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Affordances in crop diversification: Three cases from the Philippines

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ABSTRACT

This paper investigated the viability of crop diversification as an alternative production system for Filipino rice farmers in light of the *Rice Tariffication Law*. Qualitative research methods were employed, including focus group discussions, key informant interviews, in-depth interviews, and wind-screen survey. The transcript analysis employed both inductive and deductive approaches, supplemented by auditability measures such as coding guides and informal member-checking. Using the *Affordances Theory* with additional insights from the *Capabilities Theory* and *Intuitive Decision-Making Theory*, the findings show that rice farmers in Nueva Ecija, Ilocos Norte, and Tarlac shared one cognitive process and one set of variables in deciding on diversifying crops. This is despite the provincial differences in farming contexts. Affordances and *anti-affordances* in crop diversification are dependent on farmers' visual and tracking experiences, which guide them in their evaluation of crop diversification as a pro-welfare farming practice. They evaluate the suitability of crop diversification for their sociocultural, economic, and farming contexts, but then shift to intuitive decision-making for their ultimate decision. Risks that are mostly external to farmer control, such as sufficiency of irrigation, financial capital, weather, and climate, make them conclude in a posture of luck after a detailed evaluation process on the practice of crop diversification. This study provides insights into using crop diversification as an alternative production system for rice farmers.

Contribution/Originality: This research adopts a social science lens for understanding crop diversification, delving into unconventional parameters rather thanthe predominant trend which primarily aligns with the physical sciences.

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1.INTRODUCTION

Crop diversification (CD) is one of the globally recommended pathways for poverty reduction because it expands income sources in farming communities, leading to increased economic returns. This practice involves cultivating different crops and species in a cropping system, which also offers non-economic benefits including a diversified diet, climate change mitigation and adaptation, and ecological balance. Worldwide research interest in CD accelerated

between the 1950s to the 1980s, then surged in the late 2019s when Hufnagel, Reckling, and Ewert (2020) documented the research rate at around 100 per year. A global-scale study on CD by Beillouin, Ben-Ari, and Makowski (2019) recognized it as a key solution to the pressing issues of sustainable food and feed production for a growing world population (Beillouin et al., 2019; Strobl, 2022). Food security, dietary diversity, agricultural resource management, and climate change are paramount concepts in this issue. According to their study, CD research in line with these typically gauges impact via crop yield, effects on soil quality, biodiversity, pest and disease ecology, environmental outcomes, and macro-economic outcomes. The general research schema is notably calibrated on physical science measures and rarely on social science.

The Rice Tariffication Law (RTL), or RA 11203: *An Act Liberalizing the Importation, Exportation and Trading of Rice, Lifting for the Purpose theQuantitative Import Restriction on Rice, and For Other Purposes*, was enacted in the Philippines in 2019. This is a long-coming major trade development, beginning in 1986. After 25 years of exemption from the World Trade Organization's (WTO) rice importation regulations, the Philippines finally transitioned to a liberal rice trade in 2019. The entry of cheap imported rice led to a predicted decline in paddy prices (Department of Agriculture (DA), 2019). The Rice Competitiveness Enhancement Fund (RCEF), where PhP 10B of the tariffs go, served as a key measure to counter the price decline. The Department of Agriculture (DA) invests excess collections in expanded crop insurance programs and CD, among other initiatives (DA, 2020).

In 2019, the Department of Agriculture (DA) highlighted diversification as vital for modernizing agriculture and doubling the income of farmers and fisherfolk. While empirical research on Philippine-context CD is scant, consensus suggests its positive socioeconomic, environmental, and agricultural sector resilience impacts (Lin, 2011; Pellegrini & Luca, 2014). A policy paper from the Philippine Institute for Development Studies(Briones, 2009) authored by Briones discussed constraints hounding local fruit and vegetable subsector development, and consequently agricultural diversification. Reflecting on the work of Librero and Rola in the early 2000s, Briones identified the following constraints: concerns about high costs, losses from pests, lack of resources, institutional inadequacies, and poor marketing systems (Briones, 2009). Two decades later, the same narrative ensues, with Philippine agriculture being characterized by limited diversification and low productivity (Brown, Fezoil, & Reynaldo, 2018).

With the foregoing, this study seeks to investigate whether CD would prove to be a viable alternative production system for the Filipino rice farmers. This study takes on a social science lens to understand CD. The overarching question is: What are the affordances in crop diversification in the Philippines? The specific research questions are: (1) What are the important characteristics of the research sites with respect to crop diversification? (2) What are the characteristics of crop-diversified farmers and monocropping/specialized farmers? (3) What are the considerations in pursuing crop diversification? and (4) What is the needed policy support for farmers?

2. LITERATURE REVIEW

Chen et al. (2018)note that gaps persist in comprehending the risks that farmers take in doing CD and about the determinants of CD. Mindset change from rice monoculture to crop and livelihood diversification is still ongoing, especially in Southeast Asia (SEA) (Climate Change Agriculture and Food Security (CCAFS), 2019). Agriculture in the region is currently flourishing through large-scale commercial and small-scale subsistence farming, small-scale marketing, as well as traditional and artisanal practices. Smallholders farmers implement these practices, with rice dominating their production systems (Birthal, Joshi, Roy, & Pandey, 2022; Climate Change Agriculture and Food Security (CCAFS), 2019). As with the rest of the world, CD is one of the identified keys to agricultural growth in the SEA. Chen et al. (2018) affirm that it is pro-smallholder farmers, especially when coping with fluctuating markets (Chen et al., 2018).

High-value crop development and organic farming are the top CD strategies in SEAn countries with predominantly agricultural economies, such as Thailand, Vietnam, Indonesia, Cambodia, Philippines, and Malaysia (Asian Development Bank (ADB), 2022; Yanakittkul & Aungvaravong, 2020). On the other hand, countries with limited arable land, such as Brunei, Singapore, and Lao People's Democratic Republic (Lao PDR) maneuver their import-reliant food economies with technological innovation. Examples of these are precision farming, hydroponics, and vertical farming (Mok, Tan, & Chen, 2020; Musa & Basir, 2021).According to Beillouin et al. (2019) the region shares a trend with Polynesia in having the fewest CD studies.

