



# Vegetable Research Matters for Southeast Asia

M. C. S. Wopereis<sup>(✉)</sup> and C. G. Kuo

World Vegetable Center, P.O. Box 42, Shanhua, Tainan 74199, Taiwan  
marco.wopereis@worldveg.org

**Abstract.** Malnutrition presents a significant challenge across most Southeast Asian countries. Vegetable-enriched diets can contribute to reducing malnutrition by supplying phytonutrients, minerals, phytonutrients, proteins, vitamins and dietary fiber. However, average vegetable consumption in many Southeast Asian countries is far below the recommended intake. A Push-Pull-Policy framework is used to discuss knowledge gaps and research and action priorities to enhance vegetable production and consumption, leading to healthier diets but also to jobs and income opportunities in particular for women and youth. This will require a thorough understanding of vegetable value chains, food environments, dietary gaps, and consumer behavior, as well as external drivers such as climate change, urbanization, and policy. Making vegetables more available and affordable to consumers in Southeast Asia will entail technological and organizational innovations along the value chain, from seed to retail, and strong public-private sector partnerships to enhance vegetable productivity under changing climate scenarios. Significant investment in infrastructure will be needed to enable value-adding capabilities and to reduce postharvest vegetable losses and food waste. Consumer behavior also needs to be better understood; some consumer segments have a low acceptance of vegetables due to food safety concerns, high preferences for animal-based foods, or a lack of knowledge about nutrition and health. There is a need to diversify food systems with nutritious vegetables, aiming to achieve favorable and lasting dietary, economic, and environmental outcomes at scale. Given the rapid urbanization across the region, this is particularly important in and around cities. Vegetable research clearly matters for the Southeast Asia region. To realize the nutritional and economic potential of vegetables, these crops need to be given much greater attention. In the context of COVID-19 it is imperative to address disruptions in the food value chain and food environment, and an overall reduction in the consumption of nutritious vegetables due to imposed lockdown measures.

**Keywords:** Southeast Asia · Malnutrition · Food system · Vegetables · Micronutrients · Diet

## 1 Introduction

Today, malnutrition due to deficiencies in the food system threatens human health and development. Food systems in many countries in Southeast Asia are failing to combat malnutrition, provide adequate nutritious foods for healthy diets, or deliver safe foods. The prevalence of undernourishment in Southeast Asia is around 48.8 million people,

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and an estimated 15.3 million children under five are stunted (low height for age) and 6.5 million wasted (low weight for height), which can have life-long consequences [1]. Stunting prevalence is highest in Cambodia, Lao PDR, Myanmar and Timor-Leste [2], as well as in parts of Indonesia and the Philippines. Throughout the region, 27.2% of women aged 15–49 years suffered from iron-deficiency anemia [3, 4]. On the other side of malnutrition, obesity and overweight are on the rise, especially among women [5] because of rapid urbanization and economic development. Currently, one in five adults, and some 4.2 million children under five are obese or overweight. Overweight and obesity resulting from suboptimal diets have led to a rise in non-communicable diseases such as coronary heart disease, stroke, cancers, and diabetes [6]. The coexistence of both undernutrition and overnutrition is serious in Indonesia, Malaysia, the Philippines, and Thailand [7].

Undernutrition is either micronutrient deficiency or protein-energy malnourishment due to continuously insufficient intake of nutritious foods such as fruit, vegetables and dairy products. Overnutrition—excessive consumption of energy-dense and highly processed foods high in fat, animal protein and sugars at the expense of fruit and vegetables—results in obesity and overweight [7]. Nevertheless, micronutrient deficiencies are also common in normal-weight and overweight populations [8]. Undernutrition, overweight and obesity can further enhance the risk of micronutrient deficiencies through various physiological processes [9].

Southeast Asia's current population of 660 million is expected to climb to 740 million by 2035, and the percentage of urbanites will increase to 65% by 2050, compared to 50% today. This means many more people will need to be fed with nutritious foods. Climate change will complicate matters further. It is imperative to address nutrition security and healthy diets head-on now.

## **2 Vegetables as Essential Parts of Healthy Diets and Economic Development**

Fruit and vegetables are low in fat, carbohydrates, and proteins but are important sources of many minerals, vitamins and dietary fibers that are important for human health. Phytochemicals in fruit and vegetables, such as carotenoids, glucosinolates and polyphenolics act as antioxidants and also contribute to the nutritional quality of diets needed for human health and well-being. Moreover, micronutrients and antioxidants from vegetables can strengthen immune functions against infectious disease including COVID-19 [10].

