A pesticide is any chemical substance meant to kill organisms harmful to cultivated plants or animals (WHO, 2013).

Historical perspective of pesticides

Pesticides are used for a number of decades. People have been fighting with pest for centuries (Soloneski, 2016). Chemical experiment during the late 19th and early 20th centuries allowed human beings to begin to develop modern pesticides. Producing new mixtures with a right proportion made it possible to control unwanted organisms. Paris green was one of the first chemical insecticide uses in the united states in 1867 (Marcelo, 2016). By the late 19th century U.S farmers were using calcium arsenate, nicotine sulphate and Sulphur to control insect pest in field crop except Paris green. Since the middle of the 20th century these chemicals have been widely used to control pests. Crop damage from pest infestation often results in serious consequences warranting the need to use pesticides. However, despite their benefits, pesticide pose potential hazards to human health and the environment when in appropriately handled (Kishi, 2005). Despite increasing

concern about overuse and misuse of pesticides in developing countries (Tijani, 2006). Where over 3 million people have suffered severe acute pesticide poisonings (Larson, 2003).

The indirect effect include negative impact on loss of biodiversity and irreversible changes to ecosystem (Ajayi, 2000), yet pesticides has been distributed throughout the world (Balaram, 2003).

In Nigeria, pesticides has proven to be indispensable tool in combating damage from pest and ensuring sustainable production with improved yield (Tijani, 2006). At the same time, the indiscriminate use of toxic substance has become a matter of national concern in Nigeria following revelations about high levels of DDT in the environment and human breast milk (Osibanjo, 2002). In Nigeria, as in many other developing countries, the largest proportions of chemical pesticide are used by resource poor rural farmers (Dinham, 2003).

It is likely that pesticide use and pesticide induced side effects will continue to increase in Nigeria where environmental legislation is either nonexistent or in effective (Osinbanjo, 2001) and such use is thus unsustainable.

Classification of pesticides

There are different types of insecticides which include systemic pesticide, contact pesticides and ingested pesticides. All are either natural (organic), man-made (synthetic). Formulas, or preparations that are used to control or kill unwanted insect pest.

1. Systemic pesticides

The most common application for systemic pesticides is through soil drenching. The pesticide is introduced into the soil where it is absorbed by plant roots. It then moves up through the plant to external areas (leaves, twigs, fruits, branches) where it lays on the plant surface area and is poisonous to any insect that come chewing on the plant (Stewart, 2018).

2. Contact pesticides Contact pesticides act like “bullets” aimed at a target and can only kill insects that are hit by its application. Common household insect spray acts much like a contact insect, it is ineffective as a preventative pesticide (Stewart, 2018)

3. Ingested pesticides

Many other common household pest control substances are ingested pesticides that are placed throughout the home where insect will ingest the poison (Stewart, 2018).

4. Herbicides

These are yet another kind of insecticides that are used to kill infected plant. It is specifically used to destroy part of the plant that the insects feed on or the section of the plant where infection has spread. Fungicides are also from the same family of herbicides, they are used to kill weeds and fungi that are responsible for destroying the agricultural yield (Stewart, 2018).

5. Organic pesticides

These are made from plant oils and fatty acids that are derived from plant or animals. They are eco-friendly and cause no harm to crops (Stewart, 2018).

6. Insecticides soap

This is made of detergent or ivory liquid and can be sprayed on plant to protect it from being used to manage insects pests they are important for disease control and providing food and fibre for a growing world population (Wikipedia, 2014).

Humans have attained important benefits from many uses of pesticides including

- 1) Increased yields of crops because of protection from defoliation and diseases.
 - 2) Prevention of much spoilage of stored foods.
 - 3) prevention of certain diseases which conserves health and has saved the lives of millions of people and domestic animals (Phillips, 2015).
- Benefits of pesticide**

Pesticides enable farmers to produce safe, quality food at affordable prices. They also help farmers provide an abundance of nutritious all yearround foods which are necessary for human health. Fruit and vegetable, which provide essential nutrients which are more abundant and affordable in grains milk and proteins which are vital to childhood development are more widely available because of lower cost to produce (Food animal feed (Food and Agricultural Organization, 2012).

Effects of pesticides on human health

Health effect of pesticides may be acute or delayed in those who are exposed. Strong evidence also exists for other negative effect from pesticides exposure including neurological problems, birth defect, fatal death and neuron developmental disorder. According to Stockholm convention on pest and organic pollution (2012), nine (9) of the twelve (12) most dangerous and persistent chemical were pesticide).

Acute health problem may occur in workers that handle pesticides such as abdominal pain, distress, headaches, nausea, vomiting as well as skin and eye problems. Many student have examined the effect of insecticides exposure on the risk of cancer association have been found with leukaemia, lymphoma, brain, kidney, breast, prostate, pancreases, liver, and lung and skin cancer. This increased risk occurs with both residential and exposure (World Health Organization, 2013). Evidence link pesticide exposure to worsened neurological out comes strong evidence link babies exposed to insecticide with a low birth weight and had development defect, May be acute or delayed in those who are exposed. Many studies have examined the effect of pesticide exposure on the risk of cancer (Lowrence, 2017).

Association have been found north leukaemia, brain, kidney, breast, prostate pancreases, liver, lung, and skin cancer. This risk occurs with both Residential and occupational exposure. Highly hazardous pesticides may have acute and chronic toxic effect, and pose particular risk to children. Their wide spread use has caused health problems and often as a result of occupation exposure and accident or intentioned poisoning, however, the global impact of self-poisoning (suicide) from preventable insecticide ingestion has how ever been estimated to amount to 186,000 death and 4,420,000 disability adjusted life years (Dennis, 2002). Environmental consummation can also result in human exposure through consumption of residues of pesticides in food and possibly drinking water.

While developed countries have systems already in place to register pesticides and control their trade and use this is not always the case elsewhere. Guidance and legal frame works on the use management and trade on insecticides as well as proper storage and handing are available from international organization and international conventions these should be implemented globally (WHO, 2013).

A number of insecticides including dibromocyclopropane and 24D has been associated with impaired and fertility in males. Insecticide exposure

resulted in reduced fertility in number of Sperm, damage to germinal epithelium and altered hormone function. Additionally, studies have indicated that insecticides exposure is, associated with long term Respiratory problems (Phillips, 2014).

Precautionary measures for application of pesticide

Pesticides are poisonous and must be used with caution; Read the label before opening a pesticide container; apply pesticides only on the crops in the situations stated on the label; don't carry pesticides together with food in a way that allows contamination of the edible items. Never transfer pesticides in a closed passenger vehicle. -keep pesticides in original containers until used store them in a level cabinet, building or fenced area where they are not accessible to children, unauthorized persons, pests or livestock (Johnson, 2013).

Do not store food with pesticide, feed Insecticides are poisonous and unfortunately they can harm more than just the pests at which they are targeted. They are toxic and exposure to pesticides can cause a number of health effects, they are linked to a range of serious illness and diseases from respiratory problems to cancer. Pesticides can be acutely toxic, it means that they can cause harmful lethal effects after a single episode of ingestion, inhalation or skin contact (Alewu, 2012).

The Symptoms are evident shortly after exposure or can arise within 48 hours. They can be presented as:

Respiratory track irritation, sore throat and /or cough.

- Allergic sensitization.
- Eye and skin irritation.
- Nausea, vomiting, diarrheal.
- Headache, loss of consciousness.
- Extreme weakness, seizures and/or death (Alewu, 2014).

Pesticides can cause harmful effects over an extended period usually following repeated or continuous exposure at low levels. Low doses don't always cause immediate effects, but over time, they can cause very serious illness. Exposure to pesticides can be through contact with the skin ingestion, or inhalation. The type of pesticides, the duration and route of exposure, and the individual health status (e.g. nutritional deficiencies and health/damaged skin) are determining factors in the possible health

outcome. Within a human or animal body, pesticides may be metabolized, excreted, stored or bio accumulated in the body (Johnson, 2013).

The numerous negative health effects that have been associated with chemical pesticides include, among other effects, dermatological, gastrointestinal, neurological, carcinogenic, respiratory, reproductive and endocrine effects (Hayes, 2015). Carbamate pesticides, such as aldicarb, carbofuran and Ziram are another class of chemical pesticides that have been associated with endocrine-disrupting activity, possible reproductive disorders and effects on cellular metabolic mechanisms and mitochondrial function (Bouaziz, 2013).

Moreover, *in vitro* studies have revealed the ability of carbamate pesticides to cause cytotoxic and genotoxic effects in hamster ovarian cells and to induce apoptosis and necrosis in human immune cells, natural killer cells and also apoptosis in lymphocytes. There is also evidence for the ability of carbamate pesticides to cause neurobehavioral effects, increased risk for dementia and non-Hodgkin's Lymphoma (WHO, 2014).

Current Agricultural pesticides include the wide production and extensive use of chemicals known for their ability to cause negative health effects in humans and wildlife and to degrade the natural environment (McConnell, 2012). Hazard or risk of using pesticides is the potential for injury, or the degree of danger involved in using a pesticide under a given set of conditions. Hazard depends on the toxicity of the pesticides and the amount of exposure to the farmers (WHO, 2014). The toxicity of a pesticide is a measure of its capacity or ability to cause injury or illness. Suspected chronic effects from exposure to certain pesticides include birth defects, toxicity to a foetus, production of benign or malignant tumors, genetic changes, blood disorders, endocrine disruption and reproduction effects.