Crop mixing, polyculture, crop rotation, relay cropping, intercropping, diversification into high-value crops(HVCs), adoption of modern varieties and improved crops, implementation of agroforestry, and crop-livestock diversification are the various ways in which CD is implemented inSEA (Feliciano, 2019; Hufnagel et al., 2020). Examples of high-value crops are coffee, cacao, fruit crops, root crops, vegetable crops, legumes, spices, and ornamental plants (High-Value Crops Development Act, 1995). Beillouin et al. (2019) underscore the positive impact of these on crop production, biodiversity, and ecological balance, encompassing water services, pests and diseases, carbon sequestration, and soil quality. Feliciano (2019) affirms that it is indeed a solution to the "no poverty" United Nations Sustainable Development Goal (UN SDG), especially in the Global South.

Merlos and Hijmans (2022) suggest that "environmental constraints and the reliance on a few major crops for most food supply" are among the issues that come with CD but are lacking in the literature. Moreover, we must consider regional differences, noting that specialization of farms and regions results in low levels of local crop diversity worldwide.With these, the benefits of CD at the macro level become context-specific at the micro level.

Globalization and international trade play crucial roles in CD. In a study by Fraser (2006) it was noted that agricultural policies since the 1990s have emphasized liberalized trade without due consideration of microeconomic impacts. This led to prescriptive approaches to integrating smallholder farmers into global value chains. However, Olofsson, Mirjam, Joyeeta, and Yves (2021) argued that there are detrimental outcomes to this approach, including

heightened risks, increased poverty, and diversion of scarce resources away from locally nourishing food. Furthermore, Burkholz and Schweitzer (2019) pointed out that the international trade prioritization on maize, rice, soy, and wheat causes countries to specialize in the production of these, rendering them highly vulnerable to global natural and political setbacks.

Like most Southeast Asian countries, the Philippines faces constant challenges from international trade developments and environmental changes in its rice-dominated agriculture sector. CD has been among its long-running passports towards resilience, increased gross domestic product (GDP), intensified rural employment, and realizing prosperity in the lives of farmers, who are mostly smallholders (Briones, 2021; Dawe, 2015; Espino & Atienza, 2001). Figure 1 below illustrates the timeline of crop diversification programs in the Philippines. The transition from rice monoculture to rice-based farming systems has been underway in the Philippines since the late 1990s (Espino & Atienza, 2001). Local research, development of technologies, and boosting of strategies on CD were initiated by the International Rice Research Institute (IRRI) in the 1970s (Miranda and Panabokke 1989, as cited in Espino and Atienza (2001)). The Mariano Marcos State University (MMSU) and the Philippine Rice Research Institute (PhilRice) followed suit, conducting research in the regions of Ilocos and Central Luzon (Espino & Atienza, 2001).

Among the major CD efforts in the country are the creation of a National Committee on Crop Diversification (NCCD) in 1992 (Espino & Atienza, 2001)(status inactive); launching the High-Value Crops Development Program (HVCDP), pursuant to the High Value Crops Development Act of 1995 (Briones, 2009; Department of Agriculture (DA), n.d); executing the World Bank-funded Diversified Farm Income and Market Development Project (DIFMDP) from 2004 to 2009 in alignment with the Agriculture and Fisheries Modernization Act of 1997 (AFMA) (Briones, 2009);and initiating the *GinintuangMasaganang Ani* - High Value Commercial Crops (GMA-HVCC) program (Briones, 2009).

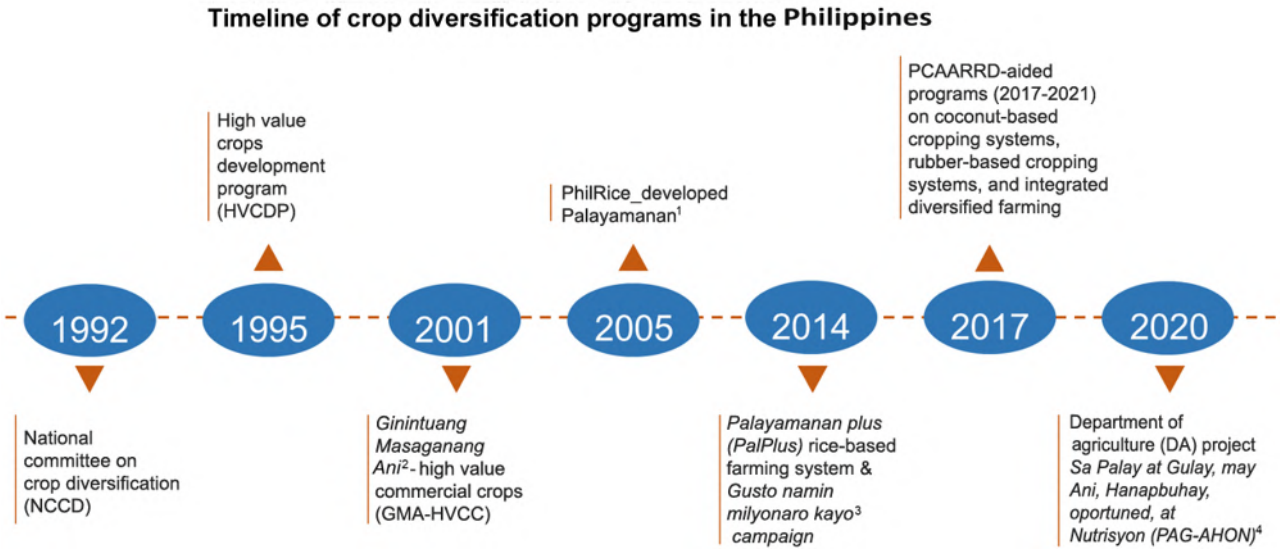

Figure 1. Crop diversification initiatives in the Philippines from the 1990s to present.

Note: 1 Palayamanan is a portmanteau of palayan (Paddy field) and yaman (Riches), suggesting that there is properity in rice farming.
2 Ginintuang masaganang Ani translate as " Golden harvest". Its acronym, GMA, are also the initials of former Philpine President Gloria Macapagal Arroyo under whose term the program was implmented.
3 Gusto naming milyonaryo kayo translate as " we want you to become millionaires". This campaign intended to inculcate in former that a million-level income is possible when farm soace is maximized with diverse crops.
4 Sa palay at gulay, may Ani, Hanapbuhay, opportinidad, at nutrisyon translate as " rice and vegetables bring harvest, livehood, opportunities, and nutrition" . Its acronym,PAG-AHON, is a fillipino word that translate as " to rice" . The program suggests that rice and vegetable farming can raise farmers' harvest, income, and food security.

