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Greening in Farming Value Chains and Networks: An Explorative Case Study

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Abstract: ***An interesting conundrum arises regarding how to transform the value chains and networks of various categories of human activities to cope with climate change effects. Ideally, in terms of sustainable development goal number 2, there is the need to concurrently deal with the effects of climate change whilst shifting agrifood value chains and networks towards nature-positive trajectories. The word 'green' and associated terminology 'greening' have taken on new significance as evidenced from extant discourse on how to mitigate and/or tackle the increasing adverse effects of climate change with concurrent shift to a nature-positive direction. In this regard, the concept of 'greening' embraces contexts such as circularity, decarbonization, vegetation greening, sustainable land use, and the preservation of biodiversity across many sectors of human endeavour. Thus, 'greening' is regarded as a principle in green growth economic policies and nature-positive strategies. Discourse on greening tends to be dominated by academic and policy/governance pundits, sometimes vitiating the opinions of 'not-so-formal' practitioners. This article discusses what 'greening' means to practitioners within a particular agrifood value chain and network. The narratives reiterate that, even within urban settings, greening practices such as sustainable land use and preservation of biodiversity are intrinsic knowledge areas for artisanal, subsistence, and small-scale entrepreneurial farmers.***

Keywords: ***Sustainable development, Sustainable, Sustainability, Greening, Farming, Greening in farming, Value Chains, Networks, value chain networks, Explorative Case Study, case study***

I. INTRODUCTION

It is widely acknowledged that the United Nations Sustainable Development Goals (SDGs) provide a blueprint for continued existence of humanity into the future. The SDGs inculcate an ethos of sustainability such that the growing consensus engenders a paradigm shift towards nature-positive trajectories for continuous development of human civilization. There is also the worldview that human civilization is transcending through Anthropocene epoch, an age in geological time scale which is 'characterized by rapid anthropogenic changes' in the natural environment and ecology ([1, xy1] {Rockström, J., & Einhorn, G. (2024)}). It is understood that the epoch describes the most recent period in Earth's history during which the collective activities of humanity is causing a significant impact on the planet's climate and ecosystems, significantly altering the "Earth's surface, atmosphere, oceans, and systems of nutrient cycling…" ([2, aaa] {Dellasala & Goldstein, 2018}), manifesting in, for example, rapid shrinking of wildlife populations.

As depicted in Fig.1, the authors in ref [3, xy2] {Richardson et al (2023)} posit that "Earth is now well outside of the safe operating space for humanity" because the "nine processes that are critical for maintaining the stability and resilience of Earth system as a whole are all presently heavily perturbed by human activities."

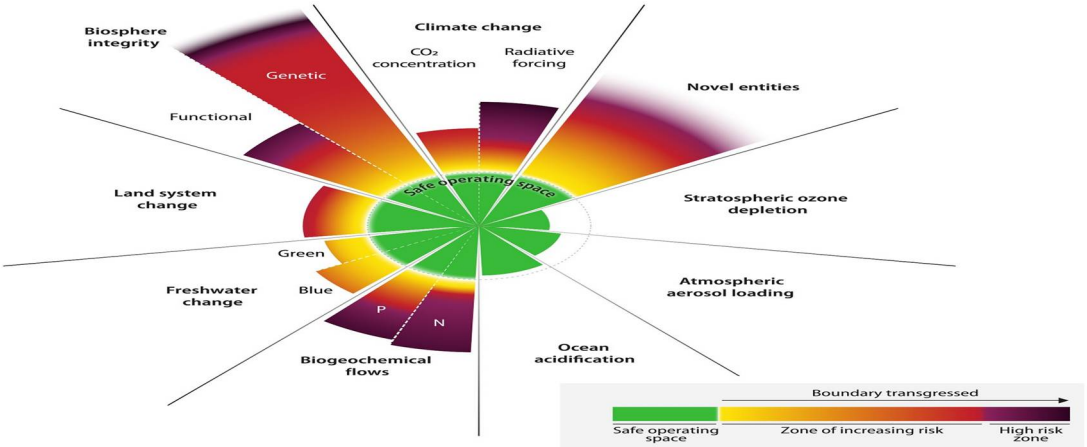

Fig.1. Current status of control variables for all nine planetary boundaries {source [3] Richardson et al (2023)}.

Based on this understanding, Anthropocene pundits reiterate that adaptation towards a nature-positive direction is paramount for the sustainability of humanity. Thus, nature-positive transition strategies are being recommended, not only to drastically minimize environmental damage but also, to actively stop, restore, and reverse the loss of various types of natural capital ([4, hum] {Locke et al (2020)}; [5, wef] {Jessen (2024)}).

