SATNET ASIA

Innovation network for food security and poverty reduction

SATNET Asia National Training Programme on Cost Benefit Analysis of Agricultural Technologies

17-18 March 2014, Islamabad, Pakistan

Workshop Report

UNITED NATIONS ESCAP Economic and Social Commission for Asia and the Pacific

CAPSA Centre for Alleviation of Poverty through Sustainable Agriculture

APCTT

FSC Food Security Center

AVRDC The World Vegetable Center

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The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia) aims to support innovation by strengthening South–South dialogue and intraregional learning on sustainable agriculture technologies and trade facilitation. Funded by the European Union, SATNET facilitates knowledge transfer through the development of a portfolio of best practices on sustainable agriculture, trade facilitation and innovative knowledge sharing. Based on this documented knowledge, it delivers a range of capacity building programmes to network participants.

SATNET Asia is implemented by the Centre for Alleviation of Poverty through Sustainable Agriculture (CAPSA) in collaboration with the AVRDC – The World Vegetable Center, the Asian and Pacific Centre for Transfer of Technology (APCTT), the Food Security Centre of the University of Hohenheim and the Trade and Investment Division of UNESCAP.

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Executive Summary

The workshop on "**Cost Benefit Analysis of Agricultural Technologies**" was organized as one of the key objectives of The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET) from 17-18 March 2014 in Islamabad, Pakistan. The workshop was organized in partnership with United Nations Asia and Pacific Centre for Transfer of Technology (APCTT), Pakistan Agricultural Research Council (PARC), Pakistan. The trainees were from Pakistan Agricultural Research Council (PARC). The main focus of the workshop was to explain the importance of Cost-Benefit Analysis in evaluating the usefulness of a project. An extensive theoretical background was given to the participants regarding the best statistical approaches to weigh the monetary gains and losses of any project.

The workshop was attended by nearly 29 scientific participants from different departments. Out of 29 participants 6 were females. The resource persons trained the participants on the relevant topics and discussed specific case studies. The training was conducted in participatory mode where in regular discussions were held between resource persons and participants. The concluding session chaired by APCTT summarized the way forward for application of the learnt techniques as well as the opportunities to apply the tools, techniques and skills learned from this training programme.

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Introduction

The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET) is working with institutions that share knowledge on sustainable agricultural technologies and improved market linkages in the region. SATNET facilitates knowledge transfer through development of a package of best practices on sustainable agriculture, trade facilitation and innovative knowledge sharing. Though this, it delivers a range of capacity-building programmes to network participants. This will enable the key stakeholders with enhanced capacity to further transfer this knowledge to smallholder farmers and small-scale entrepreneurs.

Sustainable development requires knowledge and capacity in government agencies, businesses and local communities to enable all stakeholders to participate in the decision making and to put in place appropriate strategies, thereby strengthening their communities to the desired change processes and their ability to identify with them. The work package 4 (WP4) of the SATNET Asia focuses on knowledge transfer as well as capacity development aspects of the project, with a particular emphasis on South-South collaboration.

UNAPCTT organized the **SATNET Asia National Training Programme on Cost Benefit Analysis of Agricultural Technologies** from 17th -18th March, 2014 in Islamabad in partnership with the Pakistan Agricultural Research Council, (PARC). This training attracted the participation of scientists, assistant scientist officers, assistants, research groups and soil fertility officers. The focus of this training was to provide exposure to the participants on the techniques frequently used in the industry for quantitative assessment and usefulness of an agricultural project before implementing it in the scheme. The training shared the knowledge on best practices related to quantitative estimation of projects and discussed some useful case studies depicting the implementation of CBA in farm projects. The participants developed a clear understanding of the concept of CBA and to network with each other to learn best practices related to practicing CBA in the field.

Programme structure

Methods used for capacity building of the participants included theoretical lectures, case studies, classroom interaction and audio/video presentations. Below is the program summary of the training program.

Day-1	Day-2
• *CBA Analysis* • *Ani-Chocolate Project of CBA* • *UNIDO Approach of CBA* • *LM/OECD Approach CBA* • *Comparative Analysis of UNIDO and L M Approaches of CBA*	• CBA of Genetically Modified Crop Cultivation • CBA of Organic farming • CBA of Community Forest Carbon Project • CBA of Animal Disease Control Project • Vermi-compost CBA

Key learning outcomes

1.0 An Introduction to Cost-Benefit Analysis

Cost Benefit Analysis is a decision making tool which is used to ensure the most efficient use of our resources. It is done if benefits of implementing the desired form of technology are greater than the costs involved in its introduction and integration in the current system. There are different levels within CBA on the basis of which analysis is done –

i) Financial Analysis – Here financial implications on an individual, a group or an organization (such as market prices) are studied.

ii) Economic Analysis - Economic implications in the society (shadow prices) are taken into account.

iii) Social Analysis - Incorporating social objectives or value judgments of the society is a part of social analysis that is conducted using CBA.