Other national-level CD programs from the past decade were the *Gusto naminmilyonaro kayo* campaign under the Rural Transformation Movement by PhilRice in 2014; the PhilRice-developed Palayamanan and its upgrade the Palayamanan Plus (PalPlus) rice-based farming system (2014); several programs aided by thePhilippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD)(2017-2021) on coconut-based cropping systems, rubber-based cropping systems, and integrated diversified farming; *Gulayansa Barangay* and *GulayansaPaaralan*programs; and the 2020 DA project *Sa Palay at Gulay, may Ani, Hanapbuhay, Oportunidad, at Nutrisyon*(PAG-AHON).

3. THEORETICAL FRAMEWORK

In this paper, we draw heavily from the *Affordances Theory* (Gibson, 1977; Glover, 2022; Thapa & Yingqin, 2019) with some theoretical support from Capabilities (Thapa & Yingqin, 2019) and Intuitive Decision-Making (IDM) theories in making sense of our findings.

Affordances are "immaterial things that are made available by the environment that surrounds an individual" (Glover, 2022). In other words, affordances have emergent properties. Some synonyms for affordances are "propositions," "proposals," "offers," or "invitations" (Glover, 2022).

In his seminal paper, Dominic Glover applies the Affordances theory following a technographic approach to technology. By this, he means that technologies are "viewed as a domain of technical practices, in which various tools and techniques are deployed purposefully to transform materials and so to achieve human,social objectives" (p. 94).

Glover outlines three characteristics of affordances. These are perceptual, experiential, and relational. The perceptual characteristic, citing (Pols, 2012) refers to "the properties of objects and environments as perceived by the senses and apprehended by the mind of potential users" (p. 75). For the affordances to be perceived, the "potential for use" must first be in the mind of a "potential user" (p. 75). The experiential characteristic, on the other hand, refers to affordances' discoverability. They can be discovered through trial-and-error and recognized through experience. Affordances are also cultural as they could also be discovered through observation and emulation. Lastly, the relational characteristic pertains to the "possibilities for material interactions" that emerge from the relationship "between an object or environment that has certain biophysical limitations" (p.75).

In explaining the usability of the Affordances Theory with respect to agricultural technologies, Glover identified three key areas where affordances could be investigated. These are material, cultural, and socio-economic relations. In looking for affordances under material relations, the researcher is being invited to look at the relationships between attributes of things and environments with respect to the capacities of individuals. In the context of this research, this would refer to the interactions between CD and the farmers, considering the biophysical limitations in their respective areas. Under cultural relations, one is being invited to interrogate how existing beliefs, cultures, and traditions enable or constrain affordances. In the context of this research, it would be useful to look at how CD is being supported culturally at the research sites. For example, what percentage of the community is into CD? Do the farmers in the community support any other crops that are more culturally significant than others? Socioeconomic relations invite interrogation pertaining to wealth, income, consumption, jobs, and livelihood. This is more of a political economy type of inquiry. The motivation is to look at how these elements influence the trajectory of affordances among the stakeholders involved. In the context of this research, this would pertain to how the level of income and wealth of the farmers are affecting affordances in CD among them. Or, do these elements result in "anti-affordances"?

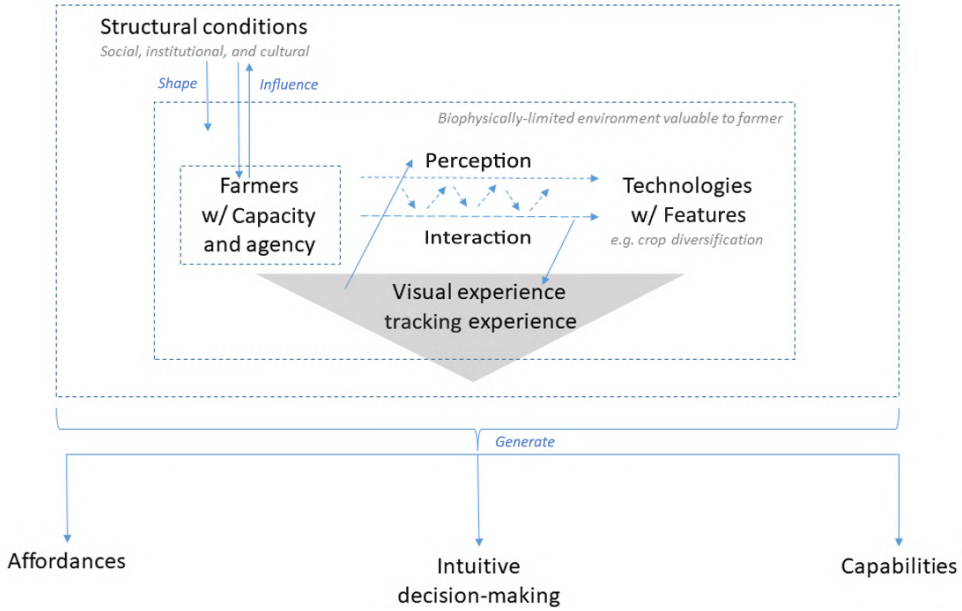

Figure 2. Theoretical framework.

This research investigates affordances in CD, as illustrated in the diagram above (Figure 2). The diagram shows that farmers coexist in one space with technologies. The farmers have individual capabilities and agency or the power to act. The technologies likewise have physical features that allow their potential for use to be perceived by the farmers. This space or environment is valuable to the farmers because it provides opportunities despite biophysical limitations. Structural conditions, such as social, institutional, and cultural conditions, shape the availability of opportunities in this environment (Thapa & Yingqin, 2019). Yet the farmers are also able to influence these structural conditions through agency.

When the farmers become aware of CD, perceive its potential, and exercise their agency to interact with it, the interaction becomes a dynamic and manifold process that creates visual and tracking experiences over time. These experiences affect the farmers' perceptions of CD. Their individual capacities or socioeconomic status also have an impact on their experience. Hence, the farmers' perception of CD co-develops with their interaction with it. Affordances in CD are generated from all of these, and are in turn evaluated by the farmers in consideration of what will lead to their well-being. At this point in the process, we argue that the farmers shift from rational decision-making to IDM.

According to Matzler, "intuition is not a magical sixth sense… nor does it signify either random and whimsical decision-making or the opposite of reason. Rather, intuition is a highly complex and highly developed form of reasoning that is based on years of experience and learning, and on facts, patterns, concepts, procedures, and

abstractions stored in one's head" (Matzler, Bailom, & Mooradian, 2007). It is tacit knowledge that is rather difficult to articulate (Klein, 2015). Sauter (1999) described it as "[appearing] to include instant information processing and choice. But decision-makers might sense feelings and visual clues or see a pattern in apparently unrelated facts."Investigating affordances in CD, the farmers are seen as such decision-makers who have the agency to shape their own lives, other people's lives, and their spaces based on a set of valued choices leading to well-being.

