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Towards measuring interventions in rainfed areas

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Abstract

This paper underlines the process through which we have arrived at the indicators for various thematic nodes to measure and evaluate interventions or comprehensive pilots in rainfed areas. We conceptualize a simple four stage process, i.e., 'objective or goal formulation', 'means finding', 'targets settings' and 'indicator identification', which we refer to as OMTI (Objective-Means-Target-Indicators) framework. In indicator literature, this kind of framework can be categorized under "thematic framework" or "goal oriented framework". The operationalization of OMTI framework highlights its nuances and brings forth its limitations. In order to overcome some of these limitations, we validate the OMTI framework using the systems approach and also classify the indicators as per some of the other frameworks in the literature. This can help formulate a baseline survey for interventions in rainfed areas as also in other areas with appropriate modifications.

Key words: Indicator exercise, OMTI (Objectives-Means-Targets-Indicators), rainfed agriculture, systems framework, thematic framework

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1. The OMTI framework

For any indicator development exercise, conceptualizing a framework is of paramount importance - the foremost task. In a recent work, Nathan and Reddy (2012) borrow from IISD (1999, 2005) to point out the relevance of a framework in indicator development in providing a logical structure that helps in deciding what to measure and what to expect from such a measurement and which data to use. Further, a well-thought-out framework should be easy to understand even from a layman's perspective. It also bestows objectivity in the selection of indicators. In addition, it also facilitates the indicators set to be complete and comprehensive, as the absence of a framework might suffer from researchers' bias making it dense in some areas, and sparse or even empty in other important areas.

We conceptualize a simple four stage process, i.e., 'objective or goal formulation', 'means finding', 'targets settings' and 'indicator identification', which we refer to as OMTI (Objective-Means-Target-Indicators) framework. In indicator literature, this kind of framework can be categorized under "thematic framework" or "goal oriented framework". We would like to highlight two aspects of this broad class of thematic framework.

First, thematic framework is suitable where we have an agenda to achieve. An example of this is the set of indicators developed by United Nations Commission on Sustainable Development (UNCSD, 1996) for assessing sustainable development at national level. This framework is based on the Agenda 21, which is United Nations' action plan for sustainable development developed in the 1992 Earth Summit. The themes and sub-themes of UNCSD (1996) have correspondence with different chapters of Agenda 21.

The second aspect of this framework is its close relation with policy. Nathan and Reddy (2012) drawing from Australia (1998) note that initiatives based on thematic framework generally emerge as a consequence of particular concerns at local, national, and global levels and cite Newton (2001) to indicate that the core idea in thematic framework is "*no policies without indicator and no indicator without policy*". In this framework, first the goals/themes are set, then the issues under each theme/sub-theme are identified, and then the indicators are mapped to represent each issue."

The above-mentioned two aspects of thematic framework, viz., 'suitability with a purpose' and 'close relation to policy', make it appropriate for our exercise refers to interventions in rainfed areas driven by a purpose, i.e., propagation of locally-appropriate, knowledge-based and cost-effective agricultural practices.[3] This purpose would get reflected in the exercise. Further, the

[3] We refer to intervention by the Revitalizing Rainfed Agriculture (RRA) Network that aims to build up evidence-base for relevant public policy support. It is in this context that interventions have started through comprehensive pilots (CPs) at different agro-climatic locations across India. At each CP, the interventions could bring together knowledge from different perspectives as per their requirement. Some of these are on water, soils, seeds, millets,

actions also have an intention to influence policy directly. Additionally, this framework gives one the flexibility of adding and subtracting sub-themes as new issues emerge and old issues lose their importance. However, as indicated earlier, this framework might suffer from researchers' bias as one might miss out on certain sub-theme or over emphasize certain other. We have addressed this limitation in the current exercise by interacting and involving the stakeholders and following some other strategies. We will detail the same in the next section. Now, we briefly elaborate on the four stages of this OMTI framework.

Objective (**O**): This is the first stage. Objectives are nothing but broad statements which we wish to pursue under each node. All the participants in the interventions must be in agreement on these statements. These statements essentially identify the problems which we want to overcome. They specify the 'directions' for improvement. Examples for objectives for different nodes are given below.

- Fisheries node: an objective can be 'to enhance fish production and related income in the intervention area if there is potential'.
- Millets node: an objective can be 'to increase millet consumption in the intervention area'.
- Livestock node: an objective can be 'to improve health care services for livestock in the intervention area'.
- Seeds node: an objective can be 'to ensure timely availability of seeds in the intervention area'.
- Soils node: an objective can be 'to enhance soil health in the intervention area'.
- Water node: an objective can be 'to provide protective irrigation for rainfed crops in the intervention area'.

The objectives provide guidance on the types of solutions, but they are not the solution themselves. In other words, objectives give direction of improvement, not the 'means'. So, 'increase in millet consumption' can be an objective; but how to achieve that increase in consumption will not be part of the objective until and unless an intervention is insistent on any particular means. In fact, means are the subject of the next stage. Objectives and means are to be kept separate. When one includes means within objective, it becomes limited, which leaves no scope for other alternative means. Rather objectives should be such that they are able to provide the basis for appraisal of alternative means or solutions.

Means (**M**): This is the second stage. It is about the ways or methods which are to be adopted to achieve the objective in question. Means imply the 'actual' ways applied on ground, not all alternative/possible ways to attain the objective. There can be one or more means per objective.

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livestock, and fisheries and are referred to as thematic nodes. In addition, these interventions also call for integration with the various government departments and existing schemes to enable scaling up as also with markets and other institutions (RRA, 2013).

Examples for means for different nodes are given below (note, these correspond to the example of objectives given above).

