USING A PROGRAMME IMPACT PATHWAY TO DESIGN, MONITOR, AND EVALUATE INTERVENTIONS TO COMMERCIALISE BIOFORTIFIED CROPS AND FOODS

GAIN Working Paper n°29

July, 2022

Valerie M Friesen, Bho Mudyahoto, Ekin Birol, Annette M Nyangaresi, Byron Reyes, Mduduzi NN Mbuya

gain
Global Alliance for Improved Nutrition

HarvestPlus
Better Crops • Better Nutrition

ABOUT GAIN

The Global Alliance for Improved Nutrition (GAIN) is a Swiss-based foundation launched at the UN in 2002 to tackle the human suffering caused by malnutrition. Working with governments, businesses and civil society, we aim to transform food systems so that they deliver more nutritious food for all people, especially the most vulnerable.

ABOUT HARVESTPLUS

HarvestPlus is a CGIAR research programme which aims to improve nutrition and public health by developing and promoting biofortified food crops that are enriched with nutrients. Founded in 2003 and hosted by the International Food Policy Research Institute in Washington, DC, HarvestPlus provides global leadership on biofortification evidence, technology, and policy.

Recommended citation

Friesen VM, Mudyahoto B, Birol E, Nyangaresi AM, Reyes B, Mbuya MNN. Using a Programme Impact Pathway to Design, Monitor, and Evaluate Interventions to Commercialise Biofortified Crops and Foods. Global Alliance for Improved Nutrition (GAIN) and HarvestPlus. Working Paper #29. Geneva, Switzerland, 2022. DOI: https://doi.org/10.36072/wp.29

Acknowledgements

The authors would like to thank Stella Nordhagen for reviewing this paper. The authors would like to acknowledge funding for this work provided by the German Federal Ministry of Economic Cooperation and Development (BMZ) and the Netherlands Ministry of Foreign Affairs for the Commercialisation of Biofortified Crops programme co-led by the Global Alliance for Improved Nutrition (GAIN) and HarvestPlus. All photographs included in this document have been taken with consent for use in publications.

GAIN WORKING PAPER SERIES

The GAIN Working Paper Series provides informative updates on program approaches and evaluations, research, and other topics relevant to helping reshape the food system to improve the consumption of nutritious, safe food for all people, especially the most vulnerable.

The Global Alliance for Improved Nutrition (GAIN)
Rue de Varembé 7
1202 Geneva
Switzerland
T: +41 22 749 18 50
E: info@gainhealth.org

www.gainhealth.org

gain
Global Alliance for Improved Nutrition

SUMMARY

Using a theory of change (TOC; a simplified definition of how and why an intervention is expected to work) or a programme impact pathway (PIP; a more detailed description of the causal pathways through which an intervention is delivered) to guide design, monitoring, and evaluation efforts is increasingly being used across various nutrition interventions, yet there are few documented examples in biofortification programmes. During the inception phase of the Commercialisation of Biofortified Crops (CBC) programme, which aims to scale up production and consumption of biofortified foods in six countries in Africa and Asia, a PIP was developed and used to inform the design of commercialisation strategies and their monitoring and evaluation. The objective of this paper is to describe that process.

Using a generic TOC for biofortification as a starting point, we developed detailed PIPs for each of the nine country-crop combinations. Within each PIP, we identified the commercial pathway(s) and selected the one(s) with the most potential for impact. We then identified the binding constraint along each pathway and a set of activities and resources to tackle it. This process formed the basis of the country-crop commercialisation strategies and associated workplans. Additionally, we developed a monitoring reference manual that included a set of standardised indicators mapped to the PIP and detailed indicator reference sheets. These tools were contextualised for each country-crop combination and formed the basis of the programme's monitoring and evaluation plans.

Using a PIP to guide the development of programme strategies and measurement of achievements is good practice to ensure that programmes have high potential for impact and that relevant information needed to understand the evolution of results along the PIP is collected throughout programme implementation.

