Securing nutrition through the revival of circular lifestyles: A case study of endogenous rural communities in Rajasthan

Abstract

This paper shows how circular economy principles are linked with nutrition-sensitive agriculture, how it can be utilized to address malnutrition among endogenous communities of India and how to address Sustainable Development Goal 2 "Zero Hunger". With the support of Linking Agriculture with Nutrition in South Asia (LANSA), the civil society organization VAAGDHARA undertook this research of applying principles of the circular economy for the revival of the traditional nutrition sensitive farming system with endogenous communities in India. Participatory tools were developed by different agencies and participatory learning and action (PLA) tools were customized and applied to 30 groups of 20 farmers each in 30 villages of Banswara districts. Based on this research we developed a framework to apply approaches of traditional circular economy principles in agriculture and support sustainable lifestyles

Introduction

As per World Bank (2009) estimates, one-third of malnourished children in the world live in India, making it one of the highest-ranking countries. National Family Health Survey (NFHS-4 2015-16) proclaims under-nutrition is leading problem issue in India, as 53.1% of women (15 to 49 years old) are anemic and 38.7% children get stunted below 5 years of age (UNICEF Report 2017). Early in 2016, in our interactions with tribal leaders, particularly women members of self-help groups, in the central-western tribal region of India, the women indicated that this situation has arisen due to ignorance of traditional farming systems and crop diversity. The interaction brought out the fact that earlier small and marginal farmers used to cultivate mainly for family nutrition and market was the second priority. Market controlled farming has resulted in gradual shrinkage in food diversity associated with traditional diets, which are now at the verge of extinction. They also showed the potential of nutrition security through local foods (vegetable and animal based). This led us to the research question "whether we can solve the problem of food insecurity through local diet diversity? Thus, VAAGDHARA started groundwork on the revival of the traditional approach of the nutrition-sensitive farming system (NSFS). There were many questions, but the key question was: How can NSFS be revived in a situation where the present generations hardly know about traditional nutritive food items, how to cultivate/collect their nutritive values, preparations, preventing post-harvest losses, food system, etc. This indicated that information and evidence gaps exist for designing interventions aiming to improve nutrition outcomes linked to traditional farming systems within the tribal belt of central-western India.

Our desk review revealed that small and marginal farmers within endogenous communities are currently facing significant challenges, producing widespread suffering and increasing the rate of farmer suicides (Mishra 2014). Focus group discussions with farmers indicate that the linear approach of farming adopted post-green-revolution has made agriculture as high input venture, and in this context, farmers are hard-pressed to sustain their livelihoods. Our organization, VAAGDHARA is a civil society organization, that has been working with endogenous farmers for twenty years. We work with endogenous communities in rural India on the issues of safe access to basic rights, water, food, nutrition, education, health services, livelihood improvement, and sustainability. Our work includes study, action research, institution building, awareness generation, knowledge building and providing hand-holding to deprived communities in remote regions. During pre-modern times these endogenous communities followed principles of circular

economy in their farming and maintained cycles of nutrient flow to ensure nutrition security for the family. Post-green-revolution has seen many farmers starting to following linear agricultural models. As part of the current linear economic system of take-make-throw away, it is known to be the cause of environmental degradation, resource depletion, waste, and pollution. (Schroeder 2018) Applied to the agricultural sector in India, it has resulted in widespread food insecurity and malnutrition. Over the decades, farming decisions have shifted from nutrition-focused family farming to market-led decisions of monocropping targeted for income generation. Modern agriculture, which is controlled by the market, is mostly monoculture following the principles of a linear approach of applying external inputs such as seeds, chemical fertilizer, pesticides, herbicides, weedicides, improper implements and technologies, harvesting, and labor. Such an approach is focused on exploiting natural resources (soil, water, energy) and applying higher external inputs to get higher returns.

The linear economic model of agriculture as indicated by Allen (2015) and shown in Figure 1. It supposes that this shift in farming results in accelerated rates of nutrient depletion causing permanent loss of land, pollution of land and water bodies, and eventually reduced the productivity of the land. This linear approach results in a higher degree of nutrient export from a farmer's sources i.e. their land, wells, ponds, pasture, homestead, common property resources. These ecosystem impacts have affected the endogenous community in the Banswara region where this study sited in three ways: first, the reduced food production for the family results in malnutrition. Second, market fluctuations leading to financial losses, pushing families further into a vicious cycle of poverty. Finally, the increasing consumption of nutrients from soil produces wastelands and water pollution leading to more scarcities and increasing vulnerabilities in the future.