- Fisheries node: one of the means for 'enhancing fish production' can be through provision of technical and extension support for all aspects of fish production.
- Millets node: one of the means for increasing millet consumption' can be the including of millets in the midday meal scheme in the area.
- Livestock node: one of the means for 'improving healthcare services for livestock' can be the provision of vaccination services for the livestock in the area.
- Seeds node: one of the means for 'ensuring timely availability of seeds' can be the establishment of seed banks.
- Soils node: one of the means for 'enhancing soil health' can be through biomass based manuring.
- Water node: one of the means for 'providing protective irrigation' can be through formation of farmer groups requiring protective irrigation.

There can be overlap among means of different objectives. For instance, 'increasing awareness on millet' can be a mean both for 'millet consumption' objective and 'millet production' objective. However, under OMTI framework, such overlaps among means will finally get reflected in terms of indicators becoming the same. This implies that there can be common indicators for different objectives, which is acceptable. So, all the means adopted to attain each of the objectives needs to be noted without bothering about overlaps.

One of the fundamental rationales for having this stage is that most of the "targets" and "indicators" will emanate from means and not from objective directly. However, there can be certain targets and indicators emanating directly from objective. For instance, with regard to the objective of increasing consumption of millets, without going into means and targets, the indicators related to consumption of millets can be directly formulated. Further, this stage of 'means' can be divided into sub-stages (intermediary means) till one reaches from objective stage to target stage. For instance, the means of 'provisioning technical and extension support' for the objective of 'enhancing fish production' will have a sub-means of 'establishing a resource centre to provide those technical and extension support'.

Targets (**T**): This is the third stage referring to the achievable targets that one is aiming at. It needs to be borne in mind that targets are to be specified in terms of time and quantity. For instance, in the case of consumption of millets in intervention area through the public distribution system the target can be 50 per cent households of that area having their due share of millets through this system by the *first* year of intervention through the millets node. Targets always go with time and quantity specifications. Targets are location specific. Depending on the ground situation, targets will differ across different pilots/interventions.

Indicators (**I**): This is the last stage in OMTI framework. Indicators emanate from the targets. It helps assess the progress towards the targets that one likes to meet. An example of indicator can be the number of households of the intervention area having supplies of millets through public distribution.

The schematic diagram of OMTI framework is given in Fig. 1. It shows that the four stages need to run for every thematic node of the intervention. If appropriate, one can also branch a thematic node into 'sub-themes' and have the four-stage model under each sub-theme.

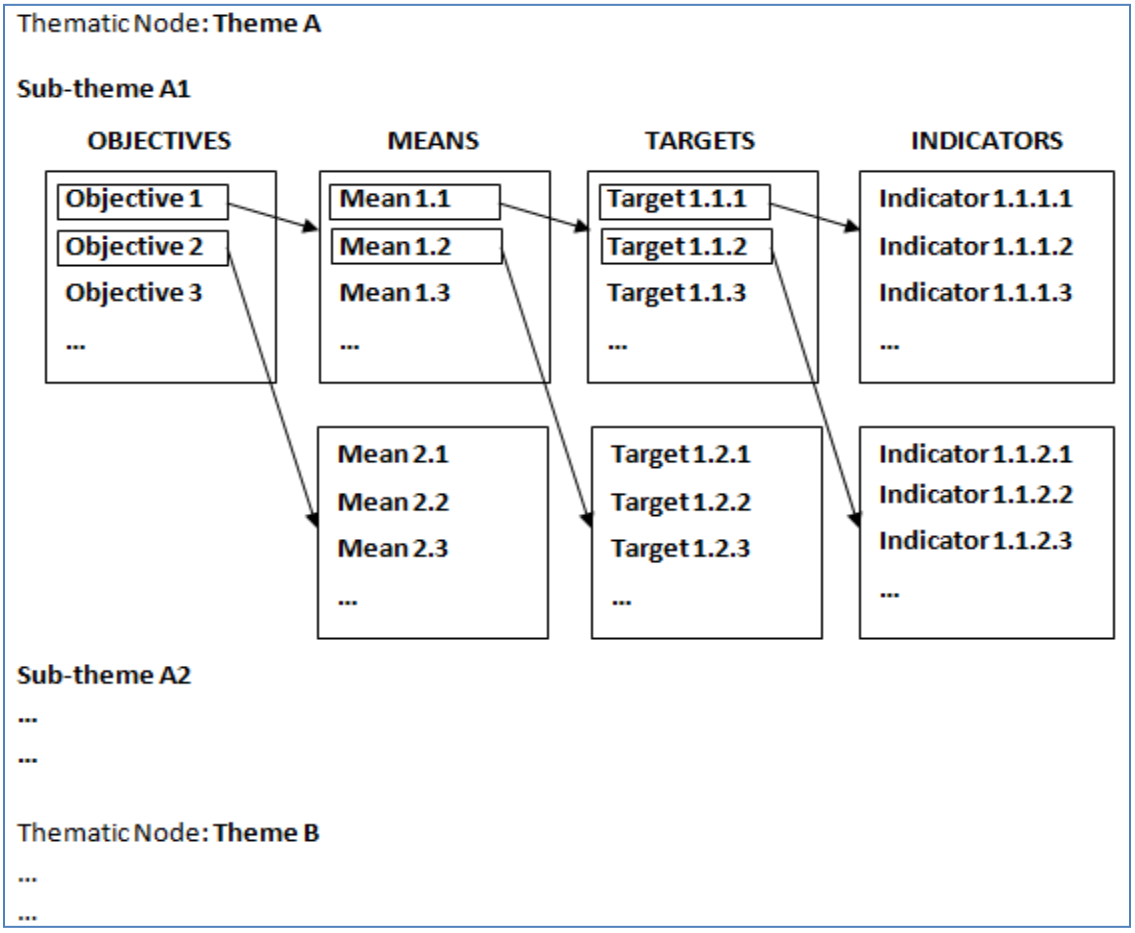


Fig. 1 OMTI framework

From the figure it might appear that one objective will lead to many indicators; this need not be the case always. The mapping is one-to-many, i.e., one objective will lead to many means, one means to many targets and one target to many indicators. However, this mapping also includes one-to-one mapping as a special case, i.e., one objective may lead to just one 'means' which might have just one 'target' that target will have just one 'indicator'.