KEY MESSAGES

- Using a PIP to guide programme design, monitoring, and evaluation can help ensure programmes have high potential for impact and collect information needed to understand not only what impacts are achieved but also how or why impacts are or are not achieved.
- Making a PIP central to the programme strategy design process sets up a framework for intentional learning by creating opportunities to rethink targets, interrogate or verify assumptions, and ask questions about what will result from specific actions and whether they will trigger the expected responses.
- Using a set of standardised indicators across all nine CBC country-crop programmes was crucial for guiding and standardising data collection and analysis methods and tools and made it possible to collate results across countries to create one global impact story and enable cross-country learning.

BACKGROUND AND OBJECTIVE

Biofortification (or nutrient enrichment), defined as the process of increasing the density of micronutrients in crops through conventional breeding methods, is a cost-effective strategy for increasing the availability of micronutrients in the food supply (1). Biofortification programmes are designed to target widely produced and consumed staple foods and the micronutrients that are most limited in diets of the target populations as a means to contribute to reducing the high burden of micronutrient deficiencies (1). Programmes include a range of activities that cut across the value chain, from seed multiplication to farm-level production to aggregation to food processing and retailing, to ultimately reach their goal of increasing the consumption of biofortified foods. As biofortification programmes are implemented, monitoring and evaluation activities should be carried out that track various indicators along the value chain from production through to purchase and consumption of biofortified foods. This information is important to understand whether programmes are being implemented as planned, how effective they are at achieving their goals, and to demonstrate attribution of programme activities to any impacts seen.

It is well established that programme design and evaluation should be theory-driven, and there are various tools and terminologies used to articulate programme theory and enable their use in programme design and evaluation (2). The "programme theory", often referred to as the "theory of change" (TOC), is a simplified explanation (usually schematic) of how and why an intervention is expected to work and generate the desired results. For example, *IF we improve the micronutrient content of foods that are widely consumed in a given population; THEN functional outcomes will be realised.* The programme impact pathway (PIP) specifies the causal pathways through which delivery of a programme or intervention to target populations (or sub-populations thereof) occurs. For example, *IF we improve the micronutrient content of foods that are widely consumed in a given population such that they are available in amounts sufficient to contribute meaningfully to nutrition and public health; THEN benefits in micronutrient intake, micronutrient status, and health and functional outcomes will be realised.* A PIP will often go further to identify in much greater detail the intermediate processes and outcomes as well as intended and potential unintended consequences and external factors that might facilitate and/or impede progress in the programme.

TOCs and PIPs have been increasingly used to guide design and evaluation efforts across various nutrition interventions, such as conditional cash transfer, infant and child feeding, and large-scale food fortification programmes (3–8). In biofortification, many implementers have similarly developed and used TOCs to guide programming efforts, but there are few published examples (9). In 2019, a group of monitoring, evaluation, learning, and impact assessment (MELIA) specialists working on biofortification from HarvestPlus, the Global Alliance for Improved Nutrition (GAIN), International Potato Center (CIP), Standing Panel on Impact Assessment (SPIA), the International Center for Tropical Agriculture (CIAT), and Wageningen University and Research (WUR) developed a generic TOC for biofortification as part of a larger collaborative effort to develop a global, harmonised MELIA system for biofortification at scale (10).

The Commercialisation of Biofortified Crops (CBC) programme, launched in 2019 and jointly led by HarvestPlus and GAIN, aims to scale up the production and utilisation of foods made from biofortified staple crops through commercial market pathways in Africa and Asia (11). The programme is carried out in six countries where high levels of micronutrient deficiencies persist and focuses on iron beans (in Kenya and Tanzania), iron pearl millet (in India), vitamin A maize (in Nigeria and Tanzania), vitamin A cassava (in Nigeria), zinc wheat (in Pakistan and India), and zinc rice (in Bangladesh). The objective of this paper is to describe how a PIP was used to inform the design of nine individual country-crop strategies and their monitoring and evaluation components in the six countries under the CBC programme.