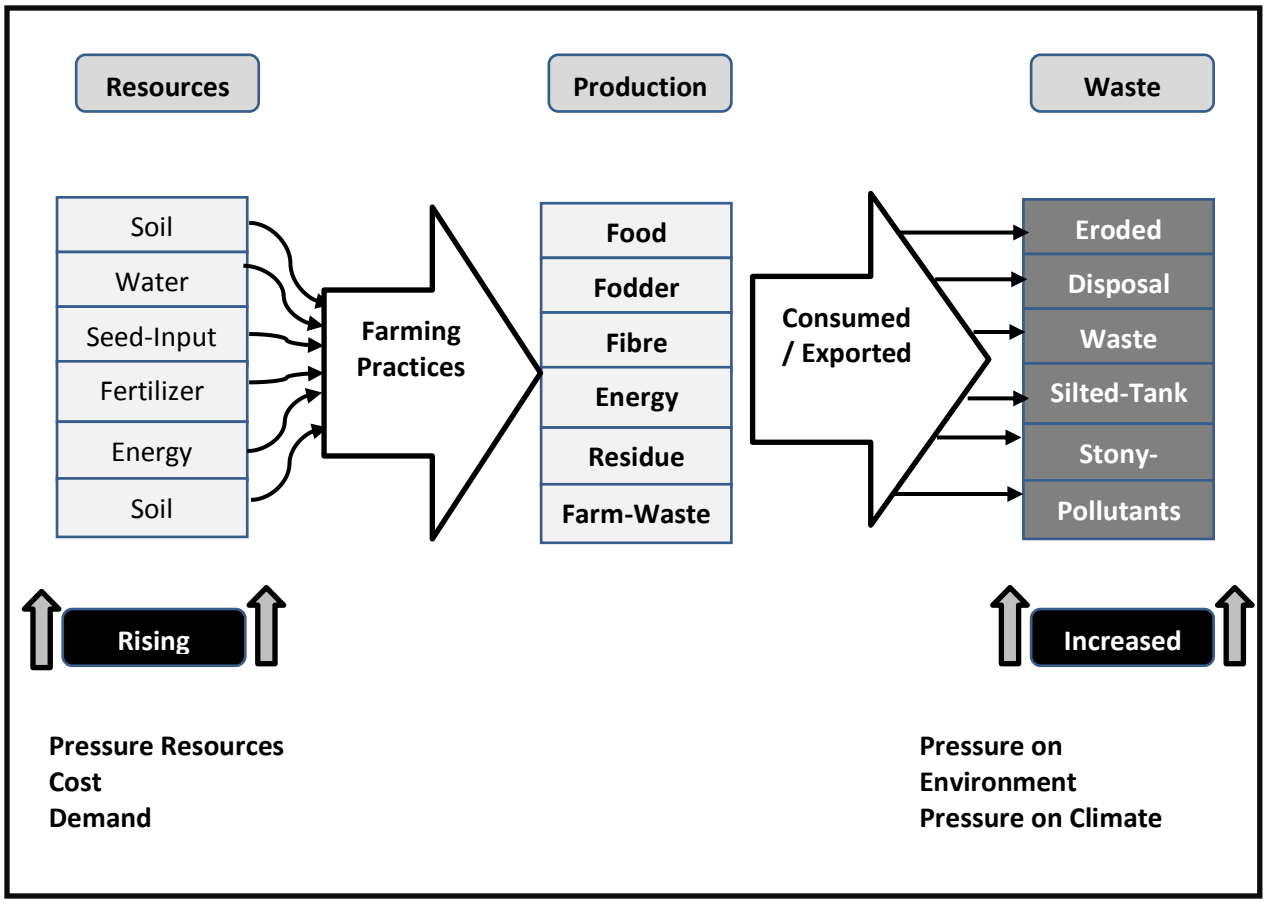

Figure 1 Linear Model of Agriculture (adapted from Allen, 2015) www.ec.europa.eu)