1.1 Steps in CBA

Like any statistical tool, CBA is also done in organized manner following a stepwise approach so that all and every element is addressed. The procedures to be kept in mind while conducting CBA are as follows –

i) Identification of Costs and Benefits - All benefits and costs associated with a particular technology irrespective of whether they can be quantified and valued or not are identified. A benefit occurs either as an additional benefit (output, revenue, etc.) or saving of a cost (lower cost of pesticide due to GM seed). Similarly, a cost is incurred either as an additional cost or loss of a benefit. A good example to study the financial, economic and social benefits is the cost of organizing a tree growers' cooperative. The following would be cost and benefit aspects of this technology -

Financial: sale of tree produce (benefit), purchase of saplings (cost)

Economic: Carbon sequestration/ better environment, increased milk production (benefits)

Social: employment generation, reduction in poverty (benefits)

ii) Quantification and Valuation of Cost and Benefits – A deeper assessment should be done to quantify and value as many identified costs and benefits as possible. The *base year* or r*eference year* should be identified and the prices of that year should be used as *constant prices* for all the years. Taxes and subsidies are to be included in financial analysis but excluded from economic analysis (transfer payments). Non-Market Items are also included in the analysis. For example, travel cost method can be used to estimate the cost of trip to Gir Forest: Cost of travel, value of time, payment for entry tickets, etc. by the visitors. Difference in Property values can be employed to assert the value of good environment. Contingent Valuation Method (CVM) is directly asking the value from affected persons: willingness to pay or willingness to accept.

iii) Aggregation of costs and benefits – All the costs and benefits thus calculated have to be converted to a common platform in both space and time for their effective comparison. Shadow Exchange Rate (SER) or shadow price of foreign exchange is a social cost-benefit analysis approach where the goods traded in foreign process are converted into domestic prices. This is done at the official exchange rate if there are distortions in the foreign exchange rate. A certain factor in the form of weights across income or consumption groups is incorporated or that of discount rates is taken into account for aggregation across time.

For example, if one has to calculate the future value to be returned if Rs 100 is lent for 3 years at an annual interest rate of 10%, then an additional factor of 0.1 is compounded for three years in the present value of 100.

iv) Criteria for Selection - Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost Ratio (BCR) are used together or separately to determine whether to adopt or reject a particular technology. Typically NPV is the difference between PVB (Present value of benefits) and PVC (Present value of costs). BCR is the ratio of PVB and PVC.

v) Sensitivity and Risk Analysis - Sensitivity of selection criteria changes with different scenarios as different assumptions are taken into account while considering different situations. A Weighted Selection Criteria can be used to quantify the risk involved in a particular technology. Selection criteria are quite sensitive to changes in different assumption as inaccurate estimation of prices could lead to delay in implementation and cost over-runs. Slow technology adoption, slow build-up of expected yields and prices could lead to reduced benefits.

2.0 Ani-chocolate Project of Kepong Cattlefeeds

Managua is a small developing country where the domestic currency is Bhater. The official exchange rate: US $ 1 = Bh 10 and the market exchange rate: US $ 1 = Bh 15. The per capita income in Managua is Bh 2000 per annum. There are two provinces: East and West where the West Province is relatively less developed as the annual per capita income in West is Bh 1000. The west has a milk economy based on cows where daily milk yield is 3 ltr/ in-milk and market price of milk is Bh 10/ ltr. Managua imports whole-milk powder with an import price (cif) of US $ 4/ kg milk powder. The domestic transport costs Bh 4/ kg imported powder.

A supplementary cattle feed has been innovated by the Government. The recorded weight of Ani-chocolate is 2.5 kg/ block. Considering that recommended feeding is 400 gms/cow/day, incremental daily milk yield is 10% per cow and recommended price by Govt. is Bh 5/block, the govt. ready to pass on this innovation to Kepong Cattlefeeds. The project is supposed to have an economic life of 20 years with a plant capacity of 10 tons per day. However, there are certain Capital Costs (Machinery & equipment, Technical services, Construction) and Operating & Maintenance Costs (Fixed costs per annum, Variable costs per ton of Ani-chocolate) associated with the project which needs to be considered before its implementation.