4. METHODOLOGY

This research is predominantly qualitative, with in-depth interviews (IDI), key informant interviews (KII), and focus group discussion (FGD) as the main methods of data collection. The exploratory nature of this research and the scarcity of studies on CD in the Philippines, particularly those addressing its social aspects, justify the use of qualitative approach (Marshall & Gretchen, 2016). The research was conducted in three rice-farmingcommunities, namely Talavera, Nueva Ecija; Bacarra, Ilocos Norte; and Moncada, Tarlac (see Results section for a description of the research sites).

We conducted 134 interviews, each lasting from 45-90 minutes (Table 1). The questions in the interviews revolved around general farming practices, the extent of CD practice, characteristics of monocrop and crop-diversified farmers, programs and enabling laws or policies on CD, and enablers and constraints on CD.

Table 1. Data collection matrix.

Method	Talavera, Nueva Ecija Brgys. Valle and Bulac	Moncada, Tarlac Brgys. Sta. Monica and Sta. Lucia West	Bacarra, Ilocos Norte Brgys. Bani and Pulangi
In-depth interview with farmers	Total interviewed: 40 Total details: 12 crop diversified 12 monocrop 16 FGD (mixed)	Total interviewed: 40 Total details: 12 crop diversified 12 monocrop 16 FGD (Mixed)	Total interviewed: 40 Total details: 12 crop diversified 12 monocrop 16 FGD (Mixed)
Key informant interviews	Total interviewed: 6 Total details: 3 KII LGU 1 KII DA-RFO 1 Windshield LGU 1 KII PhilRice	Total interviewed: 4 Total details: 3 KII LGU 1 Windshield LGU	Total interviewed: 5 Total details: 2 KII LGU 1 KII DA-RFO 2 Windshield LGU

Note: Legend: Brgy- Barangay; DA-Department of agriculture; LGU-Local government unit; RFO-Regional field office.

All interviews were audio recorded with the permission of the research participants, and were later transcribed as an auditability measure (O'Leary, 2014). We read the transcriptions line-by-line to identifiyemerging themes, adhering to the analytic objectives outlined in this paper. We identified the themes through an iterative process of inductive and deductive reading. In coding the transcript, a coding guide was developed as another auditability measure to ensure consistency, especially that six researchers participated in the coding process. Group deliberation resolved discrepancies in the coding. As a measure of trustworthiness, we employed informal member-checking among research participants (Lincoln & Guba, 1985). All participating farmers gave their consent to participate, and they were aware of their right to withdraw at any point without responsibility for their participation in this research. This paper anonymizesall participants.

5. RESULTS

5.1. Site Characteristics with Respect to Crop Diversification

In each municipality, the rice-based agricultural economy has distinct characteristics: Talavera is the vegetable basket in the lowland plains of Nueva Ecija; Bacarra contributes to the garlic, corn nut (*cornick*), feeds, and tobacco industries in semi-arid Ilocos Norte; and Moncada, Tarlac is a conducive niche for root crops, corn, and tobacco. These contextualize the observable cropping patterns, land use, and CD type at the study sites. The barangay-specific landscapes offer insights into the factors that farmers consider in doing CD, establishing why and how these might be enablers or constraints.

5.1.1. Talavera, Nueva Ecija

Bulac has a defined area conducive to planting other crops than rice. The local term for this is *bakod* or *tumana.* Farms in the *bakod* are irrigated by deepwells or water pumps, and are located in an elevated area by the village's river.*Magalas* or *mabuhangin,*which encompass silty, sandy, or sandy loam textures, describe the soil composition. The prevailing cropping pattern in the *bakod*is rice and other crops. Usually, rice is followed by onion production in the dry season. If not onion, some farmers opt for tomatoes, chili, sponge gourd (*patola*), squash, mung bean (*munggo*), eggplant, okra, corn, Chinese chard (*petchay*), or sweet potato. In contrast, the dedicated area for rice features *lagkitin*or clay soil which makes it conducive to ricecropping only. Figures 3, 4, and 5characterize the Bulac landscape.

3. 4.

Figures 3-4. Aerial view of Bulac showing production areas set for rice production.
Source: Byahenikalbo ride and fly, 2021.

Figure 5. Bakod area of Bulac where onions are grown in the dry season.

Valle has a more varied landscape, hosting a diversity of crops and vegetables in both the wet and dry seasons. The unassuming cause of this condition is water insufficiency, being located at the tail-end of the irrigation system. Valle's topography resembles a slope. Riverside farms, also called *bakod*, are situated in the lower part. Unlike Bulac, Valle has diverse soil types, which makes it possible to find rice planted amidst other vegetables in the wet season. Mid-slope is where the irrigation canal runs, level with rice fields. Then on the upper part are the rain-fed farms. All Valle farms, then, are conducive to planting non-rice crops similar to those planted in Bulac. Additionally, there are also watermelon, melon, garlic, bittergourd, *sili*, bottle gourd, and cucumber. Instead of dedicating entire parcels to a single crop, some Valle farmers apportion them to accommodate multiple crops simultaneously. Figures 6 and 7 exemplify Valle's heterogenous terrain.

Bulac and Valle also maximize backyard and communal neighborhood spaces for growing vegetables, in line with the national initiative called *Gulayansa Barangay*. These spaces grow vegetables for household consumption. In 2021, Talavera won the Best Gulayansa Barangay Championship award in Central Luzon (Gosuico, 2021).

Figure 6. Interview at the border of a bitter gourd farm and a chili production area.

Figure 7. On the other side of the bitter gourd area is a rice production area.

5.1.2. Bacarra, Ilocos Norte

Pulangi and Bani share similar CD landscapes.Figures 8 to11 demonstrate these similarities. The case here is that farmers own or tend to own dispersed parcels of land that can be situated in upland or lowland zones. The upland zones begin at the base of hills, which are already unreached by irrigation. Hence, they are cultivated with corn, garlic, chili, and onions. Some farmers grow vegetables in their backyards where possible.

Figure 8. An overview of lowland Bani.

Figure 9. Crop landscape changes at the margins of Bani rice production areas proximate to hills.

Figure 10. Topography at the margins of Bani rice production areas proximate to hills.

