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A farmer-led approach to achieving a malnutrition free India

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Abstract

Overcoming the widespread malnutrition prevailing in the country has become a priority task. Based on the experience of the green revolution, it is clear that a farmer-led approach is essential for achieving the goal of freedom from malnutrition. Also there is need for concurrent action in the following five areas – overcoming undernutrition, protein hunger as well as hidden hunger caused by micronutrient malnturition, attention to clean drinking water and sanitation and finally ensuring safe handling of food at the post-harvest level to avoid mycotoxins. If we are to achieve our goal of ending malnutrition in the country, it is essential that agriculture, nutrition and health are attended to in an interactive way.

Introduction

There is growing concern over the persistent problem of malnutrition in India. Releasing the 2011 Hunger and Malnutrition Report, prepared by the Nandi Foundation, which found that 42 per cent of Indian children under five years old were underweight - almost double the rate of sub-Saharan Africa, the then Indian Prime Minister Dr Manmohan Singh called India's "unacceptably high" levels of child malnutrition a "national shame" (Sinha, 2012). The situation has not improved since then, despite India being one of the fastest growing economies in the world. The 2016 Global Nutrition Report ranks India 114 and 120 respectively in terms of under-5 stunting and wasting, amongst 129 countries (IFPRI, 2016).

Over the past 40 years, we have had a host of programmes and interventions to tackle the burden of malnutrition. The Integrated Child Development Services (ICDS) was initiated in 1975 on the recommendation of a committee set up by the Ministry of Education under the chairmanship of Mina Swaminathan, to attend to the nutritional, health and educational needs of children below 6 in an integrated manner (Report of the Standing Group on the Development of Pre-School Child, 1972). While the ICDS has achieved considerable success in child immunisation, the nutritional outcomes have remained poor. Some state governments having their own schemes, such as the Universal Public Distribution System in Tamil Nadu, the midday meal programme in schools, across the States, and setting up of nutrition missions in Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh, to address the problem in a holistic way. In 2013, the Indian Parliament passed the National Food Security Act (NFSA), conferring a legal right to food to all those needing social protection against hunger. The Chhattisgarh Food Security Act, 2012, is more radical than the NFSA in providing for a more comprehensive nutritional package, including the supply of pulses and iodised salt, alongside cereals, through the Public Distribution System (PDS). Why then should we still rank low in the nutrition index? Despite its serious implications in terms of cognitive development and wellbeing through life, why are we unable to make a significant dent in eradicating malnutrition from the country?

In this article, the focus is on learning lessons from the past to help identify key strategies – the missing links - that could help tackle the burden of malnutrition in India today and prove the contemporary prophets of doom wrong. We discuss the key lessons from the 1960s which helped overcome the problem of food production and availability, the nutritional challenges today and strategies to address them. What emerges is the key role of farmers and farming, the need to recognise them as key actors in the fight against malnutrition.

Lessons from the 1960s: The Green Revolution Experience

The 'Green Revolution', which started as a small government programme called the High yielding varieties programme became a mass movement in the hands of farmers; it is only mass movements which can lead to revolutions. A remarkable transformation took place both in human and agricultural history, a dramatic yield increase of 100-200

per cent over five years. There were several reasons for this transformation, but perhaps most important was the fact that farmers were placed at the centre of all development, with technology, public policy, especially in terms of procurement and remunerative pricing, land and water use, and research, extension and collaboration all tuned in to serving farmers' interests and preferences. An important factor was the unhesitating political support to scientific ideas (Swaminathan, 2013). Within development discourse, with participatory approaches becoming prominent in the 1970s, there was an emphasis on 'farmers first' (Chambers et al. 1989).

This coordinated approach, the 'Green Revolution Symphony' as it is often called, had several benefits; but the importance of context-specificity and responsiveness to farmers' lives and needs, in particular, the shift in emphasis from food availability to the quality of food (and hence nutrition) in current discourse, farmers and farming seem to be somewhat forgotten. Perhaps as a result of the reduction in agriculture's share in the GDP from over 50 per cent in 1950 to around 15 per cent in 2015 (Survey of India, 2015), farmers' (both men and women) knowledge in relation to farming systems or indeed dietary habits, are virtually ignored.

