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Land use change driven out-migration: Evidence from three flood-prone communities in the Vietnamese Mekong Delta

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ABSTRACT

In developing countries where agricultural production is exposed to adverse impacts of climate change, out-migration is commonly perceived as a safety net for poor farmers who lack adequate access to resources and capacity to adapt to change. In the Vietnamese Mekong Delta (VMD), the land use change driven by the state-led development of water engineering systems (e.g., dykes) and subsequent agricultural mechanisation processes, while it fosters intensive agriculture-oriented development policies, is perceived as the key factor that dispossesses livelihood opportunities of a large segment of rural societies, particularly the poor. This paper aims to examine how land use change is linked to farmers' decisions to migrate. Drawing on the mixed data gathered from focus group discussions, in-depth interviews and household surveys in three flood-prone communities in the VMD, the paper argues that the land use change forms an underlying driver for the surge of out-migration of the rural poor. The study findings indicate that the dyke development for rice-based agricultural modernisation process (e.g., widespread adoption of agricultural mechanisation) creates greater risks of unemployment borne by the poor. As such, they exert out-migration as a viable strategy to adapt to change and to avoid "locked-in" impoverishment in rural areas. This study advocates that policy considerations for delta's rural development should be grounded on the empirical understanding of the land use change and its significance to ensure rural societies' gaining equal access to employment. The study findings provide opportunities for further investigation in comparison with other case studies across the Mekong region and beyond, where state governments still play a dominant decision-making in agricultural development.

1. Introduction

Directed by the national policies in promoting rice-based agricultural production, the Vietnamese Mekong Delta (VMD) have undergone the fast-paced development of water engineering infrastructure to over the last few decades (Käkönen, 2008; Waibel, 2010; Chu et al., 2014). Accordingly, the agricultural sector has gained a significant attention from the central government that the "rice everywhere" policy are subject to be implemented across the VMD (Biggs et al., 2009). This was followed by the expansion of structural systems (e.g., dykes) in both flooding and salinity areas that aim to control extensive floodwaters and salinity impacts and provide irrigation water for rice farming (Renaud et al., 2015; Tran et al., 2018a; Le et al., 2018). In the flood-prone areas, dykes in various typologies (e.g., low dykes (August dykes) and high dykes) have been built (Howie, 2011; Nguyen et al., 2013), occupying the large parts of the floodplains (Vo, 2012).

The scholarship of migration largely attributes the dislocations of population (whether internally or transnationally) to the proximate causes of climate change, development projects, or internal conflicts (Bardsley and Hugo, 2010; Black et al., 2011; Kumssa et al., 2014; Siciliano, 2014; Randell, 2017; Stojanov et al., 2017; Radel et al., 2018; Rajan and Bhagat, 2018). Those causes demonstrate both subjective (anthropogenic hazards) or objective (natural hazards) conditions that have direct implications to rural livelihoods. In the Asia and the Pacific, which are frequently afflicted by extreme climatic shocks, the nexus between migration dynamics and environmental change constitutes a key aspect in rural households' livelihoods (Qin, 2010; ADB (Asian Development Bank), 2012; Penning-Rowsell et al., 2013; Koubi et al., 2016; Stojanov et al., 2017).

Linkages between out-migration and farm-based livelihoods have been established in the majority of empirical studies undertaken in the Southeast Asian countries. They show how these interactions shape rural farmers' decisions to navigate for better livelihood resilience (Rigg, 2007; Barney, 2012; Manivong et al., 2014; Huynh and

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Nonneman, 2016; Porst and Sakdapolrak, 2018). While this line of inquiry reflects the implications of rural development for livelihoods across the Mekong region, the causal relationship between state-led land use dynamics and out-migration under the contested agricultural transformation in the VMD have not been adequately explored.

Migration can act as both a driver and be driven by other factors. While substantial empirical studies have focused on examining how out-migration affects agricultural production and land use practices in various rural contexts (Qin, 2010; Robson and Berkes, 2011; Chen et al., 2014; Gray and Bilsborrow, 2014; Huynh and Nonneman, 2016; Jokinen, 2018; Caulfield et al., 2019), this study investigates how out-migration is conversely triggered by the land use change and its proximate causes in the VMD. Using the mixed data (qualitative and quantitative) gathered from three flood-prone communities in the delta, this paper argues that the land use change triggered by rice-based agricultural production forms an underlying push factor to the surge of out-migration of the rural poor who have become marginalised in the post-dyke context (e.g., transformation of rural landscapes). The paper contributes to unravelling the mixed impacts of "hard measures" (e.g., dyke systems in support of flood protection and rice-based agricultural production) on livelihoods of rural people who depend on natural resources as a means of survival. It also advances the empirical understanding of how out-migration arises as a forced adaptation measure taken by the rural poor to respond to the rural change. This study suggests that policy considerations for future rural development should be based on the empirical understanding of the land use change and out-migration relations to secure farmers' equal access to employment. The study findings provide opportunities for further investigation in comparison with other case studies across the Mekong region and beyond, where state governments still play a dominant decision-making in agricultural development.

