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# Stakeholder Expectations of Future Policy Implementation Compared to Formal Policy Trajectories: Scenarios for Agricultural Food Systems in the Mekong Delta

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**Abstract:** The development of a coherent and coordinated policy for the management of large socio-agricultural systems, such as the Mekong delta in southern Vietnam, is reliant on aligning the development, delivery, and implementation of policy on national to local scales. Effective decision making is linked to a coherent, broadly-shared vision of the strategic management of socio-agricultural systems. However, when policies are ambiguous, and at worst contradictory, long-term management and planning can consequently suffer. These potential adverse impacts may be compounded if stakeholders have divergent visions of the current and future states of socio-agricultural systems. Herein we used a transferable, scenario-based methodology which uses a standard quadrant matrix in order to explore both anticipated and idealized future states. Our case study was the Mekong delta. The scenario matrix was based upon two key strategic choices (axis) for the delta, derived from analysis of policy documents, literature, stakeholder engagement, and land use models. These are: (i) who will run agriculture in the future, agri-business or the established commune system; and (ii) to what degree sustainability will be incorporated into production. During a workshop meeting, stakeholders identified that agri-business will dominate future agricultural production in the delta but showed a clear concern that sustainability might consequently be undermined despite policy claims of the contrary. As such, our study highlights an important gap between national expectations and regional perspectives. Our results suggest that the new development plans for the Mekong delta (which comprise a new Master Plan and a new 5-year socio-economic development plan), which emphasize agro-business development, should adopt approaches that address concerns of sustainability as well as a more streamlined policy formulation and implementation that accounts for stakeholder concerns at both provincial and national levels.



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## 1. Introduction

Mega deltas such as the Ganges-Brahmaputra-Meghna delta in India and Bangladesh or the Vietnamese Mekong delta are facing multiple challenges including urbanization, industrialization, and substantial environmental changes including climate change, salinization, rising sea levels, and the twin challenges of floods and droughts [1] simultaneously, these deltas are key for agricultural production and have an important role in ensuring national food security and providing local livelihoods. This raises questions of if and how sustainable intensification of agriculture is possible, and who should be involved in decision making to ensure outcomes are equitable [2,3]. Against this backdrop, it is important to develop and implement policies and practices that ensure resilient futures for people in deltaic regions. These futures, however, may be heavily contested, and the development and implementation of coherent policies is often subject to conflicts between different stakeholder groups.

In the Vietnamese Mekong delta, extensive hydraulic development has turned the delta from a 'wild landscape of rivers, ecologically shaped by the flooding of the Mekong river, the monsoon climate and the tides of the South China Sea' into a 'human-controlled waterscape' [4]. In particular, Vietnam's policy of triple rice cropping, as part of a drive to ensure national food security and increase export capacity, led to major changes in the management of water resources within the delta. This is because the triple rice cropping policy involved investing in an extensive network of high dykes to prevent the ingress of floodwaters on to rice paddies during the monsoon season, thereby enabling three crops a year to be harvested instead of the two that were the norm previously. While undoubtedly successful in increasing rice production, the widespread use of triple cropping has led to a view of floods as detrimental to people's lives and the national economy [5–7]. However, this anti-flooding policy has had many negative impacts on sustainable development, including pollution and soil nutrient depletion [5,8]. The 2013 Mekong Delta Plan began a shift in the national strategy from food volume to food quality, with actions directed towards more effective water management and significant intentions for sustainable development in the Mekong delta. However, as this paper shows, there are currently issues with policy implementation insofar as the long-term sustainability of efficient production is concerned.

The precise meaning of sustainable intensification and the social, political and economic repercussions of decision making are the subject of much research in the literature [9–11]. While sustainable intensification is generally seen as aiming to increase yields while protecting environmental assets such as soil and water, Loos et al. [2] argued that it ignores distributive issues such as food accessibility and exclusion from decision making, which often lie at the heart of food security problems. Evidence suggests that tradeoffs are complex, will be difficult to manage, and may further marginalize the poor. The balance between productivity requirements to feed a growing demand for food are balanced against issues of potential productivity declines through soil exhaustion linked to pesticide or fertilizer inputs [5], equity, poverty and migration issues of displaced workers no longer required to work in efficient mechanized agricultural systems [12,13], and the loss of biodiversity through agricultural land appropriation, toxicity to pollinators, and the broader ecosystems that support agriculture [14].

We did not evaluate the extent to which agricultural planning in the Mekong Delta adheres to criteria for sustainable intensification. Instead, we contributed to debates on sustainable intensification via methodological innovation, through which we explored anticipated and idealized future states of food systems, using the Mekong delta as a case study. To do this, we aimed to: (i) develop a transferable methodology that can be applied to other mega deltas and large river systems facing similar developments, such as the

Ganges-Brahmaputra-Meghna delta in India and Bangladesh; (ii) understand district-level stakeholder and delta-level research institutions' perspectives of plausible futures for socio-agricultural systems in the Mekong Delta; and (iii) establish how, in turn, these district/delta perspectives align with national and regional policy frameworks. The paper is structured as follows: firstly, a methods section explains the process of building an initial scenario matrix associated with plausible land use projections for 2050 as illustration. This matrix was then introduced to a delta-level stakeholder workshop in March 2019 in Ho Chi Minh City. The results from this workshop are covered in the subsequent section. Finally, the paper provides a comparative analysis of our findings in the light of delta and national level policies and proposes the relevance of this work for other socio-agricultural systems that are undergoing rapid environmental, social, and economic change.