The increasing awareness of the impacts of climate change constitutes a topical discourse of much deliberation at academic conferences and policy meetings. There is an abundance of literature regarding the impacts of climate change (see for example, the reviews cited in [6, 212] {Letcher (2021)}, and [7, xcv] {Abbass, K., Qasim, M.Z., Song, H. et al (2022)}). Curiously, it is not uncommon that the word 'sustainability', and phrases like 'sustainable development' and 'climate change' appear in policy/strategic documents of government departments, public and private agencies and institutions, as well as commercial and non-commercial business and civil society organizations. The report cited in [8, 231] surmises that "528 respondents who are familiar with their organization's sustainability strategy found that nearly two-thirds (63%) agree that sustainability initiatives must be approached in a fundamentally different way than other strategies."

In fact, there is increasing encouragement to operationalize the concepts of sustainability and sustainable development, and to engage in activities that could lead towards minimizing the impacts of climate change ([9, sdf] {Hák et al (2015)}; [10, 1p1] {Piao, S., Wang, X., Park, T. et al (2020)}). For instance, the investment community continues to introduce new schemes to promote sustainability practices (re: [11, ogh] {Kölbel et al (2020)}; [12, ddd] {Yucel et al (2023)}; [13, fgt] {Manaswi et al (2023)})

Given the social contract precedence, it is not surprising that initial attempts to operationalize sustainability were conceived in terms of corporate social responsibility programs. Nowadays, triple-bottom line reporting, environment-social-governance (ESG), and '*greening'* represent more fashionable approaches to operationalize sustainability or sustainable development that is coupled with adaptations to the impacts of climate change events. For brevity, the authors in (ref [14, ca1] {Grand & D'Elia (2018)}) support the argument that, for sustainable development to move from *pen-to-practice*, economic activity must incorporate green concepts and care for the environment.

This article contributes to discourse on '*greening'*, especially on actual '*greening*' practices by customary/traditional practitioners. A motivation for the study described herein is how to operationalize '*greening*', bearing in mind that there is skepticism (see, e.g., [15, rim] {Yildrim (2023)}) associated with 'greenwashing' tendencies. It is in this regard that this article attempts to examine the question as to how artisanal, subsistence, and small-scale entrepreneurial farmers understand '*greening*' as they engage with various activities along a typical agricultural value chain and network. A brief review on '*greening*' in the contexts of biodiversity, circularity, and sustainable land use is discussed in section 2. A conceptual model of greening within agricultural value chains and networks is articulated in section 3. The exploratory study on '*greening*' practices is described in sections 4 and 5 with some concluding remarks in section 6.

II. STATE OF THE ART

A. On Greening And Biodiversity

This section provides a very brief review of the rapidly expanding concept or topic of '*greening*'. Although the topic is widely understood in terms of the environment (e.g., [16, env] {Sajeewanie et al (2019)}), however, the discourse threads encompass industry sectors such as energy, mining, medical, and telecommunications. Furthermore, the topic of '*greening*' is discussed in various contexts and perspectives such as green economy, green technologies, vegetation '*greening*', urban '*greening*', food security, biodiversity, carbon capture and decarbonization, and circularity ([17, jin] {Li et al (2022)}). Curiously, the threads and contexts lead to narrow and broad perspectives and definitions of '*greening*'. The authors of this paper adopt the UNESCO-UNEVOC [18, x1a] definition of '*greening*' as -

"…the process of pursuing knowledge and practices with the intention of becoming more environmentally friendly, enhancing decision-making and lifestyle in more ecologically responsible manner, that can lead to environmental protection and sustainability of natural resources for current and future generations."

Perhaps, 'greening' is mostly understood with regard to the agrifood industry (see, for example, [19, fao] {FAO@RIC}, and [20, sus] {Pretty & Bharucha (2018)}). In alignment to SDG2, the objective is to increase food security whilst concurrently preserving, protecting, and hopefully restoring natural ecosystems that underpin the various food value chains and networks. In this regard, the article by Jacobs (2013) ([21, jac]) provides some insight into the nexus between green growth, environmental policy, and socio-political economy, highlighting the debate as to whether environmental policy should be a driver for economic growth.

