
Welcome

Methodology of Impact Study

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Agriculture Yesterday and Today

- It is believed that the first organized agriculture developed in West Asia, somewhere in the present village sites of ***Jarmo*** in the Kurdish hills (Iraq) date back to about 5000 BC.

  - 25 Houses with abode walls and sun-dried mud roofs, resting on stone foundations and inhabited by 150 people in the form of permanent settlement.
  - Growing wheat of two types-*Emmer*, a tetraploid awned wheat (2n= 28, *Triticum dicoccum*), commonly called *Farro in Europe*; and Einkorn, commonly called *Khapli or Single grain wheat* a diploid hulled wheat (2n=14, *Triticum monococcum),* against modern wheat (2n=42); primitive barley and lentil.
  - Using stone sickle, cutters, bowls and other objects.

Todays agriculture serves food for 2.3 billion Houses inhabited by 8.02 billion people , cultivating 6000-7000 species of crops; with $12.25 trillion global agriculture market (2022), expected to grow to $13.40 trillion in 2023 at CAGR of 9.4%.

Indian Agriculture Scenario

India Shares (2019)

2.44 % of World Area

11.28 % of World Arable Land

17.73 % of World Population.

4.00 % of Water

12.70 % of Cattle

56.70 % of Buffaloes

14.50 % of Goats

- 10.94 % of total cereals production
- 21.60 % of rice
- 25.44 % of total pulses production
- 15.70 % of milk
- GDP 4933.25 INR Billion in the second quarter of 2022

Employing 152 million (financial year 2021)

It would take 1.63 India to sustain our current level of food production If current trends continue……

It would take 1.75 Earths to sustain our current population. If current trends continue, we will reach 3 Earths by the year 2050 (How many earths will we need in 2050?)……

Story of A Tee (T) shirt

- It takes about 2,700 liters of water to make just one T-shirt , which is enough water for one person to drink for 900 days
- Our society believes there is plenty of consumable water to go around for everyone. Not really.
- Our planet's water is 97 percent salty and two percent snow and ice,
- which leaves less than one percent that we can access.
- However, 70 percent of that one percent is used to grow crops.
- Cotton is a very thirsty crop. Can you imagine how many t-shirts are in our city, towns, state, country, globally, and on this planet?
- Now over 75,000 Pakistani farmers have reduced their use of water by 39 per cent, helping reduce pressure on the Indus River

Approx. 2 billion T shirt annually

Reducing Water Footprint

The water footprint of a product (good or service) is the volume of fresh water used to produce the product, summed over the various steps of the production chain.

Blue Water Footprint: the loss of water from a particular location is referred as consumption. Among the evapotranspiration (ET) losses, our concern is to reduce the share of the evaporation (E) and shift it to the transpiration (T), as greater the share of T, which further enhances nutrients uptake in the plants through the roots and greater is the water productivity (Hossain and Bhatt 2019)

Green Water Footprint: comprises the rainwater, which instead of going waste must be used for recharging of underground water tables, which further cuts down the power required to withdraw underground water to the surface

Gray Water Footprint : it could be expressed as water volume used for producing per kg of product. However, the classical way of its representation is as m3 ton1 . Normally, two types of WFs expressed as direct (as person composed of consumed water) and indirect (person comprised of consumption of products) water footprint

Conceptual Foundation for Extension Impact

Productivity Gaps and Extension

- There are four yield levels for each type of technology infrastructure:
  - A: Actual yields
  - BP: Best practice yields
  - BPBI: Best practice, best infrastructure yields
  - BPBIRP: Best practice, best infrastructure, research potential yields
- These yield levels define three "gaps":
  - G(P): A practices gap between the best practice (BP) yield and actual (A) farmers' yields
  - G(I): An infrastructure-institutions gap between the best institutions, best practice (BPBI) yield and best practice (BP) yield
  - G(R): A research gap between the research potential yield (BPBIRP) and the best practice, best institutions (BPBI) yield
- These gaps provide a way to classify the contribution of extension activities and to show how research and extension are linked.

Rice water footprint

- Calculations of rice water footprint (Bhatt Personnel communications 2017
- 1 acre 4000 m2
- I irrigation 10 cm or 0.10 m
- 25 irrigations 250 cm or 2.5 m
- Total water used 4000 2.5 = 10,000 m3
- 1 m3 1000 L
- 10,000 m3 =10,000,000 L
- 3000 kg paddy grains= 10,000,000
- **1 kg paddy grains=3333 L**
- Rajan Bhatt, KVK Amritsar-Punjab Agricultural University Punjab India ,
- Water Footprint in Rice-Based Cropping Systems of South Asia 9 Rajan Bhatt, Akbar Hossain, Mutiu Abolanle Busari, and Ram Swaroop Meena. Chapter · December 2020 DOI: 10.1007/978-981-15-9496-0_9, Research Gate.