## 2. Methods

### *2.1. Building a Scenario Matrix*

The Mekong Delta Plan presented four scenarios for future economic development. Of these, the Vietnamese government's preferred pathway was 'agro-business industrialization.' This scenario envisages the intensification of agriculture and aquaculture while lifting the local population out of poverty and making 'optimal use of land and water resources, without negatively impacting the environment' [15]. If implemented, this would usher in a new long-term trend in economic development for the Mekong delta.

To understand trajectories towards the agro-business industrialization scenario and the current state of implementation, we developed a scenario matrix (Figure 1). This also recognises that the understanding of sustainability as well as the choices of policies and the implementation pathways are not definite and are subject to stakeholder competition.

The quadrant choices for the scenario matrix were built prior to the March 2019 stakeholder engagement and based upon initial semi-structured interviews with key stakeholders from academia, local and national governmental bodies, NGOs, and private sector actors from year X to year Y (Appendix C). The development of the components that describe the scenarios outlined in Appendix A were also developed through this interaction. The broad principle of the matrix construction built upon that identified in Marcinko et al [16], wherein plausible futures were identified from the intersection of key policy choices and stakeholders' vision of an idealized future. In the work presented here, stakeholders expanded upon this premise to include the context of a 'business as usual' future state, as well as identified which scenario most closely relates to current conditions.

Building the scenario matrix centered upon the agri-business industrialization scenario, identified by the government of Vietnam in the Mekong Delta Plan, which favored commercial development but, critically, did not identify who should run these businesses; specifically, it did not identify if these should be run by the private sector in the form of large scale agri-businesses, the so-called "new style" cooperatives, or indeed through the development of agri-enterprise at the commune level, as recent policies suggested. An indicator of this was the Prime Minister's Decision No. 445/QD-TTg, dated 21 March 2016 (Complete and expand the new cooperative model in the Mekong River Delta in the period of 2016–2020 as a pilot model), which itself links to the National Target Programme on New Rural Construction 2016–2020 (Decision No. 1600/2016/QD-TTg) and in turn the 2012 Law on Cooperatives. Under this policy, the cooperatives were to be transformed into a commercially oriented 'new cooperative model' by which cooperatives were to develop business plans and to engage more closely with the private sector in order to be better linked to value chains, markets, and capital.

The Mekong Delta Plan also went on to identify a strong interest in sustainable agricultural practices, but without giving details of how they might be implemented. The authors identified, in literature outside of the Delta Plan, that large commercial agricultural practices in Vietnam had typically been dominated by high input (pesticides, fertilizer) approaches that had low sustainability on the decadal scale [17]. However, a growing body of literature has shown that there are examples of agri-business enterprises that make

efforts to adhere to broad definitions of sustainability [18,19]. Based on these high-level strategic perspectives, a matrix was developed for use with stakeholders based upon two axes, which represented key choices that need to be made within the context of future socio-agricultural systems of the Mekong Delta. These were: (i) who will be running commercial agriculture; and (ii) to what extent will those practices be describable as sustainable. Between these combinations, we identified 4 plausible scenarios of the future of socio-agricultural systems.

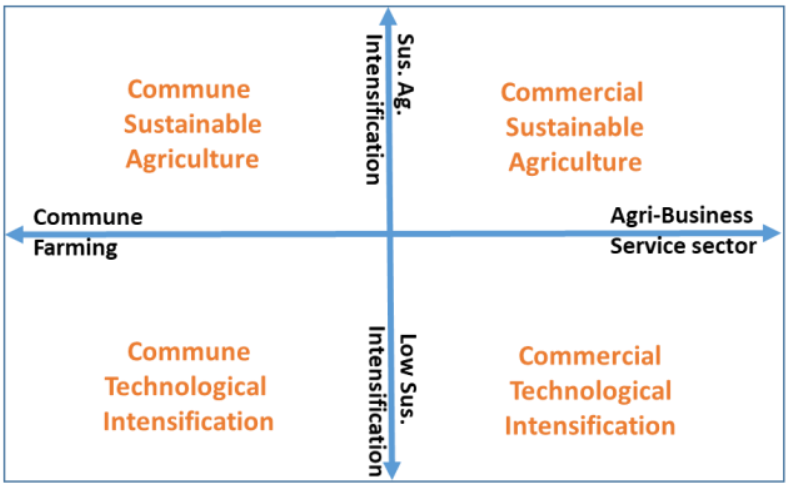


**Figure 1.** Socio-Agricultural scenario matrix for 2050, based on who is carrying out agriculture and what level of sustainability practice is applied. Cooperatives are considered as being run through the commune level to some degree with commercial interests, meaning agri-business. The left side scenarios might be argued as not fulfilling the agri-business brief of the Mekong Delta Plan, however they are present to (i) allow assessment of where agricultural systems are today, and (ii) to provide an opportunity for stakeholders to express an alternative point of view to that of the plan.