According to the World Bank (2012b) [22, www], this so-called green growth view should also be about three imperatives, viz: (i) efficient use of natural resources, (ii) minimization of pollution and environmental impacts, and (iii) building resiliency, especially with regard to *force majeure* (e.g., climate change) events and associated stressors. The challenge remains as to whether the operationalization of these three imperatives can occur concurrently, noting that "… there appears to be a conceptual divide between what domestic green growth means within developing countries and how green growth and sustainable development continue to be imagined within multilateral development agencies…" (see ref [23, 1aa] {Kyle (2023)})

Drawing on the motivation for this article, an important issue is how to operationalize green growth with minimal distortion to, and/or without sacrificing biodiversity, given that there are predictions of alarming consequences for biodiversity especially when unsustainable practices intersect with the adverse effects of climate change events ([24, bca] {Bellard et al (2012)}). Notwithstanding the adverse effects of climate change events, changes in land use due to the implementation of green growth policies and actions also have a direct impact on biodiversity. An ideal interpretation of sustainability implies that green growth practices should be mindful of land use and biodiversity. Thus, the preservation of biodiversity remains a primordial challenge for green growth economics.

A perplexing conundrum is that most settlements commenced in areas where humans could cultivate the land initially for food and subsistence, then later for commerce and industry. The proposition here is that many existing towns and cities have developed within good, if not the best, arable lands. Despite the present state of human civilization, it is estimated that 370 million indigenous peoples worldwide continue to confront exclusionary public policies which often expropriate their land for so-called development purposes (see, for example, the publication by the International Labour Organisation [25, ilo]). It is worth stating that indigenous peoples do not necessarily live in rural villages; they also live in urbanized settings typical of modern towns and cities and, they do not necessarily abandon or relinquish their indigenous knowledge, ways of living or livelihoods. Invariably, some of the governance, economic, socio-political, and environmental policies may not necessarily protect the rights of indigenous peoples with regard to land use. Furthermore, some policies vitiate, or at worst, fail to recognize indigenous peoples' existential knowledge of biodiversity and circularity which is often tacitly embedded in their land use practices.

The quandary is whether formalized innovative green growth policies, especially in developing countries within the so-called 'Global South', can advance 'catch-up' and/or 'leapfrog' pathways to conventional socio-economic development without sacrificing indigenous knowledge and livelihoods built over many generations of existence. On the one hand, a feature that characterizes a typical 'Global South' developing economy is that a notable percentage of the indigenous population tends to be engaged in livelihoods underpinned by artisanal, subsistence, and small-scale entrepreneurial agricultural practices. It is arguable that "indigenous peoples [tend] not [to be] aware of the concept of sustainable development because their way of life and practices have always been sustainable."

On the other hand, (as evident in both developing and developed economies), rapid urban densification, urban sprawling, and population growth not only amplify issues of sustainable food systems in modern cities and towns but also, industrialization activities continue to encroach and expand into virgin areas of nature. The authors in ([26, ack] {Ackerman et al (2014)}) posit that urban agriculture can act as a nexus for the economic, societal, environmental and ecological dimensions of sustainability. Interestingly, (i) the planting of vegetation in both rural and urban areas, (ii) combined with the quantification of vegetation greenness over specified time periods (see, for example, [27, qsm] {Xun, An & Lu (2024)}), and (iii) coupled with often difficult attempts to preserve virgin natural areas, have become established as '*greening*' practices. Given the current green growth pathways coupled with industrial and urban development trajectories that continue to usurp arable lands and virgin natural areas, the question remains as to whether the combination of rural and urban green practices can translate to sustainable preservation of biodiversity [28, roy] {Royer et al (2023)}).

III. CONCEPTUAL MODEL

A. Greening Of Agricultural Value Chains And Networks

Although the topic of '*greening*' extends beyond the imperative of food security and the agricultural sector, however, it is common to view '*greening*' in terms of agricultural practices; to be precise, the planting of crops followed by the harvesting of the resulting produce are typically understood as agricultural farming. Thus, in the agrifood sector, farming typically represents the upstream processes in the agricultural value chain and network. Here, the term 'value chain' refers to all activities that may be performed from the conception/inception to the final consumption/use of an agricultural product; whereas the term 'network' refers to linkages and interactions between the various categories of role players and stakeholders (i.e., farmer, consumer, logistics agent, service provider, regulator, market, policy maker, investor, etc) that interact along the agricultural value chain.

According to reference [29, fao] {FAO and UNIDO (2024)}, the value chain and network approach provides a holistic, rigorous, and standardized method for the design, synthesis and analysis of agrifood systems that should be "economically, socially, and environmentally sustainable, as well as resilient to shocks and stressors."