METHODOLOGY

USING THE PIP TO INFORM PROGRAMME DESIGN

Using the generic theory of change for biofortification developed by the MELIA collective as a starting point (10), a technical support team from GAIN and HarvestPlus with expertise in programme design, monitoring, and evaluation developed a generic PIP for the CBC programme that represented the main pathways that would be critical for scaling up biofortification using commercialisation (defined as the process of introducing a product into commerce or making it available in the market, rather than producing solely for family consumption) as the priority delivery approach (Figure 1). The PIP illustrates four key pathways through which people consume biofortified foods, of which the first three are considered commercial pathways. Briefly, the four pathways are:

1. purchased by consumers,
2. given to consumers in informal settings (e.g., friends/family),
3. given to consumers in formal settings (e.g., institutional food distribution programmes), and
4. allocated for home consumption from on-farm production (by farmer households).

Implementation and technical support teams from GAIN and HarvestPlus then used the PIP, in alignment with a review of evidence and commercialisation assessments, to inform the design of commercialisation strategies along the selected commercial pathways for each of the nine country-crop combinations. To do this, implementation teams were trained through a series of webinars on how to use the CBC programme PIP in their strategy development process to identify:

- Which path(s) presents the greatest market share?
- Which path(s) are the most modifiable/amenable to change?

