Research Article

The Consequences of Political and Economic Choices: Exploring Disaster Vulnerability with the Structure, Resource, and Behaviour Change model (SRAB)

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The Vietnamese Mekong Delta (VMD) has experienced a series of unprecedented disasters in the last decade, resulting from a combination of drought and saline intrusion in the 2015-2016 and 2019-2020 dry seasons. These events have severely impacted the region's agricultural sustainability and people's livelihoods, prompting an urgent need to explore their root causes and derive lessons for future prevention. Despite a growing body of literature on disaster vulnerability, little has been done to address these questions in the Vietnamese context. This article seeks to bridge this gap by critically examining Vietnam's food politics and agricultural modernisation policies in relation to changes in water resource management, disaster risk management and farming practices. Through a case study of Tan Hung commune in Soc Trang province, the article argues that the current vulnerability to disasters, exemplified by the unsustainable system of triple rice cultivation, is an unintended consequence of Vietnam's agricultural reform and biased water management approach, which relies heavily on large-scale irrigation infrastructure.

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Introduction: Recent Disasters in the Vietnamese Mekong Delta

Salinity intrusion has seeped deeper into coastal areas in the Vietnamese Mekong Delta (VMD) over the last two decades as a result of the consequences of sea level rise, land subsidence, and changes in upstream water flow, particularly during the dry season (Tuan 2020a). The recent occurrence of two record saline intrusion and drought crises in 2015-2016 and 2019-2020 exemplifies this trend.

In June 2016, a historic drought and salt incursion affected 52 of Vietnam's 63 provinces and cities, with 18 proclaiming a State of Emergency (UN, 2016). The event delayed the onset of and early ended the wet season while extending the dry season. In the VMD, from November 2015 to March 2016, precipitation decreased by 20 to 50 percent, with no rainfall between January and March (UNDP, 2016), leading to an intensification of the annual saline intrusion, surpassing previous records (Mai et al., 2018). Salinity intrusion also occurred earlier and further inland, covering 52.7% of the Mekong Delta and ten out of thirteen provinces and towns (FAO, 2016; Mai et al., 2018; Southern Institute of Water Resources Research, 2016). This made the river water unsafe for human or agricultural consumption and led to food and water insecurity for many rural households, forcing them to migrate (FAO, 2016; V.G. Nguyen and Ngo, 2017, 2016; Nguyen-Trung et al., 2020; Nguyen-Trung, 2019). The drought disaster damaged 244 thousand hectares of rice crops (89.6% of the country's rice crop losses), costing the VMD $360 million (Mai et al., 2018; UNDP, 2016). The same causes have led to another devastating catastrophe in the 2019-2020 dry season, which has affected 13 provinces severely, with 10 falling into a State of Emergency (Tuan 2020a, 2020b; United Nations, Catholic Relief Services, and Save the Children 2020).

This context sparks a question about what caused this series of similar disasters. A number of studies have attributed these disasters to upstream hydropower dams, land subsidence, the relative sea-level rise, riverbed sand mining (Park et al. 2020), the current risky rice crop 3, a lack of effective long-term hydro-meteorological uncertainties, a lack of information about the overall water discharge released from hydro-power reservoirs in China and Laos, and governments’ weak prevention and response capacities (N.A. Nguyen 2017). While these analyses were reasonable, they paid little attention to the link between the historical evolution of disaster vulnerability and current farming behaviours.

In this study, we aim to fill this void by examining the disaster vulnerability in the case of Tan Hung commune, Soc Trang province, using the Structure, Resource, and Behaviour Changes (SRAB) model based on vulnerability progression analysis proposed by various scholars (e.g., Wisner et al. 2004; Blaike et al. 1994). The sections that follow first introduce the research methodology, then discuss the findings in two parts, including the agricultural reform and irrigation construction and the changes in risk perception and farming practice, and finally link back those points to the present literature.

The Root Cause of Disaster Vulnerability

This section aims to contribute to the ongoing dialogue on disaster vulnerability by providing a theoretical framework for understanding the underlying causes of risk and vulnerability. Disasters cause widespread destruction and loss of life, which have far-reaching social, economic, and environmental impacts. Understanding the root causes of disaster vulnerability is crucial to effectively preventing and mitigating such impacts. According to Bankoff et al. (2004, p. 3) '[v]ulnerability is not just concerned with the present or the future but is equally, and intimately, a product of the past'. This claim implies that we should not constrain our analysis of disaster vulnerability's root causes within the present timeframe but to extend it to cover the history evolution of the affected society. This argument is brilliantly captured by Oliver-Smith and colleagues in their FORIN approach (2016, p. 23): 'Vulnerability (and resilience) is a complex social condition often deriving from the workings and interaction of multiple dynamic processes and underlying "deep-rooted causes". They assert that vulnerability research should go beyond description of surface impacts (i.e., immediate descriptive casual relations) of disaster to uncover such causes within the social structures of affected systems (Oliver-Smith et al., 2016, p. 28; Wisner et al. 2014). They suggest seeking those causes by looking at dynamic processes such as population growth and distribution, urban and rural land use patterns and processes, environmental degradation and ecosystem service depletion, poverty and income distribution (Oliver-Smith et al., 2016, pp. 29-30). Instead of constraining the analysis of the disaster vulnerability within the present timeframe, it is necessary to link the current state of human-induced vulnerability to its historical evolution (Bankoff and Hilhorst 2009; Bankoff 2003; Wisner et al. 2004; Blaikie et al. 1994; Oliver-Smith et al. 2016; Oliver-Smith 1999). In sum, disaster vulnerability should be seen as a socially constructed phenomenon (Forbes-Mewett & Nguyen-Trung, 2019).

The Pressure and Release Model (PAR) developed by Blaikie et al. (1994) and Wisner et al. (2004) is perhaps one of the most comprehensive frameworks to date that helps understand the transformation of the root causes of disaster vulnerability. Their model explains the occurrence of disasters as a result of the interaction between the progression of vulnerability (through three stages including root causes, dynamic processes, and unsafe conditions) and the hazard (e.g., earthquake, flood). The progression of vulnerability looks deep inside social systems to identify the causes of vulnerability. Root causes are general processes inherent in social, economic, political, and legal systems, including ideologies, cultural assumptions, beliefs, law, and social relations that lead to limited access to power, structure, and resources among the population. These root causes do reside within current society but also result from past events such as wars, which can contribute to identifying current disasters. Those root causes are responsible for dynamic processes that only exist in the present. These dynamic processes are "more recent or immediate, conjectural manifestations of underlying general economic, social, and political concerns" (Wisner et al., 2004, p. 48). Macro forces such as rapid population growth, rapid urbanisation, arms expenditure, and deforestation are some of these processes, which lead to a lack of local institutions, training, appropriate skills, local investments, and local markets. The function of these processes is to transform underlying root causes into unsafe conditions. These conditions are defined as "the specific forms in which a population's vulnerability is expressed in time and space in conjunction with a hazard" (Wisner et al. 2004, p. 49). Conditions ranging from living in dangerous locations and in unsafe buildings to the lack of disaster preparedness directly affect the degree to which the population can potentially suffer from hazards. In contrast to climate adaption research focusing on physical exposure (IPPC, 2007, Smit 2006), the PAR model considers exposure in a more social way. While not downplaying the state of exposure to physical threats, it is more critical to look at why some groups must engage in such conditions of exposure.

Based on the PAR model, Wisner, Gaillard, and Kelman (2011) propose a "triangle of vulnerability," showing that the progression of vulnerability includes changes in macrostructures, resources, and unsafe conditions. The framework aids in the investigation of the underlying causes and structural constraints that limit access to resources and contribute to marginalisation. The model is made up of three large circles that represent structural constraints and six sets of resources that are necessary for daily life and dealing with natural disasters.

Access to these resources determines how resistant, diverse, and sustainable people's livelihoods are, which ultimately reflects their position within society. The model emphasises that the root causes of vulnerability are interconnected and complex, and that people who are geographically isolated, live in poor ecological areas, and have limited access to administrative officials and politicians are particularly vulnerable. The model provides a complex understanding of vulnerability that can help inform strategies for enhancing capacities and reducing vulnerability.