The rest of the paper proceeds as follows. Section 2 presents the research methods that guide the selection of study areas, data collection and analysis for the study. Section 3 presents the study findings and discussions, reflecting on the land use change and its implications for out-migration. In the last section, strategies to facilitate migrants' returns and policy considerations for enhancing rural livelihood economies are discussed.

2. Research methods

2.1. Selection of the case studies

The VMD is located in the lower part of the Mekong basin, and a home to 18 million people (20% of the country's total population). The region has the total area of about 3.9 million hectares (ha), of which 2.6 million ha is devoted to agricultural production (Cosslett and Cosslett, 2014). As one of the most productive areas in the country, the VMD plays an important role in the national economy. The region contributes 50% of rice production, 65% of aquacultural production and 70% of fruits in the country (GGGI (Global Green Growth Institute), 2014). Due to its geographical location, a large part of the VMD (about 1.2–1.9 million ha) is annually exposed to flooding (Le et al., 2007). High flood events frequently occur between late September and mid-October due to the combined impacts of high upstream flow rates, local rainfall, and tidal effects from the sea (Birkmann et al., 2012; Nguyen et al., 2012).

Three flood-prone communes located in the upper and central parts of the floodplains were selected for this study, which included Phu Thanh B, Phu Xuan and Thoi Hung (Fig. 1). It was because these areas make major contribution to the agriculture sector (rice production) in the delta (GSO, 2016). The overview of the study areas was provided in Table 1 and described in the following sections:

Phu Thanh B belongs to Tam Nong district, Dong Thap province. Located in the Plain of Reeds, this area is prone to high flood inundation in the flood season influenced by flow discharge from the Mekong River, heavy rainfalls and overflows from Cambodia. Low dykes are preferred in this commune to assist two rice crops per year. The deeply flooding environments allow local farmers to practise a variety of flood-based livelihood practices, including capturing wild fish and cultivation of giant fresh-water prawn.

Located in Phu Tan district, An Giang province, Phu Xuan is situated between the two main branches of the Mekong River: the Tien (Mekong) and Hau (Bassac) Rivers. The construction of the North Vam Nao flood control scheme safeguarded by an external high embankment of 100 km and internal dykes of 300 km for 23 compartments allows year-round agricultural production in the area (Tran and Tuan, 2019). Situated within the scheme, Phu Xuan commune is surrounded by high compartment dykes (5+ meters). These systems allow local land transports for inhabitants during the flood season. Sticky rice cultivation is commonly practised by local farmers due to its stable market price and suitability to local soil conditions.

Thoi Hung belongs to Co Do district, Can Tho city, which is located within the low depression of the Trans-Bassac Depression Zone of the floodplains. Since the administration of Song Hau State Farm, the building of a highly controlled embankment system in the commune has enabled local farmers to practise multiple forms of agricultural livelihoods, particularly integrated farming systems (e.g., rice-fish farming) during the flood season.

2.2. Data collection and analysis

This study employed the mixed methods approach that guides the collection of empirical data from focus group discussions (FGDs), semi-structured interviews and household surveys in the study areas (Table 2). Conducting FGDs involved the recruitment of three selected farmer groups (poor, medium, better-off) who are at varying ages with on-farm and off-farm employment. During the FGDs, farmers are facilitated to discuss key topics, including: (1) Change in rural landscapes, (2) Role/impacts of dykes on farming systems and rural livelihoods, (3) Comparative ecological environments between pre-dyke and post-dyke contexts, and (4) adaptation options to post-dyke environmental conditions. Several key PRA (participatory rural appraisal) tools that included timeline analysis, trend analysis and impact analysis (Narayanasamy, 2009) were adopted to explore participants' views on flood conditions, land use change (pre-dyke versus post-dyke contexts) and associated adaptation practices undertaken by farmer groups. Following King and Horrocks' (2010) approach, some six to ten participants were recruited in each FGD.

Thirty-four in-depth interviews using semi-structured questions were held with key informants representing academic and research institutions, government agencies across administrative levels (communal, district, provincial) in the study areas. Those who had profound knowledge of and experience in flood-dyke interactions and directly engaged in transformation of livelihood patterns were recruited for interviews. To address the key respondents, the purposive and snowball sampling approaches (Liamputtong, 2013) were adopted. The semi-structured questions designed for interviews include three key points: (1) local flood management policies, (2) changes in livelihood practices in the pre-dyke versus post-dyke conditions, and (3) local adaptation strategies. Each interview was conducted on a face-to-face basis and lasted for approximately one hour. The fieldwork undertaken in the study areas lasted from September 2013 to April 2014. An additional fieldwork that aimed to advance the empirical knowledge of the migration issues was conducted by the author in February 2019, providing essential information for the study.