In different interventions or comprehensive pilots, depending on the ground situation, the priority among objectives might change. So is the case for means, as certain means have greater applicability in certain locations. As mentioned earlier, the targets will change from location to location. These variations in the objectives, means, and targets across interventions will get reflected in indicators. However, in this exercise we attempt to give a comprehensive list of indicators. It goes without saying that the priority of these indicators will be different across different agro-climatic locations.

2 Making OMTI operational

We have operationalized OMTI framework by involving different stakeholders. The discussions in every node comprised of the nodal experts, the members of the research node or others from the RRA network who are involved in the indicator exercise, and an independent researcher. While forming such groups for discussion, we did keep in mind that any stakeholder who is essential for this indicator initiative is not left out. This group needed to brainstorm on finding the objectives under each node. Here, we are not capturing the priority of each objective, because over time, priority might change. What we are aiming at is to cover all possible objectives related to the interventions.

The nodal experts are people who have the knowledge and expertise of ground realities and all the related facets. In order to find different ways and means and setting targets the opinion of people working in different interventions are important. Hence every time we prepared a draft list of objectives to indicators, they were circulated among the thematic partners and the anchor partners facilitating the interventions/comprehensive pilots for their feedback.

One might prefer to consider the indicators resulting in the above process as ‘potential’ indicators and not ‘final’ ones. This is done in situations where a few indicators are intended. In such situations the indicators emanating from OMTI exercise are made to go through some filters to arrive at a final list of indicators. These filters are generally based on several criteria. However, in the current exercise, we are not aiming for a few indicators. Rather we would like to have an exhaustive list of indicators which will help us in designing the questionnaires. At a later stage, when we would like to settle for a fewer indicators, we can consider such filtering exercise. And, in such an exercise, we need to include other stakeholders including the local participants, other residents and media.

One might also ask about the rationale of having a set of indicators instead of a single index. This is one of the dilemma most of the indicator initiatives encounter—the dilemma to consider a ‘set of indicators’ or an ‘aggregated index’. Both have their advantages and limitations. An example of aggregated index is Human Development Index (HDI) by UNDP where the indicators selected under the three dimensions health, education, and income are aggregated to make a composite index, i.e. HDI. An example of 'a set of indicators' is millennium development goals (MDGs), where indicators are placed under eight different goals. In our present exercise,

we will consider 'a set of indicators' against an ‘aggregated index’ for the following three reasons.

(i) In an aggregated index, there is always loss of information. When we combine multiple numbers to one number, obviously this new number will not be able to retain the full information of the constituting members. We don’t want any loss of information at this stage.

(ii) In an aggregation, compensability among the different components is always assumed. Compensability means fall of one indicator value can be compensated by rise in another indicator value. In ecosystems there are phenomena of synergy or conflict. Hence, for indicators related to ecosystem such compensability is undesirable (Funtowicz *et al*., 1990).

(iii) Most importantly, for all practical purposes, in a step wise development of indicators – ‘set of indicators’ comes before ‘an aggregated index’. Hence, it is pertinent to go for a set of indicators first and at a later stage, if only a limited number of indicators turn out to be important, one can think of an aggregation.

Thus, we limit ourselves to a set of indicators for each node for the time being.

3 Validating OMTI framework

3.1 Systems Model

As mentioned earlier, the OMTI framework being a kind of thematic framework may suffer from researchers’ bias. This means, during objective formulation, one might miss certain objectives linked with a holistic view. To overcome this, we have developed a systems model at the overall level (Fig. 2) and for each node where all the variables (components) of the node are considered and linkages among them are established. The system model corresponding to the fisheries node is given in Fig. 3. In the system model, the thematic nodes are interlinked with each other. The interventions could help increase income, but also nutrition and employment. It also requires involvement of the government and markets/institutions. Some of the pertinent features are discussed below.

Internal Benefits: Although the interventions directly aims at increasing the income for the households, there are other benefits derived from the specific interventions under millet, fisheries and livestock nodes as they will increase the nutrition status for all the households, if the consumption pattern increases, which is also the core objective for these nodes.

Convergence with line departments: There is also the creation of jobs from the available public works from different line departments e.g. Using Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) for tank silt application under soils node and creating water

bodies for fish ponds under fisheries node. In addition, jobs could also be created by establishing millet processing facilities through local CP partners.