The country faced severe droughts in the 1960s; they were frequent, and the loss of yields was high, almost 30-40 per cent, compared to 5-10 per cent now The scientists responded fast by developing photo-insensitive and short duration varieties of crops. This provided an advantage, as the crops could be grown throughout the year, under assured irrigation system. It resulted in a rapid growth in the use of ground water for irrigation. In areas of water scarcity and chronic drought, like Maharashtra, community water management systems like the 'pani panchayats' were developed in the 1970s. These systems ensured that water was managed for the common good, and was equitably shared, but also remained under farmer control. The second requirement, namely seeds, has been more problematic, as the country did set up seed villages in the early days, but the 'seed reserve', similar to the grain reserve was not built.

In the early 1970s, a need was felt to set up a National Crop Planning Board, with the responsibility of developing alternative cropping strategies and implementation plans for every part of the country based on different weather models, and 'to generate awareness of the dynamics and economics of cropping systems under diverse agro-

ecological conditions' (Swaminathan, 1972), Unfortunately, these recommendations have not been followed up. The farming system is more than crops, it includes livestock, fisheries, forestry and agro-forestry. Similar to the US National Research Council's description in the 'Lost crops of the Incas: Little known plants of the Andes with promise for worldwide cultivation' (1989), we are witnessing extensive genetic erosion, with implications for diets. Traditional diets were often rich not only in coarse cereals like millets, but also included a range of greens, fruits and game. As in the case of the Incas, the food basket has now shrunk to 5-6 major crops, mainly cereals. *Moringa* leaves, for instance, are more nutritious than the drumsticks. Farmers, especially women, knew what to consume or not at what time, as in the case of a cold or fever, or pregnancy; they had a sense of hot and cold foods, which change with season, in line with both temperature and availability. They also had techniques of sun drying and preservation of different seasonal vegetables, rich in nutrients, for the lean periods. The diversity in diets to some extent helped ensure relatively balanced nutritional intakes.

In fact, immediately after the World War II, a chain of cafeterias called 'Annapurna' were set up in several places, including Mumbai, Delhi and Chennai, to promote a whole series of millets including *ragi, bajra, jowar* etc. No rice or wheat was served (Sahgal, 1994). These cafeterias became popular, both due to their culinary taste and nutritional superiority. It is unfortunate that the British government named these 'coarse cereals', thus according them a low status, instead of calling them 'nutri-cereals'. Nutritious crops like millets will only be produced and consumed if there is market demand for them are required and there is linked not just to access and availability, but also to changing aspiration.

. This longside suitable technologies for processing and value addition – this will set an example for 'conservation through commercialisation'. Unfortunately, there has been little progress in the development of post-harvest technologies, especially in the case of these nutri- cereals. It is not enough to think about nutrition in isolation, it has to be considered as part of people's lives and livelihoods, their agricultural practices, the nature of cooking, the technologies available for processing, and so on.

Understanding the nutritional problem

The grim picture of malnutrition cannot be denied. In order to find appropriate solutions, we need to unpack the concept of malnutrition, what it entails, and how it varies across contexts. The first step is to understand the prevailing nutrition problem. Nutrition itself consists of several components, including calorie, protein and micronutrient adequacy. The second step therefore is to understand where the problem lies, to develop socially and economically acceptable solutions for achieving a malnutrition-free India (Box 1). Particular attention is needs to be paid to the first thousand days in child's life, in programmes designed on a whole life cycle approach.

Undernutrition:

The first, calorie adequacy is linked to the availability and access to food grains, the basic staple, which may of course vary across contexts, wheat being more popular in North India, rice in the eastern and southern parts of the country, and *jowar* and *ragi* in Gujarat and Karnataka. Calorie intake is directly linked to both production and purchasing power, the latter highlighted by Amartya Sen in his discussion of famines (Sen, 1981). The NFSA (2013), which ensures 5 kg per head of food grains to 80 per cent of the Indian population, is definitely the ultimate route for addressing under-nutrition, as it makes access to cereals a basic right. If the Act is properly implemented, the problem of calorie inadequacy can be overcome. In fact, recent field studies already show a high-level of calorie adequacy in malnutrition hot-spots and high burden districts as a result of the availability of cheap food grains, i.e. rice or wheat through the PDS.