Some people are more vulnerable than others to pesticide impacts. For example, infants and adults to the toxic effects of pesticides, farm workers and pesticides applicators are also more vulnerable because they receive greater exposures. Immediate health effects from pesticide exposure includes irritation of the nose, skin causing burning, stinging and itching as well as rashes and blister (WHO, 2014).

Chronic health effects include cancer and other tumour, brain and nervous system damage, birth defects, infertility and other reproductive problems, and damage to the liver, kidney, lungs and other body organs. Pesticides have been implicated in human studies of leukaemia, lymphoma

and cancers of the brain, breasts, prostate, testis and ovaries (Johnson, 2013).

Safety practices to employ when applying pesticides

The following preventive measures should be carefully observed when applying pesticides, (WHO, 2014 and Alewu, 2014).

- 1) Follow label direction.
- 2) Avoid splashing, spills, leaks, spray drift and insecticides.
- 3) Always wear protective clothing when using insecticides.
- 4) Mix insecticides outdoors or in well ventilated areas.
- 5) When applying insecticides as a spray or dust outside, avoid windy conditions and close the doors and windows of your home.
- 6) After using insecticides, wash your hand before eating.
- 7) Never carry insecticides along with food materials.
- 8) Use clean water.
- 9) Avoid storage of insecticide in house premises.
- 10) Don't use products for pests that are not indicated on the label and don't use more pesticides than directed by the label.
- 11) Use protective measures when handling pesticides as directed by the producer; such as wearing impermeable gloves, long trousers and long sleeve shirts.
- 12) Before applying a pesticide (indoors or outdoors) remove children toys and pets from the area and keep them away until the pesticide has dried or as recommended by the label.
- 13) Don't spray pesticides on windy weather.
- 14) Keep away from the reach of children and livestock.
- 15) Do not expose to sun light or rain water.
- 16) Avoid carrying bulk pesticides on head, shoulders or on the back.
- 17) Always protect your nose, eyes, mouth, ears and hand.
- 18) Read the label on the container before preparing spray solution.
- 19) Prepare spray solution as per requirement.
- 20) Do not mix granules with water.

- 21) Concentrated pesticides must not fall on hands etc. while opening sealed containers.
- 22) Do not smell the sprayer tank.
- 23) Avoid spilling of pesticide solution while filling the sprayer tank.
- 24) The operator should protect his bare face and his hands with polythene bags.
- 25) Do not eat, drink, smoke or chew while preparing solution.
- 26) Select right kind of equipment's.
- 27) Containers, buckets etc. used for mixing pesticides should not be used for domestic purposes.
- 28) Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
- 29) Do not spray just before the rains and also after the rains.
- 30) Discard used containers at designated places.
- 31) Don't wash and use used containers.
- 32) Don't wash sprayers in rivers or ponds (Johnson, 2013).

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Chapter - 6
Status and Growth of Farmer Producer
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Chapter - 6

Status and Growth of Farmer Producer Organizations in Tamil Nadu

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Abstract

FPOs are involved in procurement of agricultural products from the members and marketing of the products locally and to distant markets. The importance of the FPOs is well understood from the fact that the year 2014 was observed as the “Year of FPO” by the Government of India. These FPOs can be formed both at state, cluster, and village levels by forming groups and registered under the Indian Companies Act, 2013 as Farmer Producer Company (FPC). Farmer Producer Company helps to enhance the income security of marginal farmers by adopting innovative agri-based livelihood. FPO can improve the bargaining power of farmers through backward and forward linkages and operation of economies of scale in production.

Keywords: FPO, women participation, primary processing centre

Introduction

The Farmer Producer Organizations (FPOs) are well poised to play a critical role in maintaining the supply chain of Grains, Fruits & Vegetables to the consumers. During the pandemic attack of Corona Virus Covid-19 and lockdown condition in the country, in order to enhance the effectiveness of the FPOs and strengthen their agriculture produce supply chain across the country, SFAC assisted the FPOs in various ways in linking up them with various buyers to sustain livelihood of the farmers.

The Indian government has a target of doubling the farmer’s income in seven years, which is presently on an average less than Rs. 1.0 lakh per annum (INR 96,703 during 2015-16) to close to Rs. 2.50 lakh (INR 2,19,724) by 2022-23 by emphasizing on value addition. Among the different instruments to achieve this goal, promotion of new and scaling up of existing member-based institutions of farmers such as Farmer Producer Organizations (FPOs) has been given focus. The importance of the FPOs is

well understood from the fact that the year 2014 was observed as the “Year of FPO” by the Government of India. These FPOs can be formed both at state, cluster and village levels by forming groups and registered under the Indian Companies Act, 2013 as Farmer Producer Company (FPC). FPCs are corporate entities and they work under the principles of a cooperative society with more accountability and professionalism. These FPC are involved in procurement of agricultural products from the members and marketing of the products locally and to distant markets. Other activities of FPC also include supply of inputs such as seed, fertilizer and agricultural machineries, creating market linkages, imparting training and networking with government and other institutions and providing financial and technical advice to members of the company. It is expected that the extremely small landholdings in India, promotion of FPOs can lead to economies of scale and addresses the problems of production and marketing and improve the bargaining power of farmers through backward and forward linkages. However, FPCs face many challenges particularly with respect to governance, accessing the capital and business opportunities.

Earlier studies on financial position of FPOs showed that approximately one third of the POs experience financial stress. The greatest proportion of financial stress originated from low earnings, while a smaller proportion comes from high interest rates and leverage. Further, they find that small POs are more likely to face profitability problems, while large POs are more likely to face debt and interest rate problems. (Moller *et al.* 1996). Study on technical efficiency, allocation efficiency and sales efficiency for 89 grain marketing and farm supply POs showed that large POs and POs with a more diversified output mix are generally more efficient than smaller POs and more specialized POs. (Ariyaratne *et al.* 2000). The impact of internationalization on the performance of a number of European dairy showed that there was a positive relationship between the internationalization of POs and their performance (Heyder *et al.* 2011). There could be a positive effect of size on performance of PO which indicates that size is associated with cost reduction through economies of scale and differentiation through innovation. However, larger POs could also be associated with structural complexity and reduced flexibility (Arcas *et al.*, 2011). Most farm households lack the infrastructure to benefit from economies of scale and continue to depend on the traditional marketing system and sell their produce at unremunerative prices (GoI 2013). To improve the bargaining power of agricultural producers through collaborative farm and marketing practices, farmer producer companies and farmer producer organizations (FPOs) were introduced in India during

201112 (Singh *et al.* 2018). The contract farming system was introduced in India during the 1990s to produce and market commodities. In this system, firms contract with farmers to purchase their produce. The quality, quantity, prices and times are predetermined and, often, companies provide farmers services like inputs and technical assistance (Singh 2002). The theory of transaction costs drives a firm's decision to contract with farmers; since the transaction costs of contracting with many small farmers is higher, firms often exclude them from contract farming (Reardon *et al.* 2003; Singh 2000; Sharma 2016). Producer-led alternatives such as cooperatives and producer companies integrate farmers with markets at lower transaction costs and let farmers decide their production and marketing strategies (Trebbin 2014; Singh *et al.* 2018).

This chapter focuses on how such conglomeration of farmers is providing access to support services such as education, technical training, transport and finance, etc? Whether these farmers group have influenced policy decisions? What is the value of value chain and how tax and concessional benefits improve the members' share? Do FPO reduces the input cost and bridges the gap between farm and market price, and the farmers bargaining power? Are they successful in providing more number of markets and have some constraints for group members? Finally, what are the factors that help the FPC to sustain their business both in the short and long run? Hence, this chapter focuses on the status and growth of Farmer Producer Organizations promoted by different Institutions in Tamil Nadu.

Growth of FPOs in Tamil Nadu

Farmer Producer Organizations (FPO) in India are increasing over the period of time due to various supports including policy incentives. As on date there are 897 FPOs promoted by SFAC (Table 1). There are other 2068 FPOs, which were promoted by NABARD in India. These FPOs registered as Producers' Company, Cooperatives, Trusts and Federations under various Indian Acts like Company Act, Cooperative Act, etc. FPO helps to deal with both the input and output marketing. Many FPCs promoted by other organizations like, National Bank for Agricultural and Rural Development (NABARD), Department Marketing and Agribusiness and Non-Governmental Organization (NGOs). Uttar Pradesh has the largest number of FPCs followed by Tamil Nadu, Uttarakhand, Telangana and Assam. It is argued that the present numbers of FPCs are insufficient for the 120 million farmers in India. In Tamil Nadu, the FPO promoted by NABARD are 169 and the FPO promoted by SFAC are 17 in numbers. (Table 2, 3, 4).