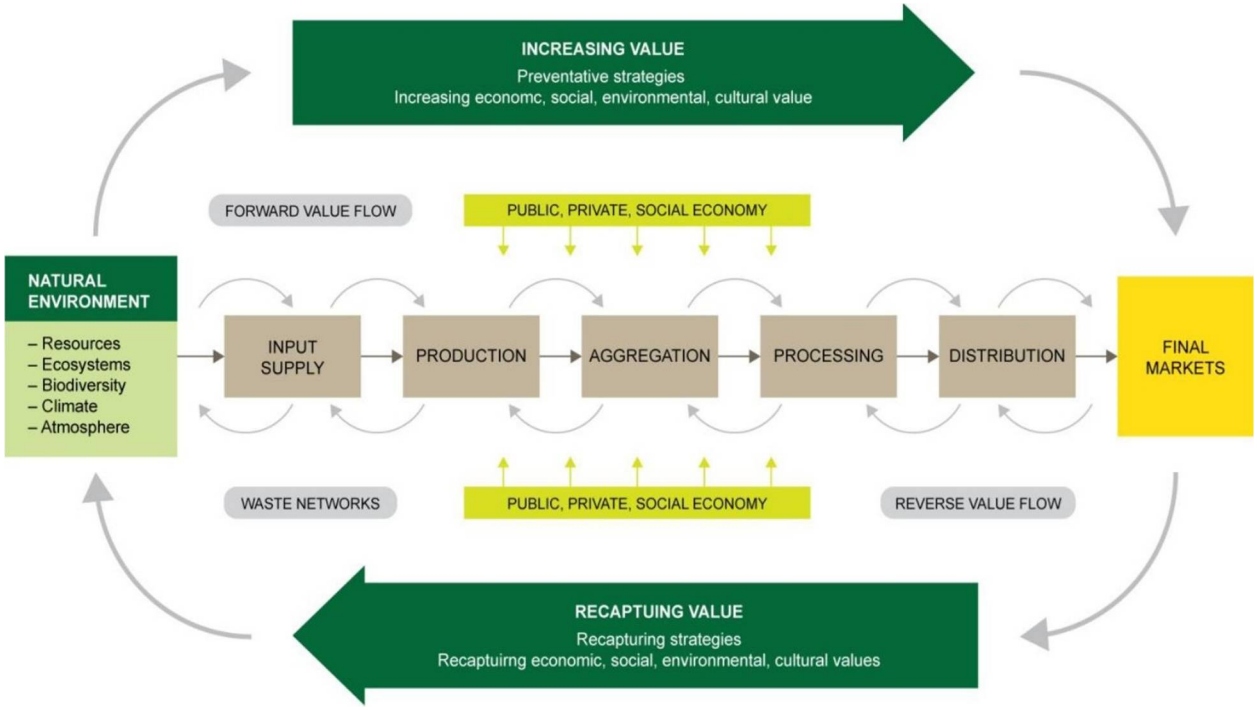

Fig. 2. The green food value chain development framework (source: [30, rep] {GFVC-FAO – FAO-FiBL(2014, p5)})

The framework depicted in Fig. 2 was adopted for the purpose of the exploratory study discussed in this article particularly because the framework highlights the crucial contexts of biodiversity and circularity. The proposition for the study stems from the premise that the agrifood knowledge and practices of some indigenous population groups may be intrinsically consistent with vegetation '*greening*', preservation of local biodiversity, and circularity principles. If so, the challenge for such population groups, notwithstanding whether the '*greening*' activities are located with rural or urban settings, is (i) how to deal with prevailing green growth policies and technologies, as well as (ii) how to respond, adapt and transform according to evolving policy (economic, environment, social, and technological) frameworks. A postulation here is that some role players within the agrifood value chain/network may actually resist the implementation of certain green growth policies; they may further reject green technologies that are perceived as abrupt, alien, and detrimental to their ways of life and livelihood. As reported in over 65 countries the tension implied in the postulation (re: [31, law {Narula (2022)}]) is supported by the evidence of the much publicized and widespread farmers' protests (see, e.g., [32, why]) that took place between 2020 and 2023 against "agricultural and economic policies which are [supposedly] endangering their livelihoods."

There is the argument of a general lack of awareness of biodiversity in a sense that the implementation of green economic policies does not often take advantage of the benefits of land use conservation practices. Could it be that the upstream role players in the agrifood value chain/network, (e.g., farmers) may be frustrated by apparent disregard of their existential indigenous knowledge of '*greening*' practices? Could it be that the protesting farmers are concerned that their livelihoods would be sacrificed in the transformation to so-called green growth economics?