The qualitative data analysis (FGDs and interviews) provide empirical insights that help inform the design of structured household surveys to be administered to selected households in the study areas. The procedures for undertaking sampling and recruitment of target households were described in detail in Tran et al. (2018b). In particular, the stratified sampling approach was employed to recruit participants (Neuman, 2011). The classification of household groups (poor,

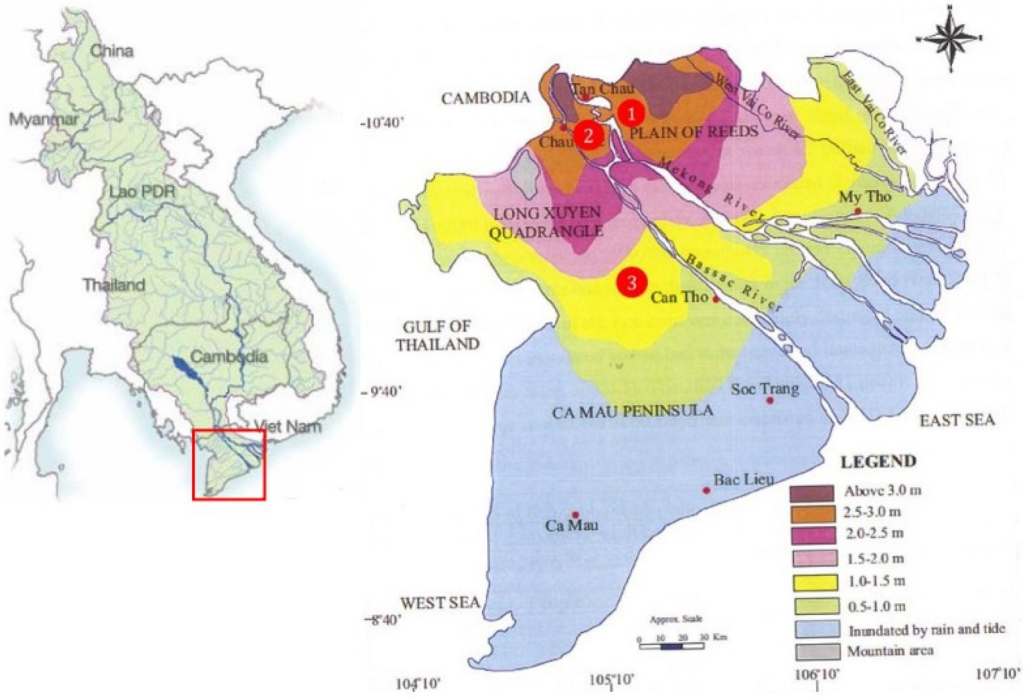


Fig. 1. Maps of the Lower Mekong Basin (left) and the Vietnamese Mekong floodplains (right) with three study areas: (1) Phu Thanh B, (2) Phu Xuan, and (3) Thoi Hung. Source: Adapted from Ghassemi and Brennan (2000).

medium, better-off) was assisted by the wealth ranking approach (Narayanasamy, 2009), using their socio-economic characteristics as the proxy. Those engaged in on-farm and off-farm work were categorised into these sub-populations (strata). Based on these strata, a random sample was drawn. This process resulted in recruiting 100 households in each commune, yielding the total number of 300 participants for the surveys.

The strategy of qualitative data analysis involved the use of NVivo software to support the thematic analysis of transcribed texts from FGDs and interviews (Bazeley and Jackson, 2013). Following Neuman's (2011) approach, three primary analysis steps were taken consecutively, including open coding, axial coding and selective coding. These processes achieved the building of a hierarchy of themes which are subsequently linked together to present patterns and relationships (Maxwell, 2005 cited in Kim et al., 2019). The quantitative analysis of the household surveys was undertaken, using the descriptive statistical methods (e.g., percentage) and assisted with Microsoft Excel (Microsoft Office 2013).

Together with the field data collection, extensive reviews of formal documentations and academic publications, including books, government policies, and scientific reports relevant to dyke development policies and adaptation practices in the VMD were undertaken before and during the implementation of the fieldwork. These sources provide essential contextual knowledge that assists the author in gaining theoretical insights into the topic under study and advancing in-depth exploration of the empirical data.

3. Results and discussion

3.1. Dyke assimilation for rice intensification and crop diversification in the VMD

The VMD has undergone the remarkable transformation of the rural landscapes as the result of land use change triggered by hydraulic

Table 1
Overview of three selected study areas in the VMD.
Source: Adapted from Tran and Rodela (2019).

Description	Selected study areas		
	Phu Thanh B commune (Tam Nong district, Dong Thap province)	Phu Xuan commune (Phu Tan district, An Giang province)	Thoi Hung commune (Co Do district, Can Tho city)
Total land area (ha)	5,161	1,837	6,925
Agriculture land area (ha)	4,636	1,629	5,200
Population (persons)	5,425	5,349	15,091
Number of households	1,337	1,396	3,432
Flood inundation depth and duration	> 1 m (4-5 months)	> 1 m (2-3 months)	< 1 m (1.5-2 months)
Geographical location	In the Plain of Reeds	In the Long Xuyen Quadrangle (the upper floodplain)	Bordering with the Long Xuyen Quadrangle in the south (the tide-affected floodplain)
Physical characteristics of the flood control schemes	Supported by low dyke systems	Supported by perimeter ring-dyke and compartment dyke systems (the North Vam Nao scheme)	Supported by high dyke systems (since the former administration by the Song Hau State Farm)
Main sources of household income in the flood season	Fishing, collecting aquatic resources, prawn farming	Growing sticky rice, field crops, collecting aquatic resources	Rice-fish culture, field crops and fruit orchards

Table 2
Summary of research methods.

