Strategies for Scaling Up the Adoption of Organic Farming Towards Building Climate Change Resilient Communities

4

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Abstract

Adjustments and adaptive responses to diminishing resources (land, water, and energy) in agriculture due to population increase and climate change in the recent decades are varied. Proactive adaptive coping mechanisms must be instituted to avoid the onslaught of massive starvation. Organic and agroecological innovations are the logical options. But organic farming is not one-size-fits-all solution. While organic farming is considered as one of the solutions to farming in crisis, there are many barriers to its adoption. Among these constraints are (1) the nature of organic farming being difficult, laborious, and knowledge and skills intensive, the required environment (air, soil, and water), and the certification requirement and (2) the support systems from government and consumers not in place.

Scaling up the adoption of organic farming has a number of prerequisites, specifically:

1. innovation from farmers—the farmers as innovators and scientist/technologists from the academics and science and technology (S/T) institutions;
2. reengineering agri-food systems into agroecotourism as a way of attracting farm visitors and tourist-enthusiasts and attracting human interests and investment flows to the rural areas, generating rural employment, slowing down or stopping out-migration to urban areas and overseas work (OFW);
3. innovative governance-led promotion by expediting the shift from capital and resource intensive (land, water, energy, inputs) to restorative, regenerative, and vibrant agriculture and food systems and expediting this system shift by an

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innovative ecological carbon emission–soil erosion–water consumption tax to finance the transition and conversion process to agroecology-based organic agriculture;
4. an innovative paradigm shift from food security to health security—from financesurance to healthsurance, from financial banking to health banking, from measuring yield per acre to health per acre as the world transitions agriculture and food system from agrochemical-intensive monoculture to organic polyculture cropping systems;
5. innovative paradigm from supply chain to value chain approach in agriculture and food systems, but implementing these innovations requires 4Ps and 2 Ms (preproduction, production, processing, postproduction linkages + marketing and management);
6. a demand-led (consumer) instead of supply-led (the farmers) approach to promotion;
7. and, finally, a consumption-led greening of agroecosystems by minimizing food wastes and consuming only what we can and reducing the thermodynamic loss in food by consuming less and less meat.

Keywords
Climate resilience · Innovation · Organic farming · Demand led · Value chain approach · Agroecotourism · Health per acre · Health banking

4.1 Introduction

In the early part of the twentieth century, chemical farming was the technological *innovation*[1] which avoided the Malthusian prognosis of massive food shortage, and it was claimed to have saved more than 1 billion people from starvation. Chemical farming started from the developed-industrialized North. Nonetheless with the recognition that chemical agriculture is unsustainable brought its subsequent change into organic farming in the developed-industrial North as early as the 1930s. Organic farming became more popular in the 1960s when Rachel Carlson published her book *Silent Spring* in 1962. Meanwhile, the International Federation of Organic Agriculture Movements (IFOAM) was organized in the 1970s, which further strengthen the promotion and adoption of organic farming.

The world population shall reach 9.8 billion by 2050. In view of this, the food supply should increase by 80%. In Africa, with a population of 1.8 billion by 2050, their food production must be doubled. However, they are confronted with the challenges of declining soil fertility, decreasing farm yard manure supply as a

[1] "Innovation is improving on or makes a significant contribution to an invention or existing product, process or service. Invention is the creation of a product or introduction of a process for the first time" (Grasty 2012).

consequence of declining population of livestock, escalating fertilizer prices, and increasing risks of droughts due to climate change. These alarming scenario deemed necessary that *out-of-the-box* approaches must be in place to avoid the onslaught of the "perfect storm" of massive starvation. "Organic and agroecological solutions are of urgent necessity to feed the world" as claimed by Cook et al. (2016). Organic, agroecological, and regenerated agriculture is the way forward. It is the agricultural systems of this millennium and beyond. Organic farming as an innovation includes the following features: *Biodiverse farms promote ecological balance and protect the environment, sustainable land management, environment- and health-friendly food production systems* yielding *safe and nutrition-healthy foods, sustain food sufficiency and food sustainability, decrease carbon footprint, and produce more with fewer inputs in a vibrant agricultural systems.*

But globally, regionally, or locally (the Philippines), there is the low adoption of organic farming. The total agricultural lands under cultivation or utilization for crops and livestock are about 1.6 billion hectares. Farmed organically are 50.9 M ha in 179 countries or 3.18% of the 1.6 billion ha agricultural lands (Willer and Lernoud 2017) cultivated by more than 570 million farmers. About two-thirds of 2.4 million organic farmers are in the developing countries. More than 90% of farms are run by an individual or a family who are primarily relying on family labor. Family farms occupy a large share of the world's agricultural land and produce about 80% of the world's food (https://www.globalagriculture.org/report-topics/industrial-agriculture-and-small-scale-farming.html). In the Asian region (ASEAN, including the Philippines) where farmers are dominated by small farms ranging from 0.5 to 3.0 ha (almost 90%), farms are cultivated using externally sourced synthetic inputs usually bought from developed countries.

The comparison is odious, but genetically modified organisms (GMO) being domesticated in farms started in the 1990s. Recent reports indicate hectarage devoted to genetically engineered corn, soybean, cotton, and canola is about 181.48 million ha (11.34% of the total agricultural lands) (CBAN 2015) or approximately 3.56 times larger than the organic farms. Adoption per decade is 60 M ha on the average, while only 10.18 M ha for the organic farms. The reckoning years were the 1970s or five decades for organic farms and 1990s for GMO farms. Despite the known merits and benefits of organic farming over the agrochemical-intensive or chemical farming, there is a low rate of adoption which explains the smaller hectarage devoted to it.

As a case study, growing rice (*Oryza sativa*) through organic farming method was four times more energy efficient than the conventional method. The agrochemical input (fertilizer/pesticides) accounted for 61% of the fossil fuel–based energy inputs and 84% of the cash cost of production in the conventional system. For every 1 calorie of fossil fuel energy used in the conventional farm, only 4 calories are produced, while from the organic farm, it is 19 calories. Organic farms were less energy consuming. One ton of paddy rice utilized only 170 of fossil fuel–based inputs (FFEI), while 844 M calories in the conventional farms (Mendoza 2004). Producing rice organically was the least energy intensive (lowest energy footprint), cheapest to produce, safe to grow (non-use of chemical pesticides; farm families are

hit first), and safe to eat. Moreover, it relaxed the farmers, mainly the housewives who shoulder the burden of where to get money to buy all inputs.