Resource Conservation Technologies in Rice Based Cropping System

1) Short Duration Rice Cultivars
2) Date of Rice Transplanting
3) Direct Seeded Rice (DSR)
4) Laser Land Levelling (LLL)
5) Permanent Raised Beds (PRB)
6) Irrigation Scheduling Based Using Tensiometers
7) Zero-Tilled Wheat
8) Crop Diversification

Return on Investment (ROI) for Extension Programs

- ROI essentially measures performance by assessing the efficiency of an investment.
- ROI values help communicate the worth of Extension programs to key stakeholders and show the net return on investments (Jayaratne, 2010).

Calculating ROI for an Extension Program

- The following are guidelines to consider when estimating ROI and communicating the results (Jayaratne, 2010):
  - Identify the desired outcome.
  - Source relevant information regarding cost of the program and make it easily accessible to those assessing the program.
  - Identify outcomes and impacts of the program being evaluated.
  - Convert outcomes/impacts to monetary values.
  - Clearly state any assumptions.
  - Provide proper justifications.

Source: Ali Amanda D. *et al, 2016*

Example of Calculating ROI for a Behavior Change in a Water Conservation Program

S.No.	Items	Amount in USD
1	Total Monetary cost including personnel time and labor costs for project implementation and evaluation	1,000
2	Behaviors influenced: 35 people adopted proper irrigation techniques	-
3	Cost to influence a person's behavior to adopt water conservation practices	28.57/person
4	Benefit per behavior (average savings of $30 monthly on their water bills	30/person
5	Gross or total economic benefit	1,050
6	Net benefit	50
7	Return on Investment (Net benefit/Total Monetary cost)* 100	5%

Following year, the same evaluation process could be done if the ROI is 20%, i.e. 'Water Conservation' program is improving compared to the ROI of 5% in the previous year.

Source: Ali Amanda D. *et al, 2016*

Estimation of Benefit-to-Cost Ratio of KVK

- The expenditure on the KVK is taken from the budget.
- estimate the gross direct benefit of the KVK by multiplying the per unit incremental Net Farm Income (NFI) in Rs/ha accrued due to KVK access and the gross cropped area operated by the direct beneficiaries of KVKs.
- Calculate the percent of farm households are reported as direct beneficiaries of the KVKs, and the percent of the gross cropped area they together cultivate.
- A survey reported that 3.6 percent of farm households are as direct beneficiaries of the KVKs, and they together cultivate 4.9 percent of the gross cropped area.
- The total direct net benefits due to KVKs are estimated to range from Rs 43 billion to Rs 64 billion and the benefit-to-cost ratio ranges from 8 to 12.
- This compares well with Benin et al. (2011) who found that the estimated benefit-to-cost ratio for spending on agricultural extension ranged from 3 to 6 in Uganda.
- The additional surplus generated from KVK is about INR 6414 crore by using Endogenous Switching Regression (ESR method).

The Impact of India's Farm Science Centers (Krishi Vigyan Kendras) on Farm Households' Economic Welfare-Evidence from a National Farmers Survey, IFPRI Discussion Paper 01832, April 2019

Agro-Ecosystem Properties

- Four system properties which, together, describe the essential behaviour of agro-eco-systems. These are **productivity**, **stability**, **sustainability and equitability**.

- **Productivity**
  - Is the net increment in valued product per unit of resource (land, labour, energy or capital).
  - is commonly measured as annual yield or net income per hectare or man hour or unit of energy of investment.

- **Stability**
  - Is the degree to which productivity remains constant in spite of normal, small scale fluctuations in environmental variables, such as climate, or in the economic conditions of market.

AGRO-ECOSYSTEM PROPERTIES

Sustainability

Can be defined as the ability of a system to maintain its productivity when subject to stress or perturbation.

A stress is here defined as a regular, sometimes continuous, relatively small and predictable disturbance, for example the effect of growing soil salinity or indebtedness.

A perturbation, by contrast, is an irregular, infrequent, relatively large and unpredictable disturbance, such as is caused by a rare drought or flood or a new pest.