Table 1: FPO Promoted by SFAC as on 31.03.2021

Particulars	Registered FPO	Under the process of registration	Total	Number of farmers mobilised	Under mobilization	Total targeted farmers
India	897	13	910	881079	22717	892409
Tamil Nadu	13	4	17	15070	1930	17000

Source: <http://sfacindia.com/>

Table 2: FPO promoted by NABARD in India

Particulars	No. of FPOs	No of districts	No. of Shareholders
India	2068	170	950593
Tamil Nadu	169	32	137683

Source: <https://nabfpo.in/>

Table 3: District wise list of FPO in Tamil Nadu

District	FPO in Number	Per cent
Ariyalur	2	1.18
Chengalpet	5	2.96
Coimbatore	5	2.96
Cuddalore	4	2.37
Dharmapuri	4	2.37
Dindigul	13	7.69
Erode	9	5.33
Kanchipuram	2	1.18
Kanyakumari	2	1.18
Karur	3	1.78
Krishnagiri	6	3.55
Madurai	11	6.51
Nagapattinam	3	1.78
Namakkal	3	1.78
Nagai	3	1.78
Perambalur	2	1.18
Pudukkottai	3	1.78
Ramanathapuram	7	4.14
Salem	7	4.14
Sivaganga	4	2.37
Thanjavur	4	2.37
Theni	5	2.96

Thoothukudi	7	4.14
Tiruchirappalli	6	3.55
Tirunelveli	7	4.14
Tirupur	3	1.78
Tiruvallur	5	2.96
Tiruvannamalai	9	5.33
Vellore	6	3.55
Viluppuram	7	4.14
Virudhunagar	12	7.10
	169	100.00

Source: <https://nabfpo.in/>

Primary processing centers

Primary Processing centers are being established for integrating and strengthening the supply chain of fruits, vegetables and other perishables and it has been implemented in 10 districts in Tamil Nadu, including Krishnagiri, Dharmapuri, Coimbatore, the Nilgiris and Trichy. It is one of a kind in the country. With the PPCs, the shelf life of vegetables and fruits increases and the process is hygienic compared to the conventional method. Primary processing of vegetables such as carrot, beetroot, potato, radish and banana were established at Nilgiris for the benefit of farmers. There are 46 PPC are operated by FPOs followed by 4 by Cooperatives and 9 PPC by other institutions (Table 4). The purpose of PPCs as stated in the Tamil Nadu Supply chain Management (TNSCM) is to establish required infrastructural facilities for strengthening the supply chain for fruits, vegetables and other perishables, reducing post-harvest losses and enhancing the shelf life of fruits, vegetables and other perishables, creating linkages with viable business propositions for the value chain players, providing necessary support for market integration with major market center's, processors and consumers and ensure remunerative price to the farmers and bringing in other stakeholders to make them part of the supply chain and expanding outreach benefiting the farming community. With these it is expected that the famers can realize better price with less risk of forced sale, the farmers can plan, produce and meet out the consistent demand and improve the production systems with the new interventions. Further, it is expected that there would be 100% price realization with 10% on savings from less process loss, saving of 15% of the cost on market handling charges, 5% direct savings on quality and quantity specific deterioration and overall savings is 20% with 100% price realization for graded produce. Realizing the importance of FPOs

in the state, Farmer Producer Organizations have been selected as Market Integration Partners (MIP) to operate the Primary Processing Centre's in order to encourage farmers' participation. Market Integration Partner is a successful bidder (Farmer Producer Organization or Company registered in Tamil Nadu under any of the following legal provisions, or as Consortium of FPCs or as Federation of FPOs) who has been awarded the contract to operate the particular PPC for 3 years.

Table 4: PPCs operated by various agencies (in Number)

District	FPOs/FPC	Cooperatives	Others
Krishnagiri	10	-	-
Coimbatore	7	-	-
Ramanathapuram	2	-	-
Thoothukudi	3	1	-
Tirunelveli	2	-	-
Tenkasi	2	-	1
Trichy	4	-	7
Dharmapuri	3	1	-
Dindigul	2	1	-
Nilgiris	7	1	1
Theni	4	-	-
Total	46	4	9

Source: TNSCM website

Operational holdings owned by women in India

Despite the high share of women in agricultural workforce, only 14% of the operational holdings were owned by them in 2015-16 (Table 5), which highlights the gender disparity in ownership of land. Such lack of land titles imposes constraints on the women farmers who often are unable to access quality inputs like subsidized credit, seeds, fertilizers etc because of lack of collateral. There is another problem vis-a-vis woman-owned landholdings- more than 90% of them are in the category of small and marginal landholdings. So, one can see that the women farmers do not own much land, and the ones they own are too tiny preventing them from benefitting from economies of scale. Much like the women cultivators, women agrilabourers suffer too.

Table 5: Percentage of operational holdings owned by women

Type of farmer	2000 -01	2005-06	2010-11	2015-16
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Marginal (<1ha)	12	13	14	15
Small (1-2 ha)	10	11	12	13
Semi medium (2-4 ha)	9	10	10	12
Medium (4-10 ha)	7	8	8	10
Large (>10 ha)	5	6	7	8
All	11	12	13	14

Comparison of female main workers in India and Tamil Nadu

Agricultural workforce of the country is broadly divided under two heads: agricultural labourers (ones who do not own or lease land and work on land owned by others in return for wages paid to them in cash or kind) and cultivators (ones who own or lease land to undertake agricultural activities). Out of the total agricultural women workforce, Women cultivators are operating in rural areas accounted for 97.62 per cent and 92.97 per cent respectively in India and Tamil Nadu. Women agricultural laborers operating in rural areas accounted for 95.90 per cent and 89.13 per cent respectively in India and Tamil Nadu. Data suggest that the percentage share of women workers in the country are higher rural areas than urban areas. Hence, there is more scope for rural women in participation in FPO activities. (Table 6)

Table 6: Comparison of Distribution of female main workers in India and Tamil Nadu as per 2011 census

(in per cent)

Worker Category	India			Tamil Nadu		
	Rural	Urban	Total	Rural	Urban	Total
Total female main workers	81.29	18.71	100.00	66.79	33.21	100.00
Cultivators	97.62	2.38	100.00	92.97	7.03	100.00
Agricultural Labourers	95.90	4.10	100.00	89.13	10.87	100.00
Household Industry	71.07	28.93	100.00	53.31	46.69	100.00
Other workers	49.28	50.72	100.00	35.92	64.08	100.00

Source: Census of India, 2011

NABARD's support to farmer producers' organizations Financial support to existing POs

NABARD created Producers Organization Development Fund (PODF) with initial corpus of Rs. 50 crores based on the operating surplus during the year 2011-12 to support the existing POs for the creation of novel finance model for normal banking. The main objective of fund helps to offer financial/non-financial support to POs to improve the credit access, to have adequate capacity building, linking markets and need based handholding service to meet the end to end requirement and ensure the economic viability and sustainability. With the success of financing to POs/PACS, to improve access to input, reasonable credits, for better price realization by members and to enhance the skill development by the farmers, NABARD constructed fully owned subsidiary, NABKISAN.

Promotion of new FPOs

NABARD promoted farmers with Farmers Clubs, Self Help Groups (SHGs), Watershed Groups, Clubs, Joint Liability Groups (JLGs), etc., to nurture the collective strengths and empowering the farmers, it took special initiative to promote and nurture new FPOs out of Producers' Organization Development and Upliftment Corpus (PRODUCE) Fund created in NABARD by the Govt. of India during 2014-15, for the promoting 2000 FPOs. From this Fund, NABARD has promoted 2154 FPOs as on 31st March 2019, of which, around 70% FPOs are registered as Producer Companies and the remaining as Cooperatives/Societies.

Promotion of FPOs is to be done through the Implementing Agencies (IAs). At present nine Implementing Agencies (IAs) have been finalized for formation and promotion of FPOs viz. Small Farmers Agri-Business Consortium (SFAC), National Cooperative Development Corporation (NCDC), National Bank for Agriculture and Rural Development (NABARD), National Agricultural Cooperative Marketing Federation of India (NAFED), North Eastern Regional Agricultural Marketing Corporation Limited (NERAMAC), Tamil Nadu-Small Farmers Agri-Business Consortium (TN-SFAC), Small Farmers Agri-Business Consortium Haryana (SFACH), Watershed Development Department (WDD)-Karnataka & Foundation for Development of Rural Value Chains (FDRVC)-Ministry of Rural Development (MoRD).

Benefits of FPO

Land holding: The average farm size declined from 2.3 hectares (ha) in 1970-71 to 1.08 ha in 2015-16. FPOs can engage farmers in collective

farming and address productivity issues results from small size of farm. Further, this may also result in additional employment generation due to increased intensity of farming.

Negotiation: FPO allows its members to negotiate as a group and helps small farmers marketing of both inputs and produce. So, FPO can help farmers compete with large corporate enterprises in bargaining.

Economics of aggregation: The FPO can provide low-cost and quality inputs to member farmers. For example, loans for crops, purchase of machinery, agri-inputs (fertilizers, pesticides, etc.) and direct marketing after procurement of agricultural produce. This will enable members to save in terms of time, transaction costs, distress sales, price fluctuations, transportation, quality maintenance, etc.

Social impact: Social capital will develop in the form of FPOs, as it may lead to improved gender relations and decision making of women farmers in FPOs.

Schemes of Govt. of India/SFAC for FPOs

Government of India, announced two major initiatives to support Farmer Producer Companies (FPCs) viz., support to the equity base of FPCs by providing matching equity grant and credit guarantee support for facilitating collateral-free lending to FPCs.

Equity grant fund scheme

The main objectives of Equity Grant Fund of SFAC are as under: i)

Enhancing viability and sustainability of FPCs.

ii) Increasing credit worthiness of FPCs.

iii) Enhancing the shareholding of members to increase their ownership and participation in the FPC.