An important feature of the NFSA is giving recognition to women's role in household nutrition. However, what is less known, is that the Act provides for not only wheat and rice, but the possibility of expanding the food basket to include 'nutri-cereals' such as *jowar, bajra*, and *ragi*. It is important that women as entitlement-holders are made aware of this provision, so they can start demanding more nutritious grains, and not restrict themselves to wheat or rice. Such demand will have spin-off effects – the government will need to procure adequate millets for instance, to meet the demand; this would mean announcing a remunerative price to incentivise the production of such crops. Addressing undernutrition then requires policy attention to pricing, procurement and public distribution, especially for nutri-cereals

Like in the 1960s, it is important for scientists, farmers and policy-makers to work together to ensure that nutritionally rich staples are produced, procured and distributed. While this may not entirely be the case, the choice of suitable crops, with high nutritive content, and their sufficient production, depends on the availability of land and water. Pressures on land are increasing, especially the demand for land for non-agricultural purposes – industry as well as urban development, but also the shift from food to commercial crops. Unless there are strong public policies that prioritise, incentivise and support nutrition security, and nutrition-sensitive agriculture, we will find a rapid replacement of nutritious crops with industrial crops. This has already happened in several states; in Puducherry, Casuarina, known popularly as a 'marriage' (dowry) crop, has replaced rice. We similarly find large-scale cultivation of eucalyptus in tribal pockets of central India, especially on mid and uplands, reserved earlier for millets and vegetables.

Protein deficiency:

The second important element of nutrition is protein adequacy, as the lack of protein can lead to generally debilitating conditions like kwashiorkor in the child. Several children in the streets of Delhi can be seen with blonde or brown hair, or with distended stomachs – evidence of protein deficiency. In the 1960s, the United Nations set up a Committee called the Protein Advisory Group (PAG), later called the Protein Calorie Advisory Group, as proteins alone are not sufficient for ensuring nutrition (Ruxin, 2000) and now the UN Committee on Nutrition, to address nutritional problems using agriculture as the pathway. Using a similar pathway Thailand rapidly moved ahead in improving nutritional outcomes of its population.

Farming systems have traditionally integrated crop-livestock-fish and forest produce, and such integration ensured adequate protein availability and intake, alongside cereals. In Maharashtra, for instance, the poultry industry is well developed; with assured backward and forward linkages, most rural households maintain a few backyard poultry. Eggs are sold and consumed, as are the birds. Eggs are socially and culturally liked and accepted by most people, hence including eggs and poultry in the diet can help meet protein hunger. Fortunately, India is one of the largest producers of eggs, and several states have included eggs in their mid-day meal programmes. Tamil

Nadu, for instance, provides three eggs per week to all children, which contains a sufficient quantity of protein for healthy growth. Eastern and coastal India, similarly, are rich in fish resources, and we need to ensure that these remain a part of people's everyday diets.

A second pathway for ensuring protein adequacy is to ensure cereal/legume rotation in the cropping system. Including pulses in the cropping system is also beneficial for soil health as leguminous plants fix nitrogen in the soil. Today, we are importing over 6 million tonnes of pulses; prices of pulses are very high and protein shortage is increasing. The Government of India is looking to other countries to grow pulses. If we reorient our farming systems, we can produce enough pulses for our needs. Special '**pulses panchayats'** can be set up, especially in dry farming areas. Krishi Vigyan Kendras can also support this process, to make sure that appropriate cereal-legume rotations are introduced in different soil and water conditions. Research is however needed to develop varieties that can help close the gap between potential and actual yields in pulses. Here too, what emerges is the need for scientists and farmers to work together, keeping in mind the nutritional requirements of the communities as well as their ability to make a decent living. Apart from efforts to enhance the production of pulses, it is important that pulses are procured at assured and remunerative prices, and distributed by the state through the PDS, as in the case of Chhattisgarh. Unless we look at production and consumption holistically, and address the various linkages in the process, taking into account the social acceptability and cultural preferences for different crop and livestock products, we will not be able to successfully address protein, and indeed calorie deficiencies.