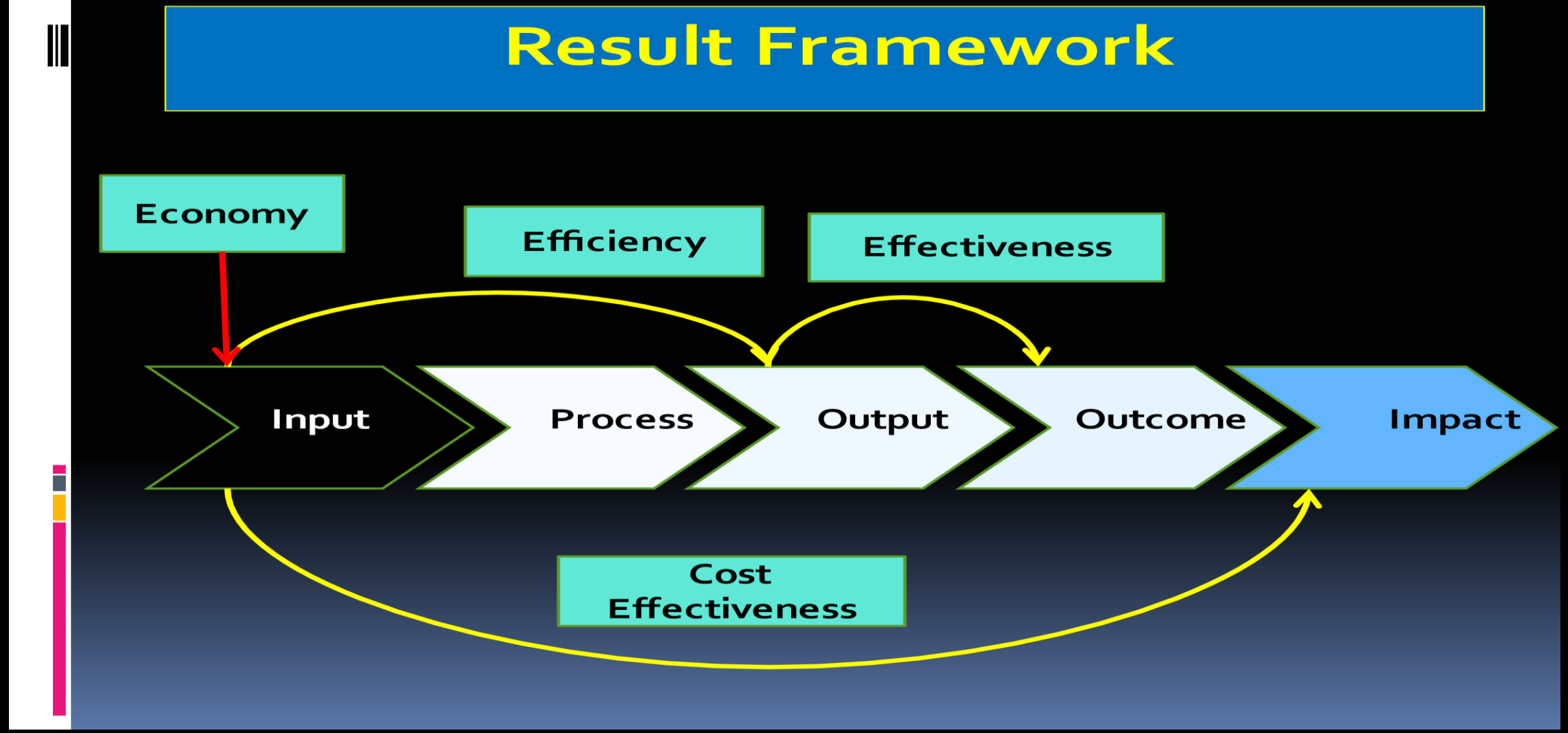
AGRO-ECOSYSTEM PROPERTIES

Equitability

Is a measure of how evenly the productivity of the agro-eco-system is distributed among the human beneficiaries.

The more equitable the system, the more evenly are the agricultural products, the flood or the income or the resources, shared among the population of the farm, village, region or nation.

RF the Most comprehensive Impact Assessment



Impact Assessment (IA) CIMMYT

IA is defined as

"a process of systematic and objective identification of the short and long-term effects–positive and negative, direct or indirect intended or unintended, primary and secondary–on households, institutions and the environment caused by on-going or completed development activities such as a program or project."