A CBA can be done from 3 different perspectives –

i) Profitability of Ani-chocolate to milk producers – Using the given information the incremental cost of using Ani-chocolate needs to be calculated. The incremental yield of milk over block shall give the incremental revenue per block. As per the calculations, the incremental revenue comes out to be greater than the incremental costs; hence this project is feasible from the point of view of the milk producers.

ii) Profitability to Kepong Cattle feeds – The initial investments, fixed costs, variable costs gives the total costs associated with the project which need to be calculated using only one time frame by taking necessary discount percentage. This gives the Present Value of Costs (PVC). The annual production is used to calculate the revenue from Ani-chocolate which can be then discounted to give Present Value of Benefits (PVB). With these values NPV, IRR and BCR can be calculated to study the feasibility from Kepong Cattlefeeds point of view.

iii) Economic Analysis – Keeping the shadow exchange rate in mind, the economic costs of urea, raw material, economic value of milk, Ani-chocolate can be calculated to do a detailed economic analysis.

Considering all the above mentioned three analyses in mind we can successfully implement CBA to get a profitability picture from the viewpoint of all the stakeholders involved.

3.0 UNIDO Approach to Cost-Benefit Analysis

The distinctive feature of the UNIDO approach is that it uses Aggregate Consumption as the Numeraire. Concepts such as Base income level, Consumption rate of interest (CRI) and Shadow price of investment are used for the calculation of CBA using the UNIDO approach. Constant Domestic Rupee as taken as the unit of account and shadow price of foreign exchange is incorporated in the calculation.

The UNIDO approach conducts CBA calculation in 4 stages and in the end also includes an adjustment factor to correlate economic price and market price.

3.1 Stage 1: Financial Analysis

Financial Profitability of different Stakeholders is seen using three basic tables of financial accounting such as financial income statement, Cash flow statement and Balance sheet. Subsequently three Discount Rates are incorporated in the analyses. Other interesting aspects of study are Real and Financial Flows and Graphical IRR.

3.2 Stage 2: Use of Economic or Efficiency Shadow Prices

Certain important concepts like Tradability, Indirect Taxes, Labour, Capital, Foreign Exchange and Externalities are considered in this stage of calculation. It is important to understand these terms before one move further to different stages of analyses.

A tradable good is the good that is imported or exported on economic grounds. A good is importable on economic grounds if its border price added with necessary transportation and handling costs is less than its domestic cost of production. A good is exportable on economic grounds if its domestic cost of production added with necessary transportation and handling costs is less than its border price. A non-tradable good is the good that is neither importable nor exportable on economic grounds. A tradable good may be traded or non-traded. A non-traded tradable good is not exported or imported due to trade policies of the country, e.g., an importable good may not be imported due to high import duty imposed on it.

If the project affects domestic production of a non-tradable or non-traded good, the production of a good may be increased by the local producers if the good is being used as an input by the project or the production of a good may be reduced by the local producers if the good is being produced by the project as an output. In both the cases, the shadow price of the good will be reflected by its marginal cost of production. If the project affects domestic consumption of a non-tradable or non-traded good there may be a reduction in the consumption of a good by existing local users if the project uses the good as an input or there may be an increase in the consumption of a good by the local users if the project produces the good as an output. In both the cases, the shadow price of the good will be reflected by its marginal value to users.

If the project affects exports of a traded good, there may be a decrease in the exports of a good; if the project uses the good as an input or there may be an increase in the exports of a good if the

project produces the good as an output. In both the cases, the shadow price of the good will be reflected by the marginal value of its exports (fob price). If the project affects imports of a traded good, there may be an increase in the imports of a good if the project uses the good as an input or there may be a decrease in the imports of a good if the project produces the good as an output. In both the cases, the shadow price of the good will be reflected by the marginal cost of its imports (cif price).

If economic valuation of a resource is based on its marginal value to users, the taxes are included in its economic price or if economic valuation of a resource is based on its marginal cost of production, the taxes are not to be included in its economic price.

The economic price of labour is the economic value of foregone marginal productivity if labour diverted from other uses. This can be employment of previously unemployed persons, employment of under employed workers, urban employment of rural workers, skilled employment of unskilled workers or even importation of workers.

The economic cost of capital includes Consumption Rate of Interest (CRI). When capital is generated through additional savings the price or rent the savers must be paid to forego an additional unit of present consumption. Discount rate can be used as a budgetary device – the discount rate can be raised or lowered looking at acceptable projects vis-à-vis available funds. Externalities may be considered as a special case of non-traded goods.

Before moving to the next stage, income transfers must be taken into account. Such transfers may change future consumption of the society due to different marginal propensities to save and consume of different income groups. The income going to the poor may be valued differently from the income going to the rich.