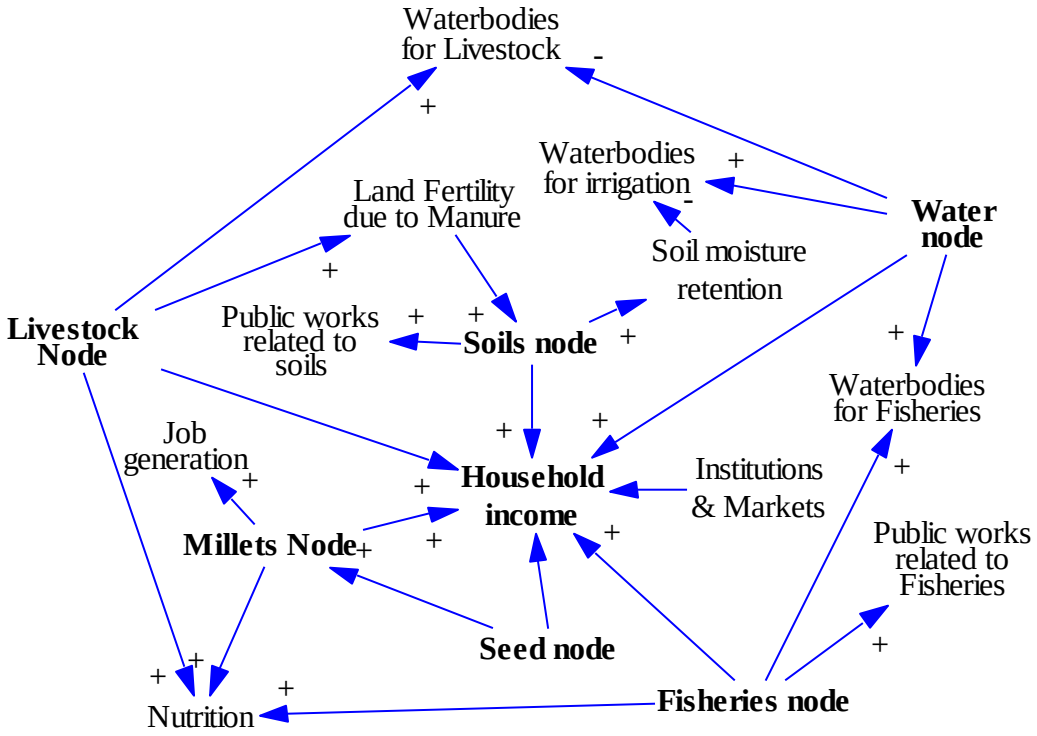


Fig. 2 System Model for all the Nodes

Interdependency with each node: From the livestock node, through farm yard manure (FYM), the soil fertility can be improved which is the core objective of soils node. If the soil moisture retention capacity is increased, then we can go for the crops which will have less dependency on irrigation. And the water harvesting structures will help in promoting protective irrigation and also increase the water bodies for livestock (drinking water purpose) and fisheries. In the same way, seeds node will help in making the availability of seeds from different millet varieties for cultivation.

3.1.1 Systems Model for Fisheries

The system model for fisheries in rainfed areas is given in Fig. 3. For fish production water bodies are required. With the increase in number of water bodies and area per water body, the water availability in the intervention area will increase. One needs to note, water availability is also constrained by the rainfall. Given the rainfall and water bodies, water availability can be increased by better management practices and water conservation. Water availability has a direct bearing on fish production. However, water bodies utilized for fish production will have a trade-off with other usage of water. Similarly, land utilized for fish production through water bodies will have a trade-off with land use for other purposes.