IV. THE EXPLORATORY SNAP STUDY

A critical examination of some of the reasons cited for the widespread farmers' protests provided direction for the exploratory study briefly described in this article. Apparently, the 2023 farmers protests referred to in [32, why] were against low prices for their crops, unfair trade deals, unrealistic environmental regulations, high cost of agricultural fertilizers, lack of support for agri-ecological practices, and government policies that were deemed as promoting unfair competition. For example, policies that favor big firms over artisanal, subsistence and small-scale entrepreneurial farmers by granting a few large *multi-* and *trans*national organizations unfair access to good arable areas of land.

Furthermore, there are contradictions evident in some structural realignment policies, arising from tensions between politically motivated short-term measures, impulsive responses to climate change effects, and purported just transition ideologies. Such contradictions suggest that vagarious green practices may neither promote circularity principles, nor encourage sustainable land use practices, nor preserve biodiversity, nor lead to shifts towards nature-positive trajectories.

A premise here is that published discourse on greening tends to be dominated by the Global North aligned constructionist views of academic and governance, policy development and implementation, as well as commercial pundits (see, e.g., ref [33, wwf] {APRSCP (2022)}); whereas actual operationalization of sustainable practices remains an intrinsic way of life for artisanal, subsistence and small-scale sole trader farmers as the upstream role players within the agrifood value chain and network. Thus, the target audience for the exploratory study were upstream actors, especially those that may be regarded as *agro-prosumers* and/or *subsistence agrifood entrepreneurs* in an area where a plant such as the coconut tree is autochthonous.

From the viewpoint of the circularity principle, it is worth stating that almost every part of the coconut plant can be processed or made into a beneficial product (see, e.g., [34, ari] {Arifin (2022)}). Furthermore, the native tropical plant is pervasive in more than 80 countries, and provides livelihood opportunities in areas characterized by large indigenous populations such as Philippines and India (re: [35, gga] {George & Kuruvila (2022)}). Therefore, the presumption here is that people in such geographies not only have the relevant knowledge, but also, they inherently engage in appropriate farming practices in order to preserve and maintain livelihoods that are underpinned by the coconut value chain and network. In their article on 'climate resilient coconut-based farming systems in Vulnerable Coconut Communities of the Philippines', Aguila et al (2023) [36, agu] posit a unified coconut value chain model and propose that capacitating a cluster of farmers can improve the resiliency of coconut farming to climate change effects.