Figure 11. Pulangi rice production area showing irrigation source.

5.1.3. Moncada, Tarlac

The majority of the rice farms in Sta. Monica also grow corn. The ecosystem is irrigated, but water supply is low in the dry season. Figures 12-15 depict the land use in the village.Sta. Monica is located at the irrigation tail-end, similar to Valle in Nueva Ecija. The irrigation comes from the municipality of San Roque in the nearby province of Pangasinan. Farmers' crop choice to alternate with rice is tied to their dynamics with the local traders, i.e., contract farming. As a result, corn becomes the frequent choice. The farmers mentioned that they attempted to plant onions in 2020 but failed.

12.

13.

14.

15.

Figures 12-15. Varied land use in Sta. Monica.

Sta. Lucia West is a catch basin for several bodies of water, which causes flooding in the wet season. This makes it a predominantly monocrop rice area and also a *diversified* area. When the farms flood, some farmers engage in daily fishing and sell their produce at the market in the nearby municipality of Paniqui. Others sell firewood or do food business, selling *tupig*, a local delicacy, in stalls along the highway.Figures 16-19 below illustrate the livelihood environment in the wet season. In the dry season, they optimize productivity and profits through hybrid rice cultivation.

16.

17.

18.

19.

Figures 16-19. Sta. Lucia West.

5.2. Characteristics of Crop Diversified Farmers and Rice Monocrop Farmers

Despite varying contextual differences that shape the nature of CD across the sites, the determinants of a farmer's ability to diversify crops remain consistent. Whether practicing CD or monocropping, farming practices stem from familial inheritance; something that the farmers were born into. The same is true with their crop choices and sometimes even market choices. The interviews reveal that various government programs and the DA, through in-kind support and technical training on nutrient management practices, have supported the CD farming lifestyle. Few, if any, narratives emerged in which the DA formally presented farmers with alternatives to their customary practices that were appropriate for their land, beyond what they could observe in others. This can be reflected bilaterally; one track can be about the information-seeking behavior of farmers, and the other about the proactiveness of the DA. Either way, these contribute to farmer mind-setting towards CD. Interestingly, crop-diversified and monocrop farmers are more similar than dissimilar. In nearly all measurable sociodemographic characteristics, they share in "having" but vary in the "extent of having" (see Table 2). For example, both types of farmers have available land to cultivate. However, the CD farmer may also have access to a *bakod* parcel (Talavera), an upland farm (Bacarra), or an opportunity to be hired labor in a non-rice farm (Talavera and Tarlac). Both types of farmers have access to water, though the CD farmer generally has less supply. Both are able to financially invest in farming, but the CD farmer is able to risk higher amounts of investment.

> *"That's what my father has been planting since time immemorial... I am not aware of any vegetable that will thrive in irrigated areas." - Farmer, Talavera, 58*
>
> *"That's what my father taught us so we know." - Farmer, Bacarra, 40s*

In general, access to farms suitable for planting non-rice crops and more resources characterize crop-diversified farmers. These farms are characterized by their distance from the main irrigation system. Furthermore, we find them to be high-risk-takers employing various CD strategies. Some do it for economic security, while others to do it for food sufficiency. Not all intentions for CD are commercial production-inclined. Some are subsistence-oriented, where any excess to the household needs may be sold to the neighbors or to vendors at a nearby market.

> *"When we plant vegetables, we have daily earnings." Farmer, Talavera, 71*
>
> *"I am only able to sell a small volume in the market. Our neighbors usually buy our vegetable produce." Farmer, Bacarra, 41*
>
> *"When we bring chili to the market early in the morning, it gets sold out immediately." Farmer, Tarlac, 58*

In terms of income, crop-diversified farmers realize that they are able to earn a higher income and improve their quality of life, as evidenced by their capacity to buy motorcycles or more farm lots, for example. Moreover, they are able to gain returns on a daily, weekly, or monthly basis due to multiple harvests. The higher return of investment relative to rice production and the chances of getting lucky when they hit the high market prices by chance are the main drivers of their CD practice.

On the other hand, monocrop farmers do not have access to farms suitable for planting non-rice crops, whether by land ownership, lease, tenancy, or labor services. Their farms are near irrigation canals, which means they are better supplied with water. Some monocrop farmers used to be crop-diversified farmers but became discouraged with several experiences of *lugi* or negative profits. These are usually caused by factors external to farmer control, such as *panahon*(weather and climate), pest infestation, crop disease, and increasing land rental rates. In general, monocrop farmers are interested in doing CD but cannot afford to risk the chances of negative outcomes.

Table 2. Summary of the characteristics of crop diversified farmers and rice monocrop farmers.

Characteristics	Rice monocrop	Crop diversified
Inherited diverse crop options	Less	More
Access to water	More	Less
Access to suitable land	Less	More
Financial or capital resources	Less	More
Government support	More	Less
Risk-taking	Less	More
Production costs	Less	More
Number of harvests from one cropping	Less	More
Income	Less	More
Return of investment	Less	More

Characteristics	Rice monocrop	Crop diversified
Chance of good price	More	Less
Price stability	More	Less
Negative profit experience (*Lugi*)	Less	More
Impact risks from bad weather	Less	More
Impact risks from pests and diseases	Less	More
Subsistence production intention	Same	Same
Commercial production intention	Same	Same
Neighborhood is target market	Less	More
Interest to crop diversify	Same	Same
Market link	Less	More

5.3. Enablers and Constraints of Crop Diversification

There are many considerations when doing CD. Based on the interviews, the assessment process of farmers is multi-staged, where the variables considered and scope of social influence differ as the stages progress. The considerations are identified in the tables below, taking off from the point of view of encouraging a monocrop rice farmer to diversify crops. The variables are also assessed on how they might enable CD or be a constraint to CD. Addressing the considerations from the previous stage advances the assessment process. These cut across all three sites and are applicable for reflection by all rice industry players.

Table 3. Stage 1 of the crop diversification assessment process.

