

An analysis of collective action in forest plantation establishment by FUGs (Case study in dry zone of Myanmar)

Introduction

The Dry Zone, one of the nine distinct natural regions, is a resource poor area. Water is scarce, vegetation cover is thin and soil erosion is severe. The region is characterized by low annual rainfall that ranges between 508 and 1,016 mm with high variability and uneven distribution. The monsoon rain is bimodal with a drought period during July when dry desiccating winds blow from the south. The undulating land, composed mainly of sandy loam with low fertility, is subjected to severe erosion under rain and strong winds. Mean temperature is above 27° C per year. This dry environment with its other natural limiting factors has led to severe environmental degradation. The dry zone lies between the latitudes of 19° 20" and 22° 50" north and longitudes 93° 40" and 96° 30" east, it includes the southern part of Sagging Division, the western and middle part of Mandalay Division and most parts of Magway Division (Geography of Metric Level, 1990). The dry zone is situated in the rain shadow of the Yakhing Yoma, which obtains most of the rainfall from the southwest monsoon, leaving very little rain to fall in this region. The zone covers approximately 67,546 square kilometers and the present population is estimated at 11.5 million (27% of the country's total). The population density is 99 people per square kilometer and it is the third most densely populated region in Myanmar (CSO, 2003).

Problem statements

The forest resources are being depleted more rapidly than the restoration of forest cover in the dry zone. The FD is recourse manager and it holds the use and control rights to the plantation establishment and natural forest conservation activities. The staff is lack of motivation under the hierarchical management system and get small amount of incentives for their livelihood. The nature of work is conducted by fixed rules and the field staffs have no decision making power. Lack of financial transparency and improper managerial systems cause the lower level staffs do not willing to participate in the field level activities. After launching the CFI, the local people have been participating in the forest plantations establishment activities. They formed the FUGs and established the forest plantations in accordance with CFI. However, the FUGs are still facing the inequity of benefit sharing and lack of voice in decision making by poor people within the members. The problems occurred not only due to the internal issues of the FUGs but also as the result of local government's strict control on the use rights of the FUGs.

Objectives of the study

Overall objective is to investigate the interaction of users by wealth strata within FUG and its effects on the outcome from the forest plantation. The specific objectives are,

- a. To investigate the contribution to and benefit from the forest plantation by wealth strata
- b. To describe the process of meeting arrangements and analyze the level of participation in decision making by wealth strata
- c. To calculate and compare between growth and utilization of products from the plantation

Theoretical background

Marshall (1998) defines the concept of the collective action as "the action taken by a group in pursuit of members' perceived shared interests" and "coordinated behavior of groups toward a common interest or purpose" Knox et. al. (2001). Meinzen Dick et. al (2004) explained that collective action, which requires the involvement of a group of people, it requires a shared interest within the group and involves some kind of common action which works in pursuit of that shared interest and this action should be voluntary. Poteete (2004) suggested that political and economic equity are important for the success of CBNRM activities. Webler and Tuler

(2000) expressed that fairness and competence play key role in citizen participation for the political equity in CBNRM. Where the fairness refers to the all participants have equal opportunities in decision making process and who can come together with the intention of reaching understanding and making public decisions in a fair process. Fairness of the discursive process means that equal opportunities of all participants to attendance, initiate discourse, participate in the discussion and decision making. Competence is a conceptualized as access to information and its interpretations and uses the best procedure for resolving disputes. Adams (1976) described that a person is motivated to achieve and maintain a fair balance between what they put into their work (inputs), and what they get out of it (outcomes). Fairness is defined by comparison with relevant others. In brief, (a) a member of participant compares his inputs (value) with the outcome he receives and the input-outcome ratio of his with other members (b) if the member in the process perceives equity or that he is receiving a fair deal, he is happy, contented and further motivated towards his job (c) however where a membership perceives inequity or injustice he responds to co-relate the inequity. He may lower productivity, reduced quality, increase absenteeism or he may even voluntarily resign the job.

The framework for empirical research

An institutional arrangement consists of a set of rules and defined tenure rights to the land, trees and their products. In other words, the members from user group have to determine how and when those products could be harvested from the community forest. The changes of institutional arrangements have an effect on the trees and forests because the process interacts within local people and their environments. The basic element to change the institutional arrangements is incentive, which motivates human behavior and its impact on forest rehabilitation. There are four kinds of attributes related to the motivation of members from the FUG. The attributes are (1) physical condition of the forest plantation where the technologies used to control, exploit and maintain them (2) the communities that control and use the forest plantation depend on their socio economic condition (3) the communities define the rules and take action for what acts are required, permitted and forbidden in exercising the authority provided by the rights and (4) the communities access the bundle of property rights by legitimately and every right that an individual holds, rules exist that authorize particular actions in exercising the right.