For the above reasons, vegetables should be one of the integral components of diversified, balanced and healthy diets as suggested by many nutrition and health experts. To prevent malnutrition, WHO [11] recommended a minimum of 160 g of fruit and 240 g of vegetables per person per day (excluding starchy roots and tubers), whereas Afshin et al. [6] consider 360 g of vegetables (which contain low amounts of sugar) per person per day optimal. The study of the EAT-Lancet Commission involving 30 world-leading scientists from across the globe reached a scientific consensus that a diet rich in plant-based foods and with fewer animal source foods will have important environmental and human health benefits [12].

Vegetables are generally more profitable than staple crops for a given area of land. They require intensive management, which provides opportunities for smallholder farmers to produce and market vegetables. Small-scale production of vegetables also has the potential to protect the environment and ensure social equity [13]. Women can benefit in particular because they are often engaged in vegetable production and marketing in rural, and mostly informal, contexts.

The role of vegetables in healthy diets and food systems for human health as well as planetary health was highlighted by the declaration of 2021 as the International Year of Fruits and Vegetables [13], and during the United Nations Food Systems Summit on September 23, 2021 [14, 15].

### 3 Vegetable Supply and Consumption in Southeast Asia

Lack of vegetable consumption is an important challenge for the majority of Southeast Asian countries, where it is considered as a key driver of micronutrient deficiencies [16]. The total production of vegetables in Southeast Asia in 2019 is 47.1 million tons [17], which is inadequate for the existing population in the region. The weighted mean of vegetable intake for Southeast Asia is 153 g/capita/day, and countries with vegetable intake  $\geq 240$  g/capita/day is only 27% [18]. Vegetable consumption was extremely low in the case of adolescents, with lack of vegetable consumption reported by 75% of youth in Indonesia, 83% of youth in Myanmar, and 67% of adolescents in Thailand [19].

The supply of vegetables in the region is characterized by low productivity and seasonality. Average yield in the region in 2019 is 11.7 t/ha, which is only half of the average yield in East Asia [17]. As for weighted mean supply of vegetables in the region as whole, it is 190 g/capita/day [18], whereas Cambodia and Timor-Leste have less than 100 g/capita/day [19].

Insufficient supply and consumption of vegetables in Southeast Asia has many inter-related causes in the food system. Apart from low productivity, high levels of losses and waste in food value chains; low availability, low affordability, and low quality in the food environment; changing demographics; socio-cultural and psychological factors; and knowledge and information underlying consumer behaviour all pose challenges to increasing intake of nutritious vegetables [20–22]. Given that so many factors are involved in increasing vegetable intake in Southeast Asia, a holistic food systems approach is needed to achieve sustainable solutions to the double burden of malnutrition. Transformative change will be needed to move Southeast Asian citizens towards healthier eating patterns. This is not restricted to policies and measures to enhance the affordability of vegetable-enhanced diets. It will also require to think across the entire spectrum of policy options to raise awareness about the importance of healthier diets - containing vegetables and fruit - and to nudge consumers towards such healthier eating patterns, which would ideally be in synch with important environmental benefits.

### 4 Research to Strengthen Vegetable-Rich Food Systems Imperative

Sustained investment in R&D will be required to address the aforementioned issues. An important focus must be on providing options for farmers to increase the safe production of vegetables year-round despite more erratic weather patterns and ensure these

production systems become climate resilient and provide more diverse and nutritious food. This will ultimately lead to benefits across the entire food system from farm to consumer. The extent of investment in agricultural research and development differs across countries in Southeast Asia and is generally low. Southeast Asian countries (excluding Brunei Darussalam and Singapore) invested just 0.33% of agro-food systems-related GDP to innovations in research and development on agro-food systems [23], ranging from 0.06% (Myanmar) to 0.94 (Thailand). This is much lower than the one percent target recommended by the United Nations. Von Braun et al. [14] advocate that low-income countries should be assisted to ensure they can reach this target as soon as possible.