Further consequences of ecosystem degradation manifest in lower crop production, shortages of clean water, destroyed farmland and biodiversity losses (Rockstroem 2009). Negative impacts on the immediate ecological system of farmers, food diversities, and soil health are so high that the system's capacity to support family livelihoods is increasingly endangered. According to the UN "the major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production" (REF). Therefore, VAAGDHARA conceptualized this research study around "Nutrition Sensitive Farming System" (NSFS) and evolving intervention strategies and activities suitable for wider acceptance by communities, government and other development stakeholders, within the pillar-3 perspective of LANSA[1] (Linking Agriculture and Nutrition in South Asia). We felt the need to design appropriate methods for promoting NSFS and test them as Participatory Learning and Action and evolve a framework for community-led NSFS to tackle under-nutrition for tribal dominated central India. Figure 2 shows how endogenous farmer community in Banswara (VAAGDHARA), Orissa and Maharashtra (MSSRF), Sundarbans (DRCRC) and other parts of India are reviving their farming system following circular economy approaches.

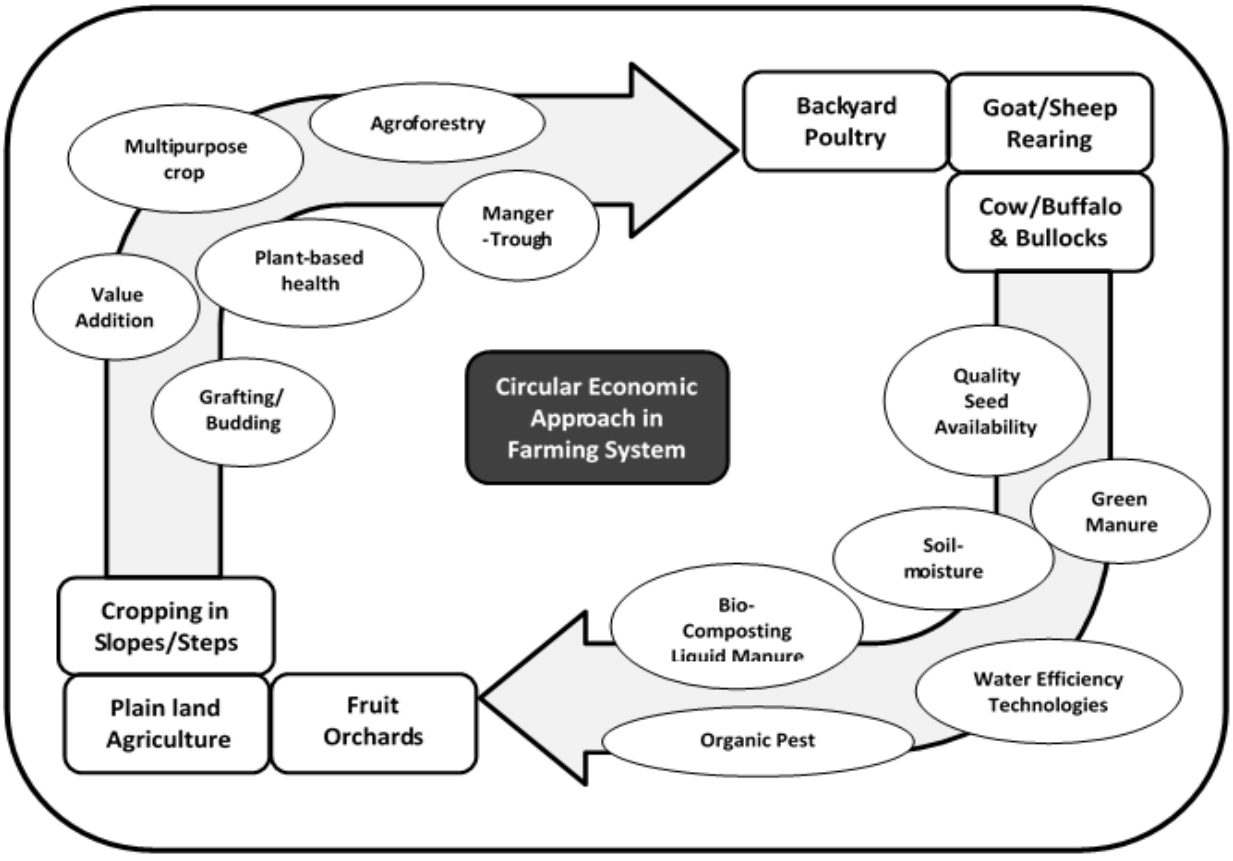

Figure 2 Circularity aspects of the revived farming system of the endogenous community (Source: VAAGDHARA)