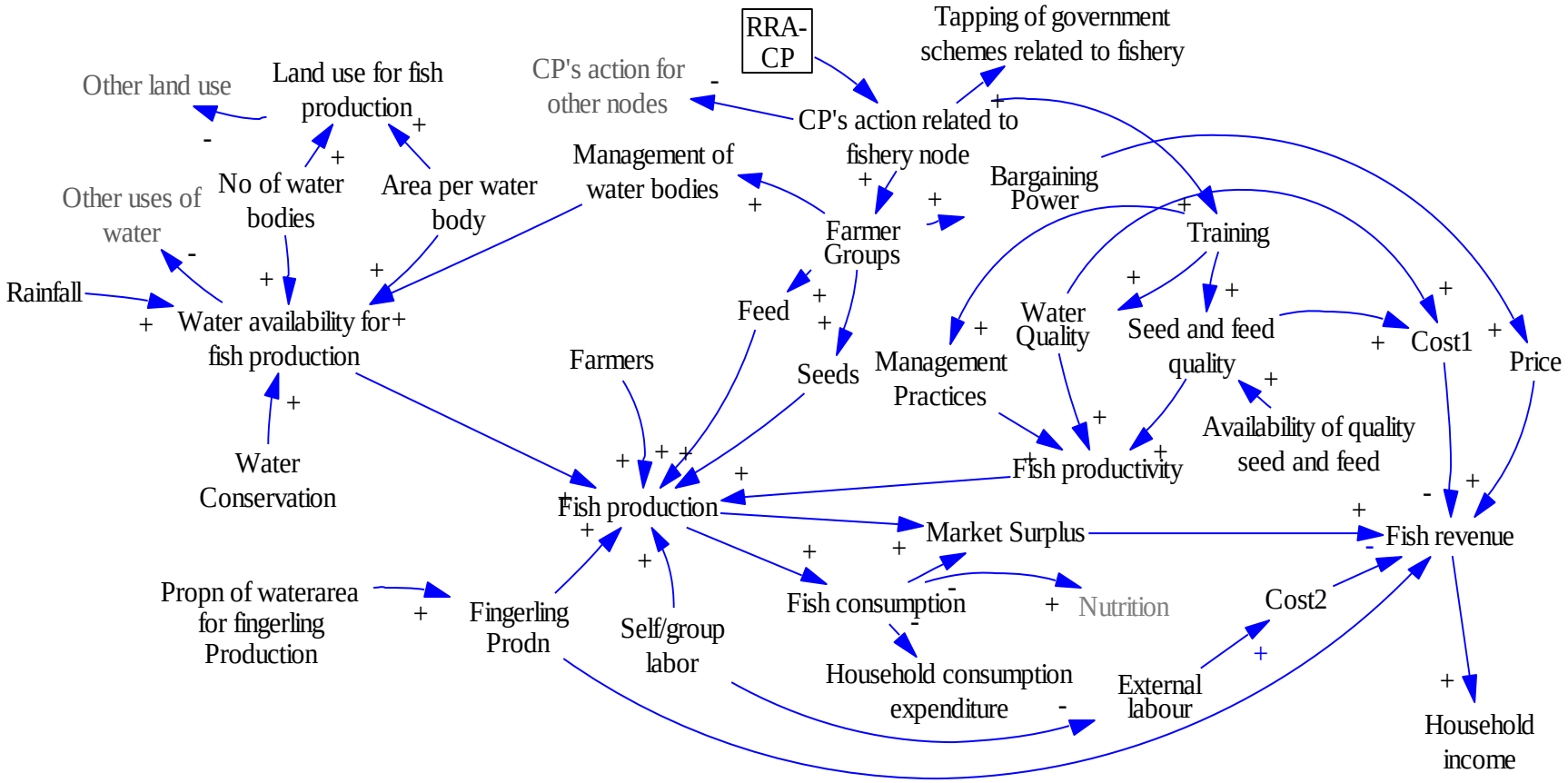


Fig. 3 System model for fisheries node

Note: The system model diagram links variables with arrows having + or – as their polarity indicating positive or negative influence. The origin of the arrow gives the influencing variable and the influenced variable is indicated where the arrow ends. No polarity is given when the influencing entity is not a variable, but a required input activity/actor for the entity it is pointing at. The variables which are not in the domain of fisheries node are put in grey colour.

Apart from water and fish rearers (farmers), the other inputs needed for fish production are fish feed, seed, fingerlings. Fingerlings production will depend upon the water availability in terms of water bodies dedicated for fingerlings production. A portion of fingerlings produced are directly sold in the market, which contributes to fish revenue. Also, fish production will increase through fish productivity, which would increase with greater quality water, seed, and feed and better management practices. The quality improvements will increase the cost of fish production. Also, quality feed and seed are constrained by their availability.

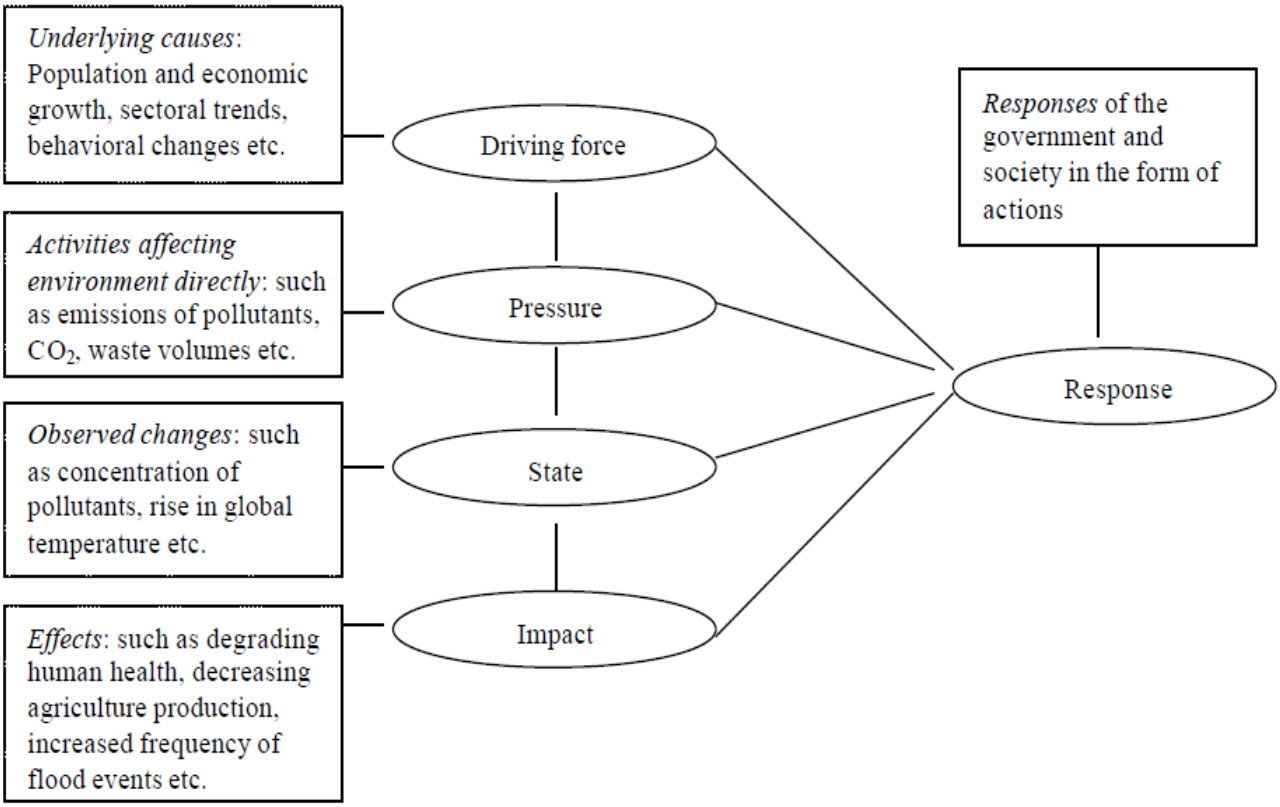
The fish produce in the area has two primary components. Part of the fish produce is self consumed and the rest are utilized as marketable surplus. Higher the marketable surplus, greater is the revenue. However, higher the cost of production lower will be the net revenue. The cost may increase with higher quality of inputs and engagement of external labour.

Anchors in a comprehensive pilot area will initiate actions related to the fisheries node which include tapping the government schemes related to fisheries, facilitating formation of farmers' groups, and provide trainings on fisheries. The farmer groups will have positive impact in accessing the requirement of seed and feed which are needed for fish production. Using their bargaining power, these groups will have positive influence on prices of fish produce. Additionally, farmer groups will effectuate better management of water bodies. The trainings provided by the facilitators in the interventions will have a positive impact on seed, feed, water quality, and management practices. The resources for fisheries will be constrained by the priorities that the intervention has on other nodes in the area.

In addition to the systems model, we also bring in perspectives related to other frameworks. In short, the indicators identified through OMTI framework will also be classified using three other frameworks as given below.