Mixed methods approach	Participants	Approaches for data collection and analysis	Data gathered
Focus group discussions	Nine FGDs with three household groups (poor, medium, better-off) in three communes: Phu Thanh B, Phu Xuan, and Thoi Hung	Selection of participants based on the participatory approach (King and Horrocks, 2010; Neuman, 2011)	Change in rural landscapes
		Thematic analysis (Neuman, 2011) using NVivo qualitative analysis software (Bazeley and Jackson, 2013)	Role/impacts of dykes on farming systems and rural livelihoods Comparative ecological environments between pre-dyke and post-dyke contexts Adaptation options to post-dyke environmental conditions
Semi-structured interviews	Thirty-four interviews with government officials at provincial, district and communal levels, senior scientists, and farmers	Purposive sampling and snowball sampling (Liamputtong, 2013)	Local flood management policies
		Thematic analysis (Neuman, 2011) using NVivo qualitative analysis software (Bazeley and Jackson, 2013)	Changes in livelihood practices in the post-dyke conditions Local-level adaptation strategies
Household surveys	300 selected participants	Stratified sampling (de Vaus, 2002)	Rural households' perceptions of distribution of natural resources and employment opportunities in the post-dyke context
		Descriptive statistical analysis using Microsoft Excel (version 2013)	Rural households' adaptation decisions in the post-dyke context

infrastructure development (i.e., dykes). From 1995–2000, land use in the delta evolved towards intensive rice farming (Le et al., 2018). The political importance of national food security and rice export particularly has enabled significant state intervention in the rice sector (Smith, 2013; Christoplos et al., 2015). The outcomes of this policy have profound implications for rural livelihood and environmental systems. On the one hand, it involves the promotion of rice-based agricultural production and diversification of cash crops (non-rice crops) in dyked areas to deal with the volatility of commodity markets (Chu et al., 2014; Demont and Rutsaert, 2017). On the other hand, localised water management approaches underpinned by integrated flood control and irrigation schemes have led to increasing disconnection between flooding zones and between flooding zones (upstream) and salinity zones (downstream) (Tran et al., 2019). While hydrological interconnections among the ecological zones inherently exist (Nguyen et al., 2017), the combined impacts (with dykes as the most visible factor) have led to greater physical fragmentation (Dang et al., 2018; Le et al., 2018), inhibiting efforts for the sharing of water resources and collaborative water management in addressing emergent environmental contexts (Tran et al., 2019). These all together create a "bottleneck" that may hamper the achievement of rural sustainable livelihoods.

The decentralisation since the post-Renovation period (late 1980s) has disentangled institutional constraints in ways it enables local governments to proactively design and formulate their economic development strategies (Bach, 2003; Fritzen, 2006). This has direct effects on how the rural landscapes are shaped until today (Biggs, 2011). The emulation for rice-based agricultural production promoted by local governments has led to the evolution and the widespread assimilation of dyke systems across the floodplains. It is the state's simplistic ideology of the technocratic-based development imposed on the delta (Käkönen, 2008) that has drastically transformed the abundant natural "waterscapes" into the controlled dyke-laden "landscapes" (Scott, 1998), characterised by the construction of scores of dykes (low dykes, high dykes) in both deeply and lowly flooding areas.

Crop diversification represents itself as the important ground initiative that assist farmers in addressing the frequent fluctuation of rice commodity markets. Evidence suggests that this has enabled farmers to proactively diversify the cash crop systems on their farm plots to yield better income (Chu et al., 2014; Tran and James, 2017). In Thoi Hung commune for instance, high protected dykes provide more options for farmers to implement integrated farming systems (e.g., rice-fish farming). A wide range of innovative farming models has also been practised by farmers in other study areas, such as the cultivation of giant freshwater prawn (*Macrobrachium Rosenbergii*) in open flooding fields in Phu Thanh B or swamp eels (*Monopterus Albus*) in Phu Xuan during the flood season.

There are risks in agro-commodity markets facing farmers in the delta. It was assumed that intensive rice production and crop diversification allow local farmers (medium and better-off) to increase chance to gain greater benefits. However, while farmers attain a shorter turnaround of the rice crops, they face a significant risk of a decline in productivity and profitability (Chapman and Darby, 2016; Chapman et al., 2016). The recurring market phenomenon "*được mùa, mất giá*" (bumper crop, dropping price) has also plagued farmers in gaining desired commodity surplus (Smith, 2013).

While their counterparts are experiencing such hardships, this study reveals that both small landholding farmers who resort solely to their farmlands and landless counterparts are struggling with their everyday livelihoods. Driven by the proximate impacts of land use policy in the delta, the large proportion of rural population has out-migrated. The following sections will delineate how these processes have taken place on the ground.