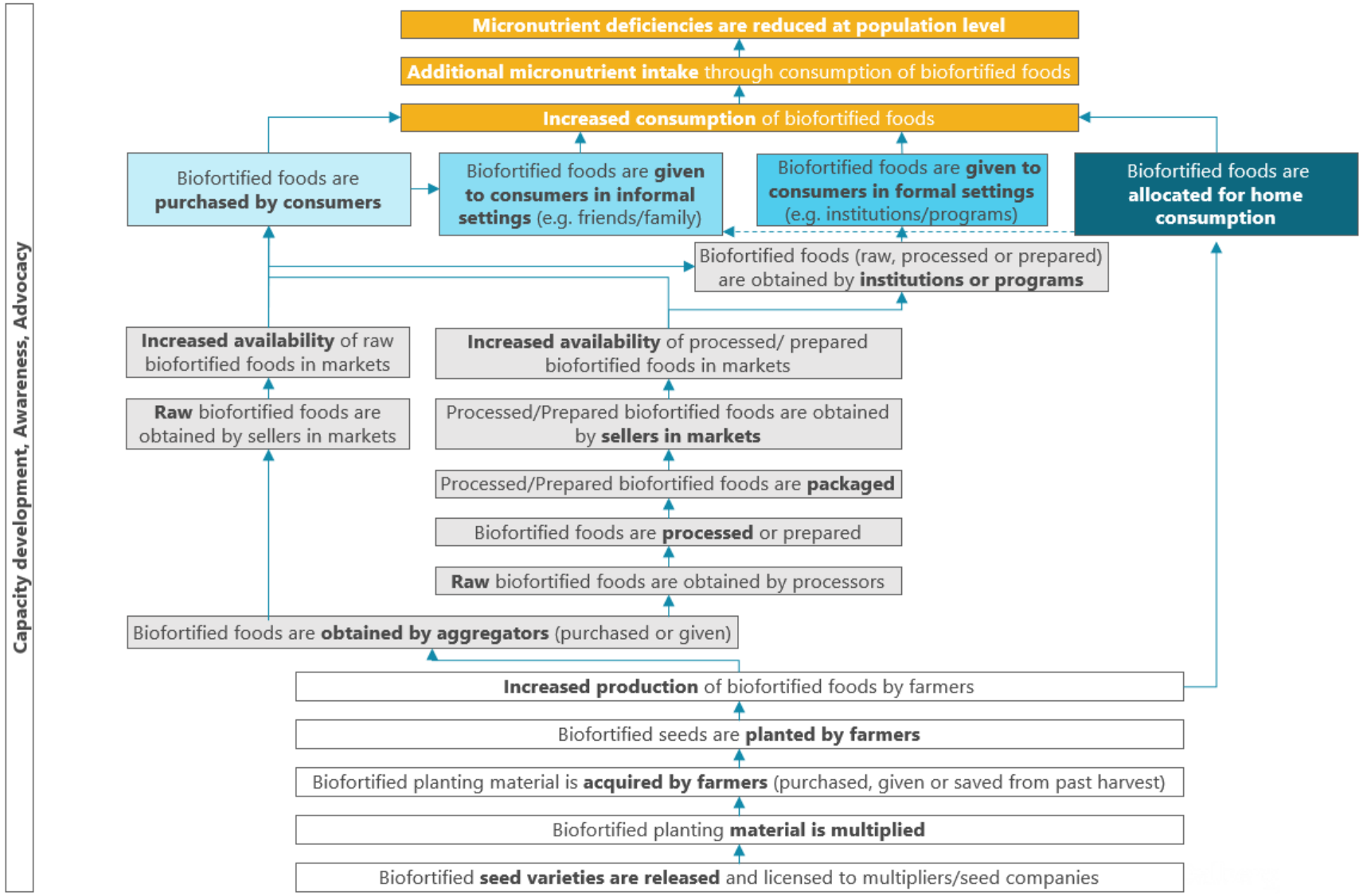

Figure 1. CBC programme impact pathway (PIP) (12)

First, the implementation teams from both GAIN and HarvestPlus reviewed all existing evidence and experiences, as well as the new evidence generated from independent commercialisation assessments that were conducted in each country to identify opportunities and barriers to commercialisation of biofortified foods (13). Then, to guide and focus discussions to answer the two broad questions above, a checklist of six questions was used to identify scalable and cost-effective interventions (or levers/pivots or mechanisms) at each node of the PIP:

1. What is known about the context (from the existing evidence and commercialisation assessment)?
2. What is needed to achieve the desired results for each select pathway (i.e., activities) and to what extent has it already been done?
3. What are the opportunities for innovation?
4. What are the barriers to success?
5. What are the enhancing factors?
6. What are the risks?

This process led to the identification of the commercial pathway(s) with the most potential for impact, the binding constraint along each pathway, and a set of activities and resources needed to tackle it and progress through the pathway. This information formed the basis of the country-crop commercialisation strategies and associated workplans for each of the nine country-crop combinations.

USING THE PIP TO INFORM PROGRAMME MONITORING AND EVALUATION

The PIP also formed the basis of what needed to be measured to assess the programme implementation progress and quality, the evolution of outcome- and impact-level results, and how to address specific internal management and donor information needs.

The technical support team identified and mapped a set of 20 indicators for the CBC programme, aligned to various nodes of the PIP. These indicators will be tracked to monitor the implementation process and outputs of commercialisation across different domains of supply, production, availability, and consumption of biofortified foods (Table 1, Figure 2). For each of the 20 indicators, detailed performance indicator reference sheets (PIRS) were developed that specified the definition, data sources and collection methods, frequency of data collection and reporting, and those responsible (see the CBC programme monitoring reference manual for more details (12)). The indicators were defined in clear and unambiguous terms and are inexpensive to measure. While each indicator tracks a single aspect of the programme results, combined they provide crucial information for decision making at each stage of programme implementation. The implementation teams contextualised the PIRS for each of the nine country-crop strategies and created results frameworks that included performance targets for each indicator. The country-crop specific results frameworks were then collated into a global CBC results framework that was shared with the donors supporting the programme. These tools formed an essential part of routine

programme monitoring and evaluation activities, which were designed to measure progress and facilitate corrective actions where needed throughout programme implementation through regular review and feedback mechanisms.