In this article, we followed these root cause analysis approaches to propose a framework Structure, Resource, and Behaviour Change (S-RAB) (Figure 1) to examine the progression of disaster vulnerability. This model argues that disaster vulnerability progresses through *three stages of change*: structural changes, changes in resource mobilisation and management, and changes in the behaviours of individuals. These three stages will transform the root causes into current risky behaviours that are exposed to hazards and risks, as in the PAR or Triangle of Vulnerability models. Structural changes are the most fundamental root of all changes since they suggest the transformation of the whole system. This process often occurs throughout historical evolution since the changes in systems require time and macroprocesses embedded in political, economic, and cultural structures. As these structures alter, they will lead to changes in resource availability, investment, management, and deployment for goal achievement. For example, the construction of water control infrastructure could alter the presence of flooding risks and thus the use of protected land.

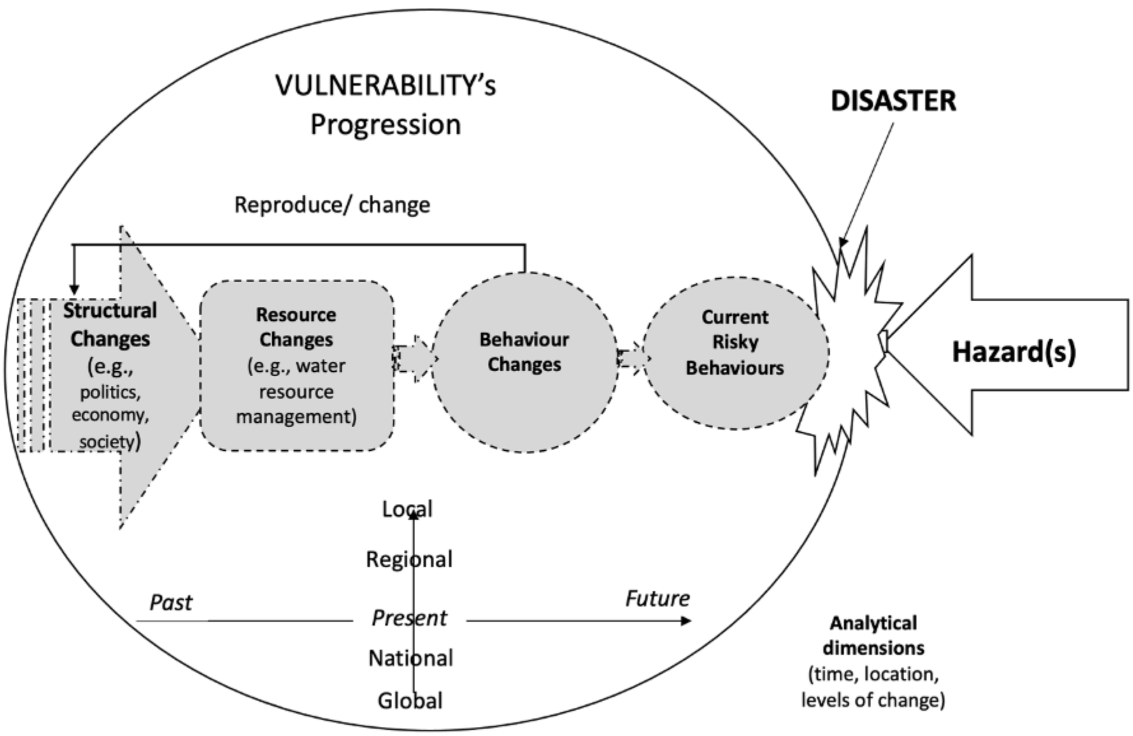

Figure 1. Structure, Resource, and Behaviour Change (SRAB) Model of Vulnerability Progression

Source: Adapted from Nguyen-Trung (2021), Wisner et al. (2011), Wisner et al. (2004)

This model will be used to examine historical changes in Vietnam's food politics, agricultural modernization, and irrigation growth in order to answer the question of what has made Vietnamese farmers so vulnerable to the risks of drought and saline intrusion in the current timeframe. We argue that the contemporary disaster vulnerability in the Vietnamese Mekong Delta is the outcome of Vietnam’s political choice of food security and economic choice of rice crop intensification.

Methodology

Research Setting

In this article, we draw on the first author's case study of Tan Hung commune, a rural community located in Soc Trang province, one of the coastal provinces of the VMD (see Figure 2). This project was conducted from 2017 to 2021, with the fieldwork carried out from February to December 2018, three years after the historic disaster (late 2015–early 2016).

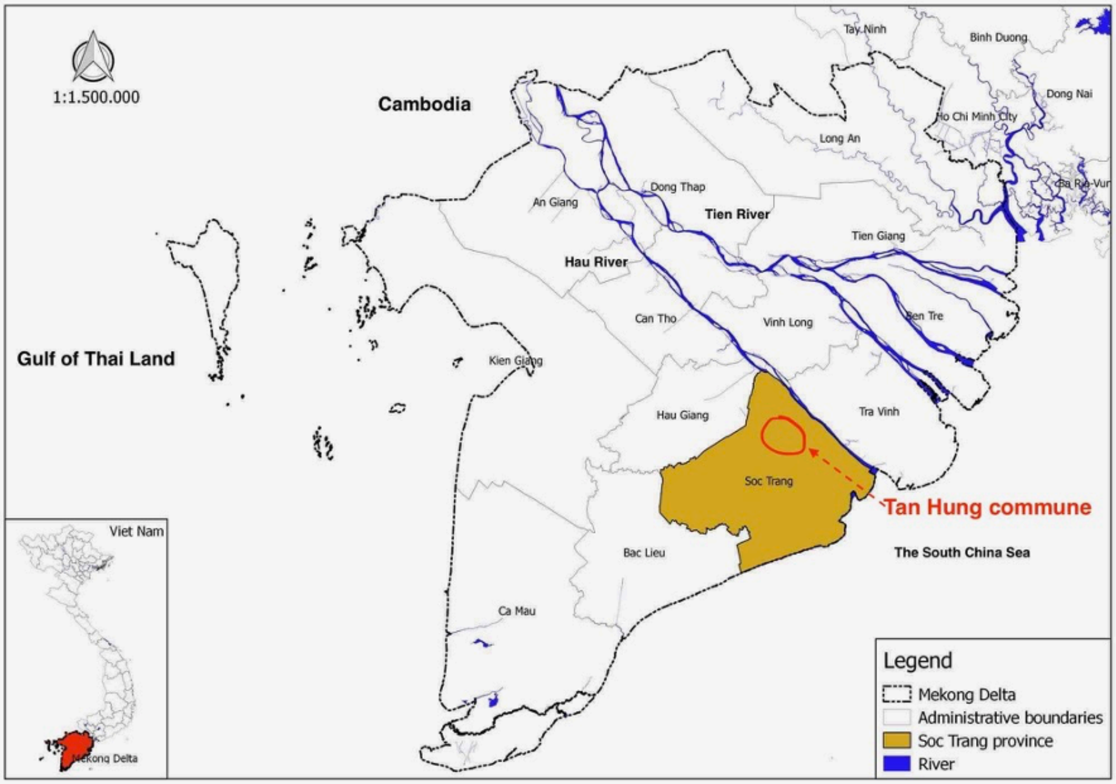

Figure 2. Map of Tan Hung commune, Soc Trang province

As of 2018, Soc Trang province, which was called Ba Xuyen when it was run by the South Vietnamese government during the Vietnam War (1954–75), has one city, two towns, eight rural districts, and a total of 109 communes, wards, and towns that are run by rural district governments. With a population of 1.3 million people in 2018, an increase of around 5,000 people from 2015, the province is home to many ethnic groups including Kinh, Chinese, and Khmer. Located in the coastal region, alongside the Bassac (Hau) river, the province shares a 72-kilometer-long coastline with Tra Vinh province to the north, Hau Giang province to the northwest, Bac Lieu province to the southwest, and the East Sea (South China Sea) to the southeast. Soc Trang province contains two ecological systems: the middle-in-land system and the coastline and island system. The latter system makes the coastal part susceptible to saline intrusion during the dry season (Tuan et al. 2007; Miller 2007; MARD 2009). Soc Trang shares this saline intrusion zone with the provinces of Ca Mau (Ca Mau Peninsula), Bac Lieu, and Tra Vinh, as well as portions of the provinces of Kien Giang, Soc Trang, Hau Giang, Ben Tre, Tien Giang, and Long An (the East Sea Coastal Region) on an area of around 47 percent of the Delta's total land area (Prime Minister of Vietnam 2018).