### *2.2. Development of Land Use Models for Each Scenario*

In order to allow stakeholders to envisage what the scenarios developed might look like in terms of land use, plausible land use outputs for each scenario were developed for 2050 using the land model CLUMondo (Figure 2). This model simulates land use change as a function of exogenously derived demands for commodities and services while accounting for local suitability and competition between land systems. Demand for services (built-up, rice production, and aquatic products) remained the same for each scenario and were calculated based on existing planning data, while the ability of each land system to provide a service was calculated by multilevel modelling using land use and census data [20]. For each year, a suitability map was created using logistic regression between the distribution of each land use and a set of explanatory factors. A total of 21 biophysical and socioeconomic explanatory factors including climate, soil properties, water logging, salinity, and demography were used. The number of explanatory factors was reduced to 11 after multiple collinearity assessments, wherein any two factors with a correlation coefficient > 0.7 were excluded. First, relationships between land use and local explanatory factors were calculated for the initial year (2014). Second, the CLUMondo model was parameterized and calibrated based on the 2014 land use map. Finally, changes in the land use from 2014 to 2050 were simulated under four different scenarios, which included alternative sets of demands for commodities and services and represented different pathways on managing the Mekong Delta's land resources [21].

The 2014 land use map of the Vietnamese Mekong Delta was used as a baseline, derived from MODIS data at a resolution of 250 × 250m using EVI time series [22]. Within the 12 classes of the VMD land use map, three classes indicate rice cultivation areas (single-season rice with shrimp aquaculture, double-season rice, and triple-season rice), two classes

indicate aquaculture (aquaculture and aquaculture in forested environments), and three classes indicate cash crops (fruits, sugarcane, and other cash crops).

Scenarios were designed according to the scenario matrix and parameters were set with stakeholders during initial project engagement meetings. In concrete terms, the specificity of each scenario was modelled using the spatial constraint component. This setting represents transitions from one land use to another, which were strictly prohibited or only allowed by predefined changes (e.g., conversion from single-season rice to triple rice was facilitated in low-sustainability scenarios to represent policies aiming at rice production, while commune-farming scenarios were pushing for diversification of production).