Table 1. CBC programme indicator list

#	Indicator
Objective 1: Improve seed supply	
Expected result 1: Supply of biofortified seed increased	
1	Quantity of seed/planting material available that is biofortified
2	Number of farmers that acquire biofortified seed/planting material
Objective 2: Improve production of biofortified crops	
Expected result 2: Production of biofortified crops increased	
3	Quantity of harvested food that is biofortified
4	Number of farmers that grow biofortified foods
5	Number of farmers that report increased production of biofortified foods
6	Number of farmers that sell harvested biofortified foods
7	Number of farmers that report increased income from sale of biofortified foods
Objective 3: Support supply chain for biofortified foods and food products	
Expected result 3: Availability of raw biofortified foods and food products increased	
8	Quantity of biofortified food obtained by aggregators
9	Number of aggregators that procure biofortified foods
10	Number of processors that procure biofortified foods
11	Quantity of raw biofortified food volume available in the market
12	Number of retailers selling raw biofortified foods
13	Number of prepared or processed food products available that contain a biofortified food in the market
14	Quantity of prepared or processed biofortified food volume available in the market
15	Number of retailers selling food products that contain a biofortified food
16	Quantity of biofortified food distributed through formal institutions/programs (in any form, i.e., raw or prepared/processed)
Objective 4: Improve awareness of biofortification of value chain actors	
Expected result 4: Consumer and value chain actors demanding biofortified foods increased	
17	Number of value chain actors (e.g., seed producers, farmers, aggregators, processors, retailers, consumers) that are aware of biofortified foods and their benefits
Objective 5: Advocacy and policy engagement	
Expected result 5: Biofortification integrated into policies and legal frameworks	
18	Number of policy/strategies/plans/legislation documents that mention biofortified foods at any level (e.g., local, regional, national)
Objective 6: Develop capacity of value chain actors	
Crosscutting: Contributes to expected results 1, 2 and 3	
19	Number of value chain actors (e.g., seed producers, farmers, aggregators, processors, retailers) that received capacity development support (e.g., technical, financial)
Objective 7: Improve consumption of biofortified foods	
Expected result 6: Increased consumption of biofortified foods	
20	Number of people who consume biofortified foods

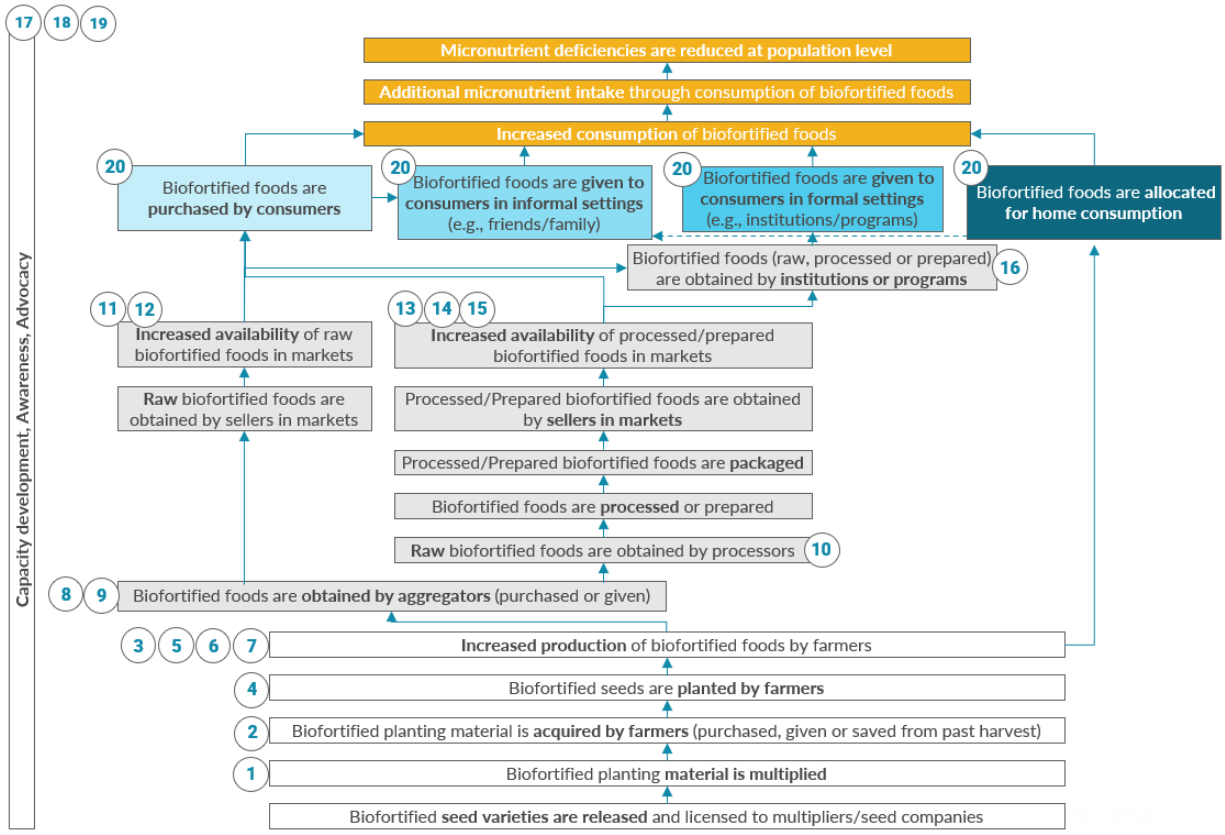

Figure 2. Indicators aligned to the CBC PIP (adapted from (12))

DISCUSSION

There were several insights gained from developing and using the PIP to guide the design of strategies to commercialise biofortified crops and foods and their monitoring and evaluation components across nine country-crop combinations in six countries under the CBC programme.