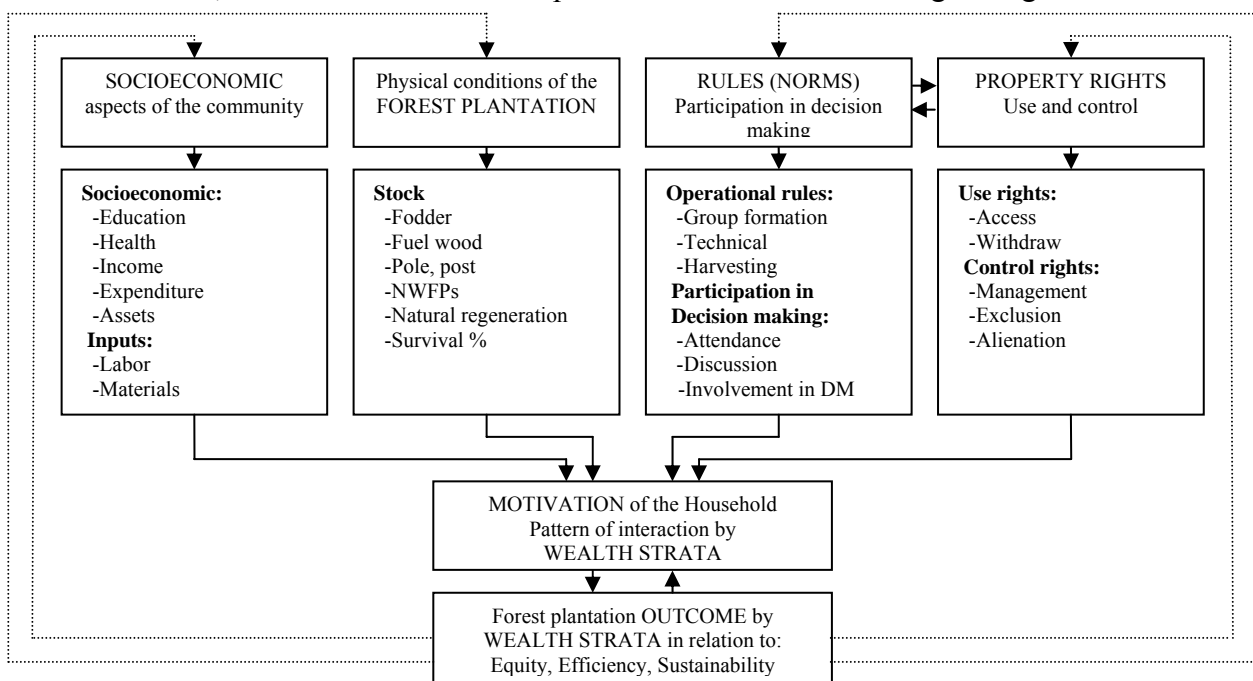


Figure 1.1. Research framework, adapted from Ostrom, Gardner and Walker (1994)

Data collection methods and data sources

The secondary data were collected from the various sources. The primary data were gathered by different methods in the villages. The methods are,

- a. Rapid Rural Appraisal: Resource mapping, transect walking, group discussion, time series and Venn diagram applied for gathering the data in the field. Participatory Wealth Ranking exercises formulated the criteria that communities themselves define the assessments of who are poor and who are rich within their communities.
- b. Questionnaire survey: After dividing the poor, medium and rich group in each village, the respondents were chose randomly and conducted door to door household surveys.

Table 1.1. Sample size and sampling fraction

Village	Poor Hhs		Medium Hhs		Rich Hhs		Total Hhs	
	PWR	Sample	PWR	Sample	PWR	Sample	PWR	Sample
Tegyikone	119	14	68	13	18	13	205	40
Kanoo	92	14	34	13	25	13	151	40
Kanharlay	121	14	72	13	25	13	218	40

- c. Tree inventory: The circular sampling unit (0.01 ha) sited at the intersections of a rectangular grid of 100 by 50 meter. The sampling fraction is 2.5%. All trees are measured the total height and DBH within the sample plots.

Table 1.2. History of forest plantation and sample plots

Village	Estb.year	Planted hectare	Sample plots	Method	System
Kanharlay	1995	8.40	21	Pit	Monoculture
Tegyikone	1998	23.43	50	Trenches	Mixed
Kanoo	1998	6.96	16	Trenches	Mixed

Economic equity by wealth groups in the FUGs

The members contribute the labor forces to the series of forest plantation activities. The members participate 5 to 7 days per year for the site selection and 30 to 90 days per year for the site preparation activities. The site preparation process has included the stacking, digging and soil filling activities. The duration is depending on the number of trenches, level of participation and available of human resources. Two people can be finished 4 to 5 trenches per day (L 2.13 m * B 0.46 m * H 0.46 m = 0.45 m³) and soil refilling can be finished around 40 to 50 trenches per day. The members contribute 15 to 30 days per year for the maintenance activities. The activities include patching, soil working- mulching and weeding, pruning and thinning, firebreak preparation, and patrol to the forest plantation. The members use locally available tools for the site preparation and the tools are crowbar, shovel, knife, old plate, pick axe and hoe. After the site preparation period, the shovel and pickaxe could not use for the next season. The old plates use for the soil collection from the trench and it lost 2 to 3 items per year.



Materials	Price (US\$/number)
Crowbar	.970
Pickaxe	.415
Hoe	.345
Shovel	.270
Knife	.150
Old pates	.045

Figure 1.2. Contribution of materials by members and their local price

H1: Poor people contribute more to collective action in the forest plantation than medium and rich people.

The Kruskal Wallis test applied to compare between the wealth groups for the labor and materials contribution. The test result showed that the significance level was .000. The result suggests that

there is a difference in labor and materials contribution across the different wealth groups. Inspections of the mean ranks for the groups suggest that the poor group had the highest contribution scores (85.01 and 72.35), with the rich group reporting the lowest (29.55 and 40.38). Therefore, the test result approved that the poor people contribute more to collective action in the forest plantation than medium and rich people. Multiple comparisons applied for each of the wealth groups. The test result showed that the significance level was .036, .000 and .000. The results show that there is a difference in labor contribution across the poor and medium, poor and rich, and medium and rich group. For the materials contribution, the test result showed that the significance level was .845, .000 and .002. The results suggest that there is not significance within the poor and medium group but differences in poor and rich, and medium and rich group.

H 2: Poor people receive more benefit from the forest plantation than medium and rich people.

The Kruskal Wallis test applied to compare between the wealth groups for the benefit sharing from the community forest. The test result showed that the significance level was .000. The result suggests that there is a difference in benefit sharing across the different wealth groups. Inspections of the mean ranks for the groups suggest that the poor group had the highest scores (81.86), with the rich group reporting the lowest (35.13). The test result approved that the poor people receive more benefit from the forest plantation than medium and rich people. Multiple comparisons applied for each of the wealth groups for the benefit sharing. The test result showed that the significance level was .044, .000 and .001. These results are respectively within poor and medium, poor and rich, and medium and rich group. The results suggest that there is a difference in benefit sharing across the poor and medium, poor and rich, and medium and rich group.

Equity on sharing of forest products out comes and inputs by wealth groups

The members contributed the labor and materials for the establishment of the forest plantation. Labor contribution conducts to the site selection, site preparation and maintenance activities. The opportunity cost for labor contribution is a day per 0.5 US\$ in the series of plantation activities. The data collected the total contribution days per household from the different wealth groups and those days are multiply by opportunity cost. The members contributed not only the labor but also different materials to the forest plantation. The data collected items and numbers of material by each household from the different wealth groups and multiply by local price. Both labor and materials costs are total contribution from the member to the forest plantation establishment. The members received the fodder, fuel wood, pole, post and NWFPs from the community forest. Within the context of benefit, the data are collected the type and harvesting amount of forest products by each household and multiply by local price. After getting the contribution to and benefit from the forest plantation, the Adam's formula applied for the ratio of equity. The poor and medium group receive more benefit than their inputs ($34.5 > 27.7$, $24.6 > 18.7$). However, the rich group receives lower benefit than their inputs ($6.1 < 6.5$). After getting the ratio, the research investigates the equitable relationship between wealth groups. Inspections of the equitable ratio for the groups suggest that the poor and medium groups had the similar scores (1.25 and 1.31), with the rich group reported the lower than the poor and medium group ($1.25 > 0.94$, $1.31 > 0.94$).

Political equity by wealth groups in the FUGs

The FUGs are carried out formal and informal meetings. The formal meeting has agenda and the committee members prepare the meeting plan 2 to 3 days ahead before launch the meeting. The announcement wrote in the black board and put in the center of village. The chair man invited to all members by using loudspeaker in the night. The announcement included the theme, date, time, agenda and place. The formal meetings did 3 to 6 times per year. The informal meetings often launch within the site preparation periods. The informal meetings are based on ad hoc plan and the members discussed about their issues within the sub groups. The formal meetings launched in the village resource center or religious house or primary school. Those places are common

properties and the members can easy to access the places. Normally, the committee chooses the meeting date on Sabbath days and the time commence after lunch. Those date and time are available for the members and they can participate in the public meeting without attention of their daily jobs. The duration of public meeting is around one hour. The 95% of respondents approved that the timing of public meetings did exactly according to the announcement. The 97% of members regularly participated and they discussed about the operational issues and sharing knowledge within the public meeting. The meeting has an agenda and if someone likes to discuss about the specific issues, the member has a chance to talk about his or her issue within the public meeting because the final section is general discussion and the member can express his or her idea to the others. The members make the decision in the public meeting and they decide the best solution for the operational issues and office activities. Before reached the consensus, the members involve in the discussion process. A member proposes tentative solution and the members discuss about the propose idea. Finally, almost members agree the propose idea. After final agreement, the committee members note down the decision and ask to the all members until three times. After asking to the members, the decision is final and all members have to follow the decision. To get the consensus, the propose ideas often change two to three times within the discussion period and the process is taking time. The 90% of members supposed that the decisions made the group leaders and members together. Only 1.7% of members described that the group leader decided alone to the operational issues and office activities. Figure 1.3 shows the situation of discussion and member’s involvement in the decision making in the public meeting.

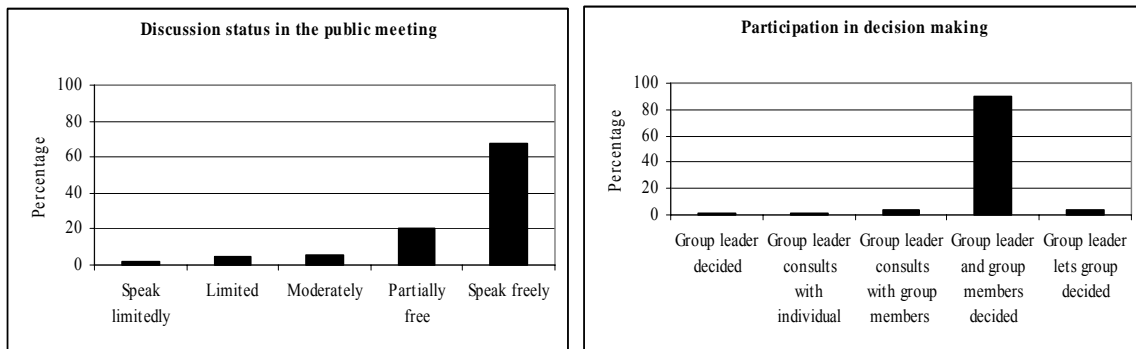


Figure 1.3. Status of discussion and member’s involvement in the decision making

H 3: Rich people participate more in decision making process than poor and medium people.

The Kruskal Wallis test applied to compare between the wealth groups for the participation in decision making process. The process included the participation in attendance, status of discussion and involvement in decision making in the public meeting. The test result showed that the significance level was .948 for the participation in attendance. This result suggests that there is not difference in attendance across the different wealth groups. Inspections of the mean ranks for the groups suggest that the poor group had the highest attendance scores (61.86), with the rich group reporting the lowest (59.41). For the participation in discussion at the public meeting, the test result showed that the significance level was .021. This result suggests that there is difference in discussion across the different wealth groups. Inspections of the mean ranks for the groups suggest that the medium group had the highest discussion scores (68.44), with the poor group reporting the lowest (51.48). According to the multiple comparisons, the test result showed that the significance level was .044 within the poor and medium group. However, the poor and rich, and medium and rich groups are not difference. The test result showed that the significance level was .957, which represents the member’s involvement in the decision making in the public meeting. This result suggests that there is not difference in the involvement in the decision making across the different wealth groups. Inspections of the mean ranks for the groups suggest that the medium group had the highest involvement in decision making scores (60.91), with the

poor group reporting the lowest (59.83). Therefore, the test results rejected that the rich people participate more in decision making process than the poor and medium people.

Financial efficiency

The member’s contributions and their arrangements of decision play the key role to establish the successful forest plantation. The FD and project’s staffs are supported technical knowledge to the members and build up their capacity through trainings, field days and workshops. The food security project formulated the cost sharing plan and both parties contributed the series of investment and running costs¹ for the forest plantation in accordance with the terms of partnership. The members have right to produce the products from the forest plantation after transferring to the FUGs. They can harvest the fodder, fuel wood, pole-post, and NWFPs in accordance with the rules of FUGs. The data are collected the local price of each item and multiply by harvesting amount from the forest plantation. For the standing trees, the dbh classes are divided into the usage of local people and multiply by the local price to calculate the benefit.

Table 1.3. The local value of poles in different dbh classes

DBH classes	Local price (US\$/pole)	DBH classes	Local price (US\$/pole)
14.51-21.5	.15	26.51-40.5	2.50
21.51-26.5	.50	40.51-51.51+	5.00

To represent the dry zone condition, Tegiyikone and Kanoo’s plantations have chosen and calculated the IRR because those villages have planted the diverse tree species in the forest plantation and they implemented the similar silvicultural treatments. The contributions are similar to the site preparation and maintenance activities from the project and the members. The discount rate chose the 12% to calculate the financial analysis because the interest rate is 12% in the government and private banks in Myanmar. The NPV is 7,939 US\$, the BC ratio is 1.87 and the IRR is 28%. Inspections of the IRR for the dry zone plantations suggest that the investment in forest plantation is higher than bank’s interest rate.

Growth and use of fuel wood and pole volume from the forest plantations

The Kantharlay forest plantation, 8.50 hectares, is established in 1995 and the Tegiyikone and Kanoo forest plantations, 23.43 and 6.96 hectares, are established in 1998. The sample plots are 21, 50 and 16 in Kantharlay, Tegiyikone and Kanoo village. Both natural and planted trees are counted and measured the dbh and height from the sample plots. The dbh is classified into natural regeneration (<=0.50 cm), fuel wood (0.51 - <14.50 cm) and pole (14.51- >51.51 cm). The natural regeneration represents the 57, 32 and 30% in the Kantharlay, Tegiyikone and Kanoo villages. The relationship of diameter and height of the trees are calculated in each plantation.

Table 1.4. Relationship between height and diameter of natural and planted trees

Village	Relationship between height and diameter	
	Natural tree	Planted tree
Kantharlay	$Y=0.0014x^2+0.743x+1.9085, R^2=0.90$	$Y=0.0031x^2 + 0.7839x+2.6958, R^2=0.92$
Tegiyikone	$Y=-0.0094x^2+0.7925x+1.1213, R^2=0.81$	$Y=0.0028x^2 + 0.804x+1.4595, R^2=0.90$
Kanoo	$Y=-0.0078x^2+0.682x+0.8858, R^2=0.96$	$Y=0.0056x^2 + 0.3197x+2.4765, R^2=0.91$

The standing trees are divided into fuel wood and pole by their dbh classes. Based on the above equations, calculated the basal area and volume of the fuel wood and pole from the natural and planted trees in each village. The growth of fuel wood is 11.43, 4.72, 5.31 m³ per hectare and the growth of pole is 34.38, 0.48 and 22.81 m³ per hectare in the Kantharlay, Tegiyikone and Kanoo village. The members are collected the fuel wood from their farm lands, community forest and the government plantations. The types of fuel woods are dry twigs, small poles and other parts of

¹ (1) Rapid Rural Appraisal (2) nursery establishment and seedling maintenance (3) site selection, site preparation, planting, maintenance (4) the salary for staff and (5) the taxes.

tree such dry leaves and fallen barks. Most of the members collected the fuel wood from the community forest and they commonly use small poles for the fuel wood. The members used the 8.21, 1.42 and 8.99 m³ per hectare per year in the Kantharlay, Tegykone and Kanoo village. The community forest plantation is the major source for the production of poles for the members. The harvesting amounts of poles are counted in each household and calculated the volume. The members used 0.57, 0.28 and 0.23 m³ per hectare per year in Kantharlay, Tegykone and Kanoo.

Comparison of growth and utilization of fuel wood and poles

The comparison is based on the hectare per year between growth and utilization of fuel wood and pole. The products have included from the natural and planted trees. The comparison shows that the fuel wood growth is higher than utilization (11.43>8.21 and 4.72>1.42 m³ per hectare per year) in the Kantharlay and Tegykone village but the growth is lower than utilization (5.31<8.99) in the Kanoo village. In 2006, the farmers did not receive the agricultural crops in the raining season and the effect interacts to the poor in the Kanoo village. They are jobless in the summer period and the committee members decided that to produce more fuel wood from the community forest. Therefore, the utilization is higher than the growth. The growth of pole is higher than utilization (34.38>0.57, 0.48>0.28 and 22.81>0.23 m³ per hectare per year) in the Kantharlay, Tegykone and Kanoo villages. The Kanoo FUG reserved the higher amount of pole volume than utilization. The amount is too high and its volume can substitute for the harvesting amount of fuel wood in Kanoo village.

Factor influence to the forest plantation outcome

Q 1. How will predict the five measures of control (input, attendance, participation in decision making, withdraw and management rights) to the forest outcome? Q 2. Which variable is the best predictor for the forest outcome?

A standard multiple regression was performed between total benefits (outcome) from the community forest plantation as the dependent variable and inputs, attendance, decision making, use right and management right as independent variables. Analysis was performed using SPSS regression and SPSS frequency for evaluation of assumptions. Results of evaluation of assumptions led to transformation of the variables to reduce skewness, reduce the number of outliers and improve the normality, linearity and homoscedasticity of residuals. A square root transformation was used on the measure of total benefits, attendance, decision making and management right. One independent variable, use right was not transformed. With the use of a p<.001 criterion for Mahalanobis distance, no outliers among the cases were found. No cases had missing data and no suppressor variables were found, N=120.

Table 1.5. Standard multiple regression of community forest out comes and participation in contribution and institutional arrangements

Variables	Out come (DV)	Input	Meeting attend ant	Deci sion making	Use right	Manage ment right	B	β	sr ² Unique
Inputs	.440**						.799**	.452	.167
Meeting attendant	.288**	.357**					4.784	.058	
Decision making	.033	.317**	.316**				-20.684	-.143	
Use right	.421**	.143	.428**	.013			20.099**	.180	.021
Management right	.416**	-.037	.106	.033	.435**		117.139**	.353	.099
**p<.01							Intercept=	-304.409	R ² =.43 ^a
Unique variability = .287; shared variability = .143								Adjusted R ² =.41, R=.66**	

Table 1.5 displays the correlations between the variables, the unstandardized regression coefficients (B) and intercept, the standardized regression coefficients (β), the semipartial correlations (sr_i²) and R², and adjusted R². R for regression was significantly different from zero, F(5,114)=17.47, p<.001. For the three regression coefficients that differed significantly from zero, 95% confidence limits were calculated. The confidence limits for inputs were 0.526 to 1.072, use

right for 0.662 to 39.536 and management right were 65.038 to 169.240. Only three of the independent variables contributed significantly to prediction of total benefits from the community forest as square root transformed, inputs scores ($sr_i^2=.17$), use right scores ($sr_i^2=.02$) and management right scores ($sr_i^2=.10$). The five independent variables in combination contributed another 0.143 in sheared variability. Altogether, 43% (41% adjusted) of the variability in total outcomes from the community forest plantation was predicted by knowing scores on these five independent variables. Although the correlation between total outcomes from the community forest plantation and attendance was .29 and decision making was .03, those were not contribute significantly to regression. Post hoc evaluation on attendance and involvement in decision making of the correlation revealed that it was significantly different from zero, $F(5,114)=2.06$ and $F(5,114)=0.03$, $p<.01$. Apparently, the relationship between the out come and number of attendance and involvement in decision making are mediated by the relationship between inputs, use rights, management rights, and forest out come.

Conclusion

According to the results, economic and political equity lead to the financial efficiency and sustainability in the forest plantation establishment by FUGs. In other words, equity cause active participation to the members and it effects to the productivity of forest products and improve the quality of forest. The IRR is higher than bank interest rate and the natural regeneration status are satisfactory condition in the community based forest plantations. The growth is higher than utilization of the fuel wood and pole under the systematic management of the forest committee. Inputs, management and use rights are important indicators to predict the forest plantation out come and among them, inputs are the best predictor for the forest plantation out come.

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