3.3 Stage 3: Impact on Savings and Investment

While income transfers may be desirable as such, they change the level of savings and investment in the economy which in turn affects future consumption of society. Shadow price of investment (Ps) indicates present value of future consumption stream generated by investment of rupee one in the current year.

3.4 Stage 4: Impact on Income Distribution

This stage is relevant when we value income in the hands of different groups of people differently. Weight for a certain income group is calculated by using base level of income, level of income and elasticity of the marginal utility of income. Savings are valued twice once at Stage-3 and then at Stage-4. Changes in consumption caused by changes in savings of different groups at Stage-3 may be added to the direct additional consumption (1-MPS), and the total additional consumption may be considered at Stage-4 with consumption distribution weights or only additional part of the income transfer may be considered at Stage-4.

3.5 Stage 5: Merit and Demerit Goods

This stage adjusts for differences between economic and social values. A good is called a ‘Merit Good’ if its social value is greater than economic value, e.g., petroleum products, which are in chronic shortage. A good is called a ‘Demerit Good’ if its social value is less than its economic value, e.g., liquor, tobacco. Use of a merit good as an input or production of a demerit good decreases the NPV of the project. Use of a demerit good as an input or production of a merit good increases the NPV of the project. Some considerations may enter directly at Stage-5 being irrelevant at Stage-2, e.g., generation of employment.

3.6 An Example of UNIDO Approach

A real life situation was presented and solved in the training workshop to demonstrate the concept of UNIDO approach to CBA. The road construction project of Grampura was taken up. All the five different stages of UNIDO approach to CBA were mathematically demonstrated to show the process and finally the NPV was calculated showing a positive value, hence a green signal for the project.

4.0 L-M/OECD/World Bank Approach to CBA

The L-M approach uses uncommitted Government income as the numeracies i.e. net benefits of a project are expressed in terms of the present value of net uncommitted Government income. The L-M approach to CBA has three stages to analysis. It includes financial, social and economic analysis. The Financial analysis makes use of the domestic market prices; the economic analysis is based on the maximization of net economic benefits and uses economic prices whereas social analysis considers income distribution and uses distribution weights for this purpose.

4.1 Financial Analysis

A good technical and financial analysis must be done before a meaningful social evaluation can be made so as to determine financial profitability. Financial profitability is indicated by Net Present Value (NPV) of the project which is measured by taking into account inputs (costs) and outputs (benefits) at market price. The calculation of NPV remains same as the UNIDO approach to CBA.

4.2 Economic Analysis

The economic prices examine whether a particular input (non-labour) or output is tradeable or non-tradeable, and whether a tradeable or non-tradeable item is traded or non-traded. One can use directly border prices or use conversion factors (accounting ratios) for converting domestic market prices to border prices. The concept of economic price of labour is also involved. Economic Accounting Rate of Interest for discounting is considered. Some conversion factors are taken into account –

i) Standard Conversion Factor (SCF) – This is an overall ratio of border prices to domestic values. The values thus obtained are for a particular year or average annual values.

ii) Group Conversion Factors - Group Conversion Factors can be used when individual items of the group are not so important to require Specific Conversion Factors. Two examples of group conversion factors are Consumption Goods Conversion Factor and Producer Goods Conversion Factor. Trade data Approach can be used to estimate the group Conversion Factor.

iii) Specific Conversion Factors – This is an individual conversion factor for an important commodity. For a traded-tradeable commodity, a similar formula like that for SCF can be used but for a non-traded-tradeable commodity, it is the ratio of its border price to its domestic market price. For a non-tradeable commodity, it is the ratio of its accounting price to its domestic market price. For its accounting price, we need to look at the accounting prices of tradeable and non-tradeable inputs that have been used to produce it.

Economic Price of labour is the opportunity cost of labour. Foregone marginal product of labour is taken at border prices. Some factors taken into account while doing calculations are economic price of labour, marginal product of labour at domestic prices and consumption conversion factor (assuming marginal product of labour mostly in the form of consumption goods).

Economic Accounting Rate of Interest (EARI) is the economic rate of discount. Opportunity cost of capital is assumed at border prices whereas marginal productivity of capital is taken at border prices. Rate of return on the marginal project with all costs and benefits is valued at economic accounting prices. For practical purpose, average rate of return in recent projects is adjusted for border prices.