Tan Hung commune in the Long Phu district was one of the hardest-hit areas in the province during the 2015–2016 disaster. The commune, which is located near the Bassac River and approximately 20 km from the Tran De sea gate, is prone to annual saltwater intrusion. The commune is a typical rice-based area, with agricultural land and rice cultivation land comprising 90.5 percent and 77.8 percent, respectively, of the commune's total land area (Soc Trang PPC 2018). Additionally, the commune's agricultural production exemplified a third rice crop cultivated in the dry season, which is extremely vulnerable to salt intrusion and drought (FAO 2016).

Provincial statistics reported one of the highest saline concentrations in river water at the adjacent Long Phu gauge station (8.5 gram/litre), ranking third among eight gauge stations placed throughout the province, after Tran De and Tham Don. The commune lost 916 ha (or 19.3 percent of the Long Phu district's total impacted area) and had 582 affected households (or 14.3 percent of the district's total affected households)—second only to Truong Khanh commune. In the aftermath of the disaster, Tan Hung received VND 1.59 billion (about US$16,500) in disaster relief assistance from the government—the greatest sum ever given to a single commune in 2016 (Long Phu DPC 2016).

Data and Methods

This article draws on a broader study conducted by the lead author following the guidelines of case study research (Yin 2014). This research design enabled the collection of a wide range of data in order to shed light on the single embedded case of Tan Hung commune in the aftermath of the historic disaster in late 2015-early 2016.As of December 15, 2017, the study's ethics application (Project number 11022) was developed, submitted to, and approved by the Monash University Human Research Ethics Committee (MUHREC) by that date. The study was deemed low-risk. In accordance with the committee's recommendations, ethical considerations were addressed throughout the investigation, especially during the fieldwork from February to December 2018. The lead author sought consent from research participants prior to conducting interviews for the purpose of gathering information and audiotaping the interviews. Consent could be given verbally or in writing. Oral consent was more commonly employed because not every farmer was familiar with the established process of research ethics.

This article's database included documentary and archival record analysis, as well as semi-structured interviews with local stakeholders. Key informant interviews were conducted with 21 different stakeholders, including government officials, representatives from mass organizations, and agricultural input suppliers. The respondents included provincial officials from the Division of Irrigation from the Department of Natural Resources and Environment (DONRE), who were in charge of water resources management; district-level staff members from the Division of Agriculture and Rural Development, who managed the irrigation systems and agricultural development of Long Phu district; commune-level officials from the Tan Hung Commune People's Committee (CPC), including the chairman, cadastral official, agricultural official, and labour and social affairs officials; and leaders from the Women's Union, Farmers' Union, Elderly's Association, and Fatherland Front; village heads; and agricultural input suppliers. These respondents offered general information on the historical and social contexts of the local farming practices, bridging the policy analysis and household interviews.

Interviews with 28 disaster-affected farm households were the main source for this article. Based on the requirements for a case study design (Yin 2014, 51-53), households were chosen if they reflected: (1) their vulnerability to the 2015-2016 disasters, which meant that they had annually cultivated the risky crop 3 during the dry season and had suffered some losses as a result of the 2015-2016 disaster.(2) The ethnic composition of the population, which reflects the presence of Kinh and Chinese groups in Village A and Khmer groups in Village B. The ethnicity of households was determined by the ethnicity of their heads. (3) The diversity of socioeconomic statuses, reflecting the presence of the two categories of household poverty: non-poor versus near-poor and poor households. The determination of household poverty was based on my consultations with village staff and the Community People's Committee's (CPC) official records, which were calculated in accordance with the criteria set forth in the Prime Minister of Vietnam's Decision Number 59/2015/QD-TTg (2015). Accordingly, a rural poor household is a household meeting one of two criteria: (i) having an average monthly income per capita of up to VND700 thousand; or (ii) having an average monthly income per capita of between VND700 thousand and VND1 million and lacking three or more indicators of accessing basic social services. A rural near-poor household is a household with an average monthly income per capita of between VND 700,000 and VND 1 million and lacking less than three indicators of accessing basic social services. Table 1 summarises the final sample's profile.

Categories of households	N	%
By ethnicity of HH head		
Khmer	14	50.0
Kinh	12	42.9
Chinese	2	7.1
By location		
Village A	14	50.0
Village B	14	50.0
By gender of HH head		
Male headed household	21	75.0
Female headed household	7	25.0
By poverty status in 2017		
Poor/Near-poor households	9	32.1
Nonpoor households	19	67.8
By land use in 2018		
Under 1.8 ha	17	60.7
1.82 ha and above	11	39.3
Total	28	100.0

Table 1. Household Profile

Source: Nguyen-Trung (2021)

The lead author drew on the list of households receiving relief funds in the 2015-2016 disaster and the list of poor and near-poor households in Tan Hung commune in 2017 and the discussions with local officials to select and approach households. At first, the lead author relied on the introduction of local officials. When he had established rapport with local farmers, he sought support from them to connect with the targeted households. Interviews with households were then transcribed, imported into NVivo, and analysed using thematic analysis (Braun and Clarke 2006), which aims to identify, analyse and report themes arising from data. In the process of data analysis for this article, the second author contributed his ideas to coding and themes, as well as to the development of a narrative that connects themes together.

In addition to interview analyses, we used documentation and archival records to cross-check interview findings (Tables 2 and 3). Documentation is the technique of dealing with numerous types of documents relevant to the topic of interest (Yin, 2014). While documentation refers to the context and content analysis of the available official or formal texts, the use of archival records represents secondary analysis of quantitative data, supporting the information collected from other sources (Yin, 2014). Documentation and archival records were often official and consistent and covered events across a broad range of time and space. Although they are created for other purposes and are often written or produced from different perspectives, the use of these sources was fundamental to my study. In this study, we relied on the analyses of documents and records produced by organisations such as the Government of Vietnam (GoV) and the Communist Party of Vietnam (CPV) at all levels. These documents and records offer information on the social structures of various locations and timeframes. Using these data to crosscheck with information from households and key informant interviews has helped to understand the context in which farmers have been both enabled and constrained.

Level of Information	Archival Records
National level	• Vietnam General Statistics Office's (GSO) databases including: census, statistical yearbooks, databases on Administrative Unit and Climate, Population and Employment, Agriculture, Livestock and Fishery, Transport, Postal Services and Telecommunications, Socio-Economic Statistical Data of 63 provinces and cities, etc.; • The World Bank's Vietnam Country Data including population, GDP, GDP per capita, poverty, and so forth; • United Nations' Data on Drought and Saline Intrusion in 2015-2016; • Databases from Emdat.be and Desinventar.net; • Vietnam's Food Association's Vietnam Rice Exports Quantity from 1989 to 2017 (2018).
Local levels	• Soc Trang's Division of Statistics Office's Long Phu Yearbook Statistics in 2016; • Soc Trang PPC's Database on Land Use (2005, 2012); • Long Phu DPC's Household Poverty Database (2015-2017); • Long Phu DPC's Loss Statistics in the 2015-2016 season (2016); • Tan Hung CPC's Household Poverty Database (2010-2018); • Tan Hung CPC's List of Households Receiving Relief Funds in 2015-2016 (2016b); • Tan Hung's Land Use Map; • Households' Buying and Selling Records.

Table 2. Archival Records and Level of Information

Source: Nguyen-Trung (2021)

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Level of information	Documents
National level	• CPV's national progresses' documents and reports (1976-2020); • GoV's laws, policies, regulations, strategies, emergency plans for coping with disasters and climate change, including drought and saltwater intrusion (1975-2020); • GoV's laws, policies, regulations, strategies, and plans for rural and agricultural development (1975-2020); • GoV's laws, policies, regulations, strategies, and plans for the Mekong Delta development (1975-2020); • Other GoV's relevant laws and policies (e.g., land laws 1993);
Local levels	• Soc Trang's Provincial People Committee's (Soc Trang PPC) Presentation on the results of land statistics collection and building the 2005 land use map for Long Phu district, Soc Trang province (2005); • Soc Trang PPC's Land Use Plan Until 2020 and the Land Use Plan for the first five years 2011-2015 in Soc Trang province (2012); • Soc Trang PPC's Decision on approving the land use plan for Long Phu district (2018-2020); • Soc Trang PPC, Provincial Steering Committee on Flood Prevention and Rescue's reports on the outcomes of preventing and coping with natural hazards and solutions for consideration (2010-2018); • Soc Trang PPC's Plan on preventing saline intrusion (2017); • Soc Trang PPC, Department of Agriculture and Rural Development's Plan on Preparation for Preventing Saline Intrusion, Storing Freshwater in order to Cope with Drought and Saline Intrusion in the Dry Season 2016-2017 (2016); • Long Phu District People's Committee's (Long Phu DPC) reports on Summarising Agricultural Development Achievements and Plans and Solutions for a New Year (2008-2018); • The Communist Party of Vietnam Branch in Long Phu District's Action Plan on Restructuring Agriculture in the Direction of Increasing Value Added and Sustainable Development in Cooperation with Building the New Rural Area Program in Long Phu district from 2016 to 2020 (2015); • Long Phu DPC's Plan for Agricultural Restructuring in the Direction of Increasing Value Added and Sustainable Development in Long Phu district until 2020 (2015); • Tan Hung Commune People's Committee's reports on Socio-economic States and Plans and Directions for a New Year (2013-2017); • Tan Hung Women's Union's reports on the Women's Movement and Women's Union's achievement and plans for a new year (2014-2017).