The equity grant support to eligible FPCs is provided on matching basis, subject to a maximum of Rs 10 lakh per FPC, provided the FPC has a minimum shareholder membership of 50 farmers

Challenges and Issues in building robust FPOs

Some of the studies commissioned by NABARD have clearly established the positive role of FPOs in terms of increased net income of farmers through informed decision making, improved access to inputs and agro-services, institutional credit, marketing facilities and enhanced efficiency in

the farming operations. However, there are challenges and policy gaps in the ecosystem. The important challenges and confronting issues in building sustainable FPOs are as under:

Lack of technical Skills/Awareness

Inadequate awareness among the farmers about the potential benefits of collectivization & non-availability of competent agency for providing handholding support are the major constraints in the rural areas in promoting strong FPOs. There is a lack of technical and legal knowledge about various acts, formation of FPOs and statutory compliances.

Inadequate professional management

A Farmers' Organization is required to be efficiently managed by experienced, trained and professionally qualified CEO and other personnel under the supervision and control of democratically-elected Board of Directors. However, such trained manpower is presently not available in the rural space to manage FPO business professionally.

Weak Financials FPOs are mostly represented by small and marginal farmers having poor resource base and, hence, initially they are not financially strong enough to deliver vibrant products and services to the members and build their confidence.

Inadequate access to credit

Lack of access to affordable credit for want of collaterals and lack of credit history are also major constraints the FPOs are facing today. Further, the credit guarantee cover being offered by SFAC for collateral-free lending is available only to Producer Companies (other forms of FPOs are not covered) having minimum 500 shareholder membership. Due to this, large number of FPOs, particularly those which are registered under other legal statutes as also FPOs with lesser than 500 members are not able to access the benefits of credit guarantee scheme.

Inadequate access to market

Marketing of produce at remunerative prices is the most critical requirement for the success of FPOs. The input prices are largely fixed by corporate producers. The cultivators lose through the complex gamut of market processes in the input and output prices. There are more market opportunities, if FPOs can identify local market needs of the consumers and

have tie-ups for sale of its produce. A linkage with industry/other market players, large retailers, etc. is necessary for long term sustainability of FPOs.

Infrastructure inadequate access: The producers are inadequate to access the basic infrastructure such as value addition, storage, transportation, processing, brand building and marketing. In commercial farming models, primary producers are expelled from the value chain.

Lack of risk mitigation mechanism

Currently risk relate to production at the farmers level covers livestock, existing crop, insurance schemes and there is no rider to cover up the business risk of FPOs.

Conclusion

Farmer Producer Company helps to enhance the income security of marginal farmers by adopting innovative agri-based livelihood. FPO can improve the bargaining power of farmers through backward and forward linkages and operation of economies of scale in production. Farmer Producer Organizations have the potential to give better bargaining power to farmers and lead to more transparent agri-markets. The growth of FPC helps to construct the confidence among all the members by diversifies their business opportunities. Since most FPOs are still in their incubation stage, they need handholding and financial support to take off. Investment on post harvest technologies is the key factor for price protection, assures the stable market price for the produce of the members of FPCs and maximizes the risk-taking ability of the farmers. Different Agricultural Censuses indicates the participation of women in operation and management is more in agricultural holdings. Efforts must be made to ease the market barriers in the growth path of FPOs. Incentives should be given to institutional lenders to lend to FPOs and give room for private equity to enter for FPCs to help them transition from a grant-based model to a self-sustaining business entity.

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Chapter - 7
The Challenges of Watershed Management in
North Sulawesi-Indonesia

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Chapter - 7

The Challenges of Watershed Management in North Sulawesi-Indonesia

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Abstract

Watershed management is a form of regional development which puts the watershed as a management unit from upstream to downstream. Upstream changes will have an impact on downstream areas, such as fluctuation in water flow, water quality and sediment transport and materials dissolved in it. In North Sulawesi, there are a big five watersheds namely Tondano, Ranoyapo, Dumoga, Mahena and Talawaan. Results of the study of reference of the general description of the watershed in North Sulawesi, show that the rules are clear, but its implementation is not by what is written, due to the lack of coordination between upstream and downstream areas in addressing watershed. Some challenges found that the problems cannot be handled only by one sector, relevant agencies working on their own, nontransparent allocation of funds, lack of law enforcement, lack of involvement and awareness of the importance of the watershed for the benefit of their communities and in supporting the activities of fishing effort.

It is expected to obtain a reference in the allocation of resources proportionally. An integrated watershed management approach that involves the community from the beginning in defining the problem will further ensure that the program to be implemented is truly a local community need. Such an approach also makes people come to feel ownership and responsibility for programs to be implemented, so it is easier to invite people to participate in managing their resources. Finally, this approach method will foster public confidence and reduce the community's dependence on the government.

Keywords: watersheds in north Sulawesi, challenges, integrated watershed management

Introduction

Water is a very important and crucial natural resource for human life. Water also has a strategic role that should be available to support a sustainable environment. Environment refers to a site/place/area/habitat, including living beings biotic and abiotic. Natural refers to situation/condition/force/sources affecting the life and development of the surrounding areas (Constitution of the Republic of Indonesia number 23 of 1997). It illustrates that the environment forms a unity with all things, space, resources and living beings including humans' behavior that affect the survival and well-being of humans and other living beings. Disharmonious relationships between humans and the environment, especially water resources will lead to continuous problems in life.

A watershed is an area that integrates with the stretch of river and tributaries that serve to receive and collect rainwater, drain the water and save water resources. A watershed is an important ecosystem in the environment because of the element of the organism and the biophysical environment that interact dynamically.

According to Waryono (2003), 458 watersheds in Indonesia, whereas 100 watersheds are still in good condition, 60 watersheds categorized as priority 1 meaning damaged very badly, 122 watersheds categorized as priority 2 meaning damaged badly and 176 watersheds as priority 3 meaning damaged. In North Sulawesi province, 11 watersheds support people's daily activities, 5 of them as priority management, because the community activities are very dynamic to meet the various needs of life, resulting in changes in the environment that brings problems.

I. Watershed

I.1 The meaning of watershed

A watershed is an area that integrates with the stretch of river and tributaries that serve to receive and collect rainwater, drain the

water and save water resources. A watershed is an important ecosystem in the environment because of the element of the organism and the biophysical environment that interact dynamically. In many places in Indonesia, watersheds bear a very heavy burden with the population density is very high and the utilization of natural resources intensive. This indicates that the environment especially watershed conditions were declining (Forestry Department, 2010). On the other hand, the demands on the ability of watersheds to support ecosystem, including community activities and fisheries in the upstream to downstream, even to the sea are so great. Therefore, integrated watershed management needs to be done thoroughly, ranging from policy, setting goals and objectives, planning activities, program implementation, and monitoring and evaluation.

Following are the meanings of the watershed:

- a) The entire area is drained by a stream or system of connecting streams such that all streamflow originating in the area is discharged through a single outlet (Linsley, 1980).
- b) One area of land that accommodates and store rainwater for later channeled to the sea through the main river (Directorate of Reforestation and Rehabilitation, 1978, *in* Forestry Department, 2011).
- c) Watershed as an area of land bounded by topographic separation serves for collecting, storing, and subsequently channeling rain falling towards the nearest river system, and ultimately empties into reservoirs, lakes, and the sea (Purnomo, 1990).
- d) A watershed is an ecosystem whose main elements consist of water resources, land vegetation, and human resources as actors and users of natural resources. Watershed condition is influenced by the upstream to downstream (Forestry Minister, 2003).
- e) A Watershed is a geographic area that drains to a common point, which makes it an attractive unit for technical efforts to conserve soil and maximize the utilization of surface and

subsurface water for crop production, and a watershed is also an area with administration and property regimes and farmers whose actions may affect each other's interests (Integrated Watershed Management, -UNEP, 2004).

- f) A watershed is an area of land which is unity with the river and its tributaries which serves to accommodate store, and drain the water from rainfall to the lake or into the sea naturally, that the limit on land is a separator topography and boundaries sea until the water area is still affected land activities (Decree Number 37, 2013 on Water Resources).
- g) Human efforts to regulate mutual relations only between the human resources in the watershed and all its activities to realize sustainability and harmony of ecosystems and increase the usefulness of natural resources for sustainable humans (Decree number 37, 2012 on Watershed Management).

Watersheds can be divided into several parts: The pit, midstream, and downstream. Ecosystem upstream is a major water catchment area and the flow regulator. The middle part is the basin and water control, whereas the downstream is the water user. Every ecosystem in the watershed has biotic and abiotic components interacting with each other (Fahmuddin & Widiyanto, 2004). Upstream watershed is characterized as a conservation area, especially in terms of the protection of the water system, while the lower is the utilization area (Decree no. 52/Kpts-II/2001). Therefore, upstream watershed management often becomes the focus of attention because of the damage occurring upstream may affect the overall material and downstream water flow, which means up to the coast and sea.

Watershed Management is a form of regional development and natural resource management to improve agricultural production, forestry, fisheries optimum and sustained by efforts to reduce damage to a minimum so that the distribution of water and its flow

can be evenly distributed throughout the year (Director General of Spatial Planning and Regional Development, 2002).