Many farmers are heavily indebted due to crop failure (pest, floods, super typhoons, etc.). Comprehensive crop insurance is yet to be formulated/legislated in the Philippines. Recently, chemically grown rice and rice products were detected to have a high level of arsenic[2] (U.S. FDA, 2016 http://www.fda.gov/food/foodborneillnesscontaminants/metals/ucm319870.htm). The recent surge in rice price in the Philippines clearly indicates that farming is in crisis (*price increase of 10–15 pesos/kg in some areas declared as calamity area, justifying the use of their calamity funds by the local officials*). Farmers who grow rice have no rice to eat. Severely hit by price jump are those in the rural areas. Farmers have sold already their rice even before its planting. Only 3–4 farmers out of 100 have rice to eat before the next season of harvest. But organic farmers had improved their living conditions. In fact, they have adequate rice to eat, they are no longer indebted, they are healthier, and they are able to send their children to school (Mendoza 2004).

4.2 Diagnosing the Low Adoption of Organic Farming

Organic farming can be dubbed as a game changer, but its adoption is considerably low. The two main clustered reasons that need to be addressed are as follows.

4.2.1 Organic Farming (OF) Is Difficult, Laborious, and Knowledge and Skill Intensive

More so, it requires more patience, perseverance, and highly positive attitude. Conventional/chemical farming is easy and less laborious farming. Key features of organic farming are the following:

- Use of compost/organic fertilizer as a replacement for synthetic chemical fertilizer (it is very laborious and time consuming to prepare compost).
- Weed control through manual weeding (mechanical use of rotary weeder in rice which is labor intensive and price of labor is high). It is easier, faster, and cheaper to use herbicides in chemical farming.
- As regards the pest management, cultural method and mechanical control demand cost-intensive skilled labor force. Most often, timely availability of skilled labor is a challenge.

[2] "Arsenic exerts its toxicity by inactivating up to 200 enzymes, especially those involved in cellular energy pathways and DNA synthesis and repair. Acute arsenic poisoning is associated initially with nausea, vomiting, abdominal pain, and severe diarrhea. Encephalopathy and peripheral neuropathy are reported. Chronic arsenic toxicity results in multisystem disease. Arsenic is a well-documented human carcinogen affecting numerous organs. There are no evidence based treatment regimens to treat chronic arsenic poisoning but antioxidants have been advocated, though benefit is not proven" (Ratnaike 2003).

- To avoid field contamination, irrigation water must be purified (separate/dedicated water pond for purification).
- Planting of tree barriers around the farm perimeter to prevent wind-blown pesticides, when neighboring farmers spray pesticides.

4.2.2 The Support Systems for Organic Farming Adoption Are Not in Place

Science and technology (S/T) institutions and the academic incentives and rewards scheme are built around and are supportive of the chemical industry. In a publish-or-perish environment in the academic institutions, S/T funding accessibility is more for the chemical industries who can afford to pay higher salaries and grant more research funds for chemical farming. On extension program, "extension" is the continuation of S/T or technology generation. Blame not the extension agents skillful in extending chemical farming. But the most effective/efficient/skillful extensionists are the employees or sales representatives of chemical companies who are provided with excellent logistics for mobility, plus attractive salaries. In return, they are expected to reach sales quota or they will be reprimanded or retrenched for their ineffectivity or inefficiency. In the Philippines, the extension bureau of the government was abolished, and it was replaced by a training institute, unfortunately, primarily extending more of the chemical agriculture!

4.3 Innovation as a *Game Changer* in Scaling Up the Adoption of Organic Farming

Providing answers or strategies to scale up the adoption of organic agriculture requires understanding of the main actors or sectors involved. There are at least three main groups or sectors that play important interrelated roles in the accelerated adoption of organic farming as an innovation over conventional farming.

4.3.1 The Farmers

Organic farmers are innovative and intelligent. They are fearless as they have transcended the "fear of the unknown." They can be briefly described as "philosophers." In fact, organic farming is a philosophy! Love of knowledge is a key attitude. Organic farmers are knowledge seekers! Hence, ***innovator!*** Innovation is the ***game changer***! Organic farms are an innovation power house! Innovation translated into action indeed would yield change towards development and positive growth not only in the locality as well as transcending beyond political boundaries. Successful farmers who are into organic farming are innovators across the value chain. A number of farmers are proactively innovating across the value chain to create change positively influencing growth and development. They believe in the dictum "the

quantity being demanded is the quantity to be produced." Among the documented innovations in the Philippines are as follows:

- Farmers select their own seeds that are locally adapted and with target market, mostly colored rice (red, black rice) as demanded by consumers.
- Scheduling land preparation in such a manner that sufficient lead time is provided for crop/weed residues to decompose, that is, 3–4 weeks before transplanting.
- Planting at the right time so as to decrease pests and diseases infestation.
- Planting three varietal types for early, regular, and late maturing varieties for sugarcane (*Saccharum officinarum)*.
- Farmers know agronomy of yield. The farmers know when and how to plant the seed (locally adapted, G X E interaction) by season (wet, dry season) and location (soil type, topography) to obtain the genetic potentials of high yield of the seed (inbred or hybrids) as shown in the agronomy of yield in equation (Eq. 4.1)
- Implementing soil quality improvement practices such as crop/weed residue recycling through its decomposition after harvesting by spreading it evenly on the farm.
- Sugarcane planters avoid burning sugarcane trash and either perform trash shredding through a mechanical shredder or incorporate into the soil by repeatedly passing tractor drawn disc harrows.
- Farmers prepare their own compost/organic fertilizer and other preparations, thus saving a lot in terms of labor and cost of production.
- Farmers in Cagayan de Oro of the Mindanao island process their organically grown black rice which is best known for its health benefits and export market.
- Cacao farmers in Kidapawan City, North Cotabato, through processing of cacao beans into tablea, increased their income as the price of cacao bean augmented from PHP 120/kg to PHP 600/kg.
- Coffee farmers in Batangas are grinding their coffee bean and selling as kapeng barako at PHP 216/kg. On the other hand, dried coffee beans are sold only at PHP 80/kg.
- Many organic farmers do direct marketing of their farm produce and some put up their own restaurant to further increase the value of their organic farm produce through "fine dining" at PHP 1200–PHP 1800 per head.