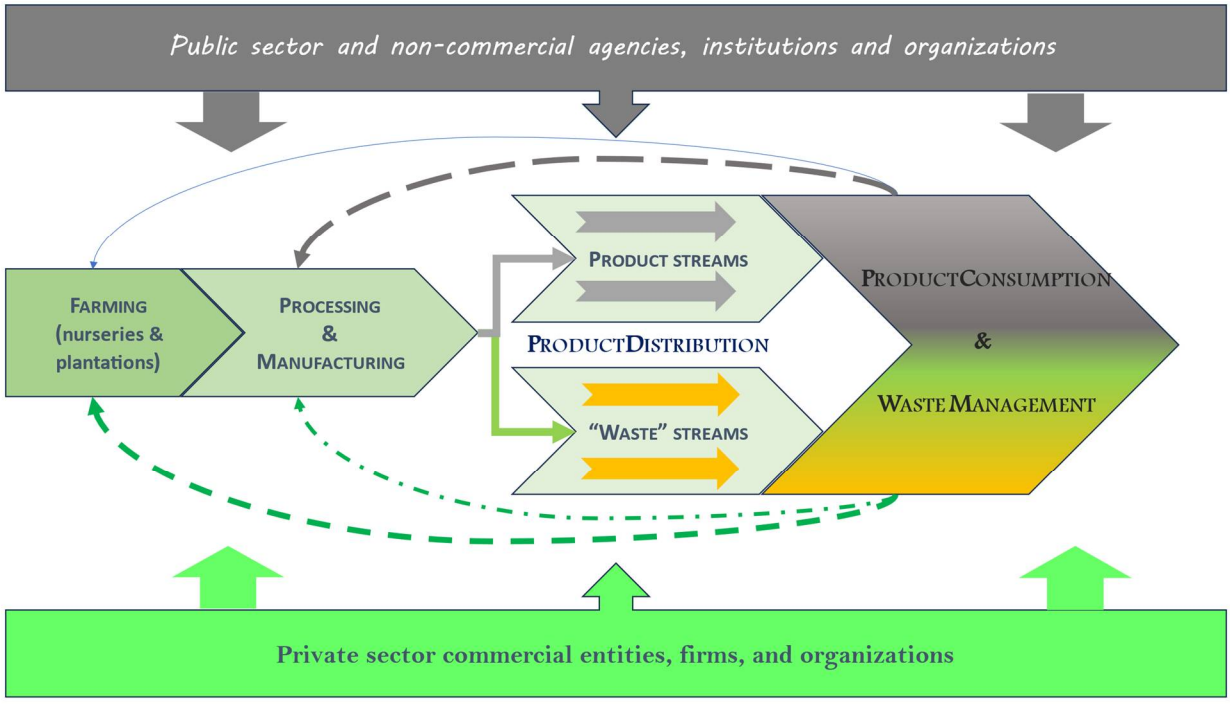

Fig. 3. A conceptual model for the greening of the coconut value chain and network

The conceptual model shown in Fig. 3 was adapted from the green food value chain development framework (see earlier Fig. 2), and the unified coconut value chain model (see figure 1 in ref [36, agu]). The conceptualization depicted in Fig. 3 informed the first phase of the narrative enquiry method (re: [37, nar]; [38, dai]) that was adopted for the exploratory study. Thus, individual narratives were obtained during casual conversations (in order to avoid the feeling of being interrogated by the authors) with each of seven practitioners who are engaged in artisanal, subsistence, and small business commercial (i.e., sole trader entrepreneurship) farming, as well as other activities along the coconut value chain and network. Each narrator had worked in formal employment, but four of the seven narrators have now adopted the archetypal farmer lifestyle.

The casual conversations with the authors took place during May 2024; with one author online while the other author met in person at the convenience and residence of each narrator. Each meeting lasted between 30 – 60 minutes. Fig. 3 was explained during the introductory part of the discussions.

Although the four 'prompting' questions listed in Table 1 were prepared *apriori*, however, they were only randomly asked as necessary to maintain a reasonable level of narrative coherency, bearing in mind that the discussion was geared to extrapolate how '*greening*' is understood by each narrator.

Table 1. Narrative enquiry 'prompting' questions

Q1	Are you aware of the concept of "greening"?
Q2	Given your involvement in the coconut value chain, discuss how you think that greening can be enhanced within your area of involvement
Q3	Do you know of other role players in the coconut value chain? Discuss your understanding of the activities of other role players.
Q4	In your opinion, who should take the lead to enhance the greening of the coconut value chain?

There was no particular order to the 'prompting' questions during the respective narration sessions. Rather, each person was encouraged to tell their story regarding farming practices and related activities. In addition to the earlier narrative sessions, during October 2024, the authors held a focus group discussion on the implications of the definition of greening adopted herein with four of the initial seven narrators and the participant identified as "P4b" in Table 2. The focus group discussions took place during a 2-hour tour of the integrated crop and livestock farm owned by the participant identified as "P7" in Table 2.

V. DISCUSSION

A. *Learning Outcomes*

Noting that the objective of the exploratory study was to deduce what greening means to each respondent, hence, analysis of the audio recorded narratives was limited to a comparison against the definition of greening as adopted for this exploratory study (see Section 2). In addition to the narratives of the respondents, another comparative narrative was obtained from a secondary source, that is, from a series of videos posted on YouTube by a proclaimed artisanal agrifood entrepreneur (see ref [39, ibo]) based elsewhere. A redacted version of each individual narrative is summarized in Table 2.

Table 2. Respondents' narrative profiles; "P" – primary data: "S" – secondary data

Data	Participant	Role/ '*Greening*' activities	View of '*Greening*'
"P1"	Assistant Professor, Agriculture University	Research and development of virgin coconut oil and chutney powder	Advocates for integrated farming systems and suitable crop combinations to enhance productivity and resilience; emphasizes reducing greenhouse gas emissions and enhancing soil health
"P2"	Coconut Husk and Shell Craft Entrepreneur	Makes handicrafts using coconut husk and shell	Emphasizes organic practices and minimal waste generation
"P3"	Full-Time Commercial Farmer	Coconut plant and vegetable farming	Prefers traditional farming methods using organic fertilizers
"P4a" & "P4b"	Assistant Director, Agriculture Directorate	Support small-scale coconut agrifood enterprises	Promote integrated nutrient management using both organic and minimal chemical fertilizers
"P5"	Value Addition Entrepreneur	New product development, e.g., coconut vinegar	Emphasizes environmental sustainability by using organic inputs
"P6"	Development Officer, Coconut Development Board	Implementation of support systems for traditional farmers	Advocates for using organic fertilizers and minimal chemicals in coconut cultivation
"P7"	Retired Engineer	Integrated multi-crop and livestock farmer	Sustainable farming practices
"S"	Artisanal Agrifood Entrepreneur	Multi-crop farming	Smart farming focused on sustainable land use and biodiversity preservation

The definition '*greening*' adopted for the study (see Section 2) is quite broad; the definition essentially emphasizes behavioural change and adaptation based on the understanding of sustainable values. The pursuance of knowledge-and-practice may be readily translated into valuable learning-and-doing based on the sustainability ethos. Respondents "P1", "P4", and "P6" may be regarded as hobby gardeners, and their respective nuanced views of '*greening*' (see 3rd column of Table 2) seems more academic; "P2" raises the context of circularity, whereas other participants' view of '*greening*' highlight the contexts of sustainable land use and preservation of biodiversity. In fact, "P7" and "S" make the case that preservation of biodiversity is the motive for their respective multi-cropping practices; both advocate multi-cropping of indigenous plants to preserve biodiversity.

A remarkable observation during the narrative sessions is that the respondents prefer and practice a 'rural way of living' within the urban residential setting. Participants "P3", "P5", and "P7" reside in their respective farm plots within the confines of urban setting, i.e., the farms are actually situated within the vicinity of a metropolitan area. During the focus group discussions, the farmers confirmed that they consume what they produce. Farmer "P3" explained that need to adapt to rapidly varying cashflow patterns drove him to convert from coconut plant to mixed vegetable farming. Participant "P2" operates a craft workshop at home, and another at a government crafts exhibition and sales facility. The participants recalled how culture is infused in farming, gardening, and handicraft practices; thus, implying that culture relates to the behaviourial aspect in the definition of '*greening*' adopted herein.

The first learning outcome of this exploratory study reinforces the view that farming practices based on indigenous knowledge often take cognizance of land use efficiency and preservation of biodiversity. The second extrapolation is that the notion of circularity is intrinsic upstream of the agrifood value chain. A third proposition arising from the primary and secondary data is that the concept of '*greening*' is better understood in terms of efficiency of land use, preservation of biodiversity, and circularity activities upstream of the agrifood value chain. Curiously, the fourth lesson is that the farmers indicated that they were cognizant of regulations regarding food hygiene and quality but felt that food security should not be an issue of great concern. In fact, "P7" and "S" both raise the opinion that multi-crop cultivation that incorporates animal husbandry and poultry farming should be encouraged, particularly in urban settings, so that young people who migrate to urban areas may consider to engage in artisanal, subsistence, and small-scale entrepreneurial farming livelihoods. During the focus group discussions, the participants reiterated the view that upstream farming within urban areas inherently promotes green vegetation resulting in increased carbon sequestration. Afterall, green vegetation, that is, a higher 'vegetation index' increases the absorption of photosynthetically active sunlight ([40, shi] {Kumakoshi et al (2020)}).

A fifth learning outcome of the exploratory study is that the constructionist view of innovation seems to be more or less embedded in the farming practices of indigenous peoples. During the focus group discussions, the farmers commented that they are always trying new things beyond what they had learned from their parents and/or predecessors. For example, they practice increasing the variety and regrouping of various crops so as to (i) enhance pollination, (ii) maintain the soil structure and increase soil nutrition, (iii) improve drainage; whilst (iv) implementing carbon capture by mixing shed dead leaves and dead tree branches/trunks together with mud from fish pond, plus animal and poultry dung, then using the resulting concentrate as organic fertilizer for the plants. Quoting from the protected cultivation practice discussed in reference ([41, sow] {Mani (2024)}), "…we solarize the land for two months each year, May and June, to harness the sun's energy. The process involves covering the soil to let it breathe. We don't use chemicals; instead, we add manure to tackle soil-borne diseases."

VI. CONCLUSION

This article contributes to discourse regarding '*greening*' concepts and practice. Although the participants in the exploratory snap study were drawn from an area where coconut tree is autochthonous, nonetheless, the farmers' narratives reinforce the view that '*greening*' is better understood in the contexts of efficiency of land use, preservation of biodiversity, carbon capture and circularity in the upstream stages of the agrifood value chain and network. The farmers' narratives also showed that they were conversant with the chitter-chatter about effects of climate change and food security challenges. The study provides some evidence leaning towards the development of strategies and implementation of green growth policies that promote and include sustainable urban farming practices in the agrifoods value chain and networks. Taking into consideration that the scope of the exploratory study is very limited, it is remarkable that the opinions expressed in the narratives not only point to the broader issue regarding the infusion of existential indigenous knowledge and practices in green growth technological innovations and economic policies, especially for countries of the Global South that are having to deal with high rates of unemployment of younger people, inter alia, the twin challenges of rapid urban densification and sprawling. The authors plan to proceed to the next phase of the exploratory study with the formation of a number of focus groups comprising the initial and other participants so as to address more contexts of '*greening*', especially carbon capture and decarbonization, over the full scope of the coconut value chain. It is anticipated that future studies will delve into inclusivity issues as they pertain to the reframing of future policies that inherently involve and rely on sustainable '*greening*' practices.