[1] Cconsortium of research and development agencies in South Asia dedicated to linking agriculture and nutrition

Circular Economy and Nutrition Sensitive Farming Systems

In the linear model, demand for high-cost input resources is increasing and farmers have to go into debt to purchase these inputs. The increased use of credit in agriculture is providing space for exploitation. Furthermore, farmers do not always benefit from the fruits of their labor as most of the production in terms of food, fodder, fiber, energy, residue, and farm-waste is exported out of the system and what is left behind are wastes in terms of eroded fields and silted tanks with high pollutants. Our hypothesis is: The adaption of circular economy approaches in farming systems can provide a solution to this problem of increased areas of eroded landscapes, silted tanks and polluted soils in agricultural lands."

According to the Ellen McArthur Foundation (EMF), the circular economy refers to a system that promotes restorative or regenerative process through deliberate product design. In this system products and services are closed loops or 'cycles' and aim to retain as much value as possible of products, parts, and materials. This means that the aim should be to create a system that allows for long life and optimal reuse (Kraaijenhagen, Van Oppen & Bocken,2016). The cyclic flows minimize losses of materials, resources, and values both qualitative and quantitative. The aim of a circular lifestyle is thus to minimize/ eliminate the waste, utilize renewable sources of energy and phase out the use of harmful substances (Ellen MacArthur Foundation, 2012).

Taking up the circular economy concept in agriculture requires an analysis of the present high-input system which follows a more or less linear approach. It will help in the identification of potential opportunities and benefits a circular economy can yield for farming families, for improvement in the local environment and benefits to the local economy. Within the circular economy vision wastage from a sub-system (for example dung from a dairy) becomes resource and inputs for another sub-system i.e. farming through composting or some other actions associated to them. Similarly, roughage from agriculture becomes fodder input for the livestock sub-system. Similarly, dung from the animal-husbandry sub-system becomes an important input for agriculture, horticulture, and pisciculture through proper composting and bio-digesting processes. Therefore, processes that help in adapting the circular economic approach, are also part of the system of sustainable production and consumption, and eventually reduces demand for raw materials. Importantly, this circular economic model, as reflected in Figure 2, has its roots in farming systems of the past, where practices followed circulation of the resources. Application of circular economy approaches in rural livelihoods eliminate wastes within the system, by adopting principles of reducing, reuse and recycling to convert them into inputs and resource for another sub-system within overall economy/livelihoods system. The circular economy approach, particularly applied in agriculture, mimics the rhythms of natural cycle of energy flow through different forms (biotic and abiotic), process (integration and disintegration), systems and strategies which are in tune with the following three key principles, which have been outlined by the Ellen MacArthur Foundation (2015).

Principle 1: Preserve and enhance natural capital: by controlling finite stocks and balancing renewable resource flows.

This principle focuses on sustainability aspects of practices in terms of balancing resource utilization and flows. Within agriculture, particularly in hilly areas the first major challenge farmers face is that of preserving and enhancing the natural capital of soil, moisture, seeds, and energy. Pursuing the linear model results in loss of all the natural capital through soil-erosion, fertility loss, lack of moisture, high cost for seed and use of fossil fuel for power resulting in waste and emissions. Thus, preserving and enhancing natural capital is the most crucial principles while applying the circular economy lens to farming. This principle provides opportunities to assess the competence of different practices within farming. Lifestyle benefits are linked to preserving and enhancing elements in soil, diversity, energy, and moisture within the system and creating the conditions for regeneration.

Principle 2: Optimize resource yields: by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles.

This is the prime principle of the circularity lens i.e. "Optimizing resource yield". In farming systems, its application establishes linkages between different sub-components of NSFS. In the linear model animal husbandry and crop cultivation are two separate interventions and taken-up by two separate sectors. Thus, they demand two separate sets of inputs and two sets of outputs along with wastes. In contrast, circular practices provide scope for designing some farm/production units following approaches of recycling within tighter, inner loops to preserve more energy and provide additional value, by enhancing loops and optimizing multiple uses, sharing implements, exchanging outputs against inputs etc.