3.2. Proximate causes for out-migration in the VMD

There exists the salient out-migration-oriented livelihood strategy among the rural poor in the VMD. While Dun (2011) claimed that flooding is the primary cause for out-migration of rural communities, this study presents an exemplary case for how the land use change (dyke development) has put a disproportionate pressure on resource-dependent households. It reflects the outcomes of rural landscape transformation (dyke building), leading to the change in livelihood patterns across the study areas (Tran and James, 2017). These findings correspond to Zhen et al.ös (2014) study on how land use shifts impact on farmers' livelihoods in Yanchang County in the Loess Plateau of China and eventually lead to out-migration. Reflecting on the relative implications of driving factors to out-migration in the Southeast Asian context, Rigg (2007: 163–164) pointed out:

> Migration may be propelled by poverty, and encouraged by wealth; it may reflect resource scarcities at the local level, or be an outcome of prosperity… Mobility is not accident; it occurs in and across social, economic and political spaces with particular reasons and with particular outcomes.

Fig. 2 presents several key factors that contribute directly to out-migration. As perceived by the majority of rural farmers, the building of

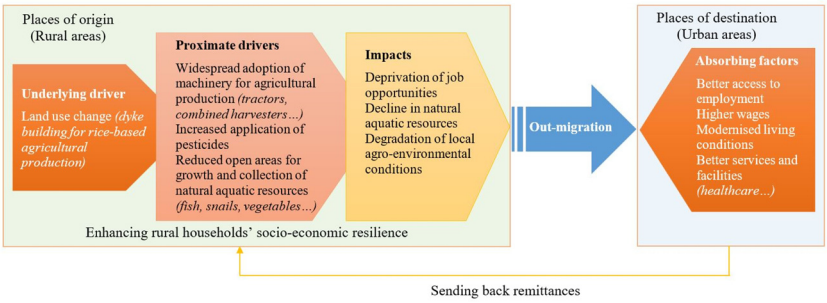


Fig. 2. Drivers of out-migration in the VMD.

dykes has driven: (1) widespread adoption of agricultural mechanisation, (2) increased application of agro-chemicals for rice production, and (3) reduction of open areas for the growth and collection of natural aquatic resources. The following sections will elaborate on how these proximate causes affect the rural poor's livelihoods, leveraging their decisions to out-migrate.

3.2.1. Widespread adoption of agricultural mechanisation

In the floodplains, dykes are built to enable the cultivation of double- or triple-rice crops. The exclusion of floods within the dyke systems enables the widespread adoption of machinery to replace labour-intensive work. FGDs with poor farmers in the study areas, for instance, indicated that farmers used to manually harvest rice (i.e., using sickles). However, this has been handled by combined harvesters due to their convenience, time-saving, and reduction of losses. The study confirms the prominent role of mechanisation promoted by the MARD (Decision No. 1898/QĐ-BNN-TT) in the agricultural sector (MARD, 2016), which serves as one of the key components to restructure the Vietnamese rice sector up to 2020 and vision towards 2030 (Tran and Vu, 2016; Demont and Rutsaert, 2017).

3.2.2. Increased application of agro-chemicals

Triggered by the land use change policy in the VMD, dyke development provides essential pathways for rice intensification and enable the large share of cultivated land areas. These together stimulate the increased application of agro-chemicals by farmers to secure their crops and maximise productivity. A case study undertaken in Thap Muoi district, Dong Thap province, for instance, suggests how dykes influence rice farmers' behaviour in using pesticides (Nguyen et al., 2016). In high-dyke areas, farmers tend to apply a greater amount of pesticides than others (low-dyke and zero-dyke areas). Similar findings were observed by Migheli (2017) that indicate the positive relationship between land ownership and use of pesticides in the VMD. More specifically, it explains that the intensive use of the land for agricultural production is closely linked to the massive use of agro-chemical products.

3.2.3. Reduction of open areas for collecting flood-based resources

Another critical constraint pressing poor farmer's livelihoods was the squeeze-up of open fields available for the collection of flood-based resources. Dyke construction is followed by enclosures of open areas for farming activities, leaving minimal areas for natural growth and free collection of aquatic resources (e.g., fish, aquatic vegetables…). Other fallows have been reclaimed by landowners, turning them into protected areas for growing fish. As expressed in an interview, a respondent from Phu Xuan commune admitted that he had to go far from his residence area to trap fish to feed his cultured swamp eels: "*Due to scarce fish in fields, I have to travel far away to capture trash feed for the eels. It is really a hard work.*" He agreed that this was not the case before the North Vam Nao flood control system was constructed. Similarly, a female involved in an FGD in Thoi Hung presented her difficulties in collecting natural resources when dykes in the commune were set up to exclude floods and enable crop production. She expressed in the following:

> Previously, I collected crabs and snails from August to October. Now, given dyke embankments, I cannot do that anymore. Farmers built low dykes around their land areas, making it as private properties. We are not allowed to get in. (A poor female participant in an FGD in Thoi Hung)