3.2 **Cause-effect classification (Driving force–Pressure–State–Impact–Response):** This classification is based on the cause and effect among the indicators. It is an extension of Pressure-State-Response (PSR) framework conceptualized and popularized by OECD (2003) in assessing the progress towards sustainable development.

The schematic model for the framework is given in Fig. 4. Under this, 'driving force' is the underlying cause of pressure; 'pressure' represents activities, processes, and patterns that impact the state; 'state' indicators provide a reading on the present state of affairs; 'impacts' are the effect of the observed changes in the state; while 'response' indicators are societal actions aimed to better the situation. There are several applications of the cause-effect classification in the literature (Eurostat, 1997; Dhakal, 2002). The schematic diagram of the classification, when applied to environmental quality, is given below.



Source: (Dhakal, 2002)

Fig. 4 Cause-effect classification

We have attempted to group the indicators obtained in OMTI framework under cause-effect classification. This classification is tricky as observed in Australia (1998) and Nathan and Reddy (2012). It is difficult to categorize an indicator as a pressure or a state or a response indicator. The indicator, which is a 'pressure' in one perspective, may be a 'state' in another and a 'response' in a third. For example, housing is a pressure indicator for land use, becomes a state indicator for construction domain and is a response for the homelessness.

To overcome this limitation, we have followed some sort of consistency in our approach. We have oriented the framework by considering interventions in comprehensive pilots as the focus. Definition of each of these five components in the present context is given below.

Driving forces: These are considered as extraneous factors, which limit or foster actions. By extraneous factors we mean these are influenced by multitude of things outside the control of those facilitating the interventions. For instance, indicators related to normative requirements of a particular area, budgetary constraint of the node, monsoon, availability/unavailability of resources, price and costs (these depend on market forces) will be considered under driving force.

Pressure: These are the factors which motivate the actions of those facilitating (location anchors and thematic nodes). Unlike driving forces, values of these indicators are primarily dependent on the interventions. Like the case of driving force, we are deviating from the conventional understanding of pressure (as in the cause-effect classification) and considering it as gap from the target; and these gaps acting as a pressure for actions. For instance, the ratio of millet productivity with respect to target will be the 'pressure' indicator.

State: Indicators grouped as 'state' will indicate the status of the state of affairs which the interventions aim to achieve. For instance, millet productivity with respect to unit land area is a 'state' indicator. Please note, its close resemblance with pressure indicators - the state of affairs mentioned with respect to target becomes pressure indicator.

Impact: The changes of state relating to a node in the intervention area will have secondary impacts. Indicators relating to such aspects will be grouped under 'impact' category. For instance production of millets may have an impact on household income; consumption of millets will have an impact on nutrition. So, indicators related to household income and health will be considered as impact indicators for millets node.

Responses: These are all the actions through the intervention taken by a node to effect any change in the area. Therefore actions related to making plans or conducting campaign or training programs for farmers will be categorized as 'responses'.

Examples of cause-effect indicators from different nodes are given below.

- Fisheries node:
    - *Driving force*: Number of potential water bodies in the intervention area or number of farmers who can be involved in fish production.
    - *Pressure*: Proportion of potential farmer households involved in fish production or proportion of such farmers given quality seeds.
    - *State*: Number of farmer households who got involved in fish production or fish production per water body area.
    - *Impact*: Knowledge of farmers in fish production or fish revenue.
    - *Response*: Number of water bodies covered or number and proportion of potential farmers trained for fish production.

- Millets node:
    - *Driving force*: Normative requirement of millets for consumption in an intervention area or requirement of processing capacities.
    - *Pressure*: Production of millets as a proportion to target, or ratio of area under cultivation of millets to area targeted.

- *State*: Amount of millets produced or area cultivated under millets.
- *Impact*: No of local jobs created through processing units and income generated through these jobs
- *Response*: Number of campaigns to enhance demand for millets and the number of households covered in such campaigns.

- Livestock node:
  - *Driving force*: Whether animal husbandry institute is present in the intervention area and how many veterinary doctors are there.
  - *Pressure*: Proportion of total cultivated area under fodder cultivation against required or proportion of livestock having shelter.
  - *State*: Number of livestock/animals who were sick, and the number of days that each animal were sick and the number of sick who got institutional treatment.
  - *Impact*: Revenue from different livestock in the form of meat, egg, leather, services (ploughing, transport), milk, manure, live animals, and wool among others.
  - *Response*: Proposal written and their success to tap the government schemes related to livestock.

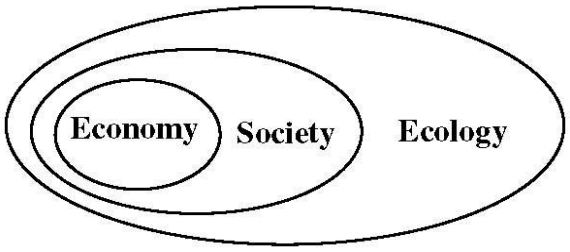
- Seeds node:
  - *Driving force*: Crop wise requirement of breeder seeds and contingent seeds in the intervention area.
  - *Pressure*: Proportion of storage or processing facilities achieved.
  - *State*: Proportion of seed demands obtained from various sources (government, private, and community) as against the targets.
  - *Impact*: Number and proportion of farmer who reported improvement in farm productivity, soil fertility, food and nutritional security on account of quality seeds and change in cropping systems.
  - *Response*: Seed mela organized and number of case studies or success stories recorded.

- Soils node:
  - *Driving force*: Number and size of the public works undertaken by government schemes (like MGNREGS) in the intervention area.
  - *Pressure*: Proportion of farmers who have formed groups for soil health related interventions or proportion of schemes/agencies to which engagement could be made.
  - *State*: Profiling of organic and chemical fertilizer use in the area.
  - *Impact*: Awareness level of farmers on soil interventions and their perception about the same.

- *Response*: Number of training programs and number and proportion of potential farmers who participated in such programs.