Principle 3: Fostering system effectiveness: by revealing and designing out negative externalities.

This includes reducing damage in terms of use, such as food wastage, agroforestry, use of biodegradable material, learning from the system, and managing externalities, such as proper land use, cover plantation, water management, avoiding pollutants. The tools applied to assess farming system (economic model) followed by a family or community, also acts as a motivation tool, which can be inferred from the data about the practices revived or adopted by the participants of the study groups. **Water use efficiency** is one of the most important indexes, which applies these principles to the farm and helps in the plan for improved sustainability. Similarly, mixed cropping against monocropping also offers scope for assessing system with this principle of effectiveness for optimizing moisture use efficiency.

The methodology of Participatory Learning Action (PLA) and Data collection

Our study aimed to identify methodologies those can help endogenous communities to attain sustainable life through the revival of circular approaches in farming. The main research question of the project was: How can PLA tools be extended to revive the approach of circular economy in nutritive sensitive farming and address problem of under-nutrition? This question was based on facts about the losses incurred by present-day farming practice in terms of erosion, higher input costs, reducing production and ever-increasing wastelands. The study targeted the feasibility of utilizing participatory learning and activities to support the revival process and attain Nutrition Sensitive Farming System for small and marginal farming community. As these were some new terms and concepts, we started with a literature review and formative interactions with community leaders, which was followed by an assessment of traditional and existing farming system through the lens of circularity.

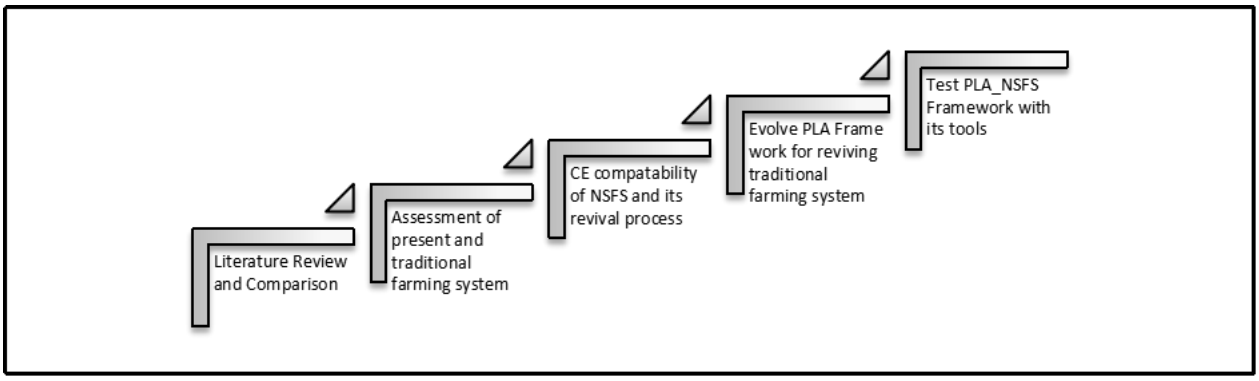

Figure 3 Steps followed in a study program

Our study had the objective to evolve and test the applicability of participatory learning action (PLA) tools and test their effectiveness in promoting circular economy principles in a nutrition-sensitive farming system and consolidate learning in the form of a framework that can be used to facilitate the wider replication of circular economy approaches in agriculture. PLA is an approach to learning about and engaging with communities (IIED, 1995). It combines an ever-growing toolkit of participatory and visual methods with natural interviewing techniques and is intended to facilitate a process of collective analysis and learning by the active participation of communities (IIED, 1995). Based on our findings we evolved a draft framework of PLA_NSFS, which focused on the adaption of circular economy approaches by endogenous farmers to achieve nutrition security.

The PLA_NSFS includes 10 learning sessions grouped in four separate identifiable phases, as shown in Figure 3, namely: triggering thought processes; deciding and taking actions; Action monitoring, and evaluating. Each of the ten sessions was normally 2-3 hours duration. During this action research, PLA included live interactions, storytelling, pictorial display, demonstrations, community actions, and guided discussions.