First, making a PIP central to the country strategy design process sets up a framework for intentional learning, such as by creating opportunities to rethink targets, interrogate or verify assumptions (e.g., what is needed to link farmers with markets), and ask questions about what will result from specific actions and whether they will be effective to trigger the expected responses. For example, after setting specific targets for all the indicators in the monitoring and evaluation plans, nearly all implementation teams realised that their initial targets for the number of people consuming biofortified foods were too high and unlikely to be feasible once accounting for progress through the other nodes in the pathway. This resulted in a process to review and revise the country strategies to see to what extent those targets were feasible or needed to be adjusted. This process facilitated communication between teams to agree on how to measure progress against targets and obtain more realistic estimates.

Second, routine monitoring allowed teams to track different aspects of the programme against the targets and to evaluate what was or was not working. However, additional complementary activities such as implementation research conducted alongside programme

implementation and routine monitoring activities also proved useful to identify blind spots that programme implementers may not see.

Third, the PIP helped to challenge some initial assumptions and identify critical linkages between programme activities. For example, the importance of and challenges with activities related to aggregating grain from farmers to ensure traceability of the biofortified grain through the supply chain to processors, retailers, and ultimately consumers were important insights that came out across countries.

The strengths of using the PIP for strategy design and progress or impact measurement were that it helped to identify the most effective and feasible strategies and clearly highlight which pathways were commercial and which were not, which was essential in the CBC programme. Additionally, using a set of standardised indicators across all nine CBC country-crop programmes was crucial for guiding and standardising data collection and analysis methods and tools across geographies and making it possible to collate results across countries to create one global progress/impact story and to enable cross-country learning.

At the same time, there were some limitations encountered. For instance, given the nascency of the CBC programme and short duration of implementation (i.e., three years), it was decided to include 'number of people who consume biofortified foods' as the highest impact-level indicator. Measurement of this indicator would be based on market food supply volume data rather than household-level surveys. As a result, the CBC programme did not include measurement at the top level of the PIP (i.e., additional micronutrient intakes and reduced micronutrient deficiencies). However, some preliminary work has been done in Rwanda using household-level surveys to test the use of more precise indicators for the number of people consuming biofortified foods (14). Additionally, higher-level impact level indicators, including measurement of amounts of biofortified foods consumed and changes in micronutrient intake and deficiency levels, are described in the MELIA collective TOC (10). Once evidence is available to confirm that commercialisation is working (i.e., there is high market availability of biofortified foods and food products), then it would be plausible to expect changes in micronutrient intakes and status at the individual level; in such cases, research can seek to collect data for these higher-level indicators.

CONCLUSION

Using a PIP to guide the development of programme strategies and measurement of programme achievements is good practice to design programmes with high potential for impact and collect information needed to understand not only what impacts are achieved but also how or why impacts are or are not achieved. The CBC programme demonstrated how these processes can be operationalised and highlights insights and challenges across different countries and contexts.

REFERENCES

1. Bouis HE. Biofortification: An Agricultural Tool to Address Mineral and Vitamin Deficiencies. In: Mannar MGV, Hurrell RF, editors. Food Fortification in a Globalized World [Internet]. Academic Press; 2018 [cited 2021 Sep 16]. p. 69–81. Available from: https://www.sciencedirect.com/science/article/pii/B9780128028612000079

2. Habicht JP, Pelto GH, Lapp J. Methodologies to evaluate the impact of large scale nutrition programs. Wash DC World Bank. 2009;

3. Leroy JL, Ruel M, Verhofstadt E. The impact of conditional cash transfer programmes on child nutrition: a review of evidence using a programme theory framework. J Dev Eff. 2009 Jun 11;1(2):103–29.