- An IA helps researchers in development to better understand the extent to which activities affect the poor, which objectives are fulfilled, and the magnitude of their effects on people's welfare.
- An IA evaluates the effects of the different stages of an innovation system or intervention, from: Inputs > Outputs > Outcomes > Final Impacts
- The IA should provide information and results that are credible and useful, enabling lessons learned to be used for decision making by all stakeholders. Impacts are the broader, longer-term, economic, social, or environmental effects resulting from research or development interventions

the 5 RWs:

The OECD (2006) distinguishes between five types of rural actors, -

- Rural World 1 – large-scale commercial agricultural households and enterprises; -
- Rural World 2 – traditional agricultural households and enterprises that are not internationally competitive; -
- Rural World 3 – subsistence agricultural households and micro-enterprises; -
- Rural World 4 – landless rural households and microenterprises; and –
- Rural World 5 – chronically poor rural households, many of which are no longer economically active
- The 5RW model provides a useful analytical framework for development programmes because it considers poverty relevant groups (RWs 3 to 5), while simultaneously acknowledging the role that larger, non-poor farms and enterprises (RW 1 and partly 2) can play in the growth process. (OECD (Organisation for Economic Co-operation and Development). (2006). Promoting pro-poor growth: Agriculture. Paris: Autho)

SMART Result Framework Based Impact Assessment Plan

- SMART: Specific, Measurable, Achievable, Realistic, and Time-Bound

A result framework-based analysis of an agriculture development program involves evaluating the program's effectiveness and impact based on predefined results and indicators. Here's a step-by-step guide on conducting such an analysis:

1. **Define the program's objectives:** Start by clearly understanding the objectives of the agriculture development program. These objectives could include increasing crop productivity, improving farmers' income, enhancing food security, promoting sustainable farming practices, or any other specific goals.
2. **Identify key result areas**: Determine the key areas or outcomes that the program aims to achieve. These can be derived from the program's objectives and may include indicators such as increased agricultural production, adoption of improved farming techniques, reduction in post-harvest losses, or improved market access for farmers.
3. **Develop a result framework**: Create a result framework that outlines the logical progression from program activities to intermediate results and ultimately to the desired long-term outcomes. The framework should define the cause-and-effect relationships between inputs, outputs, outcomes, and impacts. It should also identify specific indicators and targets for each level of results.

Result Framework Based Impact Assessment Plan contd.

4. **Collect data and monitor progress:** This can include quantitative data (e.g., agricultural production levels, number of farmers adopting new practices) as well as qualitative information (e.g., farmers' perceptions, stakeholder interviews). Regular monitoring will help track the program's implementation and identify any deviations from the expected results.

5. **Assess outputs and outcomes**: Evaluate the program's outputs (direct results of program activities) and outcomes (changes resulting from the program's outputs). Compare the actual results achieved against the targets set in the result framework. Analyze the reasons behind any gaps or variations and identify both positive and negative trends.

6. **Measure impact**: Assess the long-term impact of the program by examining changes in the broader agricultural sector and the lives of farmers and other stakeholders. Use indicators such as increased income levels, reduced poverty rates, improved nutrition, or enhanced environmental sustainability. Consider employing appropriate evaluation methods, including surveys, case studies, or econometric analysis, to measure the program's impact

Result Framework Based Impact Assessment Plan contd.

7. Analyze contributing factors: Identify the factors that have influenced the program's results and impacts. These may include facilitators (e.g., supportive policies, availability of resources, capacity-building efforts) and barriers (e.g., limited access to credit, market constraints, climate change). Analyze the role of these factors in shaping the outcomes and draw insights for future program improvement.

8. Draw conclusions and make recommendations: Based on the analysis, draw conclusions about the program's effectiveness, efficiency, and relevance. Assess the extent to which the program has achieved its objectives and delivered the expected results. Provide recommendations for program refinements, modifications, or scaling up to enhance its impact and sustainability.