Stage 1: Information gathering *(Is crop diversification for me?)*			
Social influence: DA and markets			
Cognitive process	**Considerations**	**Enabler of CD**	**Constraint to CD**
Is it possible to plant other crops than rice?	Farming type	Already a planter of other crops than rice	None
	Farm ecosystem	Rainfed and irrigated but insufficient water supply	Irrigated with sufficient water supply
	Farm location	Riverside, far from irrigation canal	Lowland, near the irrigation canal
	Farm soil type	Silty (*Magalas*), Clay loam (*Semi-lagkitin*)	Clay (*Lagkitin*)
Is it profitable?	Income	Exceeds rice income	Does not exceed rice income
	Profit	Risk when successful *(Kapagtumama)*	Risk if breakeven
	Investment	Access to informal or formal creditor	No informal or formal creditor
What crop options are available?	Knowledge on options	Proactive in seeking options through various media, e.g. Facebook, DA, local markets	Aware of inherited practices only
	Neighbor influence	Neighbor farmers have experience in planting other crops	Neighbor farmers plant similar crops

Table 4. Stage 2 of the crop diversification assessment process.

Stage 2: Weighing of personal capacities *(Can I undertake crop diversification?)*			
Social influence: Farmer and neighbor farmers			
Cognitive process	**Considerations**	**Enabler of CD**	**Constraint to CD**
Can I plant other crops than rice?	Availability of suitable land (Whether owned, rented, lent, or labored)	With access to suitable land	No access to suitable land
	Availability of resources for capital (Whether owned or loaned; social or economic)	With access to resources	No access to resources
	Availability and profitability of alternative livelihood to farming	No alternative	With available profitable alternative livelihood
	Availability of farm supply (Seeds and inputs)	Provided as aid or sampler	Unavailable
	Price of inputs	Either subsidized or within budget	Expensive
	Water supply	Scarce	Sufficient

Stage 2: Weighing of personal capacities *(Can I undertake crop diversification?)*			
Social influence: Farmer and neighbor farmers			
Cognitive process	**Considerations**	**Enabler of CD**	**Constraint to CD**
	Tenurial status	Land owner or tenant with decision-making freedom, laborer for multiple crop types	Tenant without decision-making freedom, laborer for only one type of crop
	Neighbor factor	Neighbor will not plant rice	Neighbor will plant rice
	Familiarity on crop care and maintenance of available crops	Familiar	Not familiar
Will I take the high risk?	Previous experiences of failure	1-3 times	More than 3 times
	Status of debt and available resources	With means to get by until return of investment	Cannot afford until return of investment
	Farm size	At least 2 hectares	Small farm size
	Anticipated costs and returns based on personal or other farmers' experience	Weighed as not a loss nor breakeven	Weighed as breakeven
	Age	Pre-senior	Old age
	Availability of market	With sure market, engaged in contract farming, or member of cooperative	No sure market
	Tenurial status	Land owner	Tenant
	*Lakas ng loob*or willingness to take risk	With high hopes	Doubtful

Table 5. Stage 3 of the crop diversification assessment process.

Stage 3: Prospecting markets (Who will buy my produce?)			
Social influence: Farmer, farming community, and markets			
Cognitive process	**Considerations**	**Enabler of CD**	**Constraint to CD**
To whom/Where can I sell?	Knowledge of markets and price	Many market options	Few market options
	Anticipation of supply competitors (e.g. from other provinces)	With contacts from the market, other localities, or other provinces	Poor anticipation could lead to unfavorable experience
	Byahero capacity and boundaries	Produce will be picked up in the field	Produce will not be picked up in the field

Is crop diversification for me?

Everyone desires CD for increased economic returns, but not everyone can afford it. Rice farmers in Talavera, Moncada, and Bacarra either alternate or simultaneously plant HVCs with rice (if the farmer has diverse parcels). CD is commonly an inherited practice. When monoculture rice farmers transition into CD, they consider the suitability of their farms, economic risks, and availability of options. Across the three sites, favorable environments for CD were water-limited farms (rainfed riverbanks) and well-draining soils like silty soil or clay loam, which were perceived as conducive for a wider variety of crops.

Assuming that the farm profile requirements for CD are satisfied, the farmers consider profitability next. Since rice is the primary commodity traded, the income from it is the profitability benchmark for the pursuit of CD, both for monoculture farmers and even those already practicing CD. In season, the market price of HVCs far outweighs the farmgate price of rice. However, the difference in risk between rice and HVCs lies in market stability, vulnerability to bad weather, and required capital investment. Market price of HVCs fluctuates more rapidly than rice. According to the farmers, losses from rice production are easier to recover from than losses from HVCs.

In Bulac, Talavera and Sta. Monica, Tarlac, onion is a top HVC choice. For a hectare of land, farmers estimate capital investment around at least PhP 100,000, as opposed to PhP 30,000 - 50,000 for rice. Such a costly amount is often available from formal creditors, such as banks and cooperatives. In pursuing CD, farmers need the security of having this financial resource available (whether at one time or staggered) and a high probability of returning this loan with profit.

Hitting the optimal price is challenging for most of them as they rely on supply and demand trends from previous cropping rather than forecasts, although favorable past experiences foster risk-taking. Hence, access to accurate information on market trends boosts the confidence of farmers in CD. According to the interviews, the majority of the farmers rely on community opinion for such information. Hence, advise from agricultural extension workers is most helpful for the majority of farmers' passive information-seeking behavior. A few farmers mentioned using social media for monitoring market trends or even surveying their communities for planted crops.

Can I undertake crop diversification?

Once it has been determined that CD is a suitable pursuit based primarily on physical area requirements, the assessment progresses to evaluating whether or not the farmer is personally capable of pursuing it. At this juncture, the farmer considers choice relative to personal socioeconomic capacity, social relations, roles, and experiences. Stage 1 assesses enabling contexts, while stage 2 assesses access to resources.

With knowledge of other crops and the ideal farm profile for CD, the farmers assess whether suitable land, financial resources, and needed farm supplies are available to them. They also gauge their technical capacity to manage new crops, as well as their neighbors' crop plans. This neighbor factor was most pronounced in Bacarra, where corn farmers produce for food and feed markets. White corn is used in the food industry, whereas red corn is used in the feed industry. Mixing these results in variegated corn and a lower purchase value. Hence, the Bacarra farmers are careful to consult their neighbors regarding their plans. A similar phenomenon is observed in the village of Bulac, Talavera, where farmers configure their crops according to the water requirements of their neighbor's chosen crop. For example, if a parcel suitable for both rice and HVCs has an adjacent parcel that is suitable for rice only, the former parcel will grow rice since HVCs will not survive the water requirements of rice. In Brgy. Valle, Talavera, this phenomenon also exists relative to the insecticide requirements of the crops. Farmers observe that different crops have different sensitivities to pesticides, which affect the vigor of the plants. The farmers shared about noticing *lungkot*(literally sadness; synonymous to droopiness) in their crops as a reaction to certain pesticides.