Table 3. Documents and Levels of Information

Source: Nguyen-Trung (2021)

Current Farming System and Vulnerability to Natural Risks

Tan Hung commune farmers are heavily reliant on rice production. According to the land use database in 2018, the commune's percentage of agricultural land and rice cultivation land area in its total land area were 90.5 percent and 77.8 percent, respectively (Nguyen-Trung, 2021). These figures ranked third and first among 11 towns and communes in Long Phu district. The intensive land use for agricultural production can be attributed to the operation of triple rice cropping that was found in many other provinces of the VMD's coastal region. This system implies that farmers cultivate three rice crops a year: crop 1, or Summer-Autumn crop (April to August), crop 2, or Autumn-Winter (September to December), and crop 3, or the late Winter-Spring/ Spring-Summer crop (late December to mid-March). This farming system is highly vulnerable to saline intrusion and drought because the dry season runs from November to April, with saline intrusion peaking around February to April (FAO, 2016).

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The 2015-2016 disaster, which included a 20-month drought and increased saline intrusion, damaged 31,560.15 ha of rice crops, vegetable crops, sugarcane crops, fruit trees, and fishing areas throughout the Soc Trang province. According to the Soc Trang Statistics Office (2018), total rainfall in 2015 was 1,394 mm, the lowest since 2010 (2,142 mm). The monthly average total rainfall was 16.2 mm from November 2015 to April 2016, with the first four months of the latter year recording almost no rainfall (Soc Trang Statistics Office, 2018).This drought condition sharply deteriorated saline intrusion, with the salinity concentration level in the river in the dry season 2015-2016 increasing by 2.4 from the previous year to 8.6 grammes per litre and penetrating deeper into the rice fields (Soc Trang SCPFSSR 2016). At the Long Phu water control station located in the Long Phu district, the monthly average salinity concentration level stood at 8.53 grams per litre over six months, from January to June in 2016. The maximum concentration was recorded at 23.1 grams per litre, which increased from 14.5 grams per litre in 2015. The increase in 8.6 grammes per litre was greatest in Soc Trang province's eight cities, towns, and districts.A similar pattern was found in previous years, with the highest increases often seen in March or April. The figures seen in 2010, 2013, and 2015 came close to that of 2016, with the average salinity concentration level recorded at 5.6 grams/litre, 5.26 grams/litre, and 4.83 grams/litre, respectively (Figure 3).

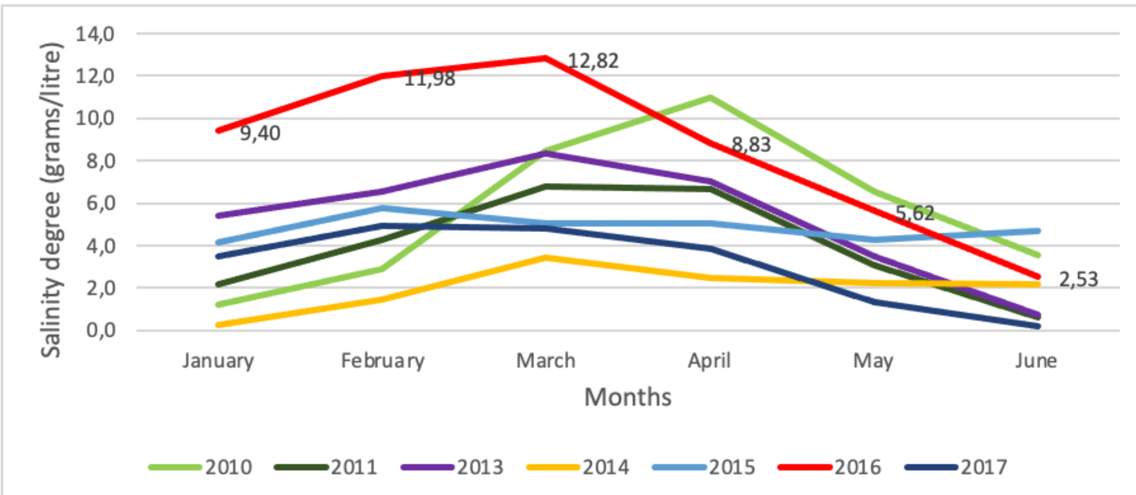

Figure 3. Average salinity concentrations measured at Long Phu station of Soc Trang province, 2010-2017

Source: Nguyen-Trung (2021)

The event caused an estimated economic loss of VND 908 billion, accounting for 73.3 per cent of total estimated economic losses (VND 1,238 billion) in eight years from 2010 to 2017 (Nguyen-Trung, 2021). In 2016, the provincial agricultural production areas with an over 70 percent drop in crop production were 12,314.7 ha, and those with a 30 to 70 percent drop were 19,245.5 ha. Between 2010 and 2017 (excluding 2012, which suffered a large flood), there were under 3,000 ha of crop losses. Both 2010 and 2013 were affected by saline intrusion, yet those losses were far less, with 5,690 ha and 12,274 ha of crop losses, respectively (Soc Trang PPC, 2010, 2011, 2012, 2013; 2014, 2015, 2016, 2017).

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Year	Main hazards	Affected agricultural production area (ha)	Estimated economic loss (billion VND)
2017	Heavy rain and flood	2,418.6	12,634
2016	Saltwater intrusion, strong winds, riverbank and beach erosion, whirlwind, and thunder.	31,560.2	908,121
2015	Saltwater intrusion and flood	504.7	9,014
2014	Flood	90.6	16,358
2013	Saltwater intrusion, flood and drought	12,274.0	72,379
2012	Flood	14,583.5	84,563
2011	Flood	2,811.2	52,129
2010	Heavy rain, flood, saltwater intrusion and drought.	5,690.0	83,077

Table 4. Estimated economic losses and affected agricultural production area in Soc Trang, 2010-2017

Source: Nguyen-Trung (2021)

Structural Changes: Vietnam's Food Politics and Rice Intensification Policies

This section seeks to trace the origins of present agricultural practices (i.e., producing a triple cropping system) back to the structural changes in the Vietnamese context in 1970s-1980s. Policy research reveals significant changes in Vietnamese agriculture dating back to the country's reunification (1975) and the well-known reform (1986). Indeed, Vietnam's first wave of modernisation began in the second part of the nineteenth century, following its initial experiences with Western civilisation, most notably the beginning of the French colonial conquest (1858). The French colonials brought the first mechanical dredgers to Vietnam, assisting in the establishment of the VMD (Biggs 2004; Biggs et al. 2009; Miller 2007). During the Vietnam War (1955-1975), both sides of the divided country began to incorporate scientific and technological developments such as Green Revolution-era high-yield varieties (HYVs), agrochemicals, and mechanisation in the 1960s (Pingali and Xuan 1992; Taylor 2007; Ut and Kajisa 2006; Xuan 1995, 1975). This process was hampered severely by the war and, later, by Vietnam's socioeconomic crises from 1976 to 1988, which forced the country to become a net rice importer (Pingali and Xuan 1992). Only until the country emerged from turbulence in the late 1990s and early 2000s did the Vietnamese state start on a continuous industrialisation (*công nghiệp hóa*) and modernisation (*hiện đại hóa*) endeavour.