Remember, conducting a result framework-based analysis requires a systematic and comprehensive approach. It is essential to involve relevant stakeholders, use a mix of quantitative and qualitative data, and ensure the analysis is conducted in an unbiased manner

Establish Result framework Plan

- Baseline and target values for selected measures to provide the means for verification to measure changes in the indicators
- Data sources or methods for data collection.
- The responsibility for collecting or providing the data (for example, independent evaluation team, project staff, and so forth).
- Designated intervals at which the data will be collected or provided.
- Assumptions and risks associated with the indictors or information being collected (such as the assumption that data will be available from a second party)

"Output," "Outcome," and "Impact"

1. Output: They are typically tangible and measurable in nature. Outputs represent the immediate results of program interventions and can include activities completed, goods produced, services provided, or events organized. Outputs are usually expressed in quantitative terms, such as the number of farmers trained, hectares of land cultivated, or agricultural inputs distributed.
2. Outcome: Outcomes are the changes that occur as a result of the program's outputs. They represent the medium-term or intermediate effects of the program and often relate to the program's specific objectives. Outcomes are typically measured in terms of changes in knowledge, behavior, attitudes, or practices among the program's beneficiaries or target population. For example, an outcome could be increased adoption of sustainable farming practices, improved access to markets, or enhanced resilience to climate change.

"Output," "Outcome," and "Impact" contd.

- Impact: Impact refers to the long-term, broader changes that are attributable to the program's outcomes.
- It represents the ultimate or desired effects of the program, which go beyond the immediate beneficiaries and can extend to the larger community or society.
- Impact is typically measured in terms of significant and sustainable improvements in social, economic, or environmental conditions.
- Examples of impact include increased household income, reduced poverty rates, improved food security, or enhanced environmental sustainability.

The Definition (OECD 2010)

- Inputs: The financial, human, and material resources used for the development intervention.
- Activities: Actions taken or work performed through which inputs, such as funds, technical assistance and other types of resources, are mobilised to produce specific outputs
- Outputs: The products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes

- OECD (2010). Glossary of Key Terms in Evaluations and Results Based Management. OECD, 2002, re-printed in 2010.

Relationship between the terms:

- **Outputs are the direct results of program activities, and outcomes are the changes that occur as a result of these outputs. The achievement of outcomes contributes to the program's impact. In other words, outputs lead to outcomes, and outcomes, in turn, lead to impact. The relationship can be depicted as follows:**

- **Outputs → Outcomes → Impact**

- It's important to note that while outputs are relatively easier to measure, outcomes and impact can be more challenging to evaluate and attribute solely to the program. Robust evaluation methodologies and data collection approaches are often required to establish the causal link between program activities and the desired impact.

Theory of Change: Theory of Change is a methodological approach that maps out the causal pathway of a program, linking inputs, activities, outputs, outcomes, and impacts. It helps in understanding the logic behind the program's intervention and assessing the contribution of various activities to the desired impacts. Theory of Change is often used in combination with other valuation methods to provide a comprehensive assessment.

Efficiency

Efficiency: Efficiency refers to the extent to which a program utilizes its resources to produce outputs. It is typically measured by comparing the inputs (e.g., financial resources, staff, time) to the outputs generated. The formula for calculating efficiency can be:

Efficiency = (Outputs / Inputs) * 100

For example, if a program invested $100,000 and produced 1,000 units of output, the efficiency would be:

Efficiency = (1,000 / 100,000) * 100 = 1%

Effectiveness

Effectiveness evaluates the extent to which a program achieves its intended outcomes. It assesses the relationship between outputs and outcomes. Effectiveness can be calculated by dividing the Outcome by output.

- Effectiveness = (Outcome/ Output)* 100

Economic Viability/ cost effectiveness

Economic viability assesses the financial sustainability and cost-effectiveness of a program. It considers the costs incurred in achieving the outcomes and impacts generated. The formula for economic viability may vary depending on the specific analysis and cost components considered. One common approach is to calculate the cost per unit of impact:

Cost per Unit = Impact/ Input

For example, if a program incurred total costs of $500,000 and achieved 1,000 units of impact, the cost per unit would be:

Cost per Unit = $500,000 / 1,000 = $500

These formulas provide general frameworks for assessing efficiency, effectiveness, and economic viability based on output, outcome, and impact data

Theory of Change

1. Social Impact Assessment: Intangible outputs and outcomes, such as social benefits and changes in livelihoods, can be evaluated through social impact assessment methodologies. These assessments involve qualitative and quantitative techniques, including surveys, interviews, focus groups, and participatory approaches to capture changes in social capital, empowerment, social cohesion, and well-being.

2. Environmental Assessment: Agriculture development programs can have environmental impacts that are not easily quantifiable in monetary terms. Environmental assessments, such as environmental impact assessments (EIAs) or sustainability assessments, evaluate the program's effects on natural resources, ecosystem services, and environmental sustainability. These assessments often rely on indicators, expert judgments, and modeling to measure environmental changes.