4.3 Social Analysis

The social analysis includes value of public income, other private consumption, private savings, social price of labour and social accounting rate of interest.

i) Social Value of Public Income (v) is equivalent to asking how many rupees of consumption of the base consumption group are equivalent to rupee one of uncommitted public income? In other words it is the present value of the future consumption stream generated by investing rupee one during the present year. It therefore depends on Marginal Propensity to Save (MPS), marginal productivity of capital or return on investment, and the rate at which future consumption is discounted, i.e., Consumption Rate of Interest (CRI).

ii) Social Value of other Private Consumption answers the question what is the relative value of consumption of rupee one of the given consumption group vis-à-vis base consumption group? This may be based on marginal utility of consumption of different consumption groups.

iii) Social value of private savings of any group of people same as that of uncommitted public income.

iv) Social Price of Labour or Social Wage Rate (SWR) answers the question as to what is the foregone marginal productivity of labour; What is the additional consumption of resources by labour (e.g, food, housing, electricity, etc.); What is the relative value of additional consumption by labour?

v) Social Accounting Rate of Interest (SARI) is the social rate of discount. Social opportunity cost of capital is included in the analysis. Considerations such as what is marginal productivity of capital, what part of the marginal product of capital would be saved and what part of it would be consumed are made.

5.0 Exercise to Compare UNIDO and L-M Approaches to CBA

A case study can be taken to understand the working difference between both the approaches to CBA.

Kepong is a small developing country. Table 1 provides data on its international trade during 2007-08. A small irrigation project on river Suang is one of the various development projects that have been recently formulated in the country. The command area of the project would be 1000 hectares. The changes in the area and production of different crops as well as the changes in labour and non-labour inputs due to the project are given in Table 2. The capital costs for the project are expected to be Bhs 20 million half of which would be in terms of foreign currency. All capital cost would be incurred in first year of the project. The changes indicated in Table 2 would take place from second year of the project. The annual operating and maintenance costs which would start from second year of the project are expected to be Bhs 1 million. The farm gate prices of paddy and tobacco would be Bhs 2000 and Bhs 3000 per ton, respectively. The market price of the un-skilled labour used for crop cultivation is Bhs 10 per manday while the opportunity cost of this labour is only Bhs 5 per manday. All the above monetary values indicate constant prices with 2007-08 as the base year.

6.0 Few Applied Examples of CBA

Some examples for application of CBA were discussed during the workshop –

6.1 Cost-Benefit Analysis of GM Crop Cultivation

Genetically Modified (GM) Crops are a major technological revolution in global agriculture. First commercial application was seen in 1996. In 2010 the global area under GM crops was 148 million ha. One of the major traits of GM crops is that they are resistant against insect pests (by incorporating a gene from the *Bacillus thuringiensis* (Bt) bacterium). They are also Herbicide tolerant (HT) or may have combination of two or more traits (Stacked traits). Currently these are a subject of controversial discussions ranging from food production and health issues to impact on ecosystems and the environment.

During the presentation, an Irish case study conducted on performance of Sugar Beet and Wheat was represented. The parameters included were

- Yield
- Gross Margin
- Seed Costs
- Pesticide Cost
- Management and Labour Cost

As a result of the application of CBA it was proved that Bt seed cost, management & labour cost are higher but pesticide cost is lower. Overall, yield and gross profit margin are higher. Hence GM crop cultivation can be considered viable from the CBA point of view.

6.2 Biogas Project of Ramdas Trust

Ramdas trust conducted a rural energy project to identify the most economical means to produce biogas. Organic material such as dung, plant waste produces biogas (methane) on anaerobic digestion and slurry (manure) as a result of bio-chemical reactions. For the production of biogas two models were being considered – the Janata model and the KVIC model. The Janata model is a fixed dome type model in which the pressure of gas is not visible, whereas the KVIC model is floating dome type in which pressure of gas is visible. It is more popular among the rural masses.

The requirements of the plant taken into account according to the villagers are the size of plant in terms of cubic meter of biogas to be produced per day, e.g., 2, 3, 4, 6, … cubic m and the requirement of biogas for cooking, which is 0.3 cu m / person / day and 0.45 cu m / hour of cooking. According the requirement of dung and the number of animals required to produce that dung can be calculated. Some external factors also affect the production of Biogas such as C-N Ratio (25:1 to 30:1 optimum), pH (6.5 to 7.5 optimum), Temperature (350 C optimum), Total solids or dry matter (8-10%), Dung:Water (50:50), Toxic substances (detergents, antibiotics), Air tightness and Type of raw material.

CBA for the project was evaluated considering installation costs, supervision during construction, initial ding requirement, operating costs are calculated and valuation of the biogas benefits for 3 cu m is done in comparison with dung cakes, firewood, kerosene and LPG. Taking a life of 15 years the present value of biogas produced is calculated involving a 10% discount rate. The NPV is then calculated which then comes out to be positive. Hence this gives a green signal for the project.