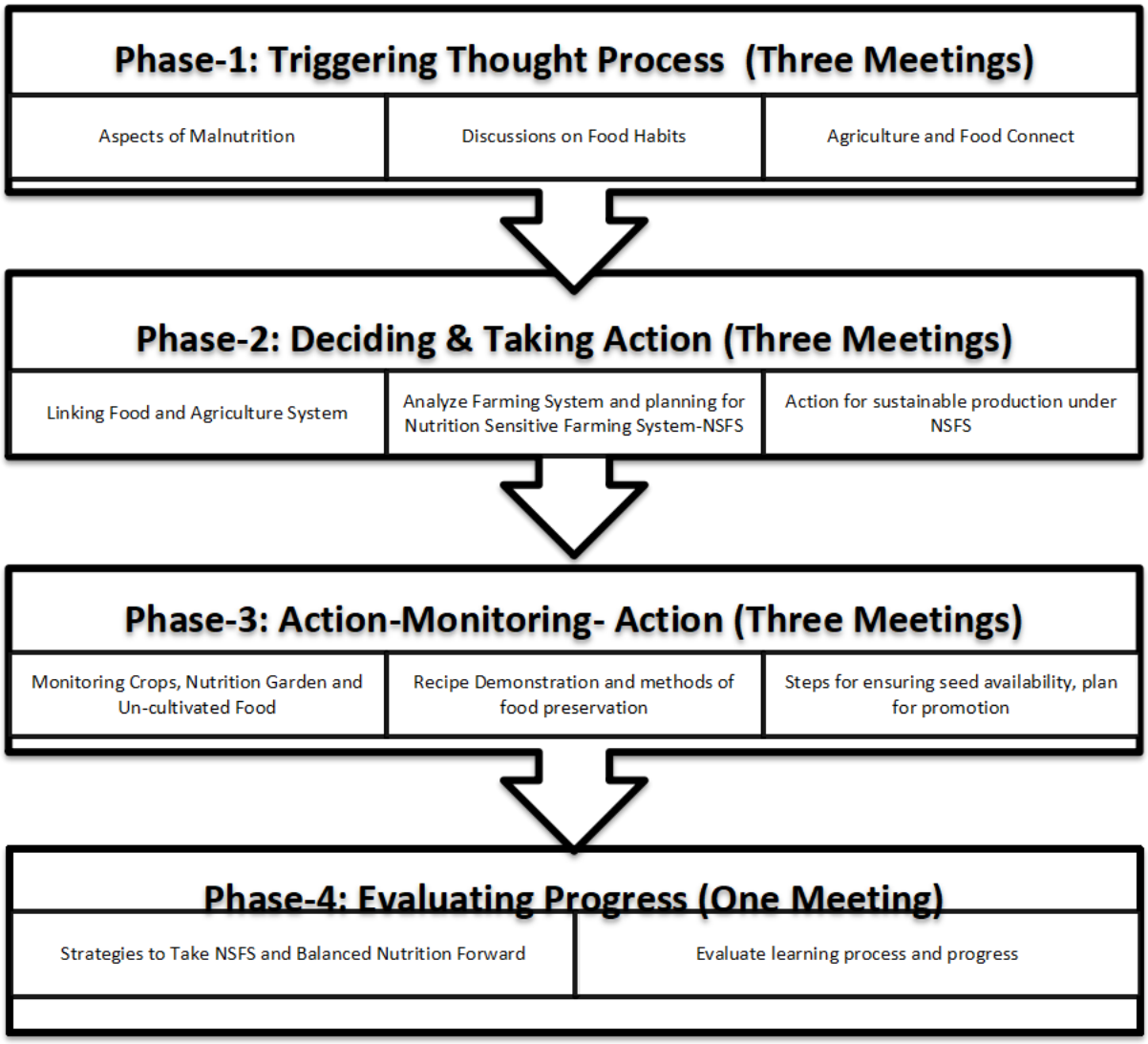

Figure 4: Framework of Participatory Learning and Action for Circular Economy approach in NSFS

As the PLA_NSFS continued for about ten months, the facilitators were provided training in three phases. Each training lasted approximately two to three days included contents of three to four meetings. Before training of facilitators, the implementing organization needed to collect information about food practices, nutrition, NRM and farming system, and about resource agencies in their local area, and orient the facilitators about these on an ongoing basis. Facilitators' review meetings are conducted on the fortnightly or monthly basis to provide ongoing handholding support for field related problems.