Micronutrient deficiencies:

The deficiency of micronutrients like iron, iodine, vitamin A and zinc, is often referred to as hidden hunger. Some micronutrients can be derived from cereals and proteins, but they are often not adequate, leading to a host of problems including anaemia and night blindness. Micronutrient deficiencies are closely linked to dietary diversity; hence shortfalls reflect not just a lack of access or purchasing power, but also changing consumption priorities. People often don't prioritise nutrition, even if they have the money. As long as they have enough to eat, they don't distinguish between calories,

proteins and micronutrients, maybe because they don't recognise the negative long-term implications in terms of cognitive development or poor health.

Many of these changes on the ground, contributing to the persistence of high levels of micronutrient deficiencies, have been exacerbated by the progressive domination of policy, especially over the past two decades, with a market-oriented, chemical-based approach, rather than a farmer-centred, food based approach. The current policy regime facilitates drug based interventions such as vitamin A drops or iron and folic acid tablets, to address problems of vitamin A deficiency and anaemia, or the introduction of chemical fortification in food to overcome micronutrient deficiencies. While these are useful in some cases, like iodized salt, but in other cases, there may be secondary nutritional problems, arising from the use of particular chemicals and pesticides in the production process. There could be residual toxicity as is becoming evident from several recent examples, but pointed out as early as the 1960s by Rachel Carson in her famous book, Silent Spring (1962). Instead of the oral administration of vitamin A, sweet potato can be consumed, as apart from Vitamin A, it also provides other naturally occurring nutrients. A food rather than drug-based approach can help ensure safety, but also general health. Such an approach however needs coordinated support.

Nutritional Literacy:

An important requirement for integrating agriculture and nutrition is nutritional literacy, both among the farmers and farm scientists. What farmers need is an exposure to the various alternatives available for integrating nutrition within farming systems. For this purpose, clarity is needed in basic concepts. A first step could be the establishment of "genetic gardens of biofortified plants". A genetic garden would contain considerable genetic diversity of the crops proposed to be included in the farming system. For example, sweet potato is a good source of vitamin A. In vitamin A deficient areas, sweet potato can even replace potato in the diet. There is variability amongst sweet potato varieties with reference to vitamin A content, hence a varietal collection and analysis will be necessary before promoting particular varieties. Also, for those who do not like sweet potato, there could be varieties of breadfruit that provide

the same amount of vitamin A. This kind of genetic analysis is the role of the genetic garden of biofortified plants.

Fortification involves adding nutrients to yield. This is a relatively recent development within agricultural research, as it involves screening natural germplasm collections for nutritive properties and not just yield characteristics. The CGIAR's HarvestPlus programme has been leading the scientific efforts in this field. In fact, the World Food Prize this year, 2016, is being awarded to a four person team of researchers from the International Potato Centre (CIP) and HarvestPlus for their achievement in developing the single most successful example of micronutrient and vitamin biofortification – the orange-fleshed sweet potato. This will definitely give an impetus to naturally occurring biofortification in the coming years.

Fortification is possible through either biological or chemical means. Biologically, there are three methods of fortification, namely natural, through conventional Mendelian breeding and by genetic modification. Golden rice is a good example of a vitamin A rich strain of rice produced by genetic modification, however, since this has a number of regulatory requirements and restrictions, it is best to select plants from nature or undertake breeding by Mendelian breeding methods. Natural biofortification implies the natural enrichment of the plant with the needed nutrients. Similar to the example of vitamin A rich sweet potato, iron is present in a number of plants like drumstick, amaranthus, spinach and others. Locally appropriate naturally biofortified plants can be selected and promoted for cultivation within farming systems. In some cases, fortification by genetic improvement through breeding can be helpful, such as in the case of iron-rich *bajra* or zinc-rich rice. Bio-fortification, which is natural or through breeding, should be the preferred options where they are both economically viable and socially acceptable (Swaminathan, 2015).

Food Safety and Quality:

An important issue, often forgotten, relates to food safety and quality, including residual toxicity (Narain, et al., 2012), as mentioned earlier. The same applies to water as well. Availability of clean drinking water and its safe storage and handling is essential to ensure nutrition security. However balanced diet people may have, if attention to food safety is lacking, we will not make any headway in addressing the nutrition problem.

Another serious problem with reference to food quality is the presence of mycotoxins particularly aflatoxins in the food material. These come largely from poor storage conditions resulting in high moisture content in the grain. The country has not invested in modern storage facilities. Lack of proper storage reduces both the quality and safety of the food.