4.3.2 Researcher's Contributions to Innovation

Yield is construed as a function of technology/innovation, use of appropriate tools/implements, and appropriate and favorable growth environment (Eq. 4.1):

$$Y = G + E + \{(G * E) * M\} \tag{4.1}$$

where Y is yield, G is genotype (variety), E is environment (climate, soil factor), and M is management (inputs applied, cultural practices, that is, land preparation,

planting, cultivation and weeding, fertilizer application practices, irrigation, harvesting/milling practices).

Innovations in organic farming aim at internalizing the inputs and using less of external inputs. Organic farmers driven by their knowledge and skills endeavor to innovate in the domain of breathing, seed production, production and use of biological control agents and botanicals, and marketing of organic farm produce.

An innovation in organic rice is planting one seedling per hill and planting in double rows spaced 20 × 10 cm (the double rows) and 40 cm interval between the double rows, using only 6 kg seeds per ha or 4 kg of seeds at 30 cm × 30 cm spacing, fertilized with bokashi and liquid manure, using rotary weeder in controlling the weeds. In Bokong, Labangan, Zamboanga del Sur, Philippines, rice-growing conditions, NSIC Rc222 (an inbred) had the highest yield at 6.07 t ha^{-1} outyielding Mestizo 19 (a hybrid) at 5.37 t ha^{-1}. Furthermore, since organically grown rice sold at 20% higher price as compared to the conventional grown price, organic rice growers earn an additional income (Lao-Ay et al. 2017).

Double-row rice planting using high-yielding location adapted inbred rice cultivars can be game changer in organic rice farming, provided (1) mechanical transplanter can be innovated from the original one-row transplanter to double-row transplanter, (2) innovated motorized rotary weeder for double-row transplanted rice, and (3) innovated-solarized submersible pump to apply liquid manure fertilizer (Lao-Ay et al. 2017). In an earlier trial, as high as 8.5 t ha^{-1} was obtained. PSB Rc18 was planted in double rows at a spacing of 20 × 10 cm and 40 cm interval between rows during the dry season (fully irrigated) at one seedling per hill, keeping the field moist, weeded by using rotary weeder, and fertilized using bokashi and amplified liquid manure fertilizer three times (Fig. 4.1) (Mendoza 2016).

Our expectation is that if we can stabilize the yield of organically grown rice at 8.5 t ha^{-1} instead of the usual 4–5 t ha^{-1}, we can convince many farmers to innovate or shift to organic rice production. In Bay, Laguna, the average yield of conventionally grown rice is only 5 t ha^{-1}. It is laborious to prepare and plant one seedling per hill, prepare and apply bokashi organic fertilizer and amplified liquid cow manure, and do the rotary weeding. At 8.5 t ha^{-1} yield level, farms workers can be paid with a competitive wage at PHP 350 per day or even higher.

Furthermore, if rice can be milled and sold as brown rice (72% milling recovery and priced at PHP 80/kg) and at 8.5 t ha^{-1} and 72% milling recovery (MR), the gross income is:

$$\text{Gross Income}\left(\text{GI}\right) = 8.5\,\text{t}\,\text{ha}^{-1} \times 0.72 \times \text{PHP}\,80 / \text{kg} = \left(6120\,\text{kg}\right)\left(\text{PHP}\,80 / \text{kg}\right) = \text{PHP}\,489{,}600 / \text{ha}$$

$$\text{Net Income}\left(\text{NI}\right) = \text{GI} - \text{CP}\left(\text{costs of production}\right)$$

$$\text{NI} = \text{PHP}\,489{,}600 - \text{PHP}\,128{,}184 = \text{PHP}\,360{,}516 / \text{ha}$$

The gross income and net income are PHP 489,600/ha and PHP 360,516/ha, respectively. With net income of PHP 360,000 ha^{-1}, many rice farmers are motivated to innovate in organic rice production.

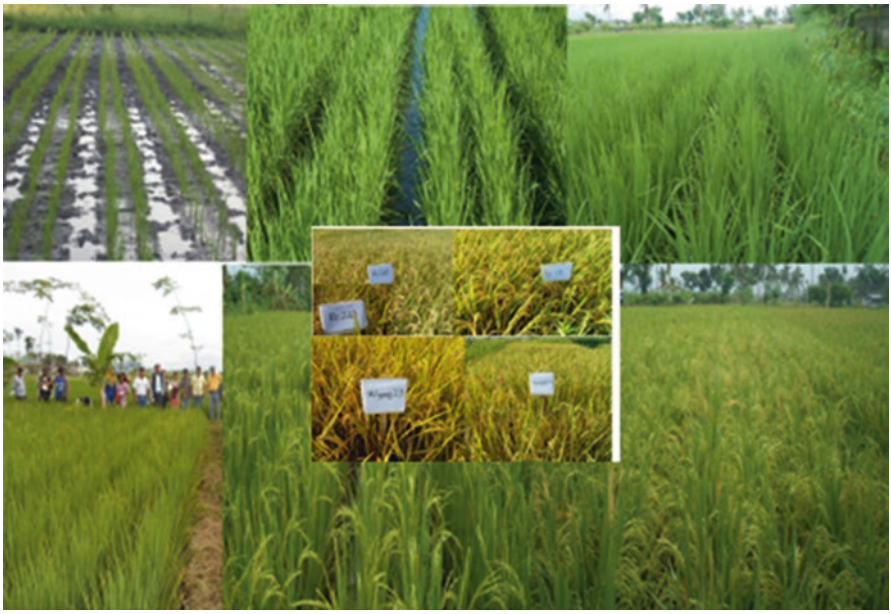

Fig. 4.1 Double-row planting pattern (20 × 10 cm to 40 cm) at various growth stages in Bay, Laguna, Philippines

As organic farming is labor intensive and difficult, innovations, as the game changer, are necessary. At the right price or competitive wage, rural labor shall be plenty and readily available. Making farm operations easier and quicker are twin goals in farming either organic or chemical farming. This is where innovations are necessary.

- Transplanting is labor intensive, and there is dire need for mechanization. Since mechanical transplanters are expensive and are unaffordable to capital-scarce small-scale farmers, they should be made available through service providers or through government support.
- Manually operated rotary weeders should be converted into motor-driven weeders like drone so as to increase the ease of operation.
- Sourcing of raw materials like molasses, poultry, hog manure, or cattle manure for organic fertilizer production must be facilitated so as to increase the adoption of organic farming. Applying amplified liquid fertilizer can be facilitated using submersible pumps.
- Each farmer must own one to two cattle/carabao for draft power and as a source of manure for bokashi fertilizer and amplified liquid manure.
- Ducklings for integrated rice + duck farming must also be provided. On-farm upgrading/mixed breeding should be done to avoid inbreeding which is considered as one of the major reasons for the decline of egg-laying capacity of ducks.
- Seeds/planting materials (vegetatively propagated fruit trees) must be provided.