The research and development agenda in Southeast Asia is heavily focused on rice, and to some extent on livestock and aquaculture (Thailand and Vietnam), oil palm and rubber (Malaysia), and forestry (Indonesia). Public sector efforts to improve the vegetable sector through innovations in research and development are relatively scarce. Moreover, international funding devoted to research and development on vegetable-rich food systems is far from sufficient if one considers the importance of vegetable crops, the multiple challenges that need to be tackled and the potential benefits that can be obtained from investing in vegetable R&D [13, 24, 25]. The World Vegetable Center seeks to catalyze more research and action on nutritious, equitable, and sustainable food systems, including vegetables, has bilateral and network collaborations with various countries in the region, and has partnered with ASEAN member states since 1998 through the AARNET platform to address opportunities for collaborative vegetable research and development in Southeast Asia.

To fully realize the nutritional and economic potential of vegetables, international organizations and national governments must pay much greater attention to vegetables than is currently the case. It is urgent to give priority to vegetable R&D efforts geared towards providing economic opportunities for smallholder farmers and ensuring access to healthier diets for all [24]. Increasing investment in vegetable R&D will increase farm productivity and management efficiency in food value chains to ensure affordable and safe vegetables are available in adequate quantities in local food environments. Multiple innovations arising from R&D investments in the vegetable sector should be embedded as part of food system changes that aim to combat hidden hunger and malnutrition [26].

## **5 Transforming the Vegetable Sector in Southeast Asia**

To ensure vegetables are taken up in agro-food systems to provide healthier diets in Southeast Asia in a sustainable manner, there is a need to address three dimensions of the agri-food system at the same time: Push (stimulating production and supply of vegetables), Pull (engagement and creating demand for vegetables), and Policy (creating enablers to stimulate supply and demand through governance and legislation). This implies a balanced combination of both Push and Pull activities with a strategic linkage between them, buttressed by policies and governance that provide essential services and infrastructure, incentivize the private sector to invest in certain food value chains, and design a framework to monitor progress. The Push/Pull/Policy framework takes multiple pathways based on a clear understanding of the socioeconomic context of local food systems to support large-scale growth across the vegetable sector.

To implement the Push/Pull/Policy framework for transforming the vegetable sector in Southeast Asia, there is a need to tackle availability, accessibility, affordability, and acceptability of nutrient-rich vegetables. Towards this end, the ‘Push’ side should concentrate on sufficient supply of nutritious vegetables in the local food environment by increasing their productivity, availability, and affordability, whilst reducing environmental risks and adapting to climate change. The ‘Pull’ side should focus on ensuring the supply of vegetable products meets local consumers’ needs and expected standards. This will require innovative retailing mechanisms, value addition, and appropriate interventions to boost demand, paying due attention to food safety. To this end, an enabling environment needs to be created for scaling of innovations such as novel technologies, practices, and business models, which provide new and exciting opportunities for youth to engage in production and other activities in the value chain. The ‘Policy’ side should place the expected dietary outcomes from the realigned agro-food system upfront in food policy-making and legislation, and work towards incentivizing systems that provide a more enabling environment [15]. Opportunities for research and action for this framework are proposed and detailed below.

## **6 Push: Boosting the Supply of Nutrient-Dense and Safely Produced Vegetables in a Sustainable Manner**

Mason-D’Croz et al. [27] found that even in the case of negligible waste, most of Southeast Asia must enhance vegetable production to reach an adequate vegetable supply for the burgeoning population. Vegetable productivity in Southeast Asia is generally low due to a myriad of environmental, technological, and organizational factors [28]. This includes lack of improved varieties, shortage of quality seeds, an array of emerging pests and diseases, high night temperatures resulting in respiratory losses, poor soil conditions (i.e., low fertility, high acidity, high salinity, low water holding capacity), limited use of essential inputs, such as irrigation, fertilizers, and bio-pesticides, and poor agricultural practices. Moreover, it is widely suggested that climate change impacts vegetable productivity [29]. The region has been categorized by the Intergovernmental Panel on Climate Change (IPCC) as vulnerable to climate change and risk. This is further aggravated by the fact that some countries in Southeast Asia have the little adaptive capacity to deal with climate change [30]. Expected increases in the occurrence and intensity of extreme weather events, especially high temperature, drought, and flooding, will impact plant growth, alter flowering/fruitlet cycles, and increase vulnerability to emerging diseases and pests, frequently resulting in major crop losses or excessive use of pesticides. All of these affect vegetable productivity, disrupt food storage and distribution, and raise food safety concerns. These factors will also have an effect on market prices for vegetables.