6.3 A Community Forest Carbon Project

A project was prepared for financing under Clean Development Mechanism (CDM) by the Harda Forest Division in Madhya Pradesh. CDM is a market based mechanism linking mitigation of greenhouse gases with sustainable development. Reductions of emissions have been achieved in developing countries through various ways (e.g., renewable sources of energy, better technologies, afforestation) can be purchased by other countries to meet their requirements of Kyoto Protocol, 1997). Prototype Carbon Fund was the first fund set up by the World Bank for such trading and was utilized for few large projects by few developing countries. Community Development Carbon Fund (CDCF) was also set up by the World Bank specifically for small scale projects in poor and rural areas of developing countries. This project based on regeneration and protection of forests in Harda Forest Division of Madhya Pradesh is prepared for financing under CDCF. It is prepared collaboratively by Community Forestry International, USA, Indian Institute of Forest management, Bhopal, Centre for Ecological Sciences, IISc, Bangalore and Ministry of Environment and Forests, New Delhi.

Harda forest division is 150 km southwest of Bhopal in the upper watershed of the Narmada river. Teak forests make upto 90% of the 1122 sq km of the total forest cover. The project developed under CDM was to determine the amount of carbon within the forest cover. However preparing a project in Land Use Change and Forestry (LUCF) sector for CDM support requires determining compatibility with sustainable development, defining the project boundary, assessing the carbon stock baseline and estimating the additional carbon stock to be created. Two distinctively different forest ranges Handia and Rahatgaon were selected based on three broad contexts for comparison – unprotected forests, community protected forests and protected old growth forests. Samples of 50 M x 50 M were selected from the above three types of forest areas. In each sample, all the trees above 1.5 meter height were enumerated and their girth (GBH) and height were measured. Within above plots, smaller quadrates of 5 square meters were delineated to enumerate seedlings and shrubs less than 1.5 M in height to know regeneration status. Biomass was calculated in each of the sample and the amount of carbon was taken to be 50% of dry biomass. Impact of Protection on Carbon Sequestration was then checked for each case.

Based on above techniques using CBA, the efficacy of the project was calculated and recommendations were made to strengthen institutional capacity to manage local forests, strengthen financial additionally and make provision of technical inputs.

6.4 Cost-Benefit Analysis of Vermicomposting

Vermiculture or vermicomposting is derived from the Latin term vermis meaning worms. Vermicompsting is essentially the consumption of organic material by earthworms. This speeds up the process of decomposition and provides a nutrient-rich end product, called vermicompost, in the form of ‘worm castings’.

Doing a financial analysis one can consider the costs as *Capital Costs* and *Operating Costs* whereas the revenue can be taken to be sale of Vermicompost and sale of worms. However, the economic analysis yields the same costs but different benefits as incremental yield/ savings in fertilizer, pesticide use, economic value of additional worms produced, reduction in waste management costs and reduction in pollution and global warming.

A case study of Dharwad District assessing production and marketing of Vermicompost in Karnataka was presented. Fixed costs, variable costs, revenue generated were calculated as cash inflows and outflows to calculate the three indicators as NPV, BCR and IRR. Further a sensitivity analysis was done to check the effect of a 10% increase in cost of agricultural waste, earthworms, labour cost, vermicompost price on the three ratios.

Assessment of Vermicomposting as a waste management technology and a livelihood alternative in the Philippines was presented. The economic performance of small and large scale Vermicompost units was studied in terms of costs and benefits and then the BCR was calculated.

6.5 CBA of an Animal Disease Control Project

An economic appraisal of the proposed new foot-and-mouth disease vaccine production plant in India was presented. FMD causes a lot of harm to animals which directly result into loss to human beings. There could be direct loss of milk, loss of milk due to infertility (delay in conception), loss of milk due to abortion, loss due to mortality of animals, value of calves lost due to abortion and mortality, cost of hiring to replace draught animals, cost of permanent disability (draught animals) and loss in young stock due to longer rearing time. Each of these losses are calculated numerically to get the cumulative loss.

Then different strategies are devised to cover up these losses. These can be full coverage of animals by vaccination - Policy 1A, Policy 1B and Policy 1C or vaccination of only productive animals (continuing the present practice) - Policy 2.