Adoption of innovation by farmers must be facilitated and be fully supported. It was not them—*the farmers*—who started to shift to agrochemical-intensive agriculture (Mendoza and Villegas 2014). Why should they be the only one now to shoulder all the burden of innovation to organic agriculture? This leads to the scrutiny of the approach in making food available to the consumers.

4.3.3 The Consumers: What Is the *Legal* Push to Organic Farming as an Innovation?

In the Philippines, **e**ven the enactment of a law, R.A. 10068, "The Organic Agriculture Act" of 2010, did not accelerate its dissemination and adoption among farmers. Consumers must realize that they exist at the core of the food systems. They determine the demand! They must be involved and be conscious of the real cost of modern agriculture or how this genetically modified organism (GMO)-based Green Revolution and the food produced out of it impact our planet's ecosystem. They should recognize the need and value of nutritional and medicinal food. In view of this, food should not be solely obtained through the chemical-based production system. As stated earlier, "Let thy food be thy medicine." This should be translated into a new demand that will lead to changes in the supply side. Consumers must directly support the plight and welfare of farmers who operate in organic and agroecological systems. This joint consumer–farmer partnership must be fully translated into their willingness to buy organically grown products, that is, direct product users such as hotels, restaurants, caterers, food processors, and other institutional buyers investing and buying their daily/weekly food needs or meeting their raw material requirements at a fair price.

From the past up to the present, organic farming has been promoted in the country wherein the focus has been on the farmers, "the supply side." Earlier, Mendoza (2004) had proposed demand-led promotion of "organic agriculture." "The product being demanded is the product to be produced!" The "product being demanded" refers to the consumers. In Europe, the USA, and other developed countries, the consumers are the main drivers in the adoption of organic agriculture. This explains the fact that two-thirds of lands devoted to organic agriculture are in the developed economies. There is an increasing number of middle class in the developing economies who look for organic–safe–healthy foods, but their purchasing power is not yet felt by the organic farmers.

After five decades or more after the "Green Revolution," how many organic agriculture (OA) converts does the Philippines have? The Farmer–Scientist Partnership for Development, Inc. (MASIPAG), a Philippine NGO composed of farmers, scientists, and peoples' organizations, estimates that there are approximately 30,000 Filipino organic rice farmers (http://www.masipag.org/news_india.htm). The CIA Factbook (https://www.cia.gov/cia/publications/factbook/geos/rp.html#Econ) estimates that 36% of the approximately 35,790,000-strong Filipino labor force is in the agricultural sector (12,884,400). Numerically, 30,000 is a lot, but proportionally their numbers are a miniscule (0.23% or 23 out of 10,000 farmers). The theory

being advanced is that the promotion of organic agriculture must be focused on the supply side of the supply and demand curve. There must be an alternative approach, the demand-led approach, to the promotion of organic agriculture. The consumers comprise the demand side of the production to postproduction linkage. Farmers follow the economic logic in production, whereby the consumers' demand are being produced by the farmers. Following this logic, if consumers demand chemical-free agricultural products, then farmers shall simply follow that signal. As proposed by Mendoza (2010), demand can be interpreted in a number of ways as follows:

1. Consumers must be willing to support farmers in the production of chemical-free products.
2. Consumers must be willing to pay a premium. Consumers' willingness to support the farmers in the production of chemical-free products as can be done in several ways as follows:

Consumers can visit and help motivate farmers to grow crops and animals the organic way. Since organic production systems are different from the agrochemical-dependent systems, consumers must also be familiar with the organic production system. As regards the "Consumers must be willing to pay a premium price for organic products," it is indeed a big issue for organic products. Consumers in the Third World countries already consider current food prices to be too high. Approximately 85% of the Philippine population lives on less than US$2.00 per day, and more than 51% of the rural population lives below the subsistence threshold as defined by the World Bank (http://www.masipag.org/news_india.htm). The government's average mandated minimum wage is PHP 400 (US$7.400) per day. The current retail price of ordinary rice in the wet markets ranges from PHP 40 to PHP 65/kg (US$0.73–US$0.94/kg). Supermarket retail prices of organic rice range from PHP 75/kg (US$1.38/kg) for ordinary varieties to PHP 150 (US$2.77/kg) for fancy varieties (red, black, glutinous, or aromatic rice). But the current high price of organic rice retards the growth in consumption and demand for organic rice. Consumption of organic rice is thus limited to those who can really afford to pay—well-off cancer patients who are advised to eat organic products; those who have undergone heart surgery; and the few environmental and health conscious sectors of the society who can afford it.

Why pay a high price? There is a need to clarify what consumers are paying for. What the consumers are simply paying if they buy chemically grown crops is the financial price. It does not truly reflect the true value of the product since all the costs of production are not included. There were no total costs accounting. The total costs should include (1) financial—the costs of purchased inputs, such as seeds, fertilizer, pesticides, fuel, machineries, cost of money, labor, storage, packaging, marketing, and distribution), and (2) ecological—soil quality deterioration due to the inputs and farming methods applied and all other environmental and ecological costs. What is paid for is simply a small fraction of the total cost. David Gould showed the true cost accounting of Big Mac to be $ 12.00 (health care—$5.69; subsidies—$0.70; environment—$0.67; cruelty—$0.38; retail price—$4.56;

total—$12.00). This means that the current market price is so low because government subsidies and the ecological costs of raising beef are not included. It means that future generations will pay dearly for these unseen costs. Even now, we are already starting to pay the price as reflected in the rise of lifestyle-related illnesses and global warming.

With pricing parity based on the true or total cost accounting (financial + ecological), there shall be a fair price in the marketing of organically grown products. Conventionally grown products are grossly underpriced or even incorrectly priced. Their price tags are way below actual costs if the true costs of production and a reasonable profit margin are included. Because of this, the market price of organic agriculture products appears to be more expensive as they are generally priced 20–30% higher. If the true price tags of conventionally grown crops and animals are to be considered, then organic agriculture products are sold at a considerably low price. But the general consuming public who are already financially hard up will not understand this logic. What they would appreciate, considering their current shrinking purchasing power, is the financially low price of products that they buy in the market. In effect, what is being presented is that the 20–30% higher price of OA products is not really high or a premium price after all. Why?