### **6.1 Building Effective and Sustainable Vegetable Seed Systems**

High quality seeds are the most vital and crucial input for vegetable production and one of the means to increase productivity. Global vegetable seed companies are present throughout the region with their hubs in Thailand, Indonesia, Vietnam, and the Philippines. They offer newly bred vegetable varieties, mostly hybrids, to at least 20% of

smallholder farmers in the region [31]. National agricultural research systems often focus more on the availability of open-pollinated varieties.

To strengthen the vegetable seed sector in the region will require collaboration between the private and public sector at national and regional levels. Respective roles may differ depending on the type of activity, type of crop, and across countries. Governments need to provide: (i) capacity strengthening on technical aspects of varietal development, seed production, and seed marketing; (ii) extension services; (iii) research infrastructure; and (iv) operational funds to facilitate core breeding and seed production activities. Such an environment would also include a legal framework for private seed companies to operate, easy access to public-sector germplasm, and vastly simplified varietal release policies and seed regulations.

Several Southeast Asian countries have recently passed new seed laws (Vietnam 2019, Lao PDR 2020, Cambodia—draft circulated), while others have existing regulations. However, most of these regulations are designed for field crops, in particular cereals, and lack regulations for vegetable crops, not to mention lacking common policy on vegetable varietal registration and exchange, and phytosanitary rules for the region. As trade in vegetable seed can be expected to continue to grow, it is crucial that seed regulations are adapted and harmonized at the regional level and recognize the special nature of vegetable crops, whilst also facilitating varietal improvement and release by the public and private sectors.

To contribute to strengthening the vegetable seed sector in Southeast Asia, the World Vegetable Center and the Asia and Pacific Seed Association (APSA) established the APSA-WorldVeg Vegetable Breeding Consortium in 2017. This Consortium aims to strengthen the vegetable seed industry in Southeast Asia and beyond, and is an example of public-private sector collaboration to move the vegetable seed sector forward. Up to the end of 2020, Consortium member companies (as reported by 31 seed companies) released 85 varieties containing WorldVeg-developed germplasm in their pedigrees. WorldVeg-developed germplasm was found in 25 tons of tomato, pepper, bitter melon, and pumpkin seed sold in Asia by 19 different seed companies of the APSA-WorldVeg Vegetable Breeding Consortium. This seed is potentially enough to plant 171,000 hectares under these vegetable crops and benefit about 0.5M small-scale farming families.

## 6.2 Raising Vegetable Productivity

Providing quality seed or seedlings of robust, well-adapted varieties to farmers is a key entry point to raising vegetable productivity. Production of seedlings using protected cultivation technology, such as insect-proof nets, will ensure seedlings are healthy and give a head start to the vegetable crop. Grafting technology may protect a tomato crop against soil-borne diseases and flooding.

Building soil health is critical to ensure use of external inputs can be minimized, or when applied, are used in the most optimal manner. This can be achieved through application of compost, recycling of crop residues and waste, and rotation with leguminous crops. Improved soil health will lead to many benefits, including carbon sequestration, enhanced soil nutrient supplying capacity and improved plant health. This will also enable farmers to adopt a preventive rather than a curative approach towards crop management. Adoption of a more nature-positive approach to vegetable farming by farmers

will depend on land tenure conditions (if farmers do not own the land they cultivate, there will not be an incentive for a more long-term view on soil quality) and market demand for products grown in a more sustainable manner.

Good soil health will also improve water holding capacity. If farmers have access to irrigation, potential yield levels will increase further. Introduction of drip irrigation technologies will enhance water use efficiency.

Pest and disease management is critical in vegetable production. Misuse of chemical pesticides to control diseases and pests is a major concern in many Southeast Asian countries [32]. This endangers both the workers applying pesticides and consumers' health, and increases resistance of pathogens to pesticides. Key elements for curative measures are use of resistant varieties, improved monitoring, forecasting and decision-making systems, and effective integrated pest management strategies that include bio-pesticides.

Providing incentives to farmers to adopt new crop management practices that enhance vegetable productivity and safety for the farmer and the consumer is critical. This may include access to improved seed, fertilizer, biopesticides, and protected cultivation and irrigation technology. There is also a need for a vibrant public or private extension system to support and strengthen the capacity of farmers to observe, analyze, and take appropriate decisions for action, and to plan and organize for such action. Affordable field-based sensors or mobile phone recognition of pest and disease symptoms or nutrient deficiencies may further improve decision-making.

### **6.3 Extending the Growing Season**

Vegetables need to be seen within the context of the entire farming system, considering options for intercropping, relay cropping, sequential cropping, and rotation cropping, taking advantage of the diversity of vegetables, including indigenous and traditional vegetables [33], to achieve a staggered supply of different vegetables year-round.