Findings

The data generated in this study is from 30 groups in 30 villages (six each in five blocks) of Banswara district, each having 20 women, comprising a total respondent number of six hundred farmers. Group-wise data was collected and analyzed to assess the effectiveness of various tools and sessions within PLA[2]. The analysis is also compared with findings from other regions and overall findings are presented below.

- The exercise focusing on "What we eat vis-à-vis what we produce" is found an eye-opener for many farmers by unveiling a widening gap that exists between cultivation and consumption in a linear model of farming. This as very first PLA session proved as triggering action to develop an urge for setting a link between Farming and Food System.
- The second session was dedicated to identify resource base of family and then link them with farming (livelihood) system. This was another triggering work in which basic finding was list of many resources, which are generally utilized but not considered as resources, for example, a plant named "*Buwari Ghas*" (Broom Grass) which is found in commons along the roadside and considered as weed but provide materials for brooms to one family for a whole year worth $ 5-6. Altogether it may result in $500 to $600 in a village. This way whole community listed around 100 plant varieties which can be included within NSFS.
- Another important exercise was on "characterizing existing production systems" of each family member and production systems of all 20 members as a group and whole village as a community. It has helped in establishing characteristic of each layer of community family, hamlet, village, area so to find out whether it is linear, circular, mixed or hybrid. It has brought out the need for changes and laid the foundation for planning
- Sessions on basics of nutrition and health linkage also helped in building community understanding on manifestations of under-nutrition, its causes, effects, and methods of measuring nutrition status.
- Once the need was established, the exercise on "designing for farming practices with the approach of CE and focusing on crop plan within the purview of NSFS. This exercise took more time than what was actually planned, because of various non-farming tasks perceived at an earlier stage. Some new actions which came in at village level are a section on un-cultivated food items (we listed around 36 food items which are found all around but not consumed by people in present system because of various socio-economic issues). It was also helped many people to recall their childhood flowers, fruits, and practices associated with food. The groups also started looking for options to revive them as well as take the knowledge to the next generation as essential inter-generational knowledge transfer.
- The plans of adapting NSFS has various components, but the common component was nutrition

[2] Process for each of the tools within PLA approach is documented separately as part of PLA_NSFS workbook (*in Hindi language*) and can be accessed from VAAGDHARA through mail to jjoshi@vaagdhara.org

kitchen garden for each partner family, therefore another learning session of whole cropping season has a review of farming practices as against planned processes; and

- We found that endogenous communities have knowledge about a large number of uncultivated traditional food items and recipes can be adopted and further improved by other stakeholder dedicated to food and nutrition security among small and marginal farming families to address through indigenous sources mainly.
- Plans were prepared for improving farm diversity mainly for food items through nutrition gardens, integrated farming; conserving and optimizing villages' resources. PLA resulted in greater diversity and sustainable production in the farm with efficient nutrition practices.
- PLA provided the link between environmental protection and sustainable natural resources management such as soil and water conservation, soil building, soil fertility maintenance, agroforestry, animal husbandry and cyclic flow of nutrients from different subsystems. The adaption of circular economy practices helped small and marginal farmers in moving towards sustainability by reducing input costs on the different front such as seed, fertilizer, pest control, implements and even labor.
- The whole process with ten sessions PLA could help 600 number of small and marginal tribal families (30 groups of 20 families each) re-establish nutrient flow and energy cycle at farm level in which plants biomass (mostly fodder varieties) serves as food for animals and the animal waste recycles nutrients to soil enabling better plant growth.
- Applying key principles of the circular economy showed that traditional farming practices of the endogenous tribal community of Banswara region follow more or less circular lifestyle concepts. Thus, it was possible for reviving practices following the concept of reduction (fodder saving, proper storage, seed selection, establishing a process of bio-composting), recycling (composting, organic waste composting, bio-composting) and reuse (adapting to multi-use implements, planters etc.)
- PLA_NSFS not only helped in achieving family nutrition but also helped in adding 8-14% of the income of participating families through sharing and sale of surplus production of some specific produces and provided higher income as compared to what they used to earn when produced crops which were dictated by the market.

Last but not least our research proved that NSFS benefits in terms of saving input, energy and opportunity costs in-turn decrease in resource dependence. It results in improved nutrition outcomes, behavioral change, improved knowledge about food diversity, and farming practices etc. Ultimately it contributed to extending the behavioral change activities towards production, consumption and nutrition outcomes.