Organically grown vegetables have higher quality and higher nutritional value with more vitamins and lower water content. Thus, they keep longer (they do not wilt) even at ordinary room temperature, and they taste better, in fresh salads or in cooked form. Organically grown rice tastes better and stores longer. A common observation is that cooked organic rice does not spoil in 24 h.

An innovative policy support to organic agriculture is an ecological tax. It should be initiated by environmentalists and organic agriculture advocates. The study of Landicho et al. (2014) validated the farmers' perception of the benefits of producing and consuming organic produce. The results gathered are substantiating that awareness is being created at the grassroots level. Specifically, farmers themselves elucidated that organic farming practices are environment-friendly, minimizing air pollution, greenhouse gases emissions, thereby contributing as well to a healthy society. The healthy society is rooted in healthy soils with crops grown organically. This ensures safe, nutritious, and healthy foods both for the farmers and the consumers. Farmer-respondents also verified that organic farming resulted in increased income due to reduced costs of production and reduced risk of crop failures. From a wider perspective, organic farming practices increase the valuation of the global ecosystem services, namely, provisioning, regulating, and supporting (Fan et al. 2016).

4.3.4 Governance/Government Sector

Organic agriculture advocates/practitioners in the Philippines were happy when the law on organic farming (R.A.10068) was enacted into a law in 2010. There were two major impacts: (1) though small, there is now regular funding for R/D for organic agriculture through the General Appropriations Act (GAA). There are now

many researchers/scientists doing agroecology/organic agriculture research for major crops including livestock (poultry, hogs, cattle fattening); (2) it removed the stigma, the fear of doing research in organic farming.

Having a law and having it implemented are poles apart. Our decade old law, in general, did not "scale up" or accelerate the adoption of organic farming in the Philippines considering the current number of organic farmers. Massive adoption needs "proverbial shot in the arm." Many farmers are ageing (57 years old and above). You cannot teach old dogs new tricks! As our national hero, Dr. Jose P. Rizal, said before, "the youth is the hope of the future." Adopting that statement of our national hero by the current "old" people is relinquishing their responsibility in favor of the young people. Cook et al. (2016) are correct in titling their paper *Organic and agroecological solutions! Farming for the future. It must be now!*

In relation to governance (policy support—legislative and executive), there are many policies that are antagonistic, nonsupportive, or directly prohibitive to the promotion of ecologically sound agricultural practices. However, there is much elbow room to "put the house in order" at the local level due to the local autonomy code. This flexibility could be incorporated as follows:

- A barangay/municipal ordinance could be enacted to fully enforce existing laws, especially in prohibiting the burning of crop residues and the dumping of hog/poultry manure into rivers and streams. This is rational particularly that anti-burning laws are already stipulated in the Philippines under Republic Act (RA) 9003 (Ecological Solid Waste Management) and RA 8749 (Clean Air Act).
- The municipal agricultural officer, now directly under the supervision of the town mayor, monitors compliance with existing laws and supervises the strict implementation of environmental regulations and ordinances. A barangay/municipal ordinance will promote the implementation of zero waste management. Biodegradable wastes and materials at home and in the community can be collected, segregated, and made into compost to serve as cheap biofertilizer for farmers. There are towns/cities that do these good practices, but they are still few.
- A barangay/municipal ordinance regarding stray animals (dogs, goats, hogs, cattle, and carabao) must be passed. In one village, farmers cannot plant mangoes or fruit trees in their farm because of the practice of open grazing (goats, cattle, and carabao) after the harvest of rainfed rice. Not all barangays or towns cities have ordinances prohibiting roaming animals and pets.
- Low enforcement, marginal funding, and irrelevance of existing rules and regulations add to the problem. There is an urgent need for strict enforcement of and rationalized funding for all existing agricultural and environmental laws and regulations. There is an urgent need to revisit the implementing rules and regulations of existing laws and even repeal irrelevant laws and regulations to make them attuned to the present situation and circumstances.

For example, there is a need to reform the budgeting system of the Department of Agriculture (DA) in accordance with the Agriculture and Fisheries Modernization Act of 1997 (RA 8435, as amended). Funding must be focused on well-defined and

well-characterized area-based and river basin–directed agriculture and fishery development zones under agrobased industrial clustering schemes. The DA must stop the ineffective and disjointed commodity–based and function-oriented budgeting that promotes mono-cropping or mono-enterprise development and scatters rural development initiatives.

4.4 Innovative Paradigm: Supply Chain to Value Chain Approach in the Agriculture and Food Systems

An agroecology-based organic agriculture should undergo metamorphosis. Implementing *innovations* require 4Ps and 2Ms (preproduction, production, processing, postproduction linkages) + marketing and management or value chain approach (Villegas 2018). A supply chain approach must be a tinge of the past and be replaced with a value chain approach. Value adding product must be identified; farmers should be capacitated and be supported to reap the benefits of the value adding/ financially enriching part of the food systems. The challenge is helping farmers achieve the benefits accruing across the "value chain." It will spell the differences between the past (twentieth century) to the present—the twenty-first century. The twentieth-century supply chain approach made our farmers to simply produce/supply raw materials (feedstock) to the processor/manufacturer of finished/processed high-value products. It should now metamorphose into "value chain approach" or put under the control and ownerships of the farmer/producers the full interrelated, interactive, interdependent process in processing the products so any added value could accrue to them. But this also requires asset reform, particularly, land asset. Permanent structures are necessary; investment in farm tools, processing equipment, etc., necessitate that farmers have long-term occupancy right on land or even secured land tenure as the basic asset.

A value chain assessment of six-fruit tree—intercrops under coconut (*Cocos nucifera*)—was done (Mendoza et al. 2016). Income from coconut alone is very low. But coconut is providing several ecosystems services, a microclimate modifier giving "shading effect" favorable to understory fruit trees, namely, coffee (*Coffea* sp.), cacao (*Theobroma cacao)*, mangosteen (*Garcinia mangostana*), durian (*Durio zibethinus*), banana (*Musa* sp.), and even rubber *(Hevea brasiliensis)* trees. Intercropping increased the net revenue using monoculture coco–copra revenue as base revenue at P 18,251/ha as follows: coconut + banana increase the revenues 12.56 X; coconut + mango (*Mangifera indica)* 9.37X; coconut + durian 7.83X; coconut + mangosteen 5.34X; coconut + cacao 2.83X; and coconut + coffee 2.36X. Income increases progressively as the product move across the value chain. Revenues multiply 10 times (coffee, cacao) and as high as 32 times in coconut + mango before the insect and disease problems set-in. However, it is imprecise to declare one crop is profitable over the others. Cacao dried beans sell higher at PHP 120/kg than coffee bean at PHP 85/kg. When Starbucks sells coffee, the gross earnings could go as high as PHP 8.4 million worth of coffee ha^{-1}. Cacao made into chocolate (too many brands, trade names are available) could yield million (more

than PHP 2 million ha^{-1}). For durian and mangosteen, farm gate sales of mangosteen and/or durian are relatively low. But retailing them increases income 2.15 times (durian) to 3.5 times (mangosteen).