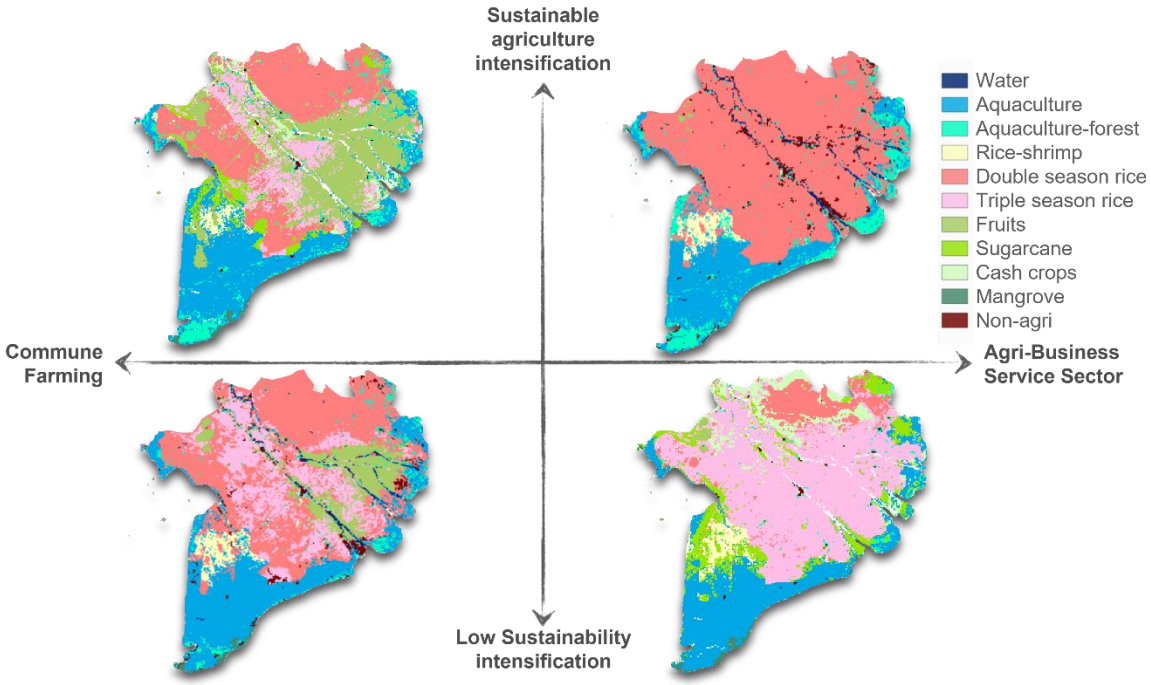


**Figure 2.** Projected land use for 2050 according to the four policy development scenarios identified by stakeholders.

Once the land use scenarios were developed through modelling, an expert project partner narrative was derived with Can Tho University, the Southern Institute of Water Resources Research, and the local government of Dong Thap to help elucidate the potential impact of such land use change. This consisted of qualitatively outlining what might be expected to occur if a given scenario were to become a reality. The intention of this description was not to act as a specific prediction, but simply to elucidate the type of changes that might be expected and as such to provide some context for the stakeholders to consider and discuss. These are fully elaborated in Appendix A. These maps were made available for the March 2019 stakeholder workshop and presented early on in its process.

### *2.3. Delta Level Stakeholder Workshop Methodology*

Following completion of the scenarios, a stakeholder workshop was held in Ho Chi Minh City in March 2019 to capture the perspectives of district-level stakeholders regarding plausible implementation and future directions of the Mekong Delta Plan's agro-business industrialization scenario. The four scenarios presented at the stakeholder workshop were built upon the work of Kebebe et al. [23] and Barbour et al. [24] with the identification of the key axis being associated with strategic socio-agricultural choices as opposed to specific issues. There was an extensive discussion around the perspectives of the stakeholders and the future of the socio-agricultural systems in the Delta in the early elements of the workshop. Participating stakeholders comprised of 55 representatives from the Ministry of Natural Resources and Environment, representatives from Can Tho City administration, representation from all 12 of the Mekong delta provinces (Dong Thap, An Giang, Kien

Giang, Ca Mau, Hau Giang, Tra Vinh, Soc Trang, Ben Tre, Tien Giang, Long An, Vinh Long, and Bac Lieu), and researchers from the Institute of Water Resources Planning, the Southern Institute of Agricultural Planning and Projection, the Southern Institute of Fisheries Economics and Planning, the Southern Institute of Water Resources Research, Can Tho University, and the Institute of Coastal and Offshore Engineering. Participants from the government were chosen due to their direct involvement in implementing the Mekong Delta Plan; participants from research institutes were chosen for their advisory roles in government agencies during the implementation of the Mekong Delta Plan and their expertise in conducting research in agriculture and climate change as relevant to the Mekong Delta Plan.

The workshop deliberately did not focus on whether or not stakeholders agreed with the government's strategy; rather, the focus was on identifying stakeholder perceptions on how they viewed the current pathways towards agro-business industrialization highlighted in the Mekong Delta Plan and whether or not current and future practices were likely to achieve these set policy goals. The primary objective of the workshop, therefore, was to define current approaches as well as perceived possible end states (set at a long-range future of 2050) within the over-arching agro-business industrialization scenario of the Mekong Delta Plan.

After discussing the matrix, the narrative behind each of the four quadrants was introduced to stakeholders in terms of what those scenarios might mean for agricultural practices and production in the Mekong delta. A summary of the key characteristics of each scenario, validated in the workshop, are given in Appendix A. Once the basis for the quadrants had been discussed and understood as a group, a series of three specific and anonymous questions were asked to each individual stakeholder in the workshop. These were:

1. Which quadrant best describes the *dominant* approach to agriculture in the Mekong delta today?
2. Where would you anticipate the *dominant* agricultural practice of the delta to be in 2050 if agricultural policy continues as it is trending currently? This is called the Business as Usual condition.
3. Where would you anticipate the *dominant* agricultural practice of the delta to be in 2050 if agricultural policy is effectively and optimally implemented? This is called the Idealized condition.

Each participant was able to select a value between 1 to10 for each axis, resulting in a coordinate point that plotted within a specific quadrant or on the line between them. This gave a greater degree of freedom than simply identifying a single quadrant. Thus, the results of the workshop (Figure 3) occurred as a spread of results with each point representing an individual.

## 3. Results from Stakeholder Workshop

In the simplest sense, the results of the anonymous identification of stakeholder participants' perception of current and plausible future states of the delta can be seen as, firstly, showing a wide range of opinions as to the current state of the delta. This became apparent in the initial discussion with stakeholders wherein, perhaps unsurprisingly, different sectoral perspectives dominated individuals' outlooks (Figure 3b,e). These range from those that considered community based sustainable agriculture as dominant across the delta to those that identified commercial high intensity agriculture as dominant. This lack of cohesion of opinion served to emphasize the far greater cohesion of the group when asked to identify which of the four scenarios is the most plausible business-as-usual outcome for 2050, with as many as 50% identifying that the current direction of travel was towards the commercially owned high input scenario of agricultural production; the other 50% were evenly distributed amongst the other three scenarios (Figure 3c,e). However, when asked to consider an idealized yet plausible future, some 75% of stakeholders retained that the private sector was dominant, but 42% of these expressed the importance of sustainability

in that future. As such, we observed that there was agreement that the future will be dominated by commercialized private sector ownership and management of the agricultural system. However, we also observed concerns that this future, insofar as it is articulated in terms of policy and implementation, would not be sufficiently focused on sustainability.