- Water node:
  - *Driving force*: Rainfall pattern or soil moisture efficiency in the area.
  - *Pressure*: Proportion of farmers who practice protective irrigation or proportion of land area covered with such methods.
  - *State*: How much rain water was captured and number of farmers practicing kharif or rabi crops.
  - *Impact*: Changes in cropping pattern and productivity on account of water interventions.
  - *Response*: Number of protective irrigation pilots implemented in the intervention area and the number of such projects that were scaled up.

3.3 **Sustainability paradigm (Economic–Social–Environmental–Institutional)**: This classification is primarily based on sustainable development paradigm with the universally accepted three dimensions; economic, social, and environmental. The sustainable development paradigm is given in Fig. 5. The figure depicts that at the most granular level every system can be seen as a set of economic activities, which needs to be efficient. However, economic efficiency is not all. Since economy is part of the society, which in turn is part of the ecology, all economic activities must lead to social well being and be environmentally compatible.



Source: (Nathan and Reddy, 2012)

Fig. 5 Sustainability paradigm

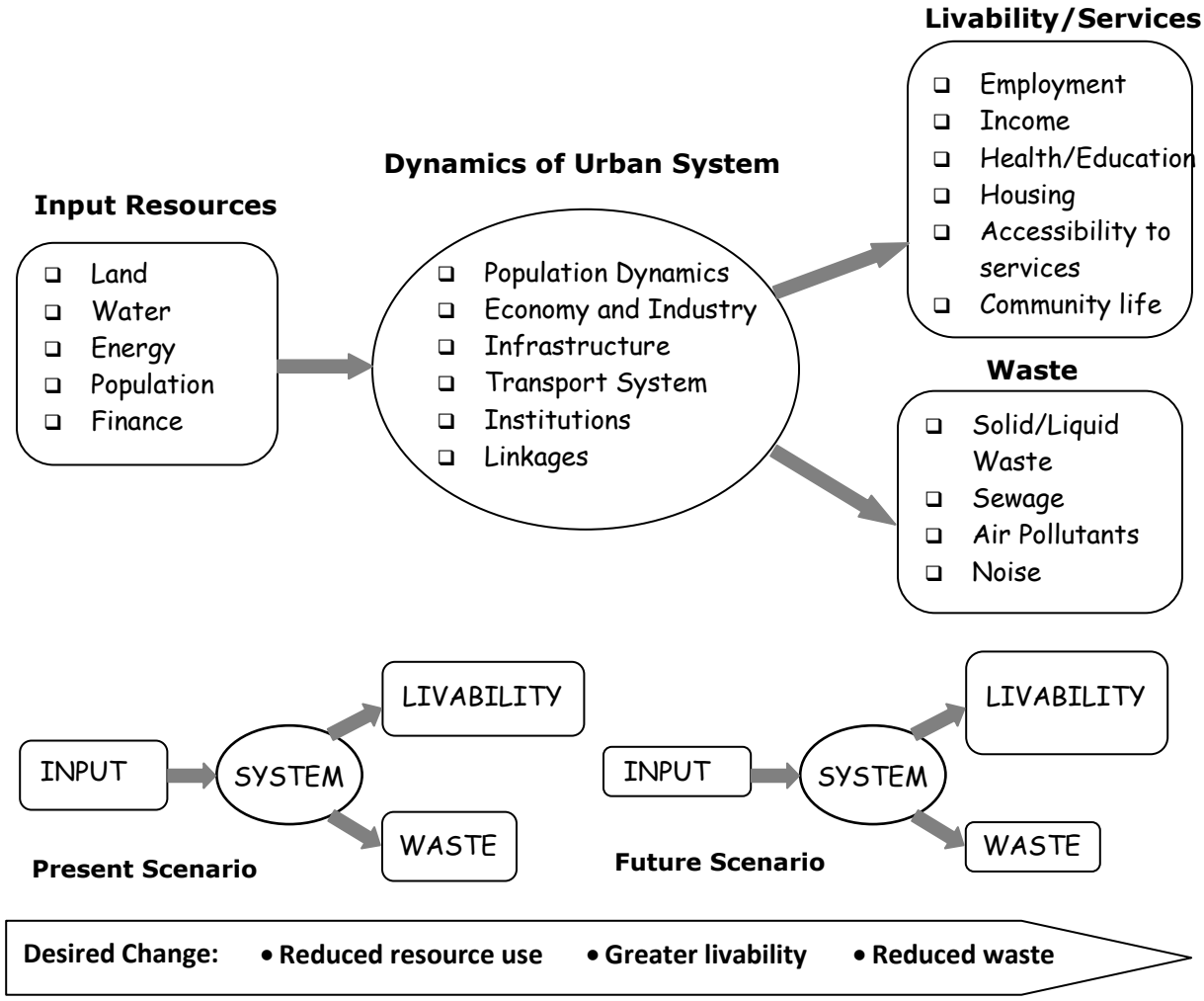
Along with the three dimensions of economy, social, and environment, a fourth dimension has been considered as 'institutional'. Such four dimension classification has been propounded and popularized by UNCSD (1996). In the current exercise, the importance of this dimension cannot be over emphasized since most of the interventions deal with building and enabling institutions.

In this classification, if an indicator qualifies to be in more than one category it is placed as so. For instance, if an indicator related to employment generation is both economic and social then we will denote both. Similarly, for other combinations. Examples from each node for this classification are given below.