3.3. Socio-economic and environmental impacts

3.3.1. Precariousness of rural employment

Precariousness is not new to the delta's inhabitants. Precariousness, as Coclanis and Stewart (2011: 105) defined, is linked to uncertainty, instability, and insecurity characterised by the changing political economy of Vietnam (Renovation policy), changing environmental conditions, and engineering development (i.e., upstream hydropower development). In this study, precariousness is closely associated with the deprivation of rural employment triggered by agricultural mechanisation. Directed by the Decision No. 491/QĐ-TTg on the approval of the national criteria for New Rural Development (Prime Minister of Vietnam, 2009) and the Decision No. 68/2013/QĐ-TTg on reducing post-harvest losses in agricultural production (Prime Minister of Vietnam, 2013), agricultural mechanisation has accelerated at a high rate, especially in the VMD (MARD (Ministry of Agriculture and Rural Development), 2013; Tran, 2015; Takeshima et al., 2018). More specifically, in 2014 the number of tractors put into use in the delta, compared to 2006, has increased by 1.6 times and the number of harvesters by 25.6 times respectively (Tran, 2016). These processes have substantial effects on out-migration in the delta.

At the local level, study results suggested that the majority of poor farmers do not enjoy the stability of seasonal employment as before. As mentioned previously, dyke-protected fields stimulated farmers to introduce machinery (e.g., rice combined harvesters) for rice harvesting. This has deprived the poor of opportunities for rice harvesting, gleaning or shaking off straws for rice gathering (Tran and James, 2017). Some respondents mentioned that, given the widespread application of machinery in the fields, they have now been hired for short-termed work, including weeding, rice transplanting, or fixing rice bunds. These precarious jobs, as confirmed, do not help cover rural farmers' daily expenditure. As FGD participants in the communes articulated that:

> These [seasonal work] are mostly short-termed. Daily wages is not sufficient to cover our living costs that are continuously increasing day after day. Our folks have to leave and seek better jobs in cities. (An FGD with a poor group in Phu Thanh B)
>
> Before dykes were built, our working days (heightening rice bunds) were lasting longer. However, after the construction of the dykes, landowners drained water out of their fields at the same time, giving us few days [two or three days] to do the work. (An FGD with a poor group in Phu Xuan)

Similarly, a retired government official in Thoi Hung commune

shared the same concern:

> Jobs in the commune have become precarious. Now, mechanisation has been widely adopted for rice harvesting and others, leaving fewer jobs available for hired labourers. (Interview 3, Thoi Hung)

Analysis from the FGDs revealed that the replacement of machinery for agricultural production is not singled out as a sole driver of out-migration in places of origin (rural areas) but attributed to other external factors identified from places of destination (urban areas). For the most part, expected income differentials between rural areas *versus* urban areas are getting larger, which provides greater stimulation for the poor to migrate (Phan and Coxhead, 2010). Some thought that urban areas are more conducive to their well-being (Koubi et al., 2016). As observed by Huynh and Nonneman (2016), recent industrialisation zones in big cities have absorbed an increasing number of labour migrants from surrounding localities, especially from the VMD. According to Huynh and Le (2011), higher wages is perceived as "a magnet" that draws rural people to these areas.

3.3.2. Decline in natural aquatic resources

Most farmers involved in the FGDs agreed that high dyke systems are responsible for the decline in fish stocks and other aquatic resources (Fig. 3). The control of floodwaters in dyked fields has made flood-based resources (e.g., *sesbania sesban* flowers, waterlily …) dwindled away (Nguyen et al., 2018a). Most of respondents claimed that high dykes prevent fish from entering into flooding open fields, and strong flood flows caused by dyke embankments in the floodplains enable them to migrate downstream through main canals or rivers. As evidenced, the increased application of agro-chemicals for multiple-rice crops has critical impacts on fish stocks (Berg et al., 2017). Other contributing factors could also be observed, including the illegal use of electrical shocking devices causing the mass destruction of natural fish, and the adoption of rice farming models (e.g., "1 must do, 5 reductions") (Demont and Rutsaert, 2017). Concerning the latter, the minimal use of irrigation water for rice production within a limited time in-field required by the model (Truong et al., 2013) does not allow an adequate duration for the full growth of stocked fish.

3.3.3. Degradation of local agro-environmental conditions

Much evidence ascertained that increased input costs associated with agro-chemicals and fertilisers required for intensive rice production have degraded the delta's natural ecosystems (Sebesvari et al., 2012; Vo and Nguyen, 2012; Berg et al., 2017; Demont and Rutsaert, 2017; Tong, 2017). It was observed that in rice-cultivating areas, pesticide residues are present in surface water, soils and sediments (Dang and Gopalakrishnan, 2003; Pham et al., 2013). An interview with a swamp eel farmer in Phu Xuan commune indicated that water in canals inside dyke-surrounded compartments of the North Vam Nao scheme, if not frequently flushed out, will become quickly polluted due to the convergence of various contaminated sources (e.g., run-off of materials (pesticides, fertilisers) used in agriculture, household consumption…).