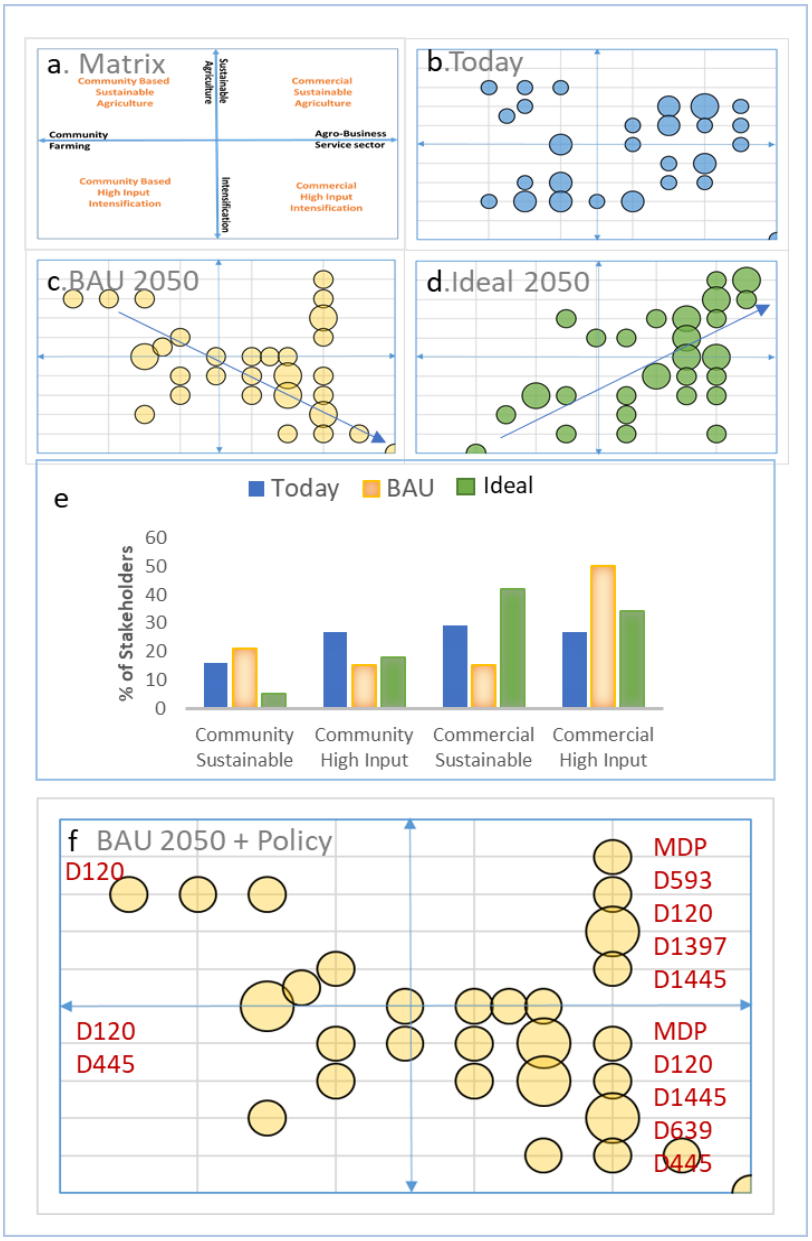


**Figure 3.** (**a**) Scenario matrix used in the workshop to identify plausible future states of agriculture in the Mekong Delta. Community is a broad term that covers commune run agricultural activities and, whilst it has elements of private ownership, it is distinct from commercial scale production by agribusiness (see Appendix A). **Note**: In **b**–**d**,**f** the largest circle size represents three persons, the medium size represents two persons and smallest represents one person. The arrow representing the broad shift in trend is indicative only. (**b**) Quadrant plot showing the distribution of stakeholder opinion as to the state of the delta **Today**. (**c**) Quadrant plot showing the distribution of stakeholder opinion as to the state of the delta under business-as-usual, 2050. (**d**) Quadrant plot showing the distribution of stakeholder opinion as to the state of the delta in a plausible idealized state, **2050**. (**e**) Plot showing the percentage of respondents selecting a given quadrant for graphs **a**–**c**. (**f**) BAU 2050 marked up with the key areas of alignment with the identified policies. Explanation of abbreviations of policies in Figure f can be found in Appendix B.

