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Forms and Factors Affecting Collective Adaptation to Saline Intrusion: A case of Kien Giang Province, Vietnam

Cam Thi Hong Nguyen^{a*}, *Van Huynh Thanh Pham*^b, *Rudi Febriamansyah*^c

^a Alumni of the Faculty of Agriculture and Natural Resources, An Giang University, VNU-HCM, 18 Ung Van Khiem, Long Xuyen City, An Giang, 90000, Vietnam

^b Faculty of Agriculture and Natural Resources, An Giang University, VNU-HCM, 18 Ung Van Khiem, Long Xuyen City, An Giang, 90000, Vietnam

^c Faculty of Agriculture, Universitas Andalas, Kampus Unand Limau Manis, Padang 25163, West Sumatera, Indonesia

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Correspondence:

*nthcamkg@gmail.com

ABSTRACT

Saline intrusion (SI) is causing serious risks for agriculture and coastal life in the Vietnamese Mekong Delta. Maintaining agricultural production under that challenging condition places more tremendous pressure on rural societies. This study aimed to get insight into adaptive adaptation's forms and factors influencing farmers' participation process by applying the social and ecological approach. The research was conducted in An Bien district, Kien Giang province, a province in the Mekong Delta in Vietnam. A mixed-method integrating quantitative and qualitative methods were used to collect data using key informant panel interviews, group discussion, and household survey. The results showed that local farmers had changed the farming system from double rice crops to shrimp-rice models to deal with the impacts of SI. Group response has emerged as the appropriate adaptation in both formal and informal forms. The adaptive group plays an essential role in connecting community members, and two forms of adaptation have worked closely to adapt to SI. Factors affecting the informal group related to relatives, households living close to each other; For the formal group, the main factor affecting participation is when joining the group, the members receive benefits from the group. Besides, prestige and having a lot of experience in the leader's production activities affect the official group participation. In addition to the positive factors, two negative factors affect group adaptation: unfavorable farm location and distrust.

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INTRODUCTION

The Vietnamese Mekong Delta (VMD) is located at the Mekong River's end. It borders with Cambodia in the North, the Pacific Ocean in the East, the Gulf of

Thailand in the West, and Ho Chi Minh City in the North East. The Mekong Delta is a flat and lowland, with an average elevation from one to two meters above sea level, deposited by alluvial deposits from the upstream. The VMD covers nearly four million ha

(39,734 km²), including over 2.4 million hectares of agricultural land and about 700 thousand Ha of aquaculture land. This land is the residence and production of more than 18 million people. It is considered the largest granary of the country, providing 55% of rice production (contributing to 90% of Vietnam's exported rice. gender), over 60% of fisheries, and more than 70% of the fruit for the country (MARD (Ministry of Agriculture and Rural Development), 2017); (MONRE (Ministry of Environment and Natural Resource), 2017). However, due to the impact of climate change, especially rising sea levels, the increased saline in delta land and rivers causes productivity of agricultural production, fruit trees, and aquaculture has decreased, affecting the lives of farmers (Tri, 2016).

The Delta is recognized by diverse hydrological characteristics varying greatly between different parts of the Delta. The upper part is characterized by flooding; the lower part is dominated by close interaction with the sea. Kien Giang is a coastal province located in the southwest of the Mekong Delta, with a natural area of 6346.3 km². Kien Giang has more than 100 large and small islands at sea, including 573 km² of Phu Quoc Island. The west tidal regime of Kien Giang (diurnal tide) greatly influences the ability to drain water in the rainy season. It is heavily affected by saline water, especially in the last months of the dry season, causing obstacles to production and life (Ministry of Planning and Investment, 2016).

SI in Kien Giang province in recent years has become more severe and increasingly affecting the socio-economic development process, especially in the coastal areas of the province (An Bien district, An Minh district, Hon Dat district) (Guong, 2016)

People have to seek ways to overcome the current difficulties and play in groups to be an appropriate response. According to the Department of Agriculture and Rural Development of An Bien District (2015), there are 13 agricultural cooperatives with 999 members (1,359 ha of production area). The agricultural sector has 1,719 members participating in the production area of 2,175 ha. The selection to join the group seems to have been part of the solution for the people to adapt to SI, support each other in production, and partly overcome difficulties to stabilize their lives. Therefore, this study was conducted to understand the group

adaptive pathway and analyze factors affecting the group participation process in SI in An Bien district, Kien Giang province, Vietnam.

RESEARCH METHODS

Research site

The process of SI in the VMD is very complicated. With flat and low topography, with a long coastline, numerous canals, and density drainage systems allowing saltwater intrudes into the Delta (Le et al., 2007; Estellès et al., 2012). Kien Giang province, located in the southwest of VMD, has been affected by SI. Administered by Kien Giang, An Bien was chosen to be the research site. The district was exposed to salinity and predicted to be more serious in the future (MONRE, 2016). An Bien district in Kien Giang is a coastal area directly affected by SI in the dry season to daily life (lack of freshwater for daily use) and agricultural production. In the district, two communes were selected following transect from the sea to inland to see impacts of SI. They include Nam Yen commune (near the sea) and Dong Thai commune (far from the sea) in An Bien district (Figure 1).

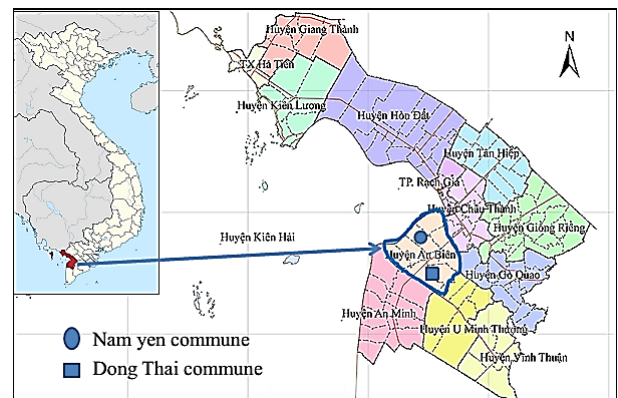


Figure 1. Map of Kien Giang province and research size in An Bien district.

(Source: <https://khongsolac.com/ban-do-du-lich-va-hanh-chinh-tinh-kien-giang.html>)

Data collection methods

The mixed-method integrating both qualitative and quantitative data using both qualitative and quantitative data collection techniques was applied in this research (Miller et al., 2010; Afrizal, 2014). For secondary data, this study collected relevant secondary data from books,

newspapers, scientific studