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RESEARCH NOTES

Economic Evaluation of Farming System Research in NEH Region: Some Issues

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I

INTRODUCTION

In NEH region, farmers typically view their farms, whether large corporations or small subsistence units, as systems. The functioning of a farm system is strongly influenced by the external rural environment, including markets, policy and information linkages. Not only farms are closely linked to the non-farm economy through commodity and labour markets, but also the rural and urban economies are strongly interdependent. For example, it is quite common for small farm households to derive 40 per cent or more of their income from off-farm activities. Keeping in view of farming condition, Farming System Research (FSR) approach, which constituted an important step forward in agricultural research in India particularly in the hilly states of northeast region, was advocated by ICAR Complex for NEH Region. The scientific reason behind it was to protect the land and water from degradation caused by adverse effect of *Jhum*/slash-and-burn/shifting cultivation without proper conservation measures in the hilly slopes of the region. Constant efforts have been made to develop suitable farming system alternative to shifting cultivation. Some of the programmes covered under this approach include soil conservation and land reclamation for permanent agriculture in hills; setting *jhumias* on wet terraced land for growing horticultural crops; engaging shifting cultivators as wage earners in the cash crop plantation and setting them on forest land in small pockets with some provision of basic amenities like schools, sales depot, etc.

A full-fledged research on farming system approach was initiated at ICAR Research Complex, Barapani in the year 1983, with a major emphasis on "Alternative Farming System to replace *jhuming*" was launched at Meghalaya led by a multi-disciplinary team with the prime objective of developing suitable land use models for optimum utilisation and management of natural resources for sustained production to replace this shifting cultivation. Eight different forms of farming systems consisting of livestock based land use (popularly known as FS-W1 at the institution), Forestry based (FS-W2), Agro forestry based (FS-W3), Agriculture based (FS-W4), Agri-

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horti-silvi-pastoral based (FS-W5), Horticulture based (Fs-W6), Natural fallow (FS-W7) and *jhum*/shifting cultivation land use (FS-W8) were visualised. Based on the research conducted at ICAR Complex, the results distinctly revealed that agri-horti-silvi-pastoral land use system is the most suitable farming system for this region. In spite of continuous efforts the achievement in weaning the people away from the shifting cultivation has not been remarkable. The proposition is that the hill farmers should shift to sustainable farming practices which would be a bundle of terraced agriculture and horticulture crops, but their intervention have failed (Chawii, 2001). More precisely, the progress of this farming system is not satisfactory and the adoption rate is abysmally low. Low adoption of alternative farming system models raised some valid doubts as far as economic viability of the systems is concerned and that is true for the agri-horti-silvi-pastoral system also (which is the best system as per the results at the experimental station). Thus there is a need to appraise the economic viability of these farming system models to understand the core economic issues, i.e., why the farmers are not interested to follow the improved method of farming in lieu of traditional shifting cultivation. So, the present paper is an attempt to answer the following questions: first, have we identified the rationality of *jhum* cultivation and the problems of *jhum* practitioners (*jhumias)* correctly? Second; how far the proposed alternative farming system model to shifting cultivation would help resolve considering the existing socio-economic condition of the farmers? And, finally; is the present orientation of farming system research appropriate or need based? Attempts have also been taken to validate the findings of the research and the lessons learned from the surrounding villages of ICAR Complex for NEH Region by investigating the sources and distribution pattern of household income among tribal farmers and suitability of proposed farming system model at ground level. The idea to intricate and examine the alternative farming options at ground level, was to test the appropriateness of the system under the real situation and to find out the various mismatches, why farmers do not prefer permanent agricultural system over age-old shifting cultivation method. The analysis on income distribution pattern is expected to help in formulation of new thoughts through identification and prioritisation of the various components of farming system to achieve higher social benefit and better livelihood of the tribal farming community in the region.

II

METHODOLOGY

Selection of Farming System Model

The agri-horti-silvi-pastoral farming system model was taken into consideration for the present investigation. The rationality of choosing the system was that this land use system was found to be the most profitable alternative of *Jhum* cultivation as per the research conducted at experimental station, ICAR Research Complex, Barapani, Meghalaya (Annual Reports, ICAR Complex for NEHR of various years). Area

under the system is 1.58 ha with a 42 per cent slope, out of which 65 per cent (1.03 ha) area is under planned use. The whole system is divided into 'bottom', 'middle' and 'top' terraced areas comprising agriculture (0.33 ha), horticulture (0.33 ha) and silvi-pasture (0.34 ha) block, respectively. The diverse agro-activities is expected to fulfill in producing most of the produce that farmers in remote areas would like to grow for their self-sufficiency in hilly states. This is an integrated farming system and capable of providing full-time and effective employment to a tribal family. Different soil conservation measures were taken, which includes, contour bunding, bench terrace, and half-moon terrace. The estimated soil loss was found to be negligible (Annual Reports, ICAR for NEHR of various years).

Data and Sources

Primary as well as secondary data source was used for the present study. Secondary data was compiled from various annual reports published in ICAR Research Complex, Barapani, during 1995-2004. Annual reports for the preceding decade were taken into consideration to obtain large number of alternative activities, which have been experimented at the model farming system research. These activities/options were analysed to have better insights and to obtain optimum plan for the 'agri-horti-silvi-pastoral' farming system. Information was collected on costs incurred, returns obtained and productivity of various agricultural, horticultural and silvi-pastoral activities. The input use and returns from the livestock unit (here 1 milch cow) was calculated from the data recorded at farming system research farm. Information on *Jhum* cultivation was used from various published (Singh *et al.,* 2003) unpublished sources and also from personal communication with the scientists of different discipline. Expenditure on input and value of output was calculated based on the cost and price prevailing at 2004-05 current prices.

Primary data was collected from a sample of 50 households from Umroi (30 farmers) and Shroewblei (20 farmers) village, which comes under Umroi block of Ri-Bhoi district of Meghalaya. The annual household income along with different sources was collected during the year 2003-04. The major income sources include income from agriculture, livestock, business activities, services and others (contractual work, occasional construction work, etc.). The sample farmers were selected purposively who are directly and indirectly involved in the day–to-day activities of the ICAR from the villages surrounding the ICAR.

Analytical Framework

Optimisation of Farm Income

Programming approach of the following form was used to optimise the farm return from 'agri-horti-silvi-pastoral' activities from experimental base farming system database.

Maximise

$$Z = \sum_{j=1}^{n} C_j X_j$$

Subject to

$$\sum_{j=1}^{n} a_{ij} x_{ij} \leq b_i$$

$$X_{ij} \geq 0$$

(i = 1, 2, 3, …….m, resources)
(j = 1,2,3,……..n activities)

Where,

Z = total returns to fixed factor,
C_j = net returns per ha of j-th activity,
X_j = the level of j-th activity,
a_{ij} = amount of i-th resources required per ha of j-th activity,
b_i = total available quantity of i-th resources.

The final optimum plans are given by solving the linear programming problem through the simplex method. (The MS EXCEL SOLVER tool has been used to solve the linear programming problem).

Real Activities

All the crops/plants grown in agricultural, horticultural or silvi-cultural block were taken as the real activities. The agriculture block include, maize, groundnut, rice-bean, ginger, radish, mustard, french bean, capsicum, brinjal, tomato, paddy and ragi. The options for horticultural crops include, Assam lemon, *khasi* mandarin, guava and pineapple. From silvi-pasture block, *Thysanolanea maxima, Alnus nepalensis*, (alder), *Simingtonia populanea, ficus auriculata, Thysanolanea populnnea*, guinea grass and broom grass was included in the linear programming model. As the 'agri-horti-silvi-pastoral' farming system model is complex and diverse, various components were included in the linear programming model to optimise the net income by using available resources.

Resource Restriction

Availability of total land under the 'agri-horti-silvi-pastoral' farming system was restricted as per the design led at the research farm. A constraint was imposed on availability of human labour but there was no such constraint for bullock labour as the use of bullocks was almost nil. Since the availability of capital at research station was not the limiting factor, no capital restriction was employed. Three different

situations were simulated based on the primary objective of farming with various assumptions. The situations are explained below:

Situation I: Availability of fixed and operational capital is abundant, area under agriculture, horticulture and forest block is fixed, area under different crops is interchangeable and growing paddy is not an essential activity in this situation. This simulation was assumed to resemble the situation when the primary objective of farming is profitability and possess highest flexibility among the three alternative situations. This scenario has been designated as progressive farming.

Situation II: Availability of capital is not restricted, area under agriculture, horticulture and forest block is fixed, area under different crops is interchangeable and growing paddy is an essential activity in this situation. This simulation is a blending of some flexibility (crop-area interchangeable depending on their profitability) and rigidity (area under paddy is a must). So, this plan resembles the situation when the objective of farming is profitability as well as to maintain household food security. This scenario has been designated as semi-progressive farming.

Situation III: Availability of capital is not restricted, area under agriculture, horticulture and forest block is fixed, a large number of crop activities are essential and minimum area under these crops are restricted, and some paddy area is must in this model. This is the situation mostly prevailing in NEH states, where large number of crop activities are taken in apiece of land i.e., mixed cropping to fulfill their households food requirement. The profitability is not the primary objective of farming and the whole system is operating at subsistence level.

Net Returns

The net returns of all real activities were calculated at 2004-05 prices by deducting operating expenses from gross return. Relevant information was taken from the experimental data conducted over a period of preceding decade, so the productivity of agricultural/horticultural/pastoral activities were considered and multiplied with the current prices to obtain the value of output. The main purpose of silvi-pastoral activities was to produce fodder, along with fuel and wood. Though there was no adequate market on fodder, fuel and wood, but in order to avoid the complexity of analysis, fodder component was valued. Secondly, the fodder production from agri-horti-silvi-pastoral system was sufficient (green fodder only) for rearing a milch cow, so the net returns of the livestock unit was calculated separately and added to the net returns to examine the change in profitability due to inclusion of livestock component.

Decomposition of Farm Income

To know the distribution pattern of the household income from different farming system activities of the farm households, a socio-economic study was conducted at Umroi Block in Ri-Bhoi district of Meghalaya. To examine the contribution of different sources in income inequality, source wise decomposition of Gini index was estimated (Lerman and Yitzhaki, 1985). Denoting total household income by y, the cumulative distribution function for total household income by F (y), which takes a value of 0 for the poorest household and 1 for the richest, and the mean total household income across all households by $\bar{y}$, the Gini index can be decomposed as follows:

$$G_y = 2\,\mathrm{Cov}\,[y, F(y)]/\bar{y} = \sum S_i R_i G_i \qquad \ldots(1)$$

Where, G_y is the Gini index for total income, G_i is the Gini index for income y_i from source i, S_i is the share of total income obtained from source i, and R_i is the Gini correlation between income from source i and R_i is the Gini correlation between income from source i and total income. The Gini correlation is defined as

$$R_i = \mathrm{Cov}\,[yi, F(y)]/\mathrm{Cov}\,[yi, F(y_i)] \qquad \ldots(2)$$

Where, $F(y_i)$ is the cumulative distribution function of household income from i-th source. The Gini correlation R_i can take values between -1 to +1. The overall (absolute) contribution of source of income i to the inequality in total household income is thus $S_iR_iG_i$. When the income source is a constant, then R will equal 0, implying that the source's share of the Gini is 0. As such components raise their share of total income, overall inequality falls.

A key rationale for studying decompositions by source is to learn how the changes in particular income source will affect overall income inequality. Consider a change in each household's income from source i equal to ey_i, where e is close to 1. Starting from equation (1), we can derive a clear expression for the partial derivatives of the overall Gini with respect to a percentage change in source i. The derivation yields:

$$\frac{\delta G_y}{\delta e_i} = S_i\,(R_i G_i - G_y) \qquad \ldots(3)$$

Dividing equation (3) by G_y yields the source's marginal effect relative to the overall Gini, which can be written as the sources inequality, contribution as a percentage of the overall Gini minus the source's share of total income:

$$\frac{\delta G_y / \delta e_i}{G_y} = \frac{S_i G_i R_i}{G_y} - S_i \qquad \ldots(4)$$

Financial Feasibility of the Farming Systems

The financial feasibility of the agri-horti-silvi-pastoral farming system model as well as shifting cultivation was estimated by using the discounted method, namely, Internal Rate of Return (IRR), Benefit Cost Ratio (BCR) and Net Present Value (NPV). The economic life was considered to be 15 years for the systems. Once the system is developed (agri-horti-silvi-pastoral) for permanent agriculture, it is expected to be cultivated over a longer period of time, but for the present study economic life was considered up to 15 years to have more realistic (longer project life leads to higher uncertainty) comparison with the shifting cultivation. The *Jhum* cycle was considered to be 7 years with 3 years continuous cultivation and 4 years fallow as per the practices followed in the study area. A 14 per cent discount rate was considered for this study, because similar interest rate is charged by the bankers for agricultural loan in the study area. As the time value of money is not possible to measure exactly, borrowing interest rate charged by the bankers is taken as a proxy for social discount rate.

III

RESULTS AND DISCUSSION

Area Allocation and Returns from Agri-Horti-Silvi-Pastoral Farming System Model

Area allocation of optimum crop plans under alternative situations were estimated along with their corresponding net returns (Table 1), results clearly indicated that as the large number of activities are included in the model (Situation III), the profitability declines (Rs. 5138 per ha). The reason is high diversification includes some comparatively less profitable activities. Situation I gave highest net return (Rs. 12784 per ha), where the choice of crops purely depends on the magnitude of profitability of individual crops. The crop activities in this model include ginger (17 per cent), radish (16 per cent), Assam lemon (32 per cent) and broom grass along with forest (36 per cent). Broom grass (provides green fodder and inflorescence is used for making broom) is an attractive economic activity prevailing in this area, which does not require any input cost. In horticultural block *Assam lemon* was found in the optimum plan in lieu of orange, *Khasi mandarin*, *guava* and *pineapple*. The productivity of orange in this region has declined drastically and performance of *guava* and *pineapple* crop was observed to be poor, hence *Assam lemon* emerged as the most profitable activity among horticultural crops. Ginger is the main cash crop and quite profitable followed by radish, which were included in the final solution of the optimum plan.

TABLE 1. AREA ALLOCATION AND NET RETURNS OF OPTIMUM CROP PLANS UNDER ALTERNATIVE SITUATIONS IN AGRI-HORTI-SILVI-PASTORAL FARMING SYSTEM MODEL

(per cent)

Activities	Area allocation			
	Situation I	Situation IIa	Situation IIb	Situation III
(1)	(2)	(3)	(4)	(5)
Ginger	16.50	12.62	17.48	6.80
Radish	15.53	-	-	-
Assam lemon	32.04	32.04	32.04	10.68
Broom grass+forest	35.93	35.92	35.92	25.24
Paddy	-	19.42	14.56	7.77
Maize	-	-	-	11.65
French bean	-	-	-	6.80
Orange	-	-	-	9.71
Pineapple	-	-	-	9.70
Guinea grass	-	-	-	11.65
All	100	100	100	100
Net returns (Rs./ha)	12784	6460	7534	5138

Situation II (resembling semi-progressive status) was further analysed into two alternative situations (Situation IIa and Situation IIb) to examine the change in profitability due to change in area under paddy. The results showed that area under paddy has inverse relationship with net return. In Situation IIb area under paddy (14.56 per cent) had declined by nearly 5 per cent as compared to Situation IIa (19.42 per cent), which improves the net return per hectare by 17 per cent. Paddy has not been considered as an important crop activity in agri-horti-silvi-pastoral system because of its low profitability resulting from poor yield performance (1.00 to 1.20 t/ha). The idea was to replace the paddy area (upland) with some alternative remunerative crop to ensure higher profit earnings and scale up farming operation at higher level, i.e., to commercial scale. But the ground reality is quite different, because, farmers (*jhumias*) prefer to grow paddy to meet their household food requirement and also due to strong preference for locally grown glutinous rice and sentiments. Mostly the *Jhum* areas that are well connected by road linkages are operating at this semi-progressive stage.

Situation III which was hypothesised to represent typical subsistence farming shows lowest net return (Rs. 5138 per ha) as compared to all other situations (Table 1). Here the only purpose of farming operation is to fulfill their household food demand. The farming includes a large number of diversified agricultural, horticultural and silvi-pastoral activities and profitability is least considered. This situation is prevailing in remote areas where the market-driven forces are almost absent or weak. So, the Situation III represents subsistence farming with large number of crop activities (mostly mixed cropping) with low net returns, but this farming engaged the

largest workforce (though not gainfully employed) and satisfy most of their household requirements.

Agri-Horti-Silvi-Pastoral Farming System Model vis-à-vis Shifting Cultivation

The net returns per hectare were calculated to examine the profitability of proposed agri-horti-silvi-pastoral farming system model and was compared with the net returns obtained from existing shifting cultivation (Table 2). The results revealed that net return under the Situation I (Rs. 12784 per ha) was estimated to be substantially high (77 per cent) as compared to shifting cultivation (Rs. 7237 per ha). However, net returns under Situation III indicate that the existing shifting cultivation was a better option with 29 per cent higher returns. This signifies that shifting cultivators under present study was operating above subsistence level but below progressive farming i.e., at semi-progressive state. This finding is further justified from the results that the net returns obtained from shifting cultivation and Situation II (Rs. 7534 per ha) is almost similar (only 4 per cent difference) which represents semi-progressive farming.

TABLE 2. IMPROVEMENT IN NET RETURNS FROM PROPOSED AGRI-HORTI-SILVI-PASTORAL FARMING SYSTEM MODEL OVER SHIFTING CULTIVATION WITH AND WITHOUT LIVESTOCK COMPONENT

	Net returns from agri-horti-silvi-pastoral model (Rs./ha)		Changes in net return (Rs./ha)*	
Situations (1)	WOLIV (2)	WLIV (3)	WOLIV (4)	WLIV (5)
Situation I	12784	17684	+5547 (76.65)	+10447 (144.00)
Situation II	7534	12434	+297 (4.10)	+5197 (71.81)
Situation III	5138	10038	-2099 (29.00)	+2801 (38.70)

WLIV and WOLIV represents with livestock and without livestock component, respectively.
*Average net return from shifting cultivation was calculated to be Rs. 7,237 per ha.
Figures in parentheses show change in percentage.

The results clearly indicate that the profitability of existing *Jhum* cultivation system is as comparable to the proposed permanent agriculture system (agri-horti-silvi-pastoral) when operating at semi-progressive state. Further, as per our assumption, semi-progressive farming is fulfilling the dual purpose of farming i.e., household food security as well as some earning. The findings clearly indicate that if the existing farming system is fulfilling this dual purpose, then why the *jhumias* will not intend to adopt the permanent agriculture system? Moreover, the decisions on adoption are influenced not only by the positive attributes of the technology, but by a host of other factors like resource endowments, risk preference, family requirements,

resource flows, the price signals, product and factor market conditions, etc. The social scientists argued that improved technologies were often rejected because they failed to mesh with this real life condition under which the farmers operate, which calls attention for a research that is need based and address these constraints (Jha, 2001).

Interestingly, inclusion of dairy base livestock component which is an integral part of farming system, shows that it improved the net return of the agri-horti-silvi-pastoral farming system substantially (39, 72 and 144 per cent under Situation III, II and I, respectively) irrespective of the situations under consideration. But in reality, jhumias rear pig, which is an integrated part of their farming system rather than dairy base livestock. It clearly indicates that inclusion of piggery along with dairy will further enhance the households' family income apart from fulfilling their own consumption demand.

Returns on Investment for Agri-Horti-Silvi-Pastoral vis-à-vis Shifting Cultivation

Financial viability of the agri-horti-silvi-pastoral farming system model as well as existing shifting cultivation was estimated by using discounted methods, namely, Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) (Table 3). The initial investment amount under the agri-horti-silvi-pastoral system calculated (at 2004-05 current prices) worked out to Rs. 29040 per ha (includes 488 man-days labour) for land development and terracing (half-moon terrace, contour bunding and bench terrace) activities. The initial investment amount required under shifting cultivation were considered the imputed value of the amount of labour employed, which includes labour requirement for burning of forest, cutting and cleaning of jungles and preparing land for cultivation. The results show that NPV was found to be favourable under all the Situations including shifting cultivation. But the magnitude of profitability was substantially higher (Rs. 37024 per ha) under Situation I as compared to other Situations (Rs. 11270, Rs. 1747 and Rs. 1265 under Situation II, III and shifting cultivation, respectively). Similarly, other criteria, namely, BCR and IRR also indicate that that the present farming system under study (agri-horti-silvi-pastoral) is financially viable option for investment activity. The magnitude of financial viability varies in different Situations, such as, BCR were 1.20, 1.10 and 1.02 under Situation I, II and III, respectively. Benefit cost ratio under shifting cultivation (1.07) shows that the investment is just viable and similar to Situation II. Financial feasibility criteria, IRR depicts that all the investment made in different Situations as well as under shifting cultivation are viable options with varying range of profitability. All the IRR values (37, 22, 15 and 16 per cent under Situation I, II, III and shifting cultivation, respectively) were observed to be higher than the discount rate (14 per cent) suggesting the viability of investment.

TABLE 3. FINANCIAL FEASIBILITY OF AGRI-HORTI-SILVI-PASTORAL FARMING SYSTEM MODEL VIS-A-VIS SHIFTING CULTIVATION

	NPV (Rs.)		BCR		IRR (per cent)	
Situations	WLIV	WOLIV	WLIV	WOLIV	WLIV	WOLIV
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Situation I	53833	37024	1.32	1.20	46	37
Situation II	24092	11270	1.21	1.10	30	22
Situation III	12953	1747	1.16	1.02	24	15
Shifting cultivation	1265	-	1.07	-	16	-

WLIV and WOLIV represents with livestock and without livestock component, respectively.

The feasibility study clearly indicated that the agri-horti-silvi-pastoral farming system model is definitely a viable option for investment activity under different situations if the availability of capital (particularly initial investment) is not a constraint. Considering the low economic status and poor resource endowment with the *Jhum* cultivators, financial feasibility study reveals that shifting cultivation cannot be termed as an absolutely non-viable option for investment. So, the farming system research should be focused on improvement of shifting cultivation rather than complete weaning it out. This view can be refreshed by the observation made by Mishra and Gupta (1998), stating that, ICAR Complex has designed and demonstrated several cropping systems for different agro-climatic zones along with input management and ensuring food security as alternatives to *Jhum* but with little success. Perhaps the alternative solutions that were offered to *jhum*, ironically were those formulated in labs and in scientists' pilot plots - designed more to test their assumptions than to reflect the ground reality in the *jhumia's* field. It is not merely a perception that the scientific research on shifting cultivation has been utterly inadequate not only in terms of insights into the prolonged so-called 'primitive' farming methods used by many a hill community, but also in finding out alternative land use packages to improve the *jhumias* farming method (Chakraborty, 2005). The experts have now started thinking about modification of shifting agriculture instead of completely replacing them. Financial feasibility study also investigates the change in profitability due to incorporation of livestock component in the farming system model. The result depicts that the magnitude of all the investment criteria (NPV, BCR and IRR) improves substantially due to livestock component, irrespective of Situations under consideration. This again re-confirms the importance of livestock component in the farming system models.

Prioritisation of Income Components Under Shifting Cultivation Practices

The importance of livestock component to improve the profitability of farming system has already been examined and discussed in the earlier section. The present decomposition analysis was carried out to prioritise the different income sources to

enhance the returns from shifting cultivation in an equitable manner. The result is expected to help in prioritising the incorporation of different income sources to achieve higher social benefit and higher distributive justice. Gini index from total household income was estimated to be 0.204 at Umroi area indicating that income distribution among shifting cultivators are almost even. This implied that, on one hand the shifting cultivators are constrained with low returns, but on the other hand the positive aspect is the equitable distribution of income. The results showed that the share of agricultural income was the highest (36 per cent), followed by income from on and off farm employment (30 per cent), business (17 per cent), others (17 per cent) and livestock (6 per cent) (Table 4). It is interesting to note that income from on and off farm employment is quite high (30 per cent) indicating the alternative source of income of the farmers. But the real concern is, even having the alternative income sources, merely 28 per cent of the sample farmers were practicing solely shifting cultivation and the rest were following shifting (part of their land) as well as permanent agriculture. The possible reason might be first, farmers have special attachments with the traditional practice as it is not only fulfilling their typical foodgrains requirements but also it is their way of life. Secondly, shifting cultivation does not require any intensive input management practices, which is absolutely matching with their low resource base endowment factor. Third, abundance of land (though land-man ratio is squeezing but still it is not a crisis in hilly terrain as far as shifting cultivators view is concerned) and finally, it is a low-input-low-output but highly labour intensive, suitable for this environmentally fragile region, where agricultural operations are bound to suffer from high weather risk.

TABLE 4. DECOMPOSITION OF SOURCE-WISE FARM INCOME INEQUALITY IN UMROI (MEGHALAYA)

Sources of income (1)	Correlation with Rank of total income (2)	Gini of sources (3)	Income share (4)	Source of income inequality (5)	Percent contribution to total inequality (6)	Marginal effect (7)
Agriculture	0.841	0.375	0.356	0.113	0.554	+0.197
Livestock	0.921	0.183	0.064	0.011	0.054	-0.010
On and off farm employment	0.712	0.163	0.296	0.034	0.167	-0.013
Business	0.933	0.245	0.167	0.038	0.187	+0.020
Others	0.634	0.102	0.116	0.008	0.039	-0.077

The results on percentage contribution to total inequality shows, agricultural income alone is contributing nearly half of the total income inequality (55 per cent) and also the marginal effect is positive. The positive marginal effect implied that as the agricultural income increases the income inequality will also increase which is not socially desirable as far as social benefit is concerned. Similar is the case for income from business also. But the marginal effect was observed to be negative for other income sources, namely, income from livestock, on and off-farm employment and others income. The negative marginal effect suggested that additional income

from a particular source (say, livestock) will reduce the total income inequality, which is socially desirable. This re-emphasises the importance of livestock component in the farming system for its double impact, improvement in profitability (desirable from private point of view) as well as reduction of household income inequality (desirable from social point of view), thus, strongly suggest that incorporation of this component will help in the process of development in equitable manner. Along with the livestock component, the results also suggested opening up avenues for on and off-farm income sources as well as income from other sources.

IV

EMERGING ISSUES

Evaluation Criteria

Mostly the profitability of different farming system models at ICAR Complex, Barapani have been judged and compared with shifting cultivation considering purely the input-output ratios only (Annual Reports of ICAR Complex for NEH) which is not a correct evaluation criterion as far as viability of the system is concerned. Because, input-output ratio does not account for the time value of money and also involves only the annual operation and maintenance cost, completely avoiding the investment made on the land development and infrastructure creation. Inclusions of this capital investment in financial viability analysis reveal that the proposed farming system model may be a viable proposition but not be highly attractive one. The farmers in the hilly region are mostly having poor resource base and low economic status with limited investment capacity. Moreover, the abject poverty creates a preference pattern where future income is discounted at a very high rate. In fact, it can be argued, poverty is such a serious problem that all consideration of the future is totally absent in their calculations (Datta and Singh, 2004). The irony is that, the obsession with maximising production continues and yield levels are still the primary discriminating criterion. Profit maximisation, efficiency of production, risk minimisation are important objectives for farmers but these are not used as evaluating criteria (Jha, 2001). In this situation farmers are not very much keen to (or capable of) investing capital on land development in expectation of future returns. Thus, the profitability analysis of farming systems should be made more critically taking into account time value of money of capital investment required as well as operating and maintenance cost.

Yield Variability and Risk Bearing Ability

The different crop activities at farming system research at ICAR Complex, Barapani shows wide yield variability, e.g., maize (44 per cent), ginger (79 per cent), radish (83 per cent), groundnut (33 per cent) and french bean (83 per cent), which

implied high risk association along with these crop activities (Annual Reports, ICAR Research Complex for NEHR various years). This variability has been observed in research farm (agri-horti-silvi-pastoral farming system) in spite of giving all necessary and timely inputs along with scientific support. For example, a case study in Sasatgre village, West Khasi hills, showed that *jhumias* learned better orchard (orange) management to promote better cash returns and they suspended their annual *jhumming*, the tiresome shifting cultivation, and instead, decided to invest their labour - the scarce and only available capital – into developing orchards, after a bumper harvest of orange in the previous year fetched them an unexpected bounty of hard cash. They get some extra income from orange orchards, when there is fruiting, which all these years had been erratic. It is like gambling with the natural elements and the decision was a disaster as most of the young fruits dropped prematurely. Now, again villagers have returned to their traditional *jhumming* with the view that even though one may not get sufficient food from the *jhum* field but it never leaves you empty-handed (Chakraborty, 2005). Keeping in mind such reality, the major concern is how far the resource poor farmers can afford this risk where the farmers are mostly risk averters.

Profitability vs. Subsistence

The objective of farming system research is to transform shifting cultivation into a permanent agricultural system through ensuring higher secured earning. But the real concern of the farming community is food security rather than profitability due to poor market linkages and hindrance to free movement of surplus output. Thus, the underlying objective of farming system research (profitability) and objective of shifting cultivation (subsistence) is completely diverging, in which a balance is possible to achieve only when different pulling and pushing factors (such as, road linkages, value addition in agricultural product like organic farming) are properly identified and fulfilled. Till then the farming system research needs to be re-oriented aiming at improvement of present shifting cultivation, rather to replace it. The re-orientation may possibly drive the present subsistence level of farming to semi-progressive level and in turn to commercial level through improving the investment capacity of the farmers. One of the major arguments for prohibiting shifting cultivation is the low productivity of crops. It is true that the productivity of crops grown in shifting cultivation areas is quite low when we consider the crop productivity individually. But the overall productivity (mixed cropping) from shifting cultivation method might be much higher. However, precise quantification of total productivity in shifting cultivation is very difficult and it requires separate methodology to be evolved. Moreover, shifting cultivators often have poor access to agro-chemicals because of poverty, inadequate extension systems and a general disregard of their farming practices by authorities. Appropriate management solutions should be made available to farmers, including improved upland crop varieties, and

more effective use of fallow vegetation by incorporating useful species (Cairns and Garrity, 1999).

Biodiversity and Shifting Cultivation

Conservation of biodiversity is one of the globally important and critical issues for world agricultural development, because the erosion of agricultural biodiversity threatens long-term stability and sustainability of agricultural production. The North eastern hilly region of India is one of the world's eighteen hot spot areas as far as biodiversity is concerned. The traditional farming systems are being followed and most of the farming practices are operating in subsistence stage, maintaining huge biodiversities, which have enormous public value for the society. The case studies on shifting cultivation revealed a number of good practices in terms of using indigenous methods, such as soil and water conservation and biodiversity management. This calls for fresh research and getting new insights to the entire gamut of hill farming system. The director general of International Center for Integrated Mountain Development (ICIMOD) Dr. J. Gabriel Campbell pointed out; we only used to think of short term and high productivity; of single mono-crops, now we are thinking in terms of organic, sustainable production, and biodiversity (Chakraborty, 2005). Several studies also highlight the importance for biodiversity of forest gardens which are maintained in many shifting cultivation systems (de Jong, 1997) as these gardens contain a mixture of productive species and manually occurring trees. Conversion of forest or shifting cultivating areas to the intensive permanent farming systems with monocropping will invariably will lead to strong reduction in biodiversity. Thus, while suggesting the permanent agricultural system in *jhum* areas one must also consider this biodiversity issue keeping in mind the future agricultural development.

Missing Link in Identification of Farm Level Needs

Hilly tribal societies have fashioned intermediate, often criss-crossing institutions, such as the household, extended- family and kinship networks; civic, commercial, and religious associations; charities; production units; and various layers of what is known as government. Each serves functions at which the others are not so good. They differ not only in terms of the emotional bonds that connect members, but also in regard to the information channels that serves them, the kinds of agreements that bind them, and the investment outlays and severance costs that help sustain them. Their elucidation, in particular our increased understanding of their strengths and weaknesses, has been the most important to compel in the process of technological intervention for any economic growth and development. The challenge is to identify specific agricultural and rural needs, and to focus investment in areas where the greatest impact on food security and poverty will be achieved. This is made possible through developing an understanding of the local factors and linkages found in the

wide range of rural locations subject to differing socio-economic and ecological conditions. One of the important issue is that the scientists are well aware and familiar of the physical and biological parameters of the system – soils, climate, growing conditions, etc., but they generally lack an understanding of the socio-economic factors which also condition behaviour, both at micro and macro levels (Jha, 2001). Agricultural development alone cannot achieve an increase in farm income but more importantly by creating demand for non-tradable goods, namely services and local products. It is this indirect effect on demand – and the associated employment creation – in the non-farm sector of rural areas and market towns, that appears to be the main contributing factor to the reduction of rural poverty. Dr. M.S. Swaminathan said in an interview with reporter of Grassroots Options *jhumming* is neither good nor bad, depending upon how you do the *jhuming*. If we still have an opportunity for regeneration of forest and soil fertility then it's alright; otherwise, we can introduce new interventions for *jhuming*, which can eliminate its negative aspects, what we call, ecologically and socially sustainable *jhum* farming and it can be done.

V

CONCLUSION

Improvement of *jhum* cultivation practices through incorporation of high value crops and improved soil management practices should be promoted. There is a need to have more knowledge, understanding and better insights regarding rationality behind the existing farm practices and more analysis and conscious efforts are required to look for interactions of shifting cultivators with various natural resource components. Special focus is needed to understand their existing socio-economic conditions and status of resource endowment existing in an almost close economy, where market-driven forces are almost absent. Re-orientation of the objectives of farming system research is essential aiming at improvement of prevailing *jhum* cultivation practices, rather not to weaning it away completely. The choice of enterprise to be included under farming system model should not be capital intensive but labour intensive. Horticultural crops may be given top priority (distribution of quality planting materials and management techniques) for allocation of cropped area under each farming system model followed by other components like animals, fisheries and forestry. The number and selection of enterprises should be based on farmers' own managerial capabilities and suited to the existing socio-economic condition. Input delivery as well as output disposal system should be ensured by the state government through public-private partnership as presently being done under horticultural commodities particularly for flower and orchids. Different pulling and pushing factors of agricultural economic development must be identified properly and accordingly differentiated strategy should be suggested in which farmers

need/aspiration and understanding of their risk preference, family requirement and resource flows should be given priority.

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