Policy 1A involves use of quadrivalent vaccine doses. All bovines are to be vaccinated twice a year indefinitely. However, 1% of the vaccinated animals still catch the disease. In policy 1B all bovines are to be vaccinated twice a year for 7 years and only 20% animals to be vaccinated once a year from 8th year through barrier and ring vaccination schemes. In policy 1C quadrivalent vaccine doses are to be used upto 1984 and trivalent vaccine doses to be used from 1985. Policy 2 requires use of quadrivalent doses to be purchased at Rs 8 per dose from the market. Only the productive crossbred cows and buffaloes are to be vaccinated twice a year. The incidence reduces from 30% to 15% in the vaccinated crossbred cows and from 15% to 10% in the vaccinated buffaloes. Severity of symptoms in vaccinated animals also reduces by 25% if they still catch the disease.

On calculation of BCRs one can conclude that it is beneficial to control FMD even by continuing the present practice (Policy 2) of vaccinating only productive animals. Under intensive vaccination (all animals), Policy 1C seems to be the most attractive. It shows higher NPV and BCR than those shown by continuation of present practice. However, the present practice may not turn out to be as attractive as the risk of disease to the improved/productive animals will increase with a general rise in population. It may also not be good for future livestock development.

Way forward

Feedback from the workshop showed that participants felt that they strongly benefitted from the training in cost benefit analysis of agricultural technologies. Participants highlighted the usefulness of learning CBA in various application such as Vermicomposting, organic farming, In Pakistan. Most of them have planned to implement the concept of CBA in their work, as well as further spreading knowledge to extension workers and agencies in Pakistan. Further, participants want to increase their capacities to implement CBA techniques at farm level, landscape, nationwide by further trainings on the subject.

Annexes

Annex 1: Workshop Evaluations

The evaluation of the workshop was conducted based on two different approaches including (i) general feedback and (ii) Knowledge, Attitude and Practice (KAP) Survey. The criteria of evaluation were completed on the scale of excellent, good, fair and poor. Further, the general feedback part was divided into two segments (content and process). Hence, this part was evaluated based on the delivery of technical sessions by the resource persons. The second part of the evaluation was prepared using the perception based approach known as Knowledge, Attitude and Practice. This segment of the evaluation mainly discusses individual knowledge gained from the workshop as well as the implementation of specific knowledge in the participants' own areas of research.

In the end, evaluation forms were collected from the participants to assess the workshops according to their usefulness in dissemination of knowledge, quality and learning of Cost benefit techniques. Overall the workshop was rated as good by more than 60% of the participants, followed by the excellent category.

Participants were given evaluation forms to rate the usefulness of the workshop content and quality of processes on the scale of "excellent to poor". Averaging both workshops, statistics in the table show that the workshops were rated as good, since around 65% of the responses were observed under the categories "good" and "excellent" in terms of the workshop content and processes. 46% of the participants rated the processes as good while over 40% rated them as excellent.

Usefulness of the content and quality of processes and logistics

Topics

In addition, topics 3, , 8 and 10 were rated 65%, 55% and 70% and 82% respectively in the "good" category because of the new approaches of CBA to these topics offered in terms of choices of sustainable agricultural technologies and their economic benefits. The other topics were rated either excellent or good by the participants because of their valuable addition to the participants' existing knowledge base.

Expectations

About 65% of the participants indicated that this workshop met their overall expectations on a large scale, while 30% of the participants felt that the workshop met its objectives beyond their expectations.

Table 1: Evaluation of SATNET Asia National Training Program on Cost Benefit Analysis of Agricultural Technologies

	TOPICS	Excellent	Good	Fair	Poor
Content	Topic 1: An overview of SATNET Asia Project	43%	52%	5%	
	Topic 2: An Introduction to Cost Benefit Analysis	45%	50%	5%	
	Topic 3: Ani-Chocolate Project of Kepong Cattle Feeds: An Exercise on Cost-Benefit Analysis	9%	65%	26%	

	TOPICS	Excellent	Good	Fair	Poor
	Topic 4: UNIDO and World bank Approaches	27%	55%	18%	
	Topic 5: L-M/OECD/World Bank Approach to Cost-Benefit Analysis	32%	41%	27%	
	Topic 6: An Exercise to Compare UNIDO and L-M Approaches to Cost-Benefit Analysis	30%	35%	35%	
	Topic 7: Cost-Benefit Analysis of GM Crop Cultivation	35%	57%	8%	
	Topic 8: Cost-Benefit Analysis of Vermin compost	9%	70%	21%	
	Topic 9: Cost-Benefit Analysis of Biogas Production	36%	55%	9%	
	Topic 10: Cost-Benefit Analysis of a Community Forest Carbon Project	9%	82%	9%	
	Topic 11: Cost Benefit Analysis of an Animal Disease Control Project	11%	78%	11%	
Process	Agenda and flow	29%	59%	12%	
	Facilitation, feedback and discussion	42%	53%	5%	
	Knowledge Sharing Processes	22%	61%	17%	
Logistics	Pre-training Communication	29%	57%	9%	5%
	Meeting Facilities	14%	81%	5%	
	Accommodation		83%	17%	
	Food		75%	25%	
	Extent Training Met Expectation	4%	65%	26%	5%
OR	Overall Rating	17%	70%	9%	4%
KAP	1. Rationale use of this training in future activities	39%	52%	5%	4%
	2. Rating of the training topics	17%	48%	30%	5%
	3. Key learning from the training	22%	35%	39%	4%
	4. Content of the Training Program	9%	68%	18%	5%