4. Habicht JP, Pelto GH. Program Impact Pathways and Contexts: A Commentary on Theoretical Issues and Research Applications to Support the EsIAN Component of Mexico's Conditional Cash Transfer Program. J Nutr. 2019 Dec 1;149(Supplement_1):2332S-2340S.

5. Rawat R, Nguyen PH, Ali D, Saha K, Alayon S, Kim SS, et al. Learning How Programs Achieve their Impact: Embedding Theory-Driven Process Evaluation and Other Program Learning Mechanisms in Alive & Thrive. Food Nutr Bull. 2013 Sep 1;34(3_suppl2):S212–25.

6. Martorell R, Ascencio M, Tacsan L, Alfaro T, Young MF, Addo OY, et al. Effectiveness evaluation of the food fortification program of Costa Rica: impact on anemia prevalence and hemoglobin concentrations in women and children. Am J Clin Nutr. 2015;101(1):210–7.

7. Olney DK, Vicheka S, Kro M, Chakriya C, Kroeun H, Hoing LS, et al. Using Program Impact Pathways to Understand and Improve Program Delivery, Utilization, and Potential for Impact of Helen Keller International's Homestead Food Production Program in Cambodia. Food Nutr Bull. 2013 Jun 1;34(2):169–84.

8. Le Port A, Zongrone A, Savy M, Fortin S, Kameli Y, Sessou E, et al. Program Impact Pathway Analysis Reveals Implementation Challenges that Limited the Incentive Value of Conditional Cash Transfers Aimed at Improving Maternal and Child Health Care Use in Mali. Curr Dev Nutr. 2019 Sep 1;3(9):nzz084.

9. de Brauw A, Eozenou P, Gilligan D, Hotz C, Kumar N, Meenakshi J. Biofortification, Crop Adoption, and Health Information: Impact Pathways in Mozambique and Uganda [Internet]. 2015 [cited 2021 Nov 15]. (HarvestPlus Working Paper). Report No.: 21. Available from: https://www.harvestplus.org/node/605

10. HarvestPlus, International Potato Center, Global Alliance for Improved Nutrition (GAIN), Wageningen University and Research (WUR), CGIAR Monitoring Evaluation and Learning (MEL) and Impact Assessment (IA) Communities of Practice (CoP) and the Standing Panel on Impact Assessment (SPIA). Monitoring, evaluation, learning and impact assessment systems (MELIAS) for large scale biofortification programs: a blueprint. In preparation; 2022.

11. Global Alliance for Improved Nutrition (GAIN), HarvestPlus. The Commercialisation of Biofortified Crops Programme: Expanding the reach of nutrient-enriched staples [Internet]. 2020. Available from:

https://www.gainhealth.org/sites/default/files/publications/documents/commercialisation-of-biofortified-crops-programme-flyer.pdf

12. Global Alliance for Improved Nutrition (GAIN), HarvestPlus. The Commercialisation of Biofortified Crops Programme: Monitoring reference manual [Internet]. Geneva, Switzerland and Washington, DC: GAIN and HarvestPlus; 2020 [cited 2022 Feb 28]. Available from: https://www.gainhealth.org/resources/reports-and-publications/commercialisation-biofortified-crops-programme-monitoring

13. Nyangaresi AM, Friesen VM, McClafferty B, van de Mere C, Haswell D, Reyes B, Mudyahoto B, et al. Developing strategies to commercialise biofortified crops and foods: Identifying opportunities and barriers to inform country-level interventions [Internet]. Geneva, Switzerland: Global Alliance for Improved Nutrition (GAIN) and HarvestPlus; 2022. Working Paper #28. Available from: https://doi.org/10.36072/wp.28

14. Petry N, Wirth JP, Friesen VM, Rohner F, Nkundineza A, Chanzu E, et al. Assessing the Coverage of Biofortified Foods: Development and Testing of Methods and Indicators in Musanze, Rwanda. Curr Dev Nutr [Internet]. 2020 Aug 1 [cited 2020 Aug 5];4(8). Available from: https://academic.oup.com/cdn/article/4/8/nzaa107/5859478