Introduction of protected cultivation technology to extend the growing season allows for enhanced availability of vegetable products throughout the year. Protected cultivation technology minimizes abiotic and biotic stresses and as much as possible employs reusable, recyclable, and biodegradable materials. This may include shade houses for seedling production; mulching (plastic or organic) to reduce soil evaporation and control weeds; row covers with plastic nets to control insect pests; high tunnel screenhouses; and greenhouses with environment-controlled systems for off-season or year-round production.

### **6.4 Curbing Postharvest Losses of Vegetables**

Postharvest losses of highly perishable vegetables along the supply chain are high in Southeast Asia because of inappropriate postharvest handling practices, inefficient and insufficient storage, and poor infrastructure and logistics. FAO [34] reports that on-farm losses in Southeast Asia for fruit and vegetables are up to 50%. The pervasiveness of low-quality vegetables in traditional retail outlets in Southeast Asia, where most vegetables are purchased, implies higher price variability and limited availability of nutrient-rich vegetables, and has clear implications for the adequate intake of micronutrients.

Reducing vegetable losses in Southeast Asia is part of a wider and integral effort to enhance the safe production of affordable vegetables produced with a minimum of environmental impact. To reduce wasted resources, increase profits along food value chains, and improve food safety, on-farm and off-farm interventions to reduce vegetable losses could include:

- Scale-up of digital links and coordination between farmers, traders, processors and retailers for improved market access in food value chains.
- Improvement of rural-based grading, packaging, storage (e.g., CoolBot™), processing and transport facilities.
- Valorization of vegetable discards. Edible discards can be transformed into pickles by anaerobic fermentation, into dried vegetables by sun drying or hot air drying, or into vegetable powder by grinding dried vegetables [35]. Non-edible discards can be transformed into animal feed by anaerobic fermentation. Field leftovers can be used as bioenergy sources or as mulch, transformed into organic fertilizers by composting, or into biochar by thermal decomposition. These by-products contribute to the circular agri-food system [36].

### 6.5 Transporting Vegetables Along the Food Value Chain

To facilitate transport of perishable vegetables from farm to market, ensure vegetables are nutrient-dense at the point of consumption, and provide adequate amounts for consumption on a sustained basis for health outcomes, policy makers and other relevant stakeholders should design, invest in, and implement strategies and actions to strengthen the functioning of food value chains. Approaches could include:

- Public-private partnerships in the investment and development of better infrastructure in the form of packaging, cold storage, and processing facilities; roads for transportation; permanent retail outlets; telecommunication systems, etc.
- Government provision of market-oriented services, including support for smallholder farmer cooperatives to aggregate vegetables from multiple sources and distribute fresh or processed vegetables of consistent quantity and quality to various markets. This is to maximize the full economic and community potential of local food systems.
- Leveraging digital technologies to link farmers with retailers for improved decision-making, to increase traceability and accountability of vegetable products, and to facilitate vendors in delivering safe vegetable products.
- Increasing the physical availability of vegetables through increased production of diverse vegetables in peri-urban and urban settings, while reducing ‘food miles’ and the risk of losses due to perishability [36]. This approach is particularly important during COVID-19-induced lockdowns, which disrupt vegetable supply chains and marketing.

## 7 Pull: Creating Demand for Vegetables

Enhancing and sustaining the supply of nutrient-rich vegetables is critical to reach recommended consumption levels, however, this must go hand in hand with efforts to change



consumer behaviour. Policies, strategies, and interventions targeting consumer behaviour are needed to transition consumption patterns to increased intake of nutrient-rich vegetables. This will require a thorough understanding of what is causing low vegetable consumption in the first place, and considering different groups of citizens (e.g. children, adolescents, adults, genders) in different countries. Research has highlighted various causes of low vegetable consumption, including taste-related neophobia, pleasure from visual and olfactory stimuli, individual awareness of health values, and culinary knowledge, as well as aspects beyond the individual, such as the surrounding environment (e.g. family, school, community) and socioeconomics (e.g. availability, affordability, socioeconomic status associated with vegetable consumption) [37]. Smarter strategies and pathways focusing on sustained behaviour change are needed to increase consumption of vegetables and long-term health benefits. Innovative interventions that can serve as entry points to enhance positive attitudes toward vegetables and stimulate demand for health-promoting vegetable foods include:

- Use of TV and radio broadcasts, social media, engaging celebrities to make the case for healthier diets, providing nutrition and health information in food environments, emphasizing the cultural aspects and excellent taste of traditional vegetables that are often highly nutritious.
- Promoting school meal programs and home gardening programs that include vegetables and actively engage children and parents and care takers.
- Nutrition and health education programs in schools
- Use of personal digital applications, the Internet as an educational tool, video games and mobile phones coupled with tailored feedback and counselling.
- Events, festivals, farmers' markets, and virtual events to make vegetables attractive to youth.
- Improved food preparation methods to enhance hedonic appeal of vegetable-rich meals.
- Making vegetables in particular attractive to young kids – through efforts in the household and at school.

The above actions for healthier diets enriched with vegetables should be backed by appropriate policies and regulations to discourage excessive intake of non-nutritious foods.

## **8 Policy: Starting from a Healthy Diet for All**

The current food system in Southeast Asia is leading to a double burden of malnutrition (micronutrient deficiency and obesity), now compounded by the COVID-19 pandemic. Food policy needs to be aligned with public health policies to develop interventions that sustain human health, starting with young children. It is critical to address the lack of vegetables in national and regional food system policy through 'reverse thinking'. This means that any policy needs to start with one clear objective: to provide affordable healthy diets for all [15, 38]. Measures that support vegetable-rich healthier diets include: encouraging the production of nutrient-rich traditional vegetables; facilitating access by

farmers to quality vegetable seed or seedlings adapted to local environments; investing in cold-storage facilities and improve transportation infrastructure, reducing losses; enhancing traceability and labelling to ensure the safety of vegetables from farm to retail; encouraging the processing of vegetables into new and attractive products adding value; and investing in food environments that prompt individual and community food choices for more vegetables.

This will require vastly increased attention to vegetable R&D, pull/push/policy innovations, and new public and private sector partnerships to boost vegetable consumption and production. It will require improved access to vegetable science and knowledge for all and adequate governance and oversight to balance the interests of all actors involved in vegetable-rich food systems and protect the right of vulnerable populations to adequate nutritious food and health.

Transitioning to vegetable-rich food systems can in principle create multiple employment opportunities beyond the farm that may be attractive in particular for women and young people. Employment may be found in food processing, transportation, and new ways of retailing, e.g. using digital platforms to take vegetable farm produce in a more direct manner to potential clients. There would also be environmental benefits. Environmental sustainability also would be enhanced if vegetable rich food systems would lead greater reductions in CO<sub>2</sub> emissions, in particular if animal-sourced food consumption would be reduced. The transition would then create a triple-win outcome.

## 9 Conclusion

Urbanization and a growing young population are major trends shaping the future of the agro-food system in Southeast Asia. These factors cause changes in the demand for nutritious food and lead to malnutrition. Southeast Asia's agro-food system must tackle these issues whilst also dealing with climate change. If no adequate measures are taken, the region's future ability to supply adequate nutrient-rich vegetables could be jeopardized. It is critical to address the lack of vegetables in national and regional food system policy through 'reverse thinking': the objective to provide affordable healthy diets for all should become the starting point in policy making. National governments and international organizations must increase investment in vegetable research and development for nutrition security and health equity, and enhance the capacity of young people and women to seize employment and income generation opportunities offered by a vibrant vegetable sector. Policies must support smallholder vegetable farming, and the private food sector can facilitate a more equitable and productive vegetable-rich food system via inclusive business models.

There is a need to pay much closer attention to local approaches to stimulate demand and supply of nutritious food, especially near urban centers. This work will be very context-specific and complex, and it will be necessary to look at both demand for and supply of nutritious food.

It is critical to establish 'food systems pilots', addressing pull, push and policy dimensions simultaneously and where research is conducted in a development setting bringing together research institutions and implementing agencies. This would mean doing 'research in development' rather than 'research for development' and conducting

impact-oriented research in real-life food systems settings, in close interaction with key policy and decision makers to ensure their buy-in and support.

The focus of these food systems pilots must be on nutritious food, such as vegetables, and how to make these high value, perishable commodities more affordable, accessible, acceptable, and available to all consumers, rich or poor, across wealth classes.

Food systems pilots can be linked with more thematic research effort upstream to leverage best know-how and technology available globally, and with public and private sector development efforts to scale out results in comparable settings. International collaboration around such food systems pilots would provide an interesting opportunity to exchange experiences and move forward together.

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