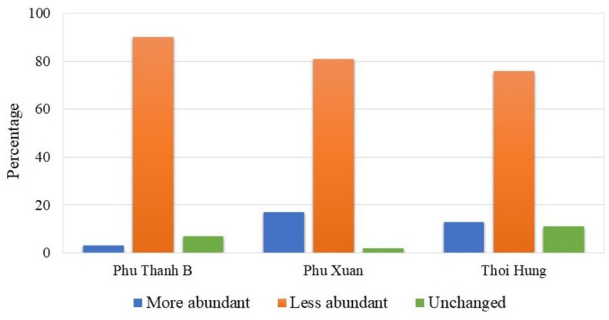


Fig. 3. Households' perceptions of change in natural aquatic resources in the post-dyke stage in the study areas.

Also, rising levels of nutrients in water could trigger the blooming of toxic algae, threatening fish population (Campbell, 2012). However, there remains loose evidence to confirm how these degradation effects contribute to the out-migration of rural inhabitants. Further research is, therefore, required to delve into this relationship.

The following section elaborates on the patterns of out-migration, and how it contributes to enhancing socio-economic resilience of rural households in the delta.

3.4. Out-migration patterns, networks and rural contribution

Migration is a widespread phenomenon in the VMD. It is not defined as the seasonal mobility of the rural people as before (e.g., migration during the flood season) (Dun, 2011) but may even prolong from year to year. Economic gains create a strong push to large-scale migration to places of destination. Sharing with the findings from household surveys, FGDs in the communes also revealed that the out-migration in the VMD is characterised by strong aspirations of the delta migrants to seek for better jobs and settle in modernised areas. The geographical proximity coupled with the blooming development of industrial zones in urban areas in the southeast of country (e.g., Ho Chi Minh city, Binh Duong) have become the most sought-after destinations that have attracted the massive flows of migrants from the VMD (Huynh and Le, 2011; Garschagen et al., 2012) (Fig. 4). These "promising lands" provide them with opportunities to earn better income compared with that in rural areas.

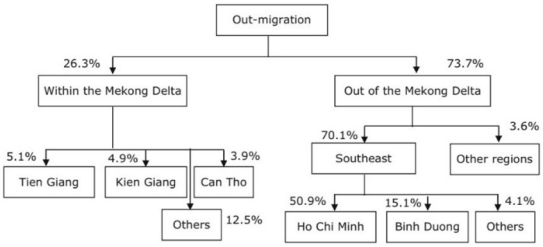
Qualitative analysis suggested that migrants establish informal bonding networks (neighbours, friends, relatives), from which they can count on. These networks include most members who shared everyday hardships (e.g., debt, joblessness…). The reliance of new migrants on old counterparts is proven essential when being far away from home. The bonding migrant networks provide them with trusts and mutual support as necessary. Using these networks allows migrants to share updated information and working experiences, to relieve working distresses at places of destination, to maintain communications, and to send remittances back homes (Greiner and Sakdapolrak, 2013). A retired government official in Thoi Hung commune reflected on how bonding networks provide support to his niece to secure an employment in Binh Duong province:

> In today's context of the VMD, there is no point just to work for one day and stay free for other days. The rural poor cannot survive that way. Following her friends' calls, my niece migrated to Binh Duong for work. She has accumulated some money and successfully redeemed her mortgaged land properties. (Interview 3, Thoi Hung)

An FGD member in Phu Xuan commune also indicated how the bonding networks provide him with a possibility to access jobs in cities. He mentioned:

> I have some relatives working as labour migrants in Ho Chi Minh city. I can call them so that they can help arrange a job there for me to do. (An FGD with a medium group in Phu Xuan)

Migration plays a vital role in enhancing social resilience in the communities of origin (Scheffran et al., 2012). Corroborating Porst and Sakdapolrak's (2018) findings, this study highlights the pivotal role migrants play in rural areas. Migrants contribute both to addressing the state of "job precariousness" in rural areas and to enhancing socio-economic resilience in the rural areas. In other words, they are the key agents of change who contribute remittances that form important resources to improve livelihood conditions of those living in the rural areas. This is consistent to study findings in the rural context of Ecuador, where migrants provide remittances back to rural communities (Gray and Bilsborrow, 2014). These translocal connections (i.e., remittances), as Porst and Sakdapolrak (2018) defined, foster motives for out-migration, which help sustain out-migration growth. In the VMD at present, there seems to be no alternative livelihood option more



(a)

(c)

(b)

(d)

Fig. 4. (a) Proportion of out-migration flows from the VMD, (b) out-migration trajectory (blue arrow) of labour migrants to cities (orange shade), (c) agricultural mechanisation in the VMD, and (d) a migrant's house in Phu Thanh B commune. Sources: Huynh and Le (2011); Nguyen et al. (2018b); Le (2015). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article).

conducive to the rural poor than out-migration that offers them greater opportunities to escape poverty and improve family well-being. While out-migration provides greater job opportunities for rural working-age population, it is equally important to realise that the absorption of a large number of migrants in urban areas presents critical challenges to the delta's agricultural development.

3.5. *In situ* impacts of out-migration

While rural migrants are increasingly engaged in urban labour markets, the out-migration results in the loss of significant rural workforce needed for farming in the delta (Huynh and Le, 2011). As observed, the acute shortage of farming labour in the delta has now sparked the soaring labour wages, especially in the agricultural sector. When asked, most farmers complained that they hardly find labourers now since those in the working-age group have left rural areas. From the policy perspective, this indicates the explicit imbalance in labour distribution between rural-urban areas, causing the instability for the socio-economic development, especially in the agricultural sector. In the case of Nepal, the absence of male agricultural labour hampers agricultural productivity and drive households to rely heavily on markets to meet their basic needs (Kim et al., 2019).