Aspects to be improved in the future

Participants felt that the inclusion of more case studies from Pakistan, specifically the different timing of the workshops to allow field visits during the harvesting season, to consolidate the learning from the sessions would have been very useful. A brief summary of key suggestions from the participants is provided below:

Content

- CBA training should also highlight more multi-discipline subjects of sustainable agriculture for learning cost effective planning in Pakistan
- Include some sessions on practical exercise
- More engagement of different participants such as farmers and vegetable growers of Pakistan to market access and CBA in Agriculture.
- Emphasis on empirical exercise to be included

Process

- Presentations should have been shared prior to workshop for better understanding.
- The duration of the program should be more than 2-3 days
- Presentation from participants should also be considered.

Logistics

- It should be organized with better conference facilities like power supply and microphone.
- More time should be given to each presentation along with interactive session with participants.

Way Forward

- Most of the participants indicated that they will apply this knowledge in the field work and will also provide training to the relevant stakeholders CBA in Pakistan.

Few of them expressed that they will follow up this subject for obtaining more advance version of this training outside their country and will

Annex 2: Program Agenda

SATNET Asia National Training Programme 17-21 March 2014, Islamabad, Pakistan

Program Agenda

SATNET Training Programme on Cost Benefit Analysis of the Agricultural Technologies, 17-18 March 2014

1 Day: 17 March 2014

Time	Programme	Speakers
	Inaugural Session	
09:00-09:10	**Welcome Address and Introduction of PARC**	Hon'ble DG, PARC/Director, PARC
09:10-09:20	**Opening Address**	Dr. Krishnan Srinivasaraghavan, APCTT-ESCAP
09:20-09:40	An overview of SATNET Asia project	Dr. Krishnan Srinivasaraghavan, APCTT-ESCAP
09.40-10.40	An Introduction to Cost Benefit Analysis	Dr. Rakesh Saxena IRMA
10.40-11.00	**Tea/Coffee Break**	
11.00-12.00	Ani-Chocolate Project of Kepong Cattle Feeds: An Exercise on Cost-Benefit Analysis	Dr. Rakesh Saxena IRMA
12.00-13.00	UNIDO Approach to Cost Benefit Analysis	Dr. Rakesh Saxena IRMA
13.00-14.00	**Lunch Break**	
14.00-15.00	L-M/OECD/World Bank Approach to Cost-Benefit Analysis	Dr. Rakesh Saxena IRMA
15.00-15.15	**Tea/Coffee Break**	
15.15-16.00	An Exercise to Compare UNIDO and L-M Approaches to Cost-Benefit Analysis	Dr. Rakesh Saxena IRMA

Day 2: 18 March 2014

Time	Programme	Speakers
	Case Studies of the Cost Benefit Analysis	
09.00-10.00	Cost-Benefit Analysis of GM Crop Cultivation	Dr. Rakesh Saxena IRMA
10.00-11.00	Cost-Benefit Analysis of vermin-compost	Dr. Rakesh Saxena IRMA
11.00-11.15	**Tea/Coffee Break**	
11.15-12.00	Cost-Benefit Analysis of Biogas Production	Dr. Rakesh Saxena IRMA
12.00-13.00	Cost-Benefit Analysis of a Community Forest Carbon Project	Dr. Rakesh Saxena IRMA
13.00-14.00	**Lunch Break**	
14.00-15.00	Cost Benefit Analysis of an Animal Disease Control Project	Dr. Rakesh Saxena IRMA
15.00-15.15	**Tea/Coffee Break**	
15.00-15.45	**Participants Discussion with Dr. Rakesh Saxena**	
15.45-16.00	**Summary and Way Forward**	Dr. Krishnan Srinivasaraghavan, APCTT-ESCAP

Annex 3: List of Participants

SATNET Training Programme on "Cost Benefit Analysis of the Agricultural Technologies" 17-18 March 2014

Agriculture Poly-technique Institute (API), NARC, Islamabad – Pakistan

List of participants

Sr.	Name	Designation	Institute	Contact	Email
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