I.2 General function of watershed

Following are the main functions of the watershed:

- 1) As water resource.
- 2) A place for community activities, especially in border areas such as crop cultivation, commercial activities, excavation and backfilling, installation of billboards, interests of counseling and warnings, as well as signs of work, electrical wiring, telephone and drinking water, organizing social activities such as the not detrimental to both physical and natural rivers, construction of traffic means water and water disposal. (Public Works Government Regulation number 63/PRT/1993 on the demarcation line of the river, the area benefits of rivers, streams and former mastery area rivers).
- 3) Elements of the course of the hydrologic cycle in which the hydrological function that is consistent with the ability of watersheds such as water transmission, a buffer at peak rain events, release water slowly, maintaining water quality (Noordwick, *et al.*, 2004).
- 4) Transporting result of erosion and deposition of pollutants, reducing erosion, and participating in the continuity of the cycle of erosion itself (Fahmuddin & Widiyanto, 2004).
- 5) Drinking water materials (Tebbut, 1992).
- 6) Drain rainwater and wastewater (Soemarno, 2011; Law Indonesia No. 7, 2004).
- 7) Means of agricultural irrigation (Waryono, 2003; Indonesian Law No. 41, 2009).
- 8) A place for attractions (Dixon *et al.* 1986; Watiningsih, 2001).
- 9) The lives of various species of fish and various aquatic plants (Act no. 45, 2009).

- 10) As powerhouse (Department of Forestry, 2003, BP-DAS Tondano, 2011).
- 11) Means of transport (European Union, 2001; Law No. 45, 2009).
- 12) Means of trading, as the market in water (Law No. 45, 2009).
- 13) Reducing the mass transfer of land, such as through landslides (Law No. 41, 2009).
- 14) Maintaining the microclimate (Tebbutt, 1992).

I.3 Community activities in watershed

A watershed is a community center and a lot of parties, ranging from the industrial sector, agriculture, forestry, mining, fisheries and economic activities. Watershed also has an important role in life such as water resources, potential fishery, and means of transport (European Union, 2001; Law no. 45, 2009). In addition, several streams can be enjoyed by the public as a tourist attraction (Watiningsih, 2009), for example, the Mahakam watershed and Tondano. There are also artisanal mining activities, for example in the watershed Talawaan and Dumoga, North Sulawesi. Land use around watersheds in general, for example in residential areas Ciliwung watershed, where most of the community living and doing activities directly in the river such as, bathing, washing, making dirt and household waste (BPCiliwung, 2013). Clearing of land for agricultural purposes and plantations can be found in almost all watersheds in Indonesia (Indonesian Forestry Department, 2010). While people in the field of fisheries activities such as fishing, farming, and fishing industries for further processing can be found on the watershed which covers over 500 square meters (Indonesia Government Regulation No. 38, 2011 on the river), for example in the Mahakam watershed in Kalimantan East, Tondano watershed in North Sulawesi, the Brantas Watershed in East Java, also watersheds Solo in Central Java. In the Kapuas watershed in West Kalimantan, the flow of river water is used in transport and trade in general.

I.4 Fishing activities in watershed

Fisheries are all activities relating to the management and utilization of fish resources and the environment ranging from preproduction, production, manufacture to marketing carried out in a system of fishery business (Act no. 45, 2009 on fisheries).

Fishing activities in the watershed include:

- 1) Fishing is an activity to obtain fish in waters that are not in a state cultivated by means or in any manner, including activities that use boats to load, transport, store, cool, handle, process and/or preserve.
- 2) Fish farming is an activity to maintain, raise, and/or breed fish and to harvest the results in a controlled environment, including activities that use boats to load, transport, store, cool, handle, process and/or preserve.
- 3) Fishery management is all efforts, including an integrated process in information gathering, analysis, planning, consultation, decisionmaking, allocation of fish resources, and implementation and enforcement of legislation in the field of fisheries carried out by the government or other authority aimed to achieve continuity of aquatic biological resource productivity and the agreed objectives.
- 4) Conservation of fishery resources is the protection, preservation, and utilization of fish resources, including ecosystems, species, and genetic to ensure the existence, availability and continuity while maintaining and improving the quality of the value and diversity of fish resources.

II. Watershed conditions in north Sulawesi-Indonesia

North Sulawesi is one of the provinces in Indonesia that have large watershed areas. According to the Central Management Tondano watershed (2011) based in Manado, North Sulawesi watershed includes 11 watersheds and 46 sub-watersheds. The eleven watersheds are: Tondano, Dumoga, Ranoyapo, Poigar, Ratahan

Beach, Mahena, Tumpaan, Likupang, Buyat, Sangkuplangi and Talawaan.

Five large Watershed according to the viewpoint of magnitude is:

- 1) Tondano watershed area of 54 775 ha located in Minahasa regency and city of Manado.
- 2) Ranoyapo watershed area of 102 577 ha is located in the South Minahasa District.
- 3) Dumoga watershed area of 214 696 ha is located in the district of Bolaang Mongondow.
- 4) Mahena watershed area of 50 852 ha located in Sangihe Talaud.
- 5) Talawaan watershed area of 822 ha is located in North Minahasa Regency.

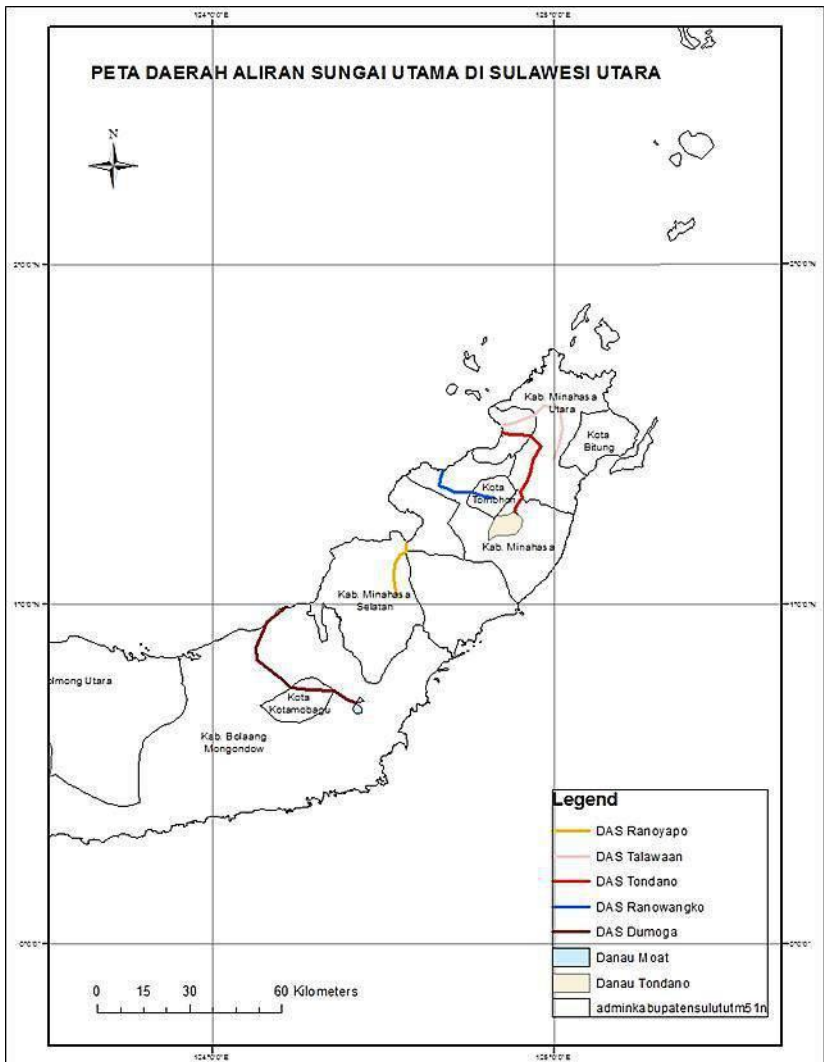


Fig 1: Main Watershed in North Sulawesi (BP-DAS Tondano, 2011)

II.1 Tondano watershed

According to data from the Central Management of Tondano watershed (2011), the Tondano watershed which covers an area of 54.775 hectares lies between 1°07-1°31 North Latitude and 124°45'-125°02 East Longitude

(Figure 2) is hilly and mountainous regions, with about 25% of land and has a slope of over 25 degrees. Tondano watershed land use is

shown in Table 1. Economic and social aspects of the population, a population of approximately 338,000 inhabitants (2000 census), of which 195 thousand people live in Minahasa Region and 143 thousand people in the city of Manado and 60% of the population live off agriculture. Agriculture contributes up to 33% of total regional income. Tondano watershed serves as a center of economic development in North Sulawesi, where more than 70% of the area in this watershed is used for agriculture. Tondano river is the main source of drinking water for residents of the city of Manado and Minahasa where these rivers serve the daily needs of about 120,000 inhabitants (BP-DAS Tondano, 2011). In addition, the Tondano river is a provider of energy to hydroelectric turbines with an installed capacity of 34 megawatts in hydropower Tonsea Lama, Tanggari I and II (Director General of Forestry and Conservation, 2011). This energy can supply 30% of the energy needs of North Sulawesi province. Tondano Lake water is used as raw water for agriculture, industry, as well as domestic demand (Department of Forestry, 2011).