Tackling the nutrition problem through agriculture

Clearly nutrition is a complex issue, with multiple dimensions, hence addressing it needs a holistic, multidimensional approach. One of the strategies to ensure informed participation is to train local men and women from each panchayat[1] as **'community hunger fighters'** (Narayanan et al. 2015). These community hunger fighters, being local, are knowledgeable about what is missing in people's diets, their culinary habits, the challenges confronting them, and can provide ideas on what might be cost effective, but also socially acceptable.

One historical example is the shift from unpolished, hand-pounded rice to polished, milled rice. Even Mahatama Gandhi in the 1940s protested against mills, which he saw as taking away the protein coat from rice, and thus reducing its nutritional value. But today hand-pounding has virtually disappeared, even from remote tribal pockets, largely due to its time and effort intensity. The same holds true for millet consumption, as its processing until recently was manual and arduous, involving mainly female labour. Even though women recognised its nutritive value, they had no time to process it, and preferred to purchase polished rice from the PDS shops. While technological changes in milling and polishing have helped reduce the drudgery of women's work, we nevertheless need to make sure that these technologies do not affect the quality of the grain adversely.

A further element of nutritional literacy is to understand what kind of foods are preferred for different types of work and health conditions – indigenous knowledge around health and food is fast disappearing. Women in particular have tremendous insight into foods suitable for different health conditions and life cycle changes, especially pregnancy and lactation; however, with the medicalisation of nutrition

[1] Panchayat: An elected village council in India

research and extension from the 1960s onwards, nutritional deficiencies increasingly came to be seen as diseases or debilitating health conditions. So, anaemia for instance, was to be addressed through iron and folic acid tablets, rather than food. In the 1970s, under Dr Gopalan's leadership, the role of agriculture and food for nutritional wellbeing was recognised; however, this link has once again weakened over the last three decades, and needs to be revived. Unless solutions are socially and culturally compatible with people's aspirations, and economically viable, they may be hard to implement. This understanding could help explain partially why despite 40 years of top-down interventions, changes on the ground are partial and location-specific.

Alongside capacity-building and awareness generation, implementation needs to be in the hands of a local committee to be led by both men and women from the community, but include connected local government officials and other partners, such as donors, technical experts such as scientists from local agricultural universities, nutritionists and public health workers. The committee, which may be designated as **'zero hunger committee'**, would be responsible for monitoring progress across a range of indicators, relating both to food and non-food factors, to achieve time-bound targets. While several states have Nutrition Missions, few of them have time-bound targets, and this makes it hard to measure progress (IFPRI, 2016).

The next step, following the identification of the nutritional problems in a particular area, is the design of the farming system to include specific crop varieties that can address the identified deficiencies. Sweet potato might provide vitamin A, drumstick tree (*Moringa oleifera*) and *Amaranthus* sp. could address the lack of iron. A genetic garden of biofortified plants should be established within a cluster of villages or at panchayat level. Varieties from the genetic garden can be adapted and adopted in the local farming systems, which are determined by two major factors – the home needs of the farmers, and the market demand for particular foods. Designing a farming system then needs to address nutritional deficiencies in the family, in other words mainstreaming nutrition in the choice of crops, but also reflecting crops which have a market value (Das et al. 2014). Markets are often not sensitive to nutrition and don't offer incentives or premiums for nutritionally-rich crops. There is hence need for market literacy, to make market leaders sensitive to nutritional requirements. Following this, equally important are the 3Ms –

management of the programme, monitoring of progress and measurement of impact. This can be effectively done by the **'zero hunger committee',** as suggested above**.**

National Nutrition Programme

Given the scale of the problem, it has to be a national nutrition initiative, led by the State. Public sector agencies like the concerned ministries of government, both at the Centre and State levels have to take the lead; drawing in the private sector under its Corporate Social Responsibility (CSR) programme; and the cooperative sector, which could include farmers' organisations, marketing cooperatives, etc. The public sector should be actively involved in developing and introducing public policies such as investment in health and social infrastructure (drinking water, sanitation) as well as, the procurement, adequate pricing and distribution of biofortified crops. Public research and extension through the Krishi Vigyan Kendras present in every district, supported by Agricultural Universities, need to be strengthened. Equally important are the macroeconomic policies such as export-import policies and input-output pricing policies. Public policies should be designed to achieve the goal of malnutrition-free India, since the economic costs of malnutrition are high.