In addition to asset reform as mentioned above, the central feature of the value chain approach is achieving the scale of operations by organizing farmers into cooperative. Implementing a value chain approach requires many services and technology providers/group, credit institutions (banks), granting reasonable and affordable interest rates since above 6% interest rate and consequent interest expense alone will eat up the added profit due to increased yield and income. Due to risks, credit must be insured (crop insurance that pays the crop value and not simply the credit value). Promoting agriculture value chain comprises a life cycle approach. It should equally emphasize the need to produce quality raw materials (feedstock) to feed the factory machines along with processing technology setup. Research and development (R&D) institutions (academics, S/T, or R& D) institutions should help/assist the farmers on their technology needs from production, processing, packaging, up to marketing. Constructing factory needs capital (amortization + interest), skilled labor (training), professional management (commitment and dedication), tools and equipment (locally fabricated), hauling trucks (logistics), and all weather road networks that are of high priority.

4.5 Agroecotourism Is Fast-Developing Farming System Options

Agro-tourism is "the form of tourism which capitalizes on rural culture as a tourist attraction. It has gained a new dimension as a potential income and job generating activity. The symbiosis between tourism and agriculture that can be found in agro-tourism is a key element of an environmentally and socially responsible tourism." Agroecotourism offers an opportunity to experience the real enchanting and authentic contact with the rural life, taste the local genuine food, and get familiar with the various farming tasks. It is perhaps *"provides a welcome escape from the daily hectic life in the peaceful rural environment and to relax and revitalize in the pure natural environment, surrounded by magnificent landscape. Agro-eco-tourism can contribute towards a green economy transition through investments leading to energy and water efficiency, waste reduction, biodiversity and cultural heritage conservation, and the strengthening of linkages with local communities"* (Barbuddhe and Singh 2014).

Agroecotourism in the Philippines (Costales Farm, Quezon; Penalosa farm in Victorias, Negros Occidental) increased the market value of their organic produce through their package tour (plus the foods and snacks)—as a training venue, as a direct marketing for their produce, when the agroecotourists go home, they buy organic produce including seedling. As regards the case examples, an entrepreneur in Victorias, Negros Occidental, earns 70% of his total income from entrance fees of the tourists who visit his farm arriving on a bus load. To accommodate overnight visits or several days' stay, he built hotel and restaurants. But the organic foods

served are all harvested from the farm. Farmers practice total quality management (TQM). They make sure that their partner-workers are happy and motivated and practice benefit sharing. Farmers are encouraged to raise native chicken and pigs, providing them the breeds, raising seedlings from fruit trees, and sales are shared equally (50–50 after deducting the initial capital).

4.6 Organic Agriculture and Health Security: An Innovative Paradigm

When we talk about agriculture, we always talk about food security, farm income, the business around it, and the life industry complex built around it. Rarely, we consider agriculture and health security or extending it further into agriculture and life security.

Agriculture is life or agriculture, ultimately, is all about health! Health is wealth! No doctor can treat death. Doctor of medicine, banking, and finance are well-established academic disciplines. Our insurance is all built around money or "finansurance[3]"—it's all about money! Money becomes evil in acquiring, using, or transactions!

What is new? Health banking is nowhere or rare in our vocabulary or even in literature and published journals. (In 38 s, 38 M total the results for banking and nothing about health banking by eating healthy foods.) Senior citizens (60 years and above) talk about maintenance medicines and their skyrocketing expenditure on the said medicines! Age is getting younger now as beginning 40 years; many are taking maintenance medicines. Search literature and mostly the explanation is related to lifestyle[4] illness (diet is more meat; less or no exercise; stress, short sleep duration, etc.). But Vandana Shiva disputed lifestyle. According to her, it is "food style."

Take a "cue" from "food style" concept; it is rooted in the way food is produced and how it is eaten! Conventional agriculture promotes monoculture rather than polyculture cropping systems. Of the 7500 edible crops, only 12 species supply 70% of our food and only three species (rice, corn, wheat) supply more than 40% of our food caloric energy. Eating less diverse food (fruits and vegetables) and more meat and eggs and drinking milk with toxins from pesticide-infested crops make the life industries of mega companies super mega rich! (http://www.prostate.net/

[3] "Finansurance—a combination of financing and insurance, which is known as the most secure kind of loan, for both parties, ever offered" (http://www.payehome.org/finansurance).

"Finansurance—a convergence of finance and insurance in which households and firms optimize their overall risk positions in life-cycle and business. … that financial technology together with information technology accelerates the trend of functional finance and will provide products to complete an incomplete system for risk optimization." (Kariya, http://www.actuaries.org/AFIR/Colloquia/Tokyo/Kariya.pdf)

[4] "A healthy lifestyle requires regular exercise/physical activity and the consumption of a fibre rich, low-calorie healthy diet. Lifestyle intervention with a combination of regular physical activity and dietary advice showed an impressive reduction in the risk of developing diabetes in all the studies" (Desai and Tandon 2009).

Table 4.1 Indicative accumulated financial costs of maintenance medicines

	Case 1[a]		Case 2[a]		Case 3[b]	
Age (Years old)	Per mo.	Per year	Per mo.	Per year	Per mo.	Per year
40–44	1000	60,000	1500	90,000		
45–49	1500	90,000	2000	120,000	[b]	1,000,000
50–54	2000	120,000	4000	240,000	10,000	600,000
55–59	3000	180,000	5000	300,000	10,000	600,000
60–64	5000	300,000	6000	360,000	10,000	600,000
65–69	6000	360,000	6000	360,000	10,000	600,000
70–74	6000	360,000	7000	420,000	10,000	600,000
75–>	6000	360,000	7000	420,000		4,000,000
Total PHP		1.83 M		2.31 M		4.0 M

[a]Did not include medical consultation and treatment for other illnesses, [b]Underwent VAS (video-assisted surgery)
Source: TC Mendoza own calculations 2018

nutrition-cancer-diet/natural-foods-for-prostate-health/pesticide-contamination-in-food/).