*Contextualizing Stakeholder Outputs in National and Regional Policy*

As seen above, the scenario of commercial sustainable agriculture was the most popular stakeholder choice for a plausible idealized future state. This scenario presents a middle ground wherein traditional knowledge, ecological production, and diversification of production, but also a form of intensification takes place where ecological conditions are appropriate. This is supported by vocational training and other forms of infrastructure, including financial mechanisms (Decision 593/QD-TTg) and transportation links (5-year Socio-Economic Development Plan 2016–2020). Successful implementation of these, however, would require an appropriate regional coordination mechanism, which is the main subject of Decision 64/QD-TTg, Decision 625/QD-BKHDT, and Decision 4259/BKHDT-KTDBLT. Therefore, policy makers and implementation agencies need to strike a careful balance between the sustainability and intensification elements that are encouraged in the original Mekong Delta Plan and subsequent policies and how these should link to coherent and integrated national policies.

The stakeholder perspective of what is considered to be business-as-usual recognizes that, in reality, sustainability has a lower profile in policy than commercialization of agriculture. However, that is not to say that the current policy landscape ignores the issues of sustainability. Indeed, as visualized in Figure 3f and shown in the policies listed in Appendix B, national policies may be classified as dominantly falling under our different scenario quadrants in terms of their priorities and emphases, and a number identify sustainability as a key issue. The main problem is the lack of coherence between often-competing policies, which may have inherent tensions that pull in different directions in the absence of an effective overall strategic governance mechanism. The centerpiece document, Resolution 120/NQ-CP, for example, included elements that appear to indicate a move towards sustainable agriculture more broadly. The resolution calls for (i) increased vocational training for new high-tech agricultural production techniques; (ii) revision of the triple rice cropping regime; (iii) more efficient use of water; (iv) maintenance of traditional agricultural methods using local knowledge; and (v) production in line with ecological zones. The combination of these provisions creates a good case for the commercial sustainable agriculture scenario. However, Resolution 120/NQ-CP then went on to call for the development of large scale high-tech agriculture, which could also lead to commercial high input agriculture. Indeed, Resolution 120/NQ-CP emphasized value chains, trademark development, and job creation as well as start-up support. Some sections of the resolution explicitly call to 'attract non-state sources of funding, especially from the private sector [and to] enable the private sector to operate in suitable fields.'

This broad intensification is in line with the government's emphasis on agricultural restructuring, a strategy emphasized in the 5-year Socio-Economic Development Plan 2016–2020. It aims to gear agricultural production towards high-tech, large scale agriculture with high land concentration and better water efficiency. Farmers are to be better-linked with credit organizations, private companies, and scientific and technological institutions. This latter provision aims to expose agricultural production to biotechnology and information technology, including the adoption of new farming techniques that ensure high yield and climate resilient crops. Private sector investment is to be encouraged in rural areas in agriculture, industry, and services, to 'mobilize resources outside of the State [to] promote economic growth, job creation, [and] income generation' [25]. Very little of this can be considered as sustainable agriculture on its own.

While it might be argued that this was simply calling for a diverse agricultural approach on the delta, no guidance regarding the sustainability of these approaches was given. Furthermore, Decision 445/QD-TTg aimed at the commercialization of commune/cooperative dominated production, while simultaneously calling for intensification of the fisheries and aquaculture sectors through land concentration and high-tech production, which further diverges from a future of the community-based or commercially based sustainable agriculture scenarios.

As a consequence, the national policy landscape itself, and indeed major individual policies such as Resolution 120/NQ-CP, exhibits considerable potential for contradiction, pulling into opposite directions of commercial high input agriculture versus community-based sustainable agriculture, or at least suggesting both are developed concurrently but without guidance as to how this might be achieved in reality. This tension is recognized in the anticipation of stakeholders, coupled with the expectation that without a clear geographically and methodologically explicit agricultural strategy to include sustainability in the intensification on the delta, sustainability will be sidelined should things continue in their current trajectory (business-as-usual).

## 4. Discussion

The government of Vietnam will shortly finalize a new Mekong Delta Master Plan for 2021–2030, and a new 5-year Socio-Economic Development Plan 2021–2025 along with a 10-year plan for 2021–2030. The government further aims to develop a Mekong Delta Integrated Regional Plan to 2030 with Vision to 2050. Implementation of these plans will be crucial for the future of the Mekong Delta, as it is undergoing processes of high-tech mechanization and land consolidation to enable private large-scale agricultural production. Potential conflicting aims exist for increasing production, moving towards higher-quality products, ensuring food security, and protecting the environment.

These problems occur despite the fact that research on stakeholder preferences shows successful government persuasion of regional delta-level stakeholders to accept the agro-business industrialization strategy [26]. It has been widely evidenced by the literature that a significant gap exists between policy making and policy implementation in Vietnam in a range of policy fields including environment, irrigation, and water management [27,28]. Analyzing the Mekong Delta's water governance regime, Ha et al. [29] found limited opportunities for adaptive freshwater management due to problems in vertical and horizontal cooperation, including an almost complete absence of public participation, a lack of knowledge and information sharing, a lack of mechanisms to allow feedback on policy implementation for future improvement, and insufficiently diversified financial resources. Focusing on district level implementation problems, Tran and Weger, [30] showed that farmers in some parts of An Giang province ignored the government's 2007 directive to move from a triple rice cropping regime to a 3-3-2 regime, partly due to concerns about the impact on their livelihoods, with tacit acceptance by local officials. This suggests that a new regional coordination mechanism would need to address at least some of these issues.