Table 1: Land Use in Tondano Watershed

No.	Type of Land Use	(Ha)	Percentage (%)
1.	Natural and semi-natural forest	3.745	6.8
2.	Secondary Forest	1.238	2.3
3.	Artificial Forest (planted)	71	0.1
4.	Plantation	22.267	40.6
5.	A mixture of gardens and shrubs	8.067	14.7
6.	Bushes and shrubs	5.562	10.2
7.	Pasture weeds	82	0.2
8.	Paddy field	5.960	10.8
9.	Freshwater marsh	267	0.5
10.	Water and Lakes	4.684	8.6
11.	Housing, etc	2.812	5.1
Total		54.775	100

Source: BP-DAS Tondano, 2011

From the point of view of fisheries, the Tondano watershed has a high source of fish. The total catch could reach more than 2000 tons of fish derived from nets floating culture system as much as 1357 tons and of traditional fishing as much as 776 tons. Fishing with fish culture production technique evolved significantly in 1990. There are 50 owners of the floating net around Tondano lake and 60 farmers along the Tondano watershed (Walangitan, 2011). The swamp at outlet Tondano lake is also used for breeding (ducks, chickens, cows, goats and pigs). The lake is also a major tourist destination, especially for local tourism. Some land area of the Tondano watershed region is a center of horticultural production in North Sulawesi (BP-DAS Tondano, 2011).

According to data from the Ministry of the Environment (2000), in general, the existing problems in the watershed Tondano are:

- 1) The decline in the quantity and quality of water.
- 2) The shrinking forest area.
- 3) Sedimentation in water bodies.
- 4) Sustainable forest encroachment.
- 5) Farming that has not been paying more attention to conservation causes floods.

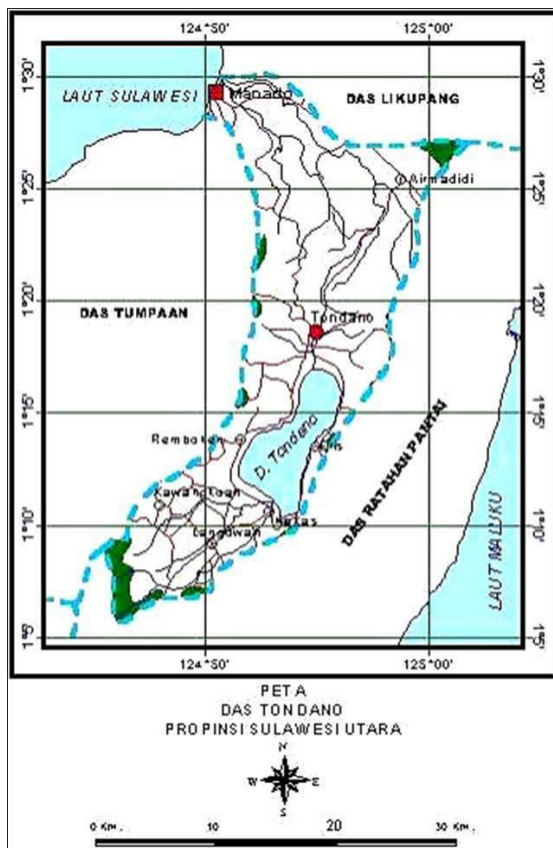


Fig 2: Tondano Watershed (BP-DAS Tondano, 2011)

On the issue of water quality decline, data from the Ministry of Environment (2000) mentions several sources of pollutants that cause deterioration of water quality, namely:

- a) Provision of chemical fertilizers is carried out by local farmers on an area of 5000 hectares of paddy fields that surround the lake. At the moment farmers use 150 kg of fertilizer per year and 60 kg phosphate per hectare per year. This leads to approximately 750 tons of urea (fertilizer) and 250 tons of phosphate into the lake of agricultural land in the vicinity.
- b) Detergents and solid waste disposal. It is estimated that the amount of detergent that goes in the upstream watershed into tributaries that are inside is as much as 50 tons per year.

Solid waste is often also thrown into the river. In addition to solid waste disposal will pollute rivers and coastal waters will also disrupt the operation of hydroelectric power (hydropower) in the Tondano river.

- c) Waste fisheries activities. Fishing is a common activity in Lake Tondano. There are 110 fisheries. This business activity using concentrated pellets for fish food.
- d) Duck farm waste. There are as many as 42,000 thousand Manila ducks bred on the border lake. Manure from the ducks goes directly into the lake and will enrich the nutrients in the lakes.

II.2 Ranoyapo watershed

According to BP-DAS Tondano (2011), administratively, the Ranoyapo watershed is a cross-county watershed covering Bolaang Mongondow district, Minahasa, South Minahasa and Tomohon. Sub-watersheds are Tambala, Ritey, Kumu, Popareng, Nimanga, Ranotouna, Sasongea, Ranowangko, Lewet, Ranoyapo, Worotikan, Liwason, Tangop, Molinow, Sidate, Impit, Mosanti, Batukapal, Ongkaw, Pinsan, Makalilu, Maintang, Noit, and Poigar. Ranoyapo river is the longest river in the Minahasa region with a length of about 60, 5 km and is the main river watershed Ranoyapo with an area of about 87 154 ha of the total area of the watershed Ranoyapo namely 102.577 ha (Figure 3).

Problems found in the watershed Ranoyapo, such as River Ranoyapo susceptible to contamination. This is because many of the upstream activity and downstream activities could potentially degrade the water quality of the river, because of the activities of agriculture, farming, residential, industrial, and mining (www.dephut.go.id, accessed January 11, 2019, 11:20 hours). According to Marmita, *et al.* (2013), in the Ranoyapo waters, there are the types of macrobenthos which is a biological indicator in determining the quality of river water is polluted, lightly polluted or unpolluted. Macrobenthos found such orders Ephemeroptera, Trichoptera, Plecoptera. Water quality in some places on the

Fig 4: Dumoga watershed (Public Department, 2015)

II.4 Mahena watershed

Mahena watershed is located on Sangihe Island Regency, up north on the map of North Sulawesi. According to the Director-General of Watershed Management and Social Forestry, Ministry of Forestry (2010), Mahena watershed is divided into 4 sub-watershed regions namely; Akembuala sub watershed, Embuhanga/Balao sub-watershed, Peliang sub watershed, Laine sub-watershed. Extensive descriptions and discharge in each watershed are presented in Table 2. In general, the hydrogeological condition at the Sangihe Islands Regency is dominated by surface water such as rivers that disgorge in the hills and mountains in the central part of the island of Sangihe and empties into the sea. Most livelihoods of the population are farmers with the number of people who work in area agriculture by 52.840 inhabitants, followed by the services sector amounted to 7034 people. Land use along the watershed over the plantation by planting coconut, nutmeg, and clove, while the river is used for inland fisheries activities (Regency of Sangihe, 2012).

Problems in the Mahena watershed are flooding and landslides. In 2006, floods and landslides are quite large (Anonymous, 2007 on Disaster Floods and Landslides), as well as in November 2012, the same thing happened in Sangihe, as many as 15 districts were flooded (<http://bencanasulut.wordpress.com/category/Sangihe/>, accessed March 30, 2014). This is because the condition of settlements where the contour of the land along with the watershed level with the sea level, so the rain of moderate-intensity alone can lead to flooding and some sections are in the bottom of the slopes and hills with unstable soil, so prone to landslides.

Table 2: Size of Mahena Watershed in Sangihe Regency

Watershed Name	Width (ha)	Debit (m³/s)
DAS Mahena		
Sub DAS Akengbuala	13.530	4
Sub DAS Embuhanga/Balao	12.488	5
Sub DAS Peliang	12.081	3

Sub DAS Laine	12.753	3
Jumlah	50.852	

Source: Department of Public Works-Field Irrigation, Sangihe District, 2011

II.5 Talawaan Watershed

Talawaan watershed (area 822 ha) is located in North Minahasa Regency, North Sulawesi (Figure 5). North Minahasa regency consists of nine districts, where the widest districts are East Likupang (197,70Km) and Kalawat as the smallest districts (49.01 Km). Most of the North Minahasa region has a hilly topography and Tereng, there is also a mountain namely Klabat (1,995 m). Rivers and streams (Table 3) in the flow of the basin are used by the local community for water supply, irrigation, cultivation inland fisheries, to supply electrical energy which treated of the hydroelectric station. The main rivers that pass through the territory of North Minahasa Regency are tipped in a mountain flowing from areas of high empties into the bay and lake and utilized by the community. The river is from upstream to downstream into a river system that did not look at administrative boundaries.