The accumulated toxin will soon take a beating. Calculations on the costs of maintenance medicine range from PHP 1.8 M, PHP 2.31 M, and PHP 4.0 M till the person reach the finish line (Table 4.1). If there will be 3 billion people who are taking maintenance medicine, their medical bills amount to PHP 5.4 quadrillion pesos ($1.8 \times 10^6 \times 3 \times 10^9 = 5.4 \times 10^{15}$)(Case1) to as much as 12 quadrillion pesos (Case 3) (1 USD = PHP 53). If this trend continues, it will be no surprise that we will have trillionaire people in this millennium.

Dr. Vandana Shiva questioned the true purpose of farming as she takes serious issue with industrial agriculture's obsession with yield (volume) per acre. "If food is nourishment, then health and nutrition per acre, is what we should be measuring." *With a passion for the power of small farms, she said, "Small, organic farms grow health."* Under Indian condition, Vandana Shiva and her colleagues argued that there will be more food and Indians shall be healthier if from chemical–conventional monocultures, they shift to organic and polyculture farming systems. Rather than measuring crops yields per ha, why not calculate health per acre! They are able to show that protein production per acre (124 kg/acre at 60 g protein/adult/day), India's farmland of 184 M ha, can feed 5 billion adults and calorie energy production could feed 2.4 billion at 2500 Kcal/cap/day (the population of India was 1.3 billion people in 2018) (http://eatstayfarm.com/2017/02/health-per-acre-with-dr-vandana-shiva/).

Organic production innovation must have organic consumption innovation. Foregoing beef eating (those 1.2 billion cattle and eating the food bill of 8.5 billion people) shall make Mother Earth free from the CO_2 emission and recapture back at least 30% emitted CO_2 via crop photosynthesis as we plant trees instead of growing forage and cereals to feed them and use a lot of synthetic fertilizers and pesticides. As we promote organic farming innovation (nonetheless it should be reiterated that organic farming itself is already an innovation), the production orientation (supply

side) and consumption (demand side) should be given equal importance. We should not overly target the producers-farmers only! Organic production innovation must have organic consumption innovation as well! In relation to this, food preparation/recipes innovation must be promoted with equal if not greater importance now. The consuming public must be informed/educated. Innovating production systems simultaneous with the demand side shall need to focus on the following platforms:

1. On the energy aspects of production and consumption, the logistic aspect of making food available (packaging, storing, transport) is energy intensive. Data shows that traveling food (i.e., rice) beyond 50 km distance, the increase in energy bill becomes significant (20% more) (May Soe Oo and Mendoza 2018; Sem and Mendoza 2018). It will be greater if food is imported overseas involving land, sea, and air travel. The energy bill becomes enormous as food reaches the plate. It does not include energy bill or processing and cold storage. Localized food is the obvious innovation rather than food importation or food globalization. Consumers should prefer locally grown food than imported food items to minimize the "food miles" effect.
2. Nature designs crop seasonality not simply due to crop adaptation but also to supply nutrient needed by the human body to cope with the weather changes and for health reasons. Colder months require consumption of vitamin C–rich fruits. It is the citrus fruit season. We should drink more water during hot summer months. It is watermelon and sugarcane harvest time. Drink fresh sugarcane juice instead of drinking highly carbonated cola sweetened by high fructose corn syrup (HFCS), aspartame, and other alternative sweeteners (https://www.curejoy.com/content/harmful-effects-of-soft-drinks/).

   Off-season crop production (vegetable, fruits) is energy intensive (needs greenhouses/glasshouses, highly embedded energy during construction and electric power to sustain and maintain operation). To induce them to flower and to protect the flowers and fruits as in mangoes requires energy-based inputs. Hence, their energy footprint is high.
3. The thermodynamics of food must be popularized. As we convert food energy from one form to another, there is considerable food loss as shown in the data below (http://www.fao.org/3/a-a0701e.pdf; Thorpe 2008):
   - >75%–84% loss of animal protein (poultry, pork, or beef).
   - 4 kg of plant protein is reduced to 1 kg broiler, chicken (a 75% loss of food protein).
   - 6 kg plant protein is needed to produce a kilo of pork (more than 84% loss of plant protein).
   - 50 g pure animal protein from broiler is equal to 2–3-day, pork = 3–5-day, grain-fattened beef = 9–10-day effective food day (EFD) (Mendoza 1991, 1994).
   - In the transformation from grain ➔ animals ➔ man, there is a loss of 90% protein, 96% calories, 99% carbohydrates, and 100% fiber.

In terms of resource use:

- $1\text{cattle} = \text{consume food of } 7.25\,\text{persons}, 1\text{kg beef} = 16\,\text{kg grain} + \text{soybean}$
  $= 8.81\,\text{of gasoline} = 22{,}000\,\text{l of water} = 77\,\text{kg of eroded soil}$
- Producing 1 mega-calorie of beef or 1000 calories requires about 150m^2 of land. Eggs or poultry require about 5m^2.
- The beef uses 1.6 cubic meters of water compared to about 1 cubic meters of water for eggs or poultry.
- Beef contributes to water pollution eight times more than eggs or poultry. https://www.pri.org/stories/2014-08-04/yes-steak-expensive-its-true-cost-even-higher-you-may-think.
- Raising beef cattle is far more environmentally costly than poultry, pork, dairy, or eggs. Per calorie, cattle requires on average 28 times more land and 11 times more water to farm. Farming cattle releases five times more greenhouse gases and uses six times as much nitrogen as the average of other animal products. When compared with staple plant foods, these ratios roughly double. So, a beef calorie requires about 50 times more land than a wheat calorie (Adam Wernick 2014. https://www.pri.org/stories/2014-08-04/yes-steak-expensive-its-true-cost-even-higher-you-may-think).
- A University of Minnesota study showed that for every 100 calories of grain fed to animals, only 40 new calories of milk, 22 calories of eggs, 12 of chicken, 10 of pork, or 3 of beef could be obtained. The UN-FAO warns that using cereals as animal feed could threaten food security by reducing the grain available for human consumption (https://www.ciwf.org.uk/media/7431690/paying-for-the-true-costs-of-our-meat-eggs-and-dairy.pdf). Furthermore, food source from animals emit more greenhouse gases (CO_2e) per kg than plant food source as shown in Table 4.2.
- Animals require more resources, land, water, and production inputs, resulting in 40% more greenhouse gas emissions than cars!
- Animals contribute 9% of total anthropogenic carbon dioxide emissions, 65% of human-related nitrous oxide from manure, 37% of all human-induced methane produced by the digestive system of ruminants, and 64% of ammonia, which contributes significantly to acid rain (http://www.fao.org/3/a-a0701e.pdf; Thorpe 2008).

4.7 Synthesis and Recommendation

Innovation is the key strategy in scaling up the adoption of agroecology-based organic agriculture and building climate change resilient communities. Innovations should aim to overcome the barriers in the metamorphosis to scale up the adoption of agroecology-based organic agriculture. Innovations are necessary across the value chain (preproduction, production, postharvest, processing, marketing interlinkages). Various innovations, starting from seed selection, using location-tested hybrid or inbred seeds, seedling preparation (i.e., rice at 4 kg seeds ha^{-1}, sowing

Table 4.2 Carbon emission of foods (per kg) and their equivalent car miles

Food source	Kg CO_2e Per kg	Equivalent Car miles
Lamb	39.2	91
Beef	27.0	63
Cheese	13.5	31
Pork	12.1	28
Turkey	10.9	25
Chicken	6.9	16
Tuna	6.1	14
Eggs	4.8	11
Potatoes	2.9	7
Rice	2.7	6
Nuts	2.3	5
Beans/tofu	2	4.5
Vegetables	2	4.5
Milk	1.9	4
Fruit	1.1	2.5
Lentils	0.9	2

Source: Environmental Working Group's Meat Eater's Guide and the EPA's Guide to Passenger Vehicle Emissions. http://www.greeneatz.com/foods-carbon-footprint.html

seed at 1500 seeds square meter^{-1}), transplanting 20-day-old seedling at 1 seedling per hill, paying transplanters PHP 500 higher ha^{-1}, using amplified liquid manure, indigenous microorganisms (IMO) inoculated hog-biogas-generated liquid sludge, moist fields not flooded are but some pre-to-production innovations. But farmers as entrepreneurs should also practice total quality management (TQM). They should make their partner-workers happy, motivate them, and practice benefit-sharing. Partner-workers must have an additional income after deducting costs, and profit is shared at 50–50 after deducting the initial capital.

Likewise, consumers must support organic farming by paying a fair price to put an economic value to the care farmers extend to the soil and to the Mother Earth at large by rebuilding–restoring soil fertility, by not applying "easy" but destructive, health hazardous and heavy greenhouse gas-emitting oil-based inputs. Consumers patronizing on-season produced crops and on their locality buy local to avoid food miles, discouraging food imports, as it imperils food sovereignty leading to food globalization by few multinational companies/transnational corporations. The innovative change from supply chain approach to value chains approach is necessary. A supply chain approach must be a tinge of the past where our farmers simply produce/supply raw materials (feedstock) to the processor/manufacturer of finished/processed high-value products. Value-adding product must be identified and farmers should be capacitated and be supported to reap the benefits of the value adding/financially enriching part of the food systems. The challenge is how to help farmers

achieve the benefits accruing across the "value chain." It will spell the differences between the past (twentieth century) to the present (twenty-first century).

Another major value adding field metamorphosis is reshaping agriculture landscape into agroecotourism. A number of farms not only in the Philippines but across Asia and the Pacific are into agroecotourism. There are farms in the Philippines whose major income are earned through the entrance fees, seeds/seedling, and fruit sales from the agrotourists. Their farm is serving as market and educational site at the same time for environment- and health-friendly farming and food consumption style.

Agriculture is primarily about food and health. This lumps together finansurance or healthsurance. Health banking refers to the growing, eating, or buying foods grown on healthy soil. Thus, agriculture should shift into biodiverse, agroecology-based organic production that innovates yield assessment into health per acre rather than monoculture yield per ha. However, organic production innovation must simultaneously have organic consumption innovation as well. For instance, mother earth can support 43 billion if we become vegetarian. By 2050, we are anticipating 9.5 to 10 billion people globally, and in Philippines, the population is projected to be 160 million. The 1.2 billion cattle consume the food equivalent of 8.5 billion people, emits more GHGs than all our cars. There must be organic food consumption innovation!

The urgent necessity to implement and scale-up the adoption of organic farming as an adaptive and mitigating mechanism to combat the looming impacts of climate change should unite us all. The shift to organic farming should not only be compelling on the supply side. But it is equally important for consumers, the demand side, to patronize organically grown produce and be supportive. The nominal premium price associated to organically grown produce compared to the conventionally chemical-based grown products has no basis if total costs accounting (financial, ecological, health costs) will be adopted in computing prices. This will undoubtedly make chemically grown crops excessively underpriced. Integrating the control of the value chain among the producers, particularly the farmers, should be institutionalized in the organic farming vis-à-vis consumer, producer, and government.

A concerted effort is necessary among the stakeholders to ensure the adoption of organic farming consequently building the resilience of the communities towards adverse impacts of climate change. In view of this, the five capitals (Morse et al. 2009; Callaghan and Colton 2008) resulting to resilient communities should be ensured as an enabling environment to realize the shift to organic farming and consumption, and they are as follows:

(a) Natural capital referring to natural resource stocks and environmental services. The natural capital shall ensure productivity with conservation of the ecological integrity. Consequently, sustainable production is assured across generations.
(b) Social capital focused on enhancing networks, social relations/affiliations, and associations including social claims. Moreover, developmental funds are usually channeled to recognized community organizations/associations thereby necessitating affiliations to official accredited community groups. As opposed

to mere construction of physical assets, social capital is founded on building trust and confidence among stakeholders towards accessing resources and sharing of benefits.

(c) Human capital is concerned about the skills, knowledge, and labor including health and physical capability. This is intertwined in the translated financial capital.

(d) Physical capital representing infrastructure, production facilities, and technologies. This captures the idea of Villegas (2018) to make available to the farmer the 4Ps and 2Ms (preproduction, production, processing, postproduction linkages + marketing and management). This provides the control of the value chain in the hands of the producer translating to a more secure economic and financial capital to be plowed back in farm development.

(e) Economic and financial capital ensuring a guaranteed capital base either sourced as cash, credit/debt, savings, or from other economic assets.

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