The private sector should adopt pro-nutrition policies in the manufacture, sale and promotion of food products as part of their business policy. A second role for the private sector can be to provide financial support for inputs like seeds, requirements of organic agriculture, or render services like improving the nutritive quality of school mid-day meals. These could be undertaken through their CSR interventions. These examples are not exhaustive, and there is scope for their expansion, particularly support to child and health care. A good example of the role the cooperative sector can play is provided by Amul dairy, which enhanced members' incomes through the collectivisation of processing and marketing of milk and milk products, while also supporting the improvement of animal nutrition through the provision of cattle feed as well as veterinary services. Farmers' cooperatives can promote farming systems for nutrition security by organising the genetic gardens of biofortified crops, and support nutrition-sensitive farming and cropping systems.

A coordinated, multi-dimensional approach is the need of the hour. This is not easy, but not impossible – the success of such a strategy has been demonstrated in the past. Institutions dealing with agriculture, health, nutrition and food technologies have to work together. Only if these actors work in tandem with each other, complementing each other's efforts, can the goals of a malnutrition-free India be achieved (Box 1).

Conclusions:

Despite the decline in agriculture's contribution to the GDP, India is still primarily a rural, agricultural country. Farm families constitute a majority of producers and consumers. With the deepening agrarian crisis over the past decade, and climate change effects, they also constitute a majority of the malnourished. The time has come therefore to review the country's strategy for achieving a malnutrition-free India. The major change is to make farm families, men and women, the leaders of the anti-malnutrition movement – a top-down, drug-based approach, needs to be replaced by a bottom-up, participatory and locally accountable, food-based approach.

Secondly, if history offers any lessons, then a key one is the synergy between technology and public policy, which in the 1960s and 70s shaped the success of programmes for attaining food security in the country, in a context of hopelessness. This synergy was driven by the needs of farmers and developed with their active involvement. Overcoming malnutrition is a national challenge. The public, private and cooperative sectors all need to work together in achieving the goal. Finally, initiatives in the field of overcoming hunger and malnutrition will help to achieve Goal 2 of the UN Sustainable Development Goals targeting to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture".

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Survey of India, 2015

Box 1: Achieving a malnutrition-free India: Steps for Action

1. Identify the major malnutrition problems, in both quantitative and qualitative dimensions, in the area of work.
2. Classify the underlying causes of the problem, namely, undernutrition, protein hunger, hidden hunger caused by micronutrient deficiencies and non-food factors like drinking water, sanitation etc.
3. Identify feasible and socially and economically acceptable solutions to these problems. These include:

    a) First, effective implementation of the National Food Security Act, 2013, will help address undernutrition / need for calories. The eldest woman in the household, holding the food entitlements, should be encouraged to demand nutri-cereals and other grains, which have been included in the food basket along with rice and wheat.

    b) Second, the production and consumption of pulses and other protein foods should be promoted through cereal-legume and crop-livestock farming systems.

    c) Third, we must promote knowledge of naturally biofortified plants like *moringa*, sweet potato, amla etc. which can help overcome hidden hunger caused by micronutrient malnutrition. For this purpose, genetic gardens of naturally biofortified plants or those developed by Mendelian breeding may be established so as to help farmers choose appropriate crops for addressing the prevailing nutritional problem.

    d) Fourth, Food safety and quality monitoring in order to ensure that the food consumed is without harmful pesticide or other toxic residues

    e) Fifth, non-food factors influencing nutrition security like clean drinking water, environmental hygiene and sanitation should get concurrent attention through ensuring convergence in the delivery of health and other infrastructure and services.

4. Design farming systems, sensitive to ecological/ ecosystem and socio-cultural factors, which will incorporate the agricultural solutions to the malnutrition problem to be overcome.

5. Launch a nutrition literacy programme by training a cadre of community hunger fighters (men and women from the community), familiar with the malnutrition problems of the area, social practices and their agricultural solutions.

6. Develop institutional structures which can bring about convergence and synergy among the various components of leveraging agriculture for nutrition.

7. Develop a monitoring framework and impact assessment criteria, with targets, to ensure effective implementation of interventions, and synergy amongst them.