Against this background we need to understand stakeholders' concerns, as expressed during the March 2019 workshop, that the delta may not be on a path towards sustainable development and that, instead, future developments may give rise to uncoordinated, exploitative, and localized projects which may generate high levels of income but only for a short, unsustainable period of time. This is essentially a business-as-usual scenario that highlights traditional problems of coordinating policy across and between government levels, sectors, and provinces.

A critical aspect of the findings presented in this paper is the plausibility of sustainable agriculture that is also highly productive. This is the option that dominates the stakeholder perspective, but there is a substantial body of literature which considers the tradeoffs between environment, societal outcomes, and the economy associated with such an approach [31,32]. This can be specifically considered in light of the SDGs and their concurrent needs. Issues of sustainable intensification have been especially highlighted for major river systems and ecologically fragile deltas [33,34]. For example, Amoako Johnson et al. [12], working in coastal Bangladesh, identified that the development of high intensity aquaculture did not compensate for the loss of rice subsistence as employment requirements were minimal, as is often the case with intensification, with migration to urban areas as the consequence. This position is supported by the work of Lazar et al. [13] which identified that the poorest members of the agricultural communities are often unable to find the initial capital to engage with or benefit from sustainable intensification. To ensure equitable

outcomes of agricultural change, therefore, it is critical that decision making is inclusive, allows for knowledge exchange, and creates networks that facilitate mutual learning and policy feedback.

Finally, our methodology, which combined stakeholder workshops for scenario production with policy analysis [35,36], is relevant to other major socio-ecological systems where local/regional sites of production or interests are dominated by centralized decision making. The Ganges-Brahmaputra-Meghna delta system, for instance, also has a strategic delta plan developed by the Bangladeshi government called the Bangladesh Delta Plan 2100. Here, delta development is compounded by issues in policy implementation and issues in creating agreement between stakeholders across government levels, calling into question the relevance and feasibility of strategic delta plans for actual policy [37]. In such a context, policy analysis and stakeholder work enable production of viable co-produced policy approaches incorporating feedback from local and regional governments back to the national policy-making process. Without this feedback there is no adaptation to or of policy and no incorporation of lessons learned during the process of implementation.

## 5. Conclusions

During the March 2019 workshop, participants were able to verify the significance of the key axes of the scenario matrix associated with sustainability and intensification as well as between community-led or cooperative-based activities and commercial development as central to policy thinking. There was also a clear agreement that the most desirable future is one wherein the efficiencies of privatization and the development of commercial-based practices are combined with a greater emphasis on sustainability. The scenario workshop identified that while there was a coherence of message between local and central government in terms of agricultural intensity and sustainability policy, there was a clear divergence between central policy as written and delta-level decision makers regarding the assessment of what business-as-usual might practically lead to in the future. Central policy identifies agricultural intensification with sustainability, while district decision makers see the intensification but are unclear how sustainability will be implemented within that context. Such an outcome is a sign of the lack of trust in the coherence, integration, and effective implementation of national policy, including sustainability, at a local level.

The twin processes of intensifying production while protecting the environment may thus be hard to achieve against the twin problems of potentially conflicting policy goals and problems in implementation. Despite changes in national policies and attempts to create a new regional governance mechanism, a sustainable future for the Mekong Delta is far from certain; a renewed focus on specifically addressing how sustainability will play a central role in the future of the Delta as well as explicit land planning are required. Indeed, in aligning the development, delivery, and implementation of policy on national to local level decision making is linked to a coherent, broadly-shared vision of the strategic management of the socio-agricultural ecological system in question, and where policies are ambiguous, and at their worst contradictory, long-term management and planning can consequently suffer. These potential adverse impacts may be compounded if stakeholders have divergent visions of the current and future states of the socio-agricultural system, calling into the question the long-term viability of agriculture and sustainable livelihoods in the Mekong delta and beyond.

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## Appendix A

Description of the scenarios:

*Scenario 1: Community Sustainable Intensification*

Proposition: By adopting low-impact, high-sustainability commune-run, high-quality and diverse agricultural strategies, traditional intensification is effectively substituted by the production of high-value products with a minimum of food waste through a sustainable, highly resilient and low carbon food system.

Flood & Drought:

(i.) great utilization of flood sediments for fertilization
(ii.) greater exposure to floods with less engineering structures
(iii.) more efficient use of water to reduce drought
(iv.) soil management to reduce drought

Agricultural Production:

(i.) run by communes
(ii.) lower overall yields
(iii.) less income ($) in the first 20 years
(iv.) lower-calorie food security but higher nutritional food security
(v.) sustainable over a long period of time
(vi.) less food waste
(vii.) high-value crops, aquiculture, and livestock
(viii.) uses traditional agricultural methods
(ix.) low fertilizer through use of flood sediment and livestock
(x.) climate and environmentally resilient
(xi.) preserve and enhance mangrove as a coastal defense
(xii.) high livelihood support and employment/possible reduced migration.