Table 3: Watershed in North Minahasa Regency

No	Nama Sungai	Potential (m ³ /det)	Length (Km)
1.	Talawaan River	150	31,7
2.	Sawangan River	200	21,0
3.	Likupang River	80	21,2
4.	Kokoleh River	-	10,5
5.	Mangeng River	-	22,5
6.	Walangitan River	-	5,2

Source: North Minahasa Government, 2018)

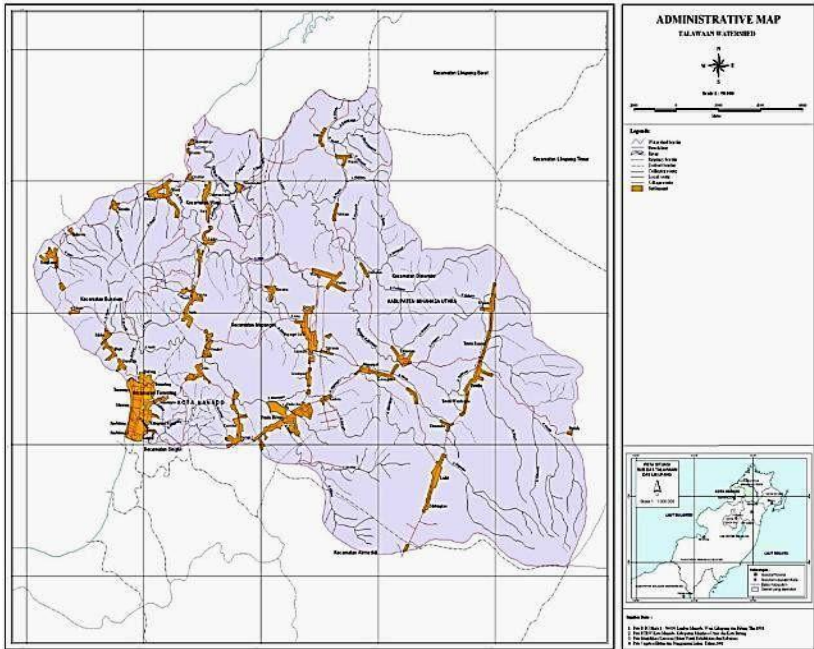


Fig 5: Talawaan watershed (Lasut, M. 2010)

Talawaan watershed topography and slope of the land vary from flat to a slope of 35° . Just as the surrounding areas, drainage patterns in the North Minahasa regency are mostly dendritic pattern branching trees. No data is showing Talawaan river discharge but from observation and information of local communities that the main rivers flow every year, being creeks and ramifications mostly experiencing fluctuating discharge, even dry in the dry period (North Minahasa in Figures, 2018). The surrounding area has a spring DAS Talawaan which should be protected because these springs into water catchment areas and Talawaan watershed water resources. These springs are available in 28 locations, namely: spring Talawaan I, Tunan, Warat, Malupu, Tumbohon, Kumersot, Huluatikup, Doud Tewasen, Doud Pinakiwe, Doud Minawanua, Papi, Tamblang, Talise, Malimbukan, Pancuran Lima, Suwaan, Keluarga Wenas, Keluarga Menanga, Tontalete, Tumatenden, Tambuk Terang, Kema I, Tuan, Tinaan, Tumaratak, Doud Waidan and Malinow, with a total spring area of about 351 ha (North Minahasa in Figures 2018).

The main problem of the Talawaan watershed is activities like artisanal mining, where many excavation C such as gold, iron ore, iron sand, titan, andesite, terrace, manganese, stone, mountain stone, and sand (the Department of Mines and Energy, North Minahasa District, 2008). The byproduct of the mining of solid and liquid sewage goes into rivers such as Mercury (Hg), Lead (Pb) and Cyanide (Zn), Kaolin, Ag, Au, As (Ridwan. A, Suhandi & C. Son, 2011; Kaunang, 2019), another pollutant waste ie. fertilizers and pesticides for agricultural activities in the region, household waste from residential areas and waste oil from palm oil processing, affected on both wild fish and cultured fish (Kaunang, 2019).

III. Watershed management

III.1 Watershed management criteria

To regulate water resource management in Indonesia, the Indonesian government has set Law 7 of 2004 on Water Resources. This law set three (3) main issues, namely the conservation of water resources, water utilization, and control of water damage. Related to water conservation, the law governing the protection and conservation of water resources, water preservation and water quality management and water pollution control.

Management of water resources has become a public concern mainly due to various natural disasters such as floods and water shortages, has raised public awareness and many people of the importance of the preservation of the watershed ecosystem, so the management must be integrated by involving all related elements (Law No. 24 of 2007).

According to Heatcote (1998), in general, watershed management aims to:

- 1) Conserve soil on agricultural land.
- 2) Harvesting/storing excess water during the rainy season and use it during the dry season.
- 3) Stimulating sustainable farming and stabilize yields through improved management of farming systems.

- 4) Improving the ecological balance (relationship upstream with downstream hydrology, water quality, the quality and capability of land, and biodiversity).

In achieving management objectives, it is necessary to first note a few things (European Union, 2001; Njrumana, 2006), such as:

- 1) What is in the watershed or what potential watershed has?
- 2) What are the problems that exist in the watershed?
- 3) What do we want from watershed management?
- 4) What can be improved/changed?
- 5) How can we fix it?
- 6) What is the impact of these improvements on existing communities around the watershed?
- 7) What improvements to the environmental impact of upstream to downstream?

III.2 Indicator of watershed management

According to Madu (2007), in general, the sustainable management of natural resources should at least meet the conservation and sustainable development indicators below, namely:

- 1) **Economic indicators:** Management that can support optimum productivity for the benefit of life.
- 2) **Social indicators:** Management that can provide equitable benefits for the sake of life.
- 3) **Environmental indicators:** The management can maintain the environmental conditions that are not degraded.
- 4) **Indicator technology:** Management by using technology that can be implemented by local livelihood conditions, thereby stimulating the growth of institutions that support the system.

A. Water quality and quantity a) Water quantity indicator

This indicator can be seen from the surface runoff water and river water discharge. These water quantity conditions are very concerned

with the condition of vegetation cover in the watershed land concerned. When the vegetation cover of watershed land in question certainly diminished water quantity changes will occur, so any implementation of activities intended to reduce land cover in a place it must be accompanied by conservation measures (Noordwijk *et al.*, 2004). **b) Water quality indicator**

Water quality conditions are affected by land vegetation cover as the condition quantity, and also by domestic effluent, industrial waste, land preparation, planting pattern. In addition, water quality can be seen from the quality of runoff water, river water or well water (Noordwijk, 2004).

B. Institutional

Watershed management in Indonesia is multi-sector, multi-stakeholder, and multi-dimensional, so we need a clear framework in the integrated management of watersheds in Indonesia. This is to support the principles and rules of watershed management (Act No. 25 of 2004; Law No. 32 of 2004). Institutions that deal with watershed management in the Department of Forestry, the Ministry of Maritime Affairs and Fisheries, the Ministry of Public Works, Agriculture Department, Central Management of Provincial Watershed and Water Resources Council (Act No. 32 of 2004; Law No. 33 of 2004; Law 32 of 2009). Watershed management involving multiple parties and across administrative areas may cause a conflict of interest between the parties involved in the use of natural resources and environmental services watershed. It would require clear policies and regulations of the national, provincial, and district levels, even to the villages/wards. Therefore, synergies between agencies are needed in managing a potential watershed, repair and protection.

C. Laws and regulations

The Law of the Republic of Indonesia and regulations related to watershed management and water management can be seen below:

- A) The Constitution-4th paragraph of the Preamble to the Constitution of 1945. -Article 33 paragraph (3) of the Act of 1945.
- B) The Law of the Republic of Indonesia:
- 1) Law of the Republic of Indonesia Number 11 of 1974 on Water.
 - 2) Law of the Republic of Indonesia Number 5 of 1990 on Conservation of Natural Resources and Ecosystems.
 - 3) Law of the Republic of Indonesia Number 12 of 1992 on Plant Cultivation System.
 - 4) Law of the Republic of Indonesia Number 24 of 1992 on Spatial Planning.
 - 5) The Law of the Republic of Indonesia Number 23 of 1997 on Environmental Management.
 - 6) Law of the Republic of Indonesia Number 41 of 1999 on Forestry.
 - 7) Law of the Republic of Indonesia Number 18 of 2004 on Plantations.
 - 8) Law of the Republic of Indonesia Number 25 of 2004 on National Development Planning System.
 - 9) Law of the Republic of Indonesia Number 32 of 2004 on Regional Government.
 - 10) Law of the Republic of Indonesia Number 33 of 2004 on Financial Balance between Central and Regional Government.
 - 11) Law of the Republic of Indonesia Number 24 of 2007 on Disaster Management.
 - 12) Law of the Republic of Indonesia Number 26 of 2007 on Spatial Planning.
 - 13) Law of the Republic of Indonesia Number 27 of 2007 on the Management of Coastal Areas and Small Islands.

- 14) Law of the Republic of Indonesia Number 32 of 2009 on the Protection and Management of the Environment.
- 15) Law of the Republic of Indonesia Number 41 of 2009 on the Protection of Agricultural Land Husbandry.
- 16) Law of the Republic of Indonesia Number 45 of 2009 on the Amendment of Law No. 31 of 2004 on Fisheries.
- 17) Law of the Republic of Indonesia Number 1 of 2014 on the Amendment of Act No. 27 of 2007 on the Management of Coastal Areas and Small Islands.

C) Government regulations related to watershed management, namely:

- 1) The Republic of Indonesia Government Regulation No. 82 of 2001 on the Management of Water Quality and Water Pollution Control.
- 2) The Indonesian Government Regulation Number 16 of 2004 on Land Use Administration.
- 3) Government Regulation of the Republic of Indonesia Number 16 of 2005 on Development of Water Supply System.
- 4) Government Regulation of the Republic of Indonesia Number 20 of 2006 on Irrigation.
- 5) The Indonesian Government Regulation Number 42 of 2008 on Water Resources Management.
- 6) Government Regulation of the Republic of Indonesia Number 43 of 2008 on Groundwater.
- 7) Government Regulation of the Republic of Indonesia Number 37 of 2010 on Dams.
- 8) Government Regulation of the Republic of Indonesia Number 38 of 2011 on the River.
- 9) Government Regulation of the Republic of Indonesia Number 37 of 2012 on Watershed Management.