- Fisheries node:
    - *Economic*: Proportion of water body area covered for fish production in the intervention area
    - *Social*: Knowledge of households in fishing activity
    - *Environmental*: Number of potential water bodies (public /private) in the intervention area
    - *Institutional*: Number of potential intervention areas which have at least one resource centre for fishery
- Millets node:
    - *Economic*: Millet production as proportion of target
    - *Social*: Number of farmers having access to millets seeds (variety wise)
    - *Environmental*: If millets cultivation would have influence on soil nutrients, indicators related to the same (soil property) will be an environmental indicator.
    - *Institutional*: Seed bank present or not in an intervention area (yes/no)
- Livestock node:
    - *Economic*: Number and share of households having livestock of different category.
    - *Social*: Household expenses under different livestock heads – fodder, water, shelter, and health care.
    - *Environmental*: Number of livestock engaged in composting facility
    - *Institutional*: Vaccination calendar present or not (in appropriate format)
- Seeds node:
    - *Economic*: Requirement and achieved financial resources in the intervention area for seeds management
    - *Social*: Number and coverage of capacity building exercises
    - *Environmental*: Farmers and land covered under mixed cropping, crop diversification, and agro-forestry.
    - *Institutional*: Whether plan in place for procurement of seeds from different sources (yes/no)
- Soils node:
    - *Economic*: Amount and proportion of proposed budget that could be tapped
    - *Social*: Awareness level of farmers on different soil intervention techniques
    - *Environmental*: The physical, chemical, and biological properties of soil
    - *Institutional*: Proportion of different soil improvement techniques having government support/funding
- Water node:
    - *Economic*: Household income of farmers from kharif/rabi as a proportion of income from agriculture and as a proportion of total household income.
    - *Social*: Ownership profile of water sources
    - *Environmental*: Crop water (transpiration) need of the area (in mm)during kharif at different locations in the intervention area

- *Institutional*: Number and proportion of potential agencies/schemes where engagement could be made

3.4 **Metabolism model (Input–Metabolism–Livability–Waste)**: This classification has its roots in extended urban metabolism model (EUMM) (Newman *et al*., 1996) (see Fig. 6). Following EUMM, one can consider each node of the intervention as systems requiring key resources which are drawn into the node processes and transforming them into desirable outputs (livability) and waste.



Source: (Nathan and Reddy, 2012)

Fig. 6 Metabolism model

If an indicator is input to the system it is grouped as so and if it represents the system dynamics/process it is grouped under metabolism. If the indicator is a desirable output it is placed under livability; if undesirable it is put under waste. All physical, financial, and human resources required for the node are grouped under input indicators, while the institutions are put

under metabolism. Productivities and prices are also put under metabolism. This model has a resemblance with process/outcome classification where metabolism corresponds to process and the rest can belong to outcome category.

Examples from each node for this classification are given below.

- Fisheries node:
    - *Input*: Area of potential water bodies
    - *Metabolism*: Ratio of number of potential intervention areas which have at least one resource centre to the total number of potential intervention areas
    - *Livability*: Fish production per unit water body area.
    - *Waste*: No of trained farmers (male/female) (among groups) who are NOT engaged in the activity.
- Millets node:
    - *Input*: Self and external labour put for millets cultivation in the intervention area
    - *Metabolism*: Production/productivity of different millet varieties in the intervention area
    - *Livability*: Revenue from millets
    - *Waste*: Proportion of children NOT covered under millet consumption through midday meal scheme in the intervention area
- Livestock node:
    - *Input*: Number and proportion of farmer groups provided with credit for livestock
    - *Metabolism*: Practice and price of penning
    - *Livability*: Proportion of livestock that availed institutional services
    - *Waste*: Indicators related to morbidity and mortality of livestock
- Seeds node:
    - *Input*: Information on the requirement of financial and human resources for seeds management
    - *Metabolism*: Is the production and supply plan for seed diversification in place (Yes/No)
    - *Livability*: Proportion of seeds channelized through seed banks.
    - *Waste*: Number and proportion of checks that did not pass quality
- Soils node:
    - *Input*: Awareness level of farmers on soil interventions
    - *Metabolism*: Number of farmer groups that the intervention has instrumented
    - *Livability*: Land area and its proportion subjected to different soil interventions
    - *Waste*: Use of chemical fertilizers
- Water node:
    - *Input*: Number proposal written and proportion of them successful
    - *Metabolism*: Cost of implementing protective irrigation pilots
    - *Livability*: Number and proportion of farmers who practice protective irrigation

- *Waste*: Land area which remains fallow under rabi/kharif

Structuring indicators along the lines of cause-effect classification, sustainability paradigm, and metabolism model will be helpful in two respects. First, at an overall level one can check which are, for instance 'pressure' indicators or 'social' indicators, or 'input' indicators. Second, it does a robustness check to the indicators obtained through the OMTI framework.

4. Concluding Remarks

Revitalising Rainfed Agriculture (RRA) attempts to rejuvenate agriculture in the rainfed areas of India by understanding and diversifying the risks in agriculture. It has initiated about 10 interventions known as comprehensive pilots at block/gram panchayat level across the country. Each of these interventions is along one or more themes - water, livestock, fisheries, millets, soils and seeds. In order to assess these interventions and to facilitate a baseline analysis in these areas, there was a requirement to develop indicators for every thematic node.

This study outlines the first steps in this indicator development exercise. During this process it conceptualized a simple four stage method of indicator development, i.e., 'objective or goal formulation', 'means finding', 'targets settings' and 'indicator identification', which is referred to as OMTI (Objective-Means-Target-Indicators) framework. This framework, being a type of thematic framework suffers from limitations of researchers' bias. To overcome this limitation, we validated the OMTI framework using the systems model.

System model gave a holistic view of the thematic node with different variables and their linkages. It connects the different actors, their inputs and outcomes. Also, discussion of OMTI in conjunction with systems model helps one to identify the important linkages in the system. In order to check the robustness of OMTI, the study also proposed to classify the indicators as per three other frameworks in the literature namely, cause-effect classification, sustainability paradigm, and metabolism model. This entire exercise sets the platform for development of baseline for monitoring and evaluation of interventions in rainfed areas of India. It can also be used for other similar interventions elsewhere.

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