Out-migration has social impacts on rural lives. It is characterised by geographical distance and the dependence of rural left-behind people (mostly children and elderly) on remittances from migrants. Out-migration threatens the dissolution of traditional family structures and values and that of the broader rural societies that have long existed. Also, there lacks social cohesion among family members (between migrants and left-behind people) due to geographical distances (Singh, 2019; Xie et al., 2019). In the VMD, out-migration has induced the disappearance of "working mainstays" in households, turning rural communities into the hollowed-out places that are mostly occupied by children and the elderly.

3.6. *Bringing labour migrants back – strategies to turn push into pull factors*

Out-migration represents the complex relationships between rural-urban development. There are some assumptions revolving around this conundrum. While the agricultural mechanisation takes away manual labour in rural areas, it provides important propensities for liberating the majority of rural labour surplus, hence contributing to rural poverty reduction. There exists another belief that improving living conditions in rural areas will reduce pressure on rural-urban migration (Rhoda, 1983). In the case of the VMD, the present study indicates that there is a critical shortage of agricultural labour. Farmers hardly find labourers who can take over sundry work, although wages is much higher compared to previous years.

The Government's initiative of New Rural Development, while it attempts to transform agricultural and rural economies, does not bring about desirable impacts. Paradoxically, while greater investments in rural infrastructure (paved roads, facilities) have been implemented in recent years, flows of out-migration to cities remain unabated. Interviews with local farmers indicated the untold narratives underlying rural development policies in the VMD that "*the rural*

infrastructural development does not accommodate livelihood benefits for the poor, but the better-off, who afford to buy fancy cars and drive on these paved roads." Whatever the rural development rationale should be, this study proposes that rural people do need a stable job to meet their basic needs.

The promulgation of the Government's Resolution No. 120/NQ-CP on sustainable and climate-resilient development of the VMD (Government of Vietnam, 2017) aims to fill up these policy lacunae. It is hoped to make an important move forward to effectively tackle existing socio-political and environmental impacts of climate change and upstream hydropower development facing the delta. It also attempts to bring labour migrants back provided that new jobs would be secured. While rice-based commodity does not gain much competitive advantage in the international market, restructuring the agriculture sector as stipulated in the Resolution No. 120/NQ-CP is critically important. To this end, the restructuring of three crucial economic pillars: aquatic products – fruit trees – rice coupled with realistic investments in these sectors would add a meaningful contribution to "turning push into pull factors" in the delta. In this light, the study points to the efficacy of the state-led policy "*ly nông bất ly hương*" (leaving agriculture, remaining in rural areas) that has been implemented across rural areas in Vietnam (Tam Thoi, 2017). Taken together, these innovative policies would be productively implemented if the persistent puzzles between land use policy and out-migration are radically resolved.

4. Conclusions

This study provides an empirical foundation to confirm the causal link between the land use change and out-migration in the VMD. The land use change is perceived as an underlying factor that prompts the wide adoption of machinery in agricultural production, increased use of pesticides, and reduction of open areas for the natural growth and collection of aquatic resources across the study areas. The study articulates that the wide adoption of agricultural mechanisation promoted by the New Rural Development, while it has sought to modernise the agricultural production, comes at economic costs. It deprives poor farmers of traditional means of livelihoods that they depend on, turning them into the state of being impoverished and socially marginalised in rural areas. Among others, this driving factor is key to accelerate the process of out-migration. The poor are the most affected due to their lack of capacity and resources to earn a living. This study presents an accelerating out-migration by smallholding farmers who are also affected by increased costs in agricultural production, stagnated markets of agricultural commodity, and changing environmental conditions. The narratives on the land use change and out-migration nexus in the VMD could mirror the effects of development processes in other countries of the Mekong region and beyond, where state governments still play a dominant decision-making in agricultural development.

Drawing on the exploratory study on the land use change-migration nexus with reference to the operation of Government's Resolution No. 120 in the VMD, the present study contributes a nuanced understanding that the redistribution of rural workforce would align not only with the development of the agricultural sector alone, but also with that of associated processing and supporting industries, rural tourisms, and other service sectors. This underscores the needs to both create more employment opportunities for rural people and balance the socio-economic development between rural and urban areas. Effective implementation of these adaptive policies would hold back contemporary out-migration and facilitate the prospective returns of labour migrants as reckoned by the state policy "leaving agriculture, remaining in rural areas."

This study does not involve the land use change and out-migration relationship in the broader socio-ecological contexts of the VMD but is limited to the flood-prone areas. Further studies therefore are needed to investigate this issue in the delta's coastal zones. Together with this study, empirical understanding of out-migration in the coastal areas, which are profoundly afflicted by combined effects of sea level rise, hydropower development in the Mekong region, and the state-directed policy "freshening salinity areas", is essential to evaluate the state intervention in land use in the delta.

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