Conclusions and Recommendations

Adoption of NSFS presents a **win-win-win situation** for small and marginal farmers by addressing the problem of malnutrition, supporting the family economy and maintaining local environment. In the long-run, this transformation could offer an essential competitive advantage to create more value from resources, lowering costs (both input and environmental), increasing production and securing food and nutrient supplies to family (WHH 2013). Adapting cyclic approaches in production and consumption within the farming system may significantly reduce resource extraction, alleviating the problem of resource scarcity. The concept of reduce-reuse-recycling which is at the core of circular lifestyles and sustainable consumption and production combined with organic agriculture can help in preventing agricultural pollution while contributing to a healthier society. This goes hand in hand with the recommendations of the Food and Agriculture Organisation (FAO, 2014), MSSRF and LANSA community who believe that agriculture for nutrition is much more above the farming for the market.

This way a community of 600 in 30 villages endogenous farmers (20 families *30 groups) learned to link nutrition with agricultural practices and farming system. These families participated and contributed to the overall validity of the results. Executing 10 tools with 30 groups allowed the VAAGDHARA to not only see the implementation process rather evolve it with the community using different perspectives, and

also to get more insights in important topics related to Sustainable Consumption and Production with the endogenous community and rural perspectives. Findings pertaining to the PLA approach have shown that it can be an appropriate approach tool for promoting NSFS for food security of small and marginal farming families even in degraded regions. It also adds to improve environmental, economic, socio-cultural performance of their resources with the principles of sustainable consumption and production. The conducted research, however, indicates the possibility for adapting the PLA learning cycle to help community groups to adopt CE and NSFS in its totality and overcome the vicious cycle of malnutrition and poverty. PLA helps in identifying factors and their role in either hinder or enable circularity within farming systems. Some factors are rather external and therefore could possibly be harder to influence, but others are part of the system and can be overcome through.

However, the role of government policies is also critical in deciding upon the food system of a community or society as a whole. For examples in India government policy and investment on the promotion of wheat and rice as a major food grain, their distribution through the public distribution system has influenced traditional farming practices of on distribution of the concept exhibits some gaps in regard to policy environment and tribal food environment. Therefore, the implementation of PLA_NSFS cannot be equated with achieving SDG1 "No Poverty" and SDG2 "Zero Hunger", rather it would also need to apply NSFS lens to various policies of the government, those influence agriculture and food system of endogenous communities. Thus, another future research question for us is "Is there some role of government policies in changing farming and food system of endogenous communities?" and "What is the competitiveness of existing government policies vis-à-vis circular economy approach for agricultural development"

According to DAVIDOVA Ms. Sophia (2014) "Family farming is often more than a professional occupation because it reflects a lifestyle based on beliefs and traditions about living and work" which goes quite hand in hand with NSFS approach promoted by this study. Experiences from endogenous communities in rural India on the revival of traditions of CE provides scope for changing power relationship in agriculture, particularly most vulnerable small and marginal farmers. It can help to spread, family farming[3] to address wide-spread malnutrition. These changed relationships will reduce the drudgery of women and children on account of access to nutritive food. The experiences indicate the importance of applying the CE lens on agriculture and other allied occupations to alter power relations, bringing farmers sovereignty and ensure nutrition security.

The VAAGDHARA experience provided the potential for applying principles of the circular economy within one of the world's largest and oldest occupations: farming. It can help to achieve SDGs, in particular, SDG 2 "Zero Hunger" within the global agenda of SCP and address the problem of malnutrition through local solutions, with global thinking. VAAGDHARA plans to take this research agenda to diverse communities with other stakeholders in the country, in the wider Asia region and internationally. This research also opens scope for advocacy with other Indian states to review various policies with the lens of the circular economy and check compatibility of policies, rules, and regulations with it. Furthermore, VAAGDHARA plans to apply BSI 8001 guideline or similar guidelines provided by different agencies to evolve a guideline to define Circularity within farming system and assessment of its benefits in terms of economic, environmental and social impacts resulting in sustainable development.

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[3] Family farming is a means of organizing agricultural and allied production which is managed and operated by a family on family labor, including both women's and men's (FAO, 2014)

heritage of farming system and lifestyle which go hand in hand with the concept of sustainable consumption and production through the diversity of indigenous farming and food system. They thank the team of LANSA for carrying forward the whole concept of SCP towards NSFS.

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