3. Outcome Mapping: Outcome mapping is a participatory approach that focuses on changes in behavior, relationships, and actions of program participants and stakeholders. It helps assess the intangible outcomes and impacts by identifying progress towards desired outcomes and understanding the program's contribution to broader changes. Outcome mapping involves defining outcomes, developing progress markers, monitoring and documenting changes, and reflecting on lessons learned.

Valuing Intangible Benefits

- Such as increased knowledge and empowerment, in economic terms can be challenging since these benefits do not have readily observable market prices. However, there are some methods and approaches that can be used to estimate the economic value of intangible benefits. Here are a few commonly used methods
- Stated Preference Methods : For example, individuals can be asked about the amount they are willing to pay for an educational program that increases their knowledge
- Revealed Preference Methods: For instance, the travel cost method can be used to value the knowledge gained from visiting an educational or training facility by analyzing the costs individuals incur (e.g., travel expenses) to access the facility. The idea is that individuals would only spend such costs if they derive value from the intangible benefits offered.

Valuing Intangible Benefits

- **Productivity-based Methods:** For example, increased knowledge or empowerment gained through an agriculture development program may enhance farmers' decision-making abilities, leading to higher yields or improved agricultural practices. The increase in productivity or earnings can be monetized by estimating the additional value generated as a result of the intangible benefits.
- **Cost-based Methods**: For instance, increased knowledge may help farmers reduce input costs, improve efficiency, or minimize risks, leading to cost savings. These cost savings can be quantified and attributed to the intangible benefits.
- Social Return on Investment (SROI): a comprehensive approach that aims to measure and value the social, economic, and environmental impacts of an intervention. It involves identifying and quantifying the outcomes and impacts, including intangible benefits, and assigning monetary values to them. SROI takes into account the perspectives of multiple stakeholders and considers both financial and non-financial value creation.

Potential Confusions

Firstly,

- there is sometimes confusion between activities and outputs. Outputs the products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes.

Secondly,

- The second confusion is between outputs and outcomes, and here the difference can be more subtle. Some definitions of output only include the deliverables of a project or programme, whilst others interpret initial changes (such as enhanced knowledge or understanding following a training course, or community organisations engaging with government following community mobilisation meetings) as outputs.

Potential Confusions contd.

The OECD DAC definition, for example, allows that an output "may also include changes resulting from [an] intervention which are relevant to the achievement of outcomes."

Thirdly,

- The third confusion is between outcomes and impact, For example, the OECD DAC definition ('positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended') allows for long-term changes in institutional capacity or policy change to be classed as impact. However, the preferred definition for many CSOs is "lasting or significant change – positive or negative, intended or not – in people's lives brought about by an action or a series of actions" (Roche 1999), which focuses more on change at individual or household level

Potential Confusions contd.

Working with outcomes

- Outcomes are usually very important for an M&E system.
- because they provide early information on whether a project or programme is on course, and whether any desired changes are beginning to happen.
- For instance, if a deliverable of a project is to provide seeds to farmers, an early outcome might be that 90% of the seeds have been planted by farmers.
- This does not mean the project or programme has achieved its desired impact, but it means that it remains on track.
- If the farmers are not planting the seeds, this lets project staff know that adjustments are required, and the ultimate impact is not likely to be achieved.

Potential Confusions contd

- Any M&E system or process designed to feed into management decision-making needs to assess outcomes on a regular basis. The danger otherwise is that M&E focuses only on what is being delivered, assuming that if products or services are delivered properly they will automatically translate into change.
- Outputs, outcomes and impact are terms used to describe change at different levels. Outputs are the products, goods and/or services which result from a development intervention. These are designed to produce outcomes – the short- to medium-term effects of an intervention – and eventually impacts. Whilst the terms are in common use, there is great inconsistency in how they are interpreted.

- Outputs, outcomes and impact. Outputs-outcomes-and-impact.pdf (intrac.org)

To Conclude

- In the context of present scenario of agriculture, **there is need for a paradigm shift in both extension research and methodology.**

- Extension research **need to be more broad-based and holistic both in content and scope**,
  - much beyond determining impact of socio-economic factors for transfer of technology of post mortem in nature.

- There is need for research in
  - **micro level institutional restructuring**
  - **management of extension programme,**
  - **models of research-extension-civil society linkage**
  - **capacity building of farmers**
  - **models of empowerment**
  - **mainstreaming gender implication in agriculture**
  - **overall sustainability of agricultural extension as a discipline**

Thank You