Despite the fact that Vietnam began industrialisation far later than Western countries, it has profited from the second modernity's trends towards multidimensional globalisation and individualisation (Beck and Beck-Gernsheim 2002; Beck 1992). This is demonstrated by the synchronisation of Vietnamese agricultural modernisation strategies with global trends (Fortier and Thi Thu Trang 2013). The 1986 reform enabled Vietnam to combine industrialisation (including de-collectivisation of the economy and agriculture, farmer liberation from cooperatives, transfer of rights over land and production materials to farm households, privatisation of input markets (e.g., fertilisers, pesticides), introduction of new high-yield rice varieties, and mechanisation of agricultural production (Pingali and Xuan 1992)) with the global trend of outsourcing. This tendency has given the private sector, local governments, and agricultural households more autonomy, culminating in Vietnam's success story, which saw the country achieve lower middle-income status in 2010. (Khan 1998; Minot and Goletti 2000; Niimi, Vasudeva-Dutta, and Winters 2004; Pham and La 2014; Pingali and Xuan 1992).

To achieve its objectives, the Vietnamese government chose to centre its economy on rice crop intensification. After suffering from the severe flood of 1978 (Biggs et al. 2009) and food shortages in the 1980s (Hoanh et al. 2003; Tuong et al. 2003), the political leaders led by the Communist Party of Vietnam (CPV) navigated its food politics by strongly promoting its "rice everywhere" campaign and an "all rice strategy." 'Intensive farming, increasing crops, and increasing productivity' (*thâm canh, tăng vụ, tăng năng suất*) was central to this approach, which was implemented by reclaiming fallow land, extending irrigated areas through the construction of large-scale irrigation systems, and developing new rice varieties (Communist Party of Vietnam 1982). This approach was applied to the development and planning of the VMD and the Red River Delta, especially the former.

Table 5 (in the next page) presents the summary of food security politics in the Vietnamese Communist Party's strategies. From the Fourth National Congress (1976) to the Ninth National Congress (2001), political leaders always portrayed the VMD as the country's "crucial rice bowl" (Communist Party of Vietnam 1977), the "largest commodity rice producer" (Communist Party of Vietnam 1982), one of the "most substantial food producers" (Communist Party of Vietnam 1987), the delta having a "strategic mission to ensure national food security" (see Table 5). Even after Vietnam had become one of the world's largest nett rice exporters, the CPV continued to frame the VMD as a major region serving national food security (Communist Party of Vietnam 2007). The Vietnamese government (GoV) has acknowledged this symbolic status in a number of strategies and development plans. For example, the Resolution No. 09/2000/NQ-CP (The Government of Vietnam 2000) consistently designated the VMD as one of two rice-producing deltas in the north, alongside the Red River delta. The VMD has traditionally been associated with the envisioned image of a food producer, such as "a major agricultural production region in the global market" by 2050 (Prime Minister of Vietnam 2009), "a central agricultural production area employing modern approaches" (Prime Minister of Vietnam 2013), and "national food security and agricultural and fishing output exportation to global markets" (Prime Minister of Vietnam 2014).

National Congress (year)	Food security	Vietnamese Mekong Delta (VMD)
Fourth National Congress (1976)	The foremost problem.	A potentially important rice bowl for the country.
Fifth National Congress (1981)	The most pressing and basic problem.	Together with the Red River Delta, VMD is to be the focal point for the country's comprehensive food and agricultural production.
Sixth National Congress (1986)	Food is the number one focus, vital for survival, one of three major economic programs, alongside consumer goods and export goods programs.	VMD is to be the largest commodity rice producer in the country; the Red River Delta to be the focal point of rice production in the North.
Seventh National Congress (1991)	Food is still key but not urgent. Food production to ensure both national demand and export.	One of the most substantial producers of food, vital for commodity food production.
Eighth National congress (1996)	National food security always needs to be ensured.	Together with the other deltas, has a strategic mission to ensure national food security.
Ninth National Congress (2001)	Food production continues to be a crucial activity to ensure national food security.	The country's largest commodity, vegetable, fruit and aquatic product production region; stabilising rice growing areas.
Tenth National Congress (2006)	National food security is always vital.	Alongside the Red River Delta, VMD is a major place serving national food security.
Eleventh National Congress (2011)	Ensuring national food security is one of the missions of agricultural production.	No explicit link between VMD and rice production, food security, and export. Areas specialised in large-scale commodity rice production; step up intensive rice production.
Twelfth National Congress (2016)	Ensuring national food security is one of the missions of agricultural production.	No explicit link between VMD and rice production, food security, and export.
Thirteen National Congress (2021)	Ensuring national food security in relation to each area/region's strength and climate changes	No explicit link between VMD and rice production, food security, and export. Focusing on aquatic products-fruit trees-agricultural production

Table 5. Concerns for food security and the Mekong Delta's role in the CPV's strategies

doi.org/10.32388/MMNAQG

Source: Nguyen-Trung (2021)

Furthermore, in order to increase rice production, the state implemented de-collectivisation policies and land reforms beginning with Resolution 10-NQ/TW in April 1988, followed by Land Law 1993, Land Law 2003, and Land Law 2013, which not only restored land use rights but also economic motivation to farm households (Pingali and Xuan 1992).Parallel to the de-collectivization, Vietnam reintroduced rice high yield varieties (HYVs) into agricultural production, a practise that had begun in the 1960s. The rate of use of HYVs increased from 17 percent in 1980 to nearly 90 percent in 2000. At the national level, HYV yield increased from approximately 2-2.5 tons per hectare in 1980 to 3-5.5 tons in 2002, depending on the producing location (Utah and Kajisa 2006). The development of a second generation of HYVs with strong resistance genes to brown plant hopper, rice blast disease, and salinity (such as IR42) was critical in facilitating the transition from single cropping to double and triple cropping (Ut and Kajisa 2006). In the 1990s, a third generation of HYVs with a shorter duration (80–90 days) was developed, including Omon Chin Som (OMCS2000), OMCS21, VND95, and VND96 in the VMD, and C70, C71, DT, and DT11 in the North (Ut and Kajisa 2006). The rate of HYV adoption increased dramatically from 9.7 percent in the VMD in 1980, which was lower than the country's average (16.9 percent), to 99.5 percent in 2002, which was higher than the country's average (94.2 percent) (Ut and Kajisa 2006). Furthermore, the state allowed for the marketisation of agricultural inputs, allowing farmers to access and purchase fertilisers and pesticides from private sellers (Fortier and Thi Thu Trang 2013).

Changes in Resource Management: Large-scale Water-Control Infrastructure

The agricultural modernisation with an institutionalised rice-based focus has led to the VMD's devotion of energy and resources to develop large-scale irrigation systems. The state considered natural forces such as flooding and saline intrusion the enemy of food production and national security. As such, the main area of investment in the VMD was the building of large-scale irrigation systems to prevent saline intrusion and flood. To do so, the irrigation development policy's core idea was to shut down the delta (Miller 2007).

This idea began to take shape in late 1970s to mid-1990s and was first realised in Decision no. 99-TTg (1996) on long-term direction and the 1996-2000 plan for irrigation development, transportation, and building rural areas in the VMD. This Decision goals were twofold: one, constructing flooding control infrastructure in the upper part of the VMD including the Plain of Reeds (Dong Thap Muoi), the Long Xuyen Quadrangle and the West of the Hau River; and two, constructing a 'sweetening project' with salinity control and freshwater storage works (dikes, sluice gates, earthen weirs, pumping stations) in the coastal part, including Ca Mau, Go Cong, and South Mang Thit (Can, Le Thanh Duong, and Miller 2007). The above mentioned projects were extended by Decision no. 84/2006-QD-TTg (2006), which aimed to make local agriculture harmonious with the dry season with low river flows and saline intrusion, and Decision no. 1397/QD-TTg (2012), which aimed to make the current irrigation system adaptable to climate change and sea level rise. The investment in irrigation systems has resulted in a very dense network of four-level canals with over 3,000 km of main canals and nearly 90,000 km of level-1, level-2, level-3 canals, and on-farm canals; 880 sluice gates with the width of 2 or more meters and 20,000 km of small sluice gates; over 1,000 large and medium-sized electric-based pumping stations and thousands of small pumping stations; 450 km sea dikes, 1,290 estuarine dikes, and 7,000 km of local dikes (Tuan and Ty 2016, 171-174).