D) Regulation and the Presidential Decree on the Management of the watershed, such as:

- 1) Regulation of the President of the Republic of Indonesia Number 12 of 2008 on Water Resources Council.
- 2) Regulation of the President of the Republic of Indonesia Number 33 of 2011 on the National Policy of Water Resources Management.
- 3) Decree of the President of the Republic of Indonesia Number 12 of 2012 on the Establishment of the Watershed.

E) Regulation and Decision ministerial-level associated with watershed management, namely:

- 1) Regulation of the Minister of Public Works No. 63/Prt/1993 on Line Border Rivers, Regional Benefits River, River Regional Mastery and Former River.
- 2) Regulation of the Minister of Public Works No. 11A/PRT/M/2006 on criteria and Zoning River.
- 3) Regulation of the Minister of Public Works No. 18/PRT/M/2009 on Guidelines for River Flow Diversion And/Or Utilization Segment Former River.
- 4) Regulation of the Minister of Environment No. 01 of 2010 on Procedures for Air Pollution Control.
- 5) The Ministerial Decree No. 52/Kpts-II/2001 regarding Implementation Guidelines for Watershed Management.
- 6) Decree of the Minister of the Environment No. 110 of 2003 on Guidelines for Determination of Water Capacity on Water Resources.

D. Human resources

Watershed management is the process of formulation and implementation activities of manipulation of natural resources and the people who live in the watershed ecosystem for the benefit of production and optimum environmental services, without causing damage to land and water resources. Human plays a central role in

watershed management. Community participation in watershed management is done either individually or in groups through the coordination of watershed management forums (Act No. 37 of 2012 article 57). Tasks related to the implementation of watershed management are necessary to increase the capacity of the personnel or human resources (Waryono, 2003; UNDP, 2008; US Environmental Protection Agency, 2011). Community participation can be seen in the preservation, maintain and enjoy the quality of the environment resulting in the watershed ecosystem. In addition, the awareness and participation of communities along the watershed is also very important to be maintained and enhanced, for the management, utilization, and conservation is the responsibility of individuals, communities, and the government.

E. Geographic location

According to the Ministry of Forestry Republic of Indonesia through Decree No. 52/Kpts-II/2001, the watershed is classified according to the expanse of the region and its strategic functions, namely:

- 1) Local watershed. It is located fully in the district/city, the utilization by the district/city.
- 2) Regional watershed. It is located geographically passing through more than one district/city, and the suggestion of the district/city and the assessment results are set to be utilized (developed and maintained by the province) and the watershed that is potentially strategic regional for developing areas.
- 3) The national watershed. It is located geographically passing more than one area of the province, which is potentially exploited by more than one province, and the results of the assessment are set

and used by the central government and/or watershed that are potentially strategic for national development.

F. Climate

According to Taylor (2008), which plays a key role in the condition of streams such as the amount of rainfall somewhere, is strongly influenced by the conditions of climatology surrounding area, while the condition of climatology is independent of changes in land cover so that in case of major changes in land cover will affect the climatology and also rainfall. According to Soemarno (2011), variations in the diversity of temperature, water conditions, and humidity also affect the handling of watershed management. Knowledge of these parameters will simplify the management of the watershed.

G. Technology and Methods

Some of the technologies and methods used in watershed management, among others are:

- 1) Geographic System Information Technology/GIS (Djuwansah, 2006). In watershed management several activities must be carried out, among others, determine the direction of land use and determines the watershed handling priority. Implementation of these two activities requires different spatial and attribute data that is used by GIS. GIS can provide information that can be used as data to determine the direction of land use and determines the watershed handling priority.
- 2) TRO (total run-off) is the variation of the process of collecting water that eventually resulted in the flow of the river (Sutapa, 2012).
- 3) Catchment wells (catchment area) is the area that can drain water runoff, both surface runoff and groundwater due to the river system concerned (Tebbutt, 1992).
- 4) Streeter-Phelps method is a method of determining water pollution load capacity of water sources by using a mathematical model developed by Streeter-Phelps. Two things are studied are the reduction of dissolved oxygen

(deoxygenation) due to the activity of bacteria in degrading organic matter present in the water and the increase of dissolved oxygen caused by turbulence in the flow of the river (Minister of the Environment No. 110 of 2003 on Guidelines for Determination Load Capacity of Water Pollution in Water Resources).

The formula used:

$$dL/dt = -K'.L$$

Where:

L = concentration of organic compounds

(mg/L) t = time (days)

K ' = constant of first order reaction (day - 1).

IV. Watershed environmental management to support fisheries

IV.1 Planning

The principle of watershed management is to integrate the interests of productivity and conservation. The plan can use hydrologic models to formulate land use according to the function and structure of the land. In addition, it should be supported by calculations or economic modeling as an example of plant production (Soemarno, 2011). Initially, watershed management planning using the physical and sectoral approach, but since ten years ago has started with a holistic approach, namely the Integrated Watershed Management Plan.

According to Barrow (1998), the importance of the position of the watershed as a whole unit plan is a logical consequence to maintain the sustainability of the forest resource use, soil, and water. Flawed planning can lead to the degradation of watersheds. Law No. 24 of 2007 on disaster management mentioned in the effort to create an integrated approach to watershed management, planning is necessary for an integrated, holistic, sustainable, and environmentally friendly by considering the watershed as a management unit. Thus if there is a disaster, whether it's a flood or

drought, mitigation can be done thoroughly covering watersheds ranging from upstream to downstream. People who are in a watershed know how to rehabilitate the damage, having known the proper planning of the watershed. Things that need also to be considered in the context of planning are the preparation of the plan document and watershed management activities. According to the Minister of Forestry Decree 52/Kpts-II/2001, in the manufacture of a watershed management plan necessary measures such as:

- a) Identifying characteristics of the watershed (boundary and area, topography, geography, soil, climate).
- b) Assessing hydrological conditions.
- c) Calculating the land use.
- d) Calculating drainage density.
- e) Seeing the state of social and economic.
- f) Identifying problems.
- g) Formulate goals and objectives.

IV.2 Organization

A Watershed is an ecosystem, where elements of the organism and the biophysical environment as well as chemical elements interact dynamically from materials and energy, resulting in the watershed ecosystem, especially upstream, is an important part because it has the function of protection against a whole part of the watershed. These protections, among others in terms of water function; therefore the upstream watershed planning becomes a focus of attention given in a watershed, the upstream and downstream has the biophysical linkage through the hydrological cycle (Regulation of the Director-General of Watershed Management and Social Forestry, Ministry of Forestry, 2013). Organize a watershed in the determination of the classification is very important. According to Law No. 37 of 2012 on the Management of Watershed, the determination of Watershed classification is based on the following criteria:

- a) Land conditions.

- b) Quality, quantity and continuity of water.
- c) Socio-economic.
- d) Water work investment.
- e) Spatial use.

IV.3 Monitoring and Evaluation

Monitoring in watershed management is the process of observing data and facts. Implementation is done periodically and continuously on the course of events, the use of inputs, the results of the activities carried out (output), and external factors or constraints that affect it. While the evaluation of watershed management is the process of observation and analysis of data/facts from program planning, implementation, and development of a watershed management program (Government Regulation No. 37 of 2012). From the data and facts of the criteria, indicators, and performance watershed, the "status" or "critical level" of a watershed can be determined. At the beginning of the monitoring and evaluation of the performance of the watershed, it is important that you should know, such as: 1) Water System includes river regime coefficient, coefficient of variance, the index of water use, runoff coefficient; it can determine the flood and drought (Djuwansah, 2006).

- 2) The rate of sediment to see the sedimentation (Jakeman *et al.* 1998).
- 3) Water quality is the physics parameters that calculate pollutant content such as color, TDS (total dissolved solids), turbidity which chemically by calculating pH, DHL analytical, NO₃, SO₄, PO₄, K, Ca, Mg, and biologically by measuring parameters of substance organic, BOD (biochemical oxygen demand), COD (chemical oxygen demand) (Soemarno, 2011).
- 4) Conditions DTA/catchment area (catchment area), by calculating the index of land use, land-use capability, the index of erosion, landslide susceptibility (Roll., *et al.*, 2009).
- 5) The socio-economic aspect is the study of individual awareness, public participation, population pressures,

dependence on the land, income level, land productivity, environmental services (Roll., *et al*, 2009).

- 6) Institutional, things were examined as the empowerment of local institutions, local community dependence on the government, and the activities of joint ventures (Act No. 25 of 2004).

As a qualitative overview in Table 4, to fit in the category of good performance watershed, if:

- a) Provide high production for life in the watershed is a concern.
- b) Ensure the preservation of the watershed, where the erosion occurs below the tolerable erosion.
- c) There is flexibility, where if there is interference on one part, the other part can provide supply.
- d) Is uneven, where every stakeholder in the watershed can act following the capabilities that belong and get rewarded accordingly.

Table 4: Categorical Classification of Watershed Work Values

No.	Watershed Work Values	Categorical
1	< 1,7	Good
2	1,7 – 2,5	Good enough
3	2,6 – 3,4	Middle
4	3,5 – 4,3	Bad enough
5	> 4,3	Bad

Source: Forestry Department, 2011

According to the Forestry Department (2011), measured from biophysical aspects of Watershed are said to be good if:

- River debit is constant from year to year.
- Water quality is below water quality standards from year to year.
- Fluctuations between the maximum and minimum debit are small.

- The height of the groundwater level is constant from year to year.
- Precipitation Condition does not change within a certain time.

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