*Scenario 2: Commercial Sustainable Intensification*

Proposition: The use of high technology is promoted in this approach, but it can still be used in a sustainable manner. This might include bio-gas generation, technical responses to food waste, and some diversity. Fields are aggregated and mechanized. Unlikely to be able to use sediment as fertilizer in all areas, as it is highly costly not to have three crops.

Flood & Drought:

(i.) some utilization of flood sediments for fertilization
(ii.) development of substantial engineering structures
(iii.) limited soil and water conservation.

Agricultural Production:

(i.) run by agro-business-pressure to sell and aggregate land
(ii.) same overall yields as current production
(iii.) similar income as today ($) over the first 20 years, though declining fertility after that
(iv.) same calorie food security, but potentially higher nutritional food security
(v.) sustainable over a longer time, but progressive decline in soil health
(vi.) less food waste hence intensification of output
(vii.) higher diversity of high-value crops, but less than commune run
(viii.) medium/high fertilizer use
(ix.) some climate and environmentally resilient
(x.) medium/high carbon release
(xi.) preserve and enhance mangrove as a coastal defense
(xii.) lower levels of livelihood support and higher migration

*Scenario 3: Community High Input Intensification*

Proposition: The use of high technology is promoted in this approach but it can still be used in a sustainable manner. This might include bio-gas generation, technical responses to food waste, and some diversity. Fields remain within the commune and there is some mechanization. Unlikely to be able to use sediment as fertilizer in all areas as it is highly costly not to have three crops.

Flood & Drought:

(i.) reasonable utilization of flood sediments for fertilization
(ii.) development of some engineering structures
(iii.) reasonably high soil and water conservation
(iv.) run by commune and or cooperative
(v.) similar overall yields as today
(vi.) similar income ($) in the first 20 years, though possibly declining fertility after that
(vii.) same calorie food security, but potentially higher nutritional food security
(viii.) sustainable over a longer time, but progressive decline in soil health
(ix.) less food waste hence intensification of output
(x.) high diversity of high-value crops
(xi.) medium fertilizer use
(xii.) some climate and environmentally resilient
(xiii.) medium levels of carbon release
(xiv.) preserve and enhance mangrove as a coastal defense
(xv.) similar levels of livelihood support and similar migration.

*Scenario 4: Commercial High Input Intensification*

Proposition: The high-impact, high-technological approach is based upon maximizing output over the short to medium term in order to invest in other areas of the economy such as the service sector. It involves high-input levels and is not designed to be sustainable.

Flood & Drought:

(i.) no utilization of flood sediments for fertilization
(ii.) development of extensive further engineering structures
(iii.) no soil & water conservation.

Agricultural Production:

(i.) run by agri-business with pressure to sell and aggregate land
(ii.) very high income ($) in the first 15–20 years followed by a steep decline
(iii.) profits removed from local area
(iv.) high-calorie food security, but lower nutritional food security
(v.) sustainable over a short/medium time only
(vi.) typically high food waste, but could be decreased
(vii.) high-value mono crops

(viii.) uses large-scale technological practices, high efficiency agriculture
(ix.) very high fertilizer use and intense livestock and aquiculture
(x.) climate and environmentally low resilience, but operational in the short to medium term
(xi.) engineered coastal defenses for rapid deployment of high intensity agriculture
(xii.) low general livelihood support and employment with technical exceptions and increased migration.

## Appendix B

MDP: 2013 Mekong Delta Plan as agreed between the governments of Vietnam and the Netherlands;

D593: 2016 Decision 593/QD-TTg on Piloting Sub-regional Socio-Economic Development Planning;

D120: 2017 Resolution 120/NQ-CP on Sustainable and Climate-Resilient Development in the Mekong Delta;

D1397: 2012 Decision No. 1397/QD-TTg approving irrigation planning in the Mekong River Delta from 2012 to 2020 and orientations to 2050 under the conditions of climate change and sea level rise;

D1445: Decision No. 1445/QD-TTg approving the master plan on fisheries development through 2020 with a vision towards 2030;

D639: Decision 639/QD-Ttg on the Working Program of the Central Steering Committee of the National Target Program on New Rural Construction promulgated by the Prime Minister;

D445: 2016 Decision No. 445/QD-TTg to Complete and expand the new cooperative model in the Mekong River Delta in the period of 2016–2020 as a pilot model

## Appendix C

These included World Bank (Vietnam),
Centre for Agricultural Policy, Ministry of Planning and Investment,
Centre for Water Management and Climate Change, IUCN,
Mekong Delta Development Research Institute,
People's Committee of Dong Thap,
Department of Natural Resources and Environment of An Giang,
Division of Irrigation of An Giang,
Department of Natural Resources and Environment of Soc Trang,
Division of Irrigation of Soc Trang, JIRCAS,
Centre for Climate Change Adaptation Research and Community Development
SWIRR (Southern Institute of Water Resources Research)
Can Tho University.

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