Soc Trang province and Tan Hung commune have benefited from the building of the irrigation scheme of Quan Lo-Phung Hiep in the early 1990s. This scheme covers 403,335 ha in five provinces, including Ca Mau Province (Cau Mau Peninsula), Bac Lieu, Soc Trang, and Hau Giang (Eastern Coastal Region), and Kien Giang (Western Coastal Region) (MARD 2020). Of which, Soc Trang contributes 182,065 ha of the total project area (55 percent). Up to 2020, with 148 sluice gates, 733 km of 37-level canals, 8,624 km of level-2 canals, 1,042 km of dykes, and in-field canals, the scheme will have the capacity to supply water to 328,808 ha of agricultural land, of which 71 percent is rice production area (231,652 ha). Under this scheme, there are three sub-projects: 1) The Long Phu - Tiep Nhat project, constructed in 1993-1994 and 2003-2004, spans 46,094 ha in the Long Phu and Tran De districts of Soc Trang province.2) The Ba Rinh–Ta Liem project, built in 1993–1994 and 2003, covers an area of 35,492 ha, including My Tu district in Soc Trang province. 3) The Quan Lo–Phung Hiep project, built in 1992, covers an area of 247,222 ha in Bac Lieu and part of Soc Trang (MARD 2020; M.T. Nguyen, Renaud, and Sebesvari 2019). Tan Hung commune is part of the

Long Phu - Tiep Nhat system, which has 29 sluice gates and produces 11,313 hectares of triple rice crop, 29,485 hectares of double rice crop, 4,419 hectares of aquatic products, and 877 hectares of forest (MARD 2020).

The construction of irrigation works necessitated considerable changes in the risk perception and behaviour of local rice farmers during the transition from a single crop system to double and triple cropping patterns. This topic is covered in the subsequent section.

The Changes in Farming Behaviours

Changes in political, economic, and natural resources led to corresponding shifts in agricultural practises. Figure 4 demonstrates that every shift in political orientation and agricultural policies resulted in a commensurate shift in farming practises.

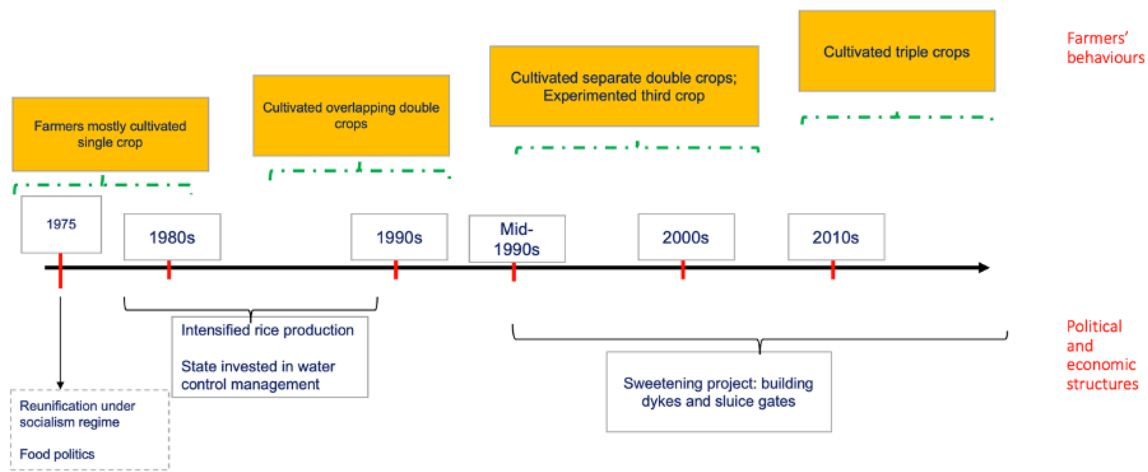

Figure 4. Changes in Farmers' Behaviours

Source: Adapted from Nguyen-Trung (2021)

In the 1970s, farmers in the province of Soc Trang predominantly planted a single rice harvest annually. Rice crops were primarily rain-fed and largely dependent on Mekong river flows, as they were cultivated in places that were not susceptible to severe flooding and salinity (Miller 2007). As a result, local farmers faced no risk of saltwater intrusion, as observed during the epic tragedy of 2015-2016 (Miller 2007; Xuan 1975). Dien Kinh, a female farmer in Village A of the Tan Hung commune, disclosed in an interview that prior to 1975, her family and neighbours grew only one crop per year, which required around six months of labour from planting to harvest. Information from local officials verified that it took at least 145 days to finish a rice cultivation season during that time period. The cultivation of rainfed rice crops posed little risk, but provided relatively low yields of about 2-3 tonss per 1.3 ha (Xuan, 1975), which was just below half of the present yield (6-8 tons/1.3 ha) (Nguyen-Trung 2021).

As stated previously, in the 1990s, the government began constructing the Long Phu – Tiep Nhat project in the Quan Lo – Phung Hiep system in 1993-1994 and then again in 2003-2004. This project involved the construction of dyke systems, sluice gates, and canals in order to support double rice cropping (M.T. Nguyen, Renaud, and Sebesvari 2019). This structure effectively made available freshwater during the dry season and expanded rice cultivation to previously inaccessible regions. In the 1980s and 1990s, the construction of irrigation systems, along with the introduction of short-duration HYVs and the commercialisation of agrochemicals, significantly motivated local farmers to switch from a single cropping system to a double cropping system combining a Summer-Autumn crop (crop 1) and a Winter-Spring crop (crop 2).

Agricultural modernisation initiatives have inadvertently erected hurdles that hinder local governments and farmers from escaping the rice production cycle or, more generally, the borders of the agricultural field (World Bank 2017). As a result of the dominance of rice cultivation, farmers were constrained and could rarely earn more than subsistence from rice farming (Bruun 2020a; Coxhead, Linh, and Tam 2012; C. Tran, Do, and Le 2013). In other words, farmers are confronted with a conundrum: they struggled to move to non-rice livelihoods while rice farming barely supported them. Thus, farmers did not limit themselves to the double cropping system (Nguyen-Trung 2019). In pursuit of new revenue, farmers began experimenting with rice crop 3 during this time. According to Berg (Berg, 2002), the availability of inexpensive fossil fuels and the ability to use agrochemicals, antibiotics, and high yielding rice varieties contributed to the trend towards intensified rice production and the perspective that high rice yield is the only goal of rice farming, regardless of whether or not such yields are sustainable.

Rice Crops	**Dry Season**						**Rainy Season**					
	NOV	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**
Double cropping system prior to 2000s												
First Crop								S			H	
Second Crop			H									S
Triple cropping system after 2000s												
First Crop							S			H		
Second Crop		H									S	
Third Crop		S				H						

Table 6. Shift from double cropping to triple cropping in Tan Hung

*Note: * S= Sowing; E: Harvesting; **: the period of each rice crop is only relative according to common patterns. Some households/areas might start or end earlier or later than others.*

Source: Nguyen-Trung (2021)

Table 6 shows the differences between two rice cropping systems. Compared to the rice cropping arrangement before to the 2000s, farmers began cultivating a new crop during the dry season. The new rice cropping technique requires farmers to sow crop 1 and crop 2 approximately one month sooner than in the past (Table 6). This allowed for the planting of a late-winter-spring crop, a spring-summer crop, or crop 3 between late December or early January and mid-March. Analysing family interviews revealed the fundamental shift in farmers' perceptions of saline intrusion risks when evaluating threats to their dry-season crops. As early as 1997 or 1998, when some farm households began experimenting with crop 3, this shift occurred.

When asked why they planted crop 3, some farmers highlighted adequate access to freshwater and the ability to prevent salt intrusion during the dry season due to the recently constructed irrigation infrastructure. Mr. Man, one of the first farmers to sow the crop in Village B, recounted how the agricultural pattern shifted as a result of the installation of the dyke system and sluice gates:

> I began planting the third crop quite early on. By 1998, I had already done so. The earliest inhabitants of [Village B]. Here there was sufficient freshwater, so I [planted] [crop 3]. Prior to that time, it was impossible due to the absence of a dyke and sluices that prevented saltwater entry.