Whether or not farmers will risk the pursuit of CD-for the first time or not-depends on various factors. CD farmers frequently cited that experiencing three crop failures or instances of irrecoverable crop loss are tipping points leading to reassessing CD or exploring alternative crops. According to the farmers, risk is more comfortable for those with large landholdings who can self-finance. Sometimes, farmers who have experienced extreme losses still consider risking the next time around in hopes of hitting the jackpot to clear piled-up debts. Having a sure market aids in such risk-taking, which membership in a cooperative is able to provide. On some occasions, the creditor-borrower relationship between farmers and traders helps ensure the market, as observed in Bacarra.

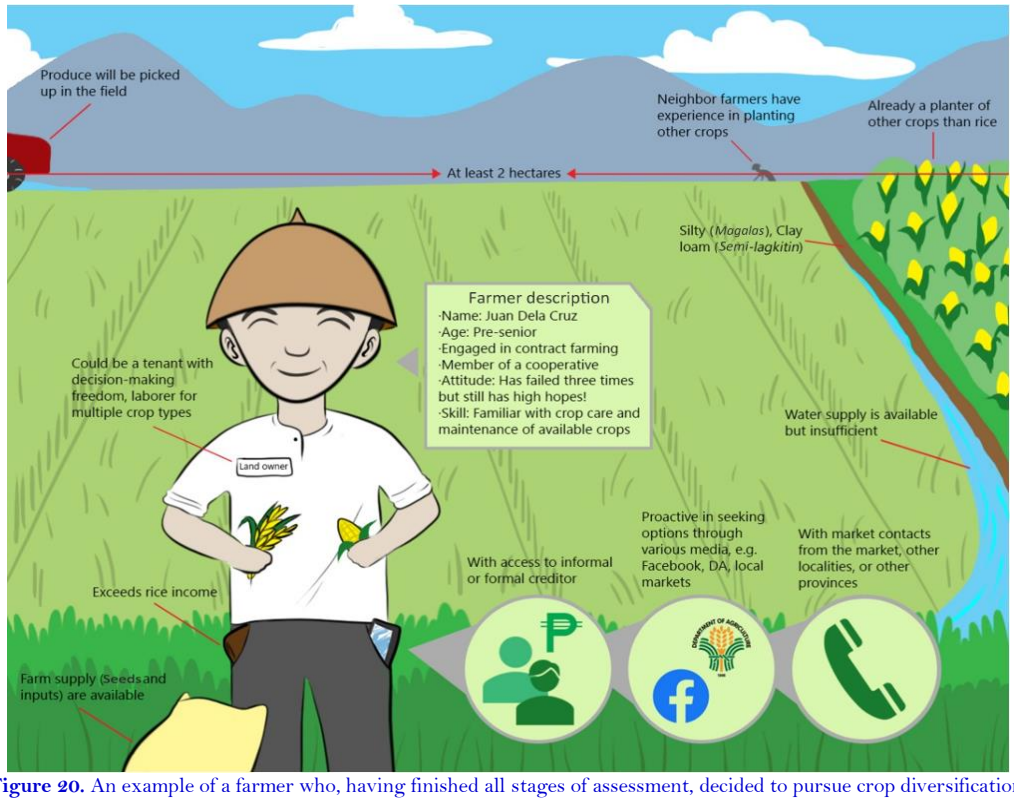

Figure 20. An example of a farmer who, having finished all stages of assessment, decided to pursue crop diversification.

Who will buy my produce?

Not all farmers have sure markets nor are shareholders in cooperatives. For example, the farmers in the villages ofBulac and Valle shared that traders (*biyaheros*) require volume before the produce can be picked up at the farm. However, they are often unable to meet this requirement due to their small production capacity and because they seldom practice product aggregation. This makes them highly vulnerable to market fluctuations. The farmers commonly practice bringing their own produce to the market (*bagsakan*), while others opt to sell it to their neighbors for earnings regarded as a daily allowance. While they have contacts in the market, they shared that they sometimes lose to delivery time relative to traders from Pangasinan, an adjacent province to Nueva Ecija, whose bulk supply causes prices to drop in an instant. In contrast, cooperative-linked Bacarra farmers are less impacted by market fluctuations but aim to broaden market linkages so as to expand their price options.

At the end of such detailed considerations, the farmers deduce that the highest risks are mostly external to farmer control, such as sufficiency of irrigation, soil type, economic resources (capital), and *panahon*(weather and

climate)-concluding in a posture of luck. It is observed that sufficient knowledge on suitable complementary and alternative crop options, production supply from local to provincial levels, and market demand were almost absent in the Stage 2, where the extent of social influence was observed to be farmer-to-farmer only. "*Minana*" [inherited], "*nakagisnan*" [traditional practice], "*nakasanayan*" [traditional practice], crop choice by personal or co-farmers' experiences, and "*sumusugal*" [gamble] underscore the farmers' narratives.

6. DISCUSSION AND CONCLUSIONS

Using the Affordances Theory, there are some findings that are worth discussing in this section. Firstly, the study revealed that farmers perceive CD as a farming lifestyle. This pertains to the cultural relations of affordances. This means that CD is widely supported in the community, and that it is being experienced directly and through observation by other farmers in the area. It should also be highlighted that the decision to diversify crops is constrained by extrinsic factors such as irrigation access and resource availability. These agree with the findings of Feliciano (2019). This would refer to material and socioeconomic relations, according to the Affordances Theory. For example, farmers whose areas do not allow CD result in or could be construed to result in "anti-affordances." This is especially true for farmers who have experienced *"lugi"* or negative return on investment in the past, owing to various factors that are outside their control.

For those whose land is suitable for CD, CD yields benefits in terms of production volume and increased income. Affordances in CD — i.e. seeing its possibilities for the goal of increased income and improved economic standing — are dependent on the farmer's visual and tracking experiences. By doing so, the farmer will be able to evaluate whether there is value in choosing CD to achieve welfare. The affordances are actualized through a non-linear yet meticulous intuitive decision-making. In Table 4, farmers' decision to diversify is shaped by visual and tracking experiences, notably when 2-3 consecutive crop failures and unimpressive demand discourage the pursuit of CD. These findings relate to experiential characteristics of affordances.In their research assessment on the impact of CD in India, Birthal et al. (2022) addressed this aspect, stating that while CD generally has a positive economic effect, it deteriorates beyond a certain threshold due to constraints such as capital and labor.