VII. ACKNOWLEDGMENT

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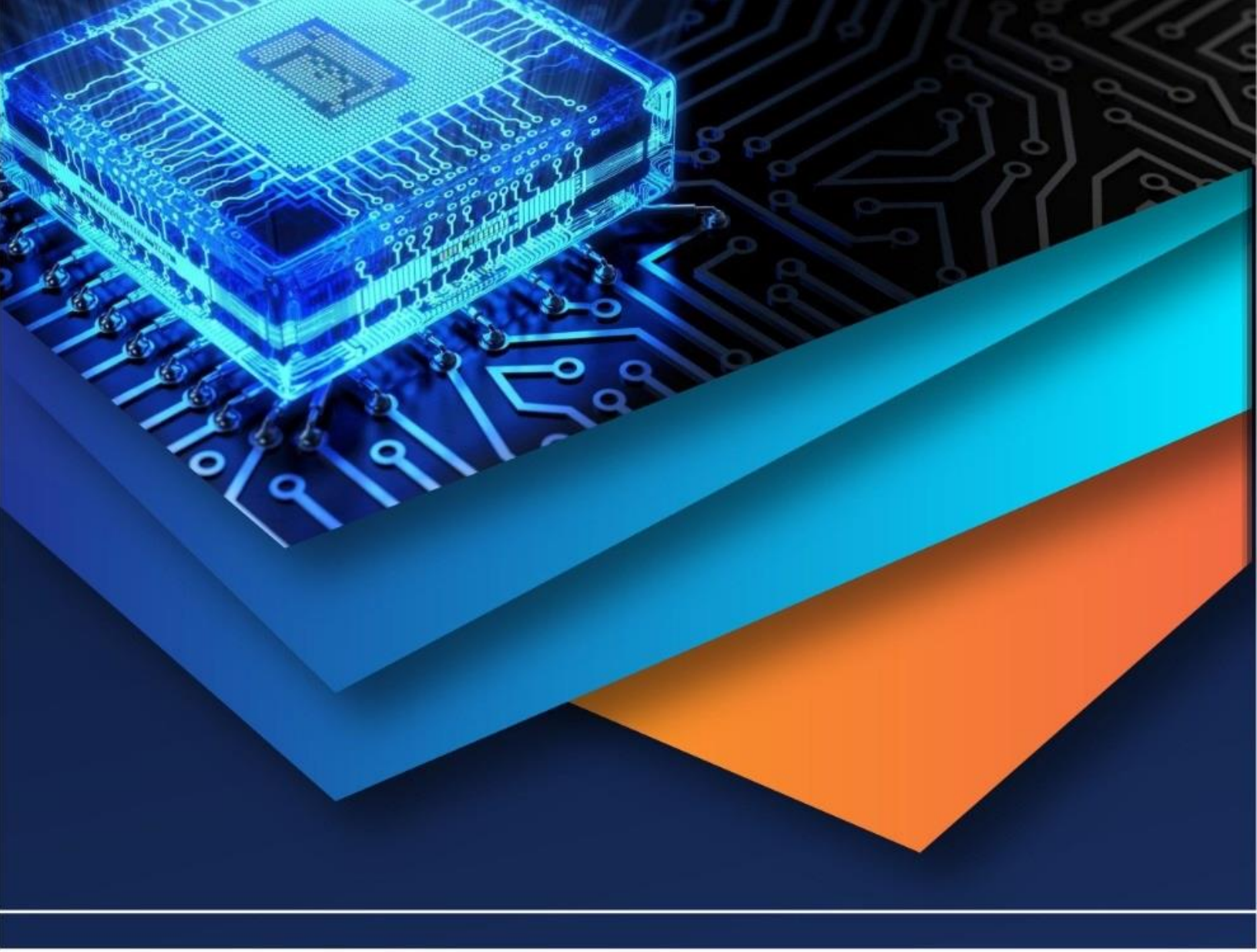

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