Before the installation of irrigation works, local farmers were fully aware of the dangers associated with saline incursion during the dry season, according to this account. As a result of this apprehension, Mr. Man waited for several years before planting crop 3 in 1998. Recalling his reluctance to cultivate a new crop at the time, he stated:

> I was unfamiliar with the new crop and afraid of saltwater. I feared that I would fail and that no one had the courage to plant it at that time... I followed them only after I witnessed several farmers in Chau Khanh [a commune in the district of Long Phu]

> triumph. In addition, the state did not restrict farmers from cultivating crop 3 at that time. (Man, Khmer)

Early on, the planting of crop 3 was not an easy procedure. According to Mr. Tao, a Khmer farmer, his family experimented with this crop for several seasons before including it into their planting calendar. Under the instruction of his still-living father, his family attempted crop 3 in the 2000s but failed terribly, losing two hectares of cultivated land to seawater intrusion. After abandoning the crop for several years, the family has been cultivating it again since 2010, when the Long Phu – Tiep Nhat project's dyke systems were completed.

> In 2010, I chose to plant a third crop because the state had completed the dikes and there was sufficient fresh water. Since then, I have completed seven consecutive crop 3 seasons... Before 2010, no farmers in the vicinity of my area dared to plant a third crop because there was no barrier to prevent saltwater intrusion. And after observing the success of my crop, they followed suit. (Tao, Khmer)

The aforementioned anecdotes demonstrate a progressive shift in the local farmers' sense of risk (saline intrusion) as a result of the advent of newly constructed irrigation embarkments. In a situation where farmers barely make a living from rice production (Bruun, 2020; Coxhead et al., 2012), they viewed the initial results of harvest 3 as an excellent chance to generate a new source of revenue. In addition to changes in resources (fresh water) and natural threats (risks), a severe lack of income motivated Tan Hung's decision to move to crop 3. One farmer stated that the custom of giving cash as a sign of gratitude at local rituals or festivities (such as weddings and funerals) drains their annual budget.

> We planted crop 3 since we must pay for so many ceremonies and celebrations (*đám tiệc*) throughout the year. If we do nothing, we have no means of subsistence. Even if the third crop is dangerous, it must be tried... We are optimistic that the newly constructed dyke systems will allow us to cultivate crop 3 efficiently. (Co Tuong, Kinh)

A few years later, after some pioneers had experienced early success with crop 3 trials, farmers began to view crop 3 as a lucrative source of revenue. This notion resulted from their comparison of crop 3's profit to those of crops 1 and 2: "Crop 3 significantly boosted the productivity of our farmers: its profit is doubled while its labour requirements are greatly decreased compared to the Summer-Autumn crop [crop 1] and the early Winter-Spring crop [crop 2]. This was the reason why farmers selected crop 3' (Bong Ban, Kinh).

Yet, the trial with crop 3 only gained traction in late 2009 and early 2010 in the Tan Hung commune, where farmers had substantial success with this crop (Ji Co, official). "Crop 3 cultivation followed group patterns." Co Vua, a Kinh farmer from Village A who began planting crop 3 in 2004, recalled that in the late 2000s, all the owners of the riverside rice fields surrounding his farms decided to sow crop 3. Ji Co, a Tan Hung official, concurred with this view and saw the change from before 2010 to after 2010 when the irrigation system for the Long Phu – Tiep Nhat project was completed. Prior to 2010, only rice-growing households in low-lying regions had the courage to plant crop 3. After that, however, farmers experienced a surplus of freshwater, allowing them to plant this crop extensively in 2013 and 2014. (Ji Co, official). In turn, the community practise urged and compelled farmers to adopt this new crop pattern. Mr Thanh Long (Kinh), who performed crop 3 for the first time in 2008, clarified this point:

> I planted crop 3 since I had nothing to do for six months [between crop 2 and crop 1]. As there was adequate freshwater, I attempted to grow crop 3. I took a chance by following other farmers. If they cultivated and I did not, my fields would only produce grass. (Thanh Long)

Observing the emergence of crop 3 in Tan Hung commune in particular and Soc Trang province in general, Ka Co (official) reflected not only on the disparity between the state's original planning goals and farmers' choices, but also on their lack of active responses to the emerging pattern of local farmers. He remarked:

> The Long Phu district was intended to be a rice-growing region with a modest shrimp-rearing area. However, farmers understood the benefits of paddy agriculture and planted a third crop of rice, known as crop 3. As a result, the irrigation system was unable to provide adequate water for this district, as it was originally designed to feed two crops. The triple cropping system was the result of a voluntary experiment by farmers.

In the 2000s and 2010s, the agricultural development of the entire province of Soc Trang shifted from double cropping to triple cropping. This province has led the way in the reform of agricultural practices across the VMD. Prior to the development of large-scale irrigation projects, Soc Trang, along with other coastal provinces such as Tra Vinh (35 ha) and Ben Tre (35 ha), had approximately 45 ha of crop 3 in 1995 (22.1 ha). However, after the construction of irrigation works, the planting area for crop 3 in Soc Trang increased dramatically to the first triple-digit figure in 1998 (137.2 ha), and continued to rise to its peak in 2015 (196.7 ha) before decreasing in 2017 (183.9 ha) as a result of the 2015-2016 natural disaster (GSO 2020).

The preceding description demonstrates that farmers chose to plant crop 3 within the context of the state's choice of food security and rice intensification agenda. Farmers' decision was made because they had few chances to diversify their income and earn money outside of agriculture (World Bank, 2017). Adding another crop to the usual crop calendar was a good idea in this situation because it increased farmers' revenue and allowed local governments to report an increase in crop productivity in their commune. Farmers and the Vietnamese government did not anticipate, however, that this road would put pressure on the human-nature relationship. It forced farmers to rely on the government's management of irrigation systems, which had gradually reached their capacity to provide enough freshwater for a three-crop system. In the contexts of growing upstream dam construction (Piman, Cochrane, and Arias 2016; Tuan 2020b; T.A. Tran, James, and Nhan 2020) and global warming that causes more frequent droughts (Carro, Naumann, and Barbosa 2016; Naumann et al. 2018), the water deficit has worsened. In this context, the practice of farming crop 3 during the dry season poses an enormous risk to local farmers, resulting to a succession of disasters in the 2015-2016 and 2019-2020 growing seasons. In sum, the changes in political and economic structures have led to the alternation of resources used for crop production. We contend that current risky behaviour is a result of this historical evolution. Figure 5 helps summarise three stages of changes during this process.