Tables 3, 4, and 5 reveal that risk-taking is important to farmers. It is evidenced by the number of variables they evaluate, as these will shape their debt-standing, among others. Their land use is valuable to them; hence, CD is a make-or-break. The social influence per decision stage shows how the external structural conditions aid them in decision-making. Yet at the end of such seemingly linear assessments, the persona of the farmers as experts who are especially rich in experience must be revisited. Having more enabling factors than constraints cannot predict their ultimate decision on whether or not they will pursue CD. After their rational decision-making, they shift to IDM.

The cultivation of instinct, according to Matzler et al. (2007) requires experience, networks, emotional intelligence, tolerance, curiosity, and limits. According to Klein (2015) "in the naturalistic decision-making field (NDM), experts are identified as those having rich repertories of patterns, being able to make fine discriminations that may be invisible to novices, having sophisticated mental models of how things work, and having resilience to adapt to complex and dynamic situations." With the farmers' extensive experience, going through the assessment stages, they find patterns beyond quantities and combinations of enabling and constraining factors. This is how policymakers are often able to make sense of things, but it may not always make sense to them when the farmers respond unexpectedly to patterns based on their IDM.

These findings may change based on various factors. For example, from the data, it was seen that there had been enabling laws and programs in the past that had reported some levels of success. Reviving or building on these enabling laws may result in better opportunities for farmers. Several studies affirm that farmers need training on value-adding and marketing (All-Asian Centre for Enterprise Development Inc (ASCEND), 2021; Deriada & Doloriel, 2022). Providing these training programs will widen the "landscape of opportunities" amongst farmers. For equity, the government or an interested third party may perhaps put on some interventions for farmers who are limited by various external factors, biophysical limitations, for instance, from optimizing the benefits of CD. If these interventions are not provided, the gap between farmers whose farms are favourable for CD and those that are not is likely to widen or create new ones. In short, the government or an interested third party can very well change the affordances in CD in farming communities in the Philippines.

At the outset, this study provides support to the robustness of the Affordances Theory in understanding the benefits, opportunities, and risks of agricultural technologies. Through this theory, it is far easier to determine the winners and losers in CD in the future, depending on how the landscape of opportunities will change.

6.1. Policy Support Needed

The DA and other agricultural policymakers related to CD may well go through the same cognitive process as the farmers and also provide counterpart answers. When advocating CD, essential criteria like knowing who exactly it is for, locating eligible farmers, and the certainty of securing market linkages for the farmers are imperative.

One of the challenges faced by CD farmers is that of competing with external product supplies that arrive at their local markets. For example, in Talavera, some farmers lament that by the time they reach the Sangitan Market in Cabanatuan, their anticipated price has dropped due to the supplies from Pangasinan. They also shared that, unlike the Pangasinan farmers who can reach Nueva Ecija, they are unable to cross to other provinces. Farmers can therefore be better equipped for market information gathering, price projections, and crafting strategies accordingly. They can also be protected through market regulations, such as volume management for certain periods of time.

Another relevant support would be research intensification. This includes research on improving the quality of alternative crops, value chain opportunities, and linking farmers to markets. Advocating CD should entail readiness

to respond to the kind of diversification suitable for them, which requires extensive research on the resource base of farmers, among others. Additionally, given that farmers consider land, water supply, and capital for CD, the government and other invested agencies must demonstrate responsiveness to these specific concerns. Visibly addressing these concerns,rather than tangential ones, is critical for farmers.

In this regard, support may also be leveled up or reconsidered. According to a 2019 report from the International Fund for Agricultural Development (IFAD) authored by Bresciani et al. (2019) in-kind aid is not most effective for the long term in the discipline of agricultural extension. Instead, it emphasizes the need for a shift towards making social protection programs, ecosystem services, and incentivized sustainable practices more available (Bresciani et al., 2019). The DA could promote CD as an export-focused and climate change-responsive mindset in rice production (Huang, Jiang, Wang, & Hou, 2014) aligning with sustainable food sufficiency goals. This entails intensifying CD promotion and strengthening extension services (Deriada & Doloriel, 2022). Currently, the DA operates through its crop-based banner programs(National Economic Development Authority (NEDA), 2019). This means the rice, corn, and HVC programs operate separately, lacking interdependent implementation so as to realize a unified CD strategy. Future CD support strategies may also reconsider this.

In a study on the determinants of CD in Northeast India, Kumar, Nayak, and Pradhan (2022) note that, "Despite the persistence of favorable climatic conditions, CD is necessary for the growth of this region; however, it is constrained by insufficient agricultural credit for cultivation, lack of physical infrastructure for transportation, marketing, and storage of the agricultural products… Greater investment is necessary to develop the local markets and other institutions, such as encouraging self-help groups, co-operatives, and contract farming, so that credit can be pooled for the agricultural purposes from microfinance institutions, and mass awareness is required in order to train the farmers regarding advanced farming technology so that more and more land can be brought under cultivation in a short time." (p.7-8).

The DA can also leverage the Farmer Field School (FFS) for market linking and enhance farmers' understanding of marketing processes (All-Asian Centre for Enterprise Development Inc (ASCEND), 2021). It can also be a good avenue for more intensive promotions on CD as a climate-adaptive and ecologically-benefitting approach. Moreover, the DA can also strengthen its public-private partnerships (PPPs), especially for the marketing arm.

Quoting from a report by the Organisation for Economic Co-operation and Development (OECD) (2021) it will also be beneficial to "*unlocalize* regimes to prevent vulnerability to shocks and stabilize food security; complemented by maximizing local import sources and distributing crop areas. A localized regime iswhere economies are less interconnected via global value chains (GVCs), has significantly lower levels of economic activity and lower incomes. A localized regime has less trade and less geographic diversification of production stages in supply chains. Because of this, a localized regime was found to be more, not less, vulnerable to shocks."

As for monocrop rice farmers, provision of spaces to diversify their crops and farming will address their challenge of adapting their irrigated lands for hydrophobic HVCs and other crops. Enhancing other agricultural income sources,such as poultry and livestock, may also be explored. It is essential to provide marketing aid, including buyer assurance. These can be embedded in programs introducing new crops or products.

Many monocrop farmers lack awareness about suitable crops for their irrigated farm areas. More research on soils, suitable crops, multi-function crops, and demonstrations could bridge this knowledge gap. Furthermore, exploring strategies similar to Vietnam's practice of CD (e.g., in river deltas) may be researched. It is also worthwhile to explore strategies to aggregate harvests and protect susceptible monocrop farmers from price declines.

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