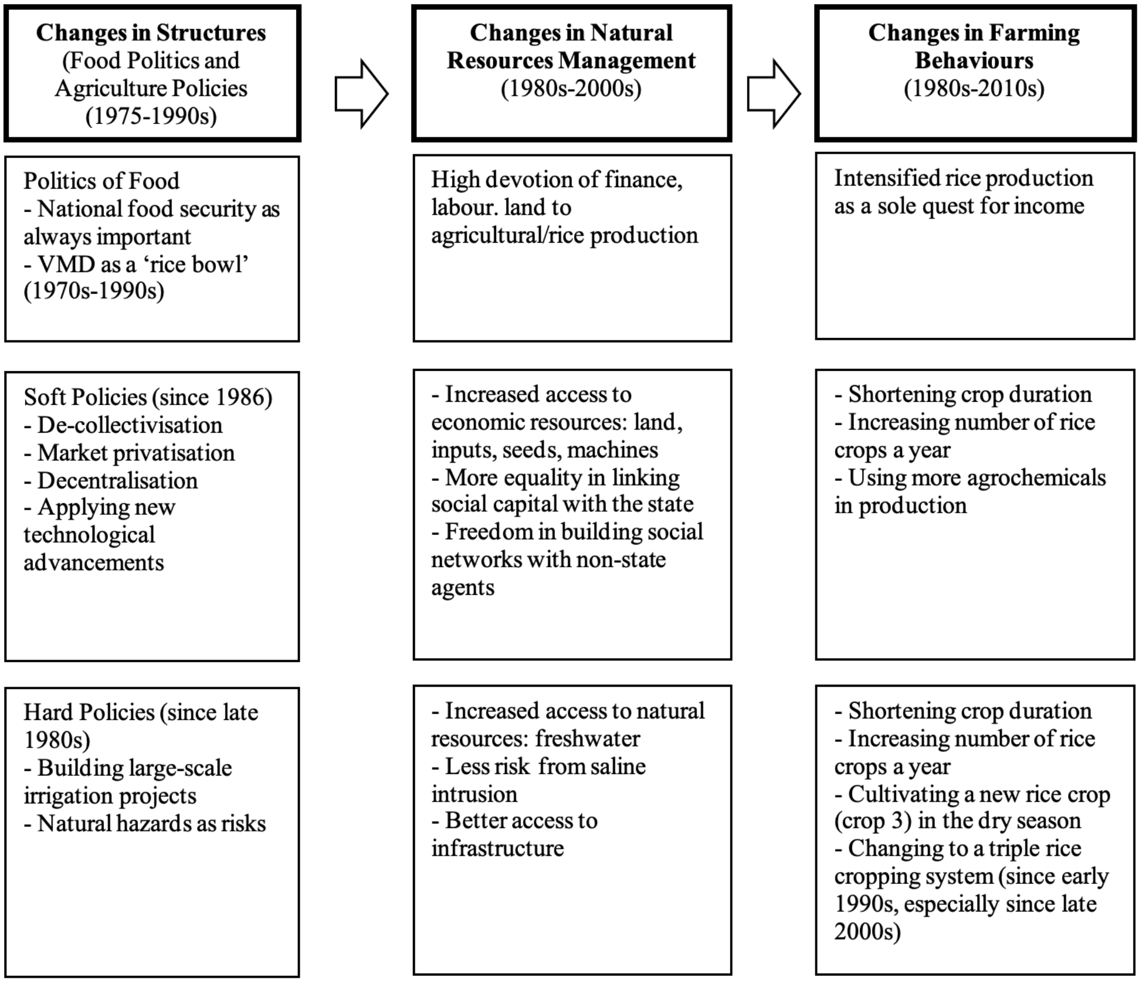

Figure 5. The transformation of agricultural, resources and farming pattern in VMD

Source: Adapted from *Nguyen-Trung (2021)*

Discussion

From the 1970s to the present, many farmers in Tan Hung commune in particular and elsewhere in the Vietnamese Mekong Delta (VMD) have become entangled in rice growing, putting them on the verge of facing environmental and agricultural threats (Nguyen-Trung 2022). The shift from double cropping to triple cropping was pushed by the low productivity and low income of double rice crops during this time period (Bruun, 2020; Coxhead et al., 2012; C. Tran et al., 2013). Yet, in the 1980s and 1990s, as a result of economic reform, they had numerous opportunities to abandon rice farming for non-rice work. Many farmers have shifted to more eco-friendly models, such as the prawn rice rotational cropping system or the lotus crop and tourism model (Park et al. 2020; D.D.Tran et al. 2018). Many others, however, chose to stay and continue cultivating intense farming. Instead of adopting non-rice livelihoods, they utilised the newly constructed water control system and the advent of new input markets (fertilisers, pesticides, high yield varieties) to expand the double farming to triple rice cropping system. There are numerous reasons why farmers remained in agriculture. Some note the significance of following family and community traditions (Nguyen-Trung 2023), or of inheriting the value of rice and land (Bui & Nguyen-Trung 2017) while others note that farmers tended to be restrained by the perceived deficiencies or livelihood hazards of other forms of work (T.A. Nguyen, Gillen, and Rigg 2020). In this way, rice cultivation provides them with a safer arena in which to confront uncertainties and risks.

Nonetheless, the state's politics and command economy play a crucial role in keeping farmers in rice farming, whatever their behaviours and decisions. Farmers were not "free decision-makers" under the domination of the state's ideological choice of food security and agricultural intensification (T.A. Nguyen, Gillen, and Rigg 2020). Our research does not stop at attributing the root causes of the 2015-2016 disaster to farmers' 'forced' choices, but to place the greater emphasis on the state's political (i.e., food security) and economic choices (i.e., intensified rice production), which led to the irresistible development of large-scale infrastructure. Infrastructure systems are metaphorically the "hands" of the state, allowing it to regulate even natural dangers and ensure compliance with the food security rule. The emphasis on food security through symbolising the VMD as the nation's main food producer and subsuming agriculture to secure national food security and economic growth (Bruun 2020) exemplifies the control- and stability-oriented nature of Vietnamese politics. These political and economic decisions resulted in the unsustainable dominance of rice agriculture in the VMD (Le et al. 2018). This approach has increased farmers' passive reliance on government regulation and investment (Biggs et al. 2009; Miller 2007). This reliance is expensive since it imposes burdens on disaster risk management, such as investing huge amounts of resources (e.g., manpower, money) for regular maintenance and upgrades, especially in the face of variable environmental and climatic conditions (Fortier and Thi Thu Trang 2013). Moreover, the excessive reliance on the function of authority has restricted the participation and voice of local populations, preventing the policies from satisfying local needs (Bruun and Olwig 2015; Lohmann and Lechtenfeld 2015). Our research provides a compelling example of how poor water management might impede rural farmers from acquiring the knowledge and skills necessary to respond to increasing threats (T.A. Tran, James, and Nhan 2020; Kenney et al. 2015). This theory applies not only to the management of water resources, but also to the nationwide programme of modern rural development, which likewise employs the technocratic authoritarian approach (Bruun 2020; Kien and Minh 2015). In this regard, we demonstrate the decisive influence of an authoritarian state on the agricultural production and decisions of farmers. Similar to authoritarian regimes like Taiwan's, the state appears to control the development paths of local communities in a communist state like Vietnam (Hsu et al., 2015). Through its authoritarian top-down approach, the state has been able to considerably modify regulations, power, and resource allocation, placing farmers' practises in a submissive position (Kenney et al. 2015).

Moreover, the state's goal of modernised agriculture and political stability has resulted in increasing vulnerability and potentially environmental disasters (Hoanh, Suhardiman, and Anh 2014; Nguyen-Trung 2019). Large-scale water control works provide only temporary protection against salinity for farms. Due to increasing sea level rise (SLR), salinity intrusion is anticipated to be more severe (i.e., intruding further inland and beginning earlier in the dry season) (Toan 2014). According to Toan (2014), if sea levels rise by 1 metre and the Mekong River maintains its current flow, salt water might infiltrate an additional 20 kilometres along the Mekong River and 27 kilometres along the Bassac (Hau) River. This scenario will lead to the reduced frequency of sluice gate openings, which will have a negative effect on drainage in affected areas. This also indicates that local farmers who cultivate the Winter-Spring crop (crop 3) are more likely to be affected by saltwater intrusion and water scarcity. It is not a coincidence that, after only four years, another historic saline intrusion-induced disaster happened in the 2019-2020 season, which exceeded the levels of the 2016 disaster and historical norms (Park et al. 2022). In this regard, our research adds to the existing body of knowledge regarding the negative effects of large-scale flooding and salinity control works, such as the alteration of natural landscape (T.A. Tran, Pittock, and Tuan 2019; Thang, Tran, and Luong 2020), the increasing pressure on water drainage and supply systems (V.K. Nguyen et al. 2016), and the increasing conflicts between rice farmers (demanding freshwater) and shrimp farmers (demanding saltwater), as (Can 2011; Q.H. Nguyen et al. 2020). Rice monoculture in general and the triple rice cropping method do not guarantee farmers a good income; rather, this dependence exposes farmers to both natural and agro-commodity market-related hazards. Although farmers believed that farming the third rice crop of the year would result in greater profits, productivity expenses increase (D.D. Tran et al., 2018) and their earnings are greatly impacted by the fluctuation of rice prices (e.g., *"được mùa, mất giá"* (bumper crop, falling price)) (T.A. Tran 2019).

Conclusion

Using the *Structure, Resource, and Behaviour Change (SRAB)* model, this article analyses the root causes of recent disasters in the Mekong Delta of Vietnam. This model allows us to examine the relationship between macro influences at the structural level, resource management at the local level, and agricultural behaviour modification. We believe that the choices of political stability exhibited in food security emphasis and rice intensification policy have had far-reaching repercussions in the present. As a result of this approach, the VMD and its farmers have been branded as the nation's primary food security and export provider. The institutionalisation of rice-based emphasis into the region's development plan has had a significant impact on how farmers decide how to earn a living (World Bank 2017). In this environment, modernisation initiatives, such as de-collectivisation, land reform, the adoption of high yield varieties (HYVs), the marketisation of agricultural inputs, and, most significantly, the substantial investment in irrigation construction, have caused complicated unintended consequences. On the one hand, the policies have resulted in a significant increase in crop production; on the other hand, they have pushed farmers in coastal areas to the tipping point, which necessitates an intensive engagement with a highly risky crop (i.e., crop 3) and exposes them to the risks of saline intrusion and drought.

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The authors have no relevant financial or non-financial interests to disclose. This work reproduces data and materials from Dr Kien Nguyen-Trung's PhD thesis with permission.

Consent for publication

All participants provided consent for publication of the data anonymously. All names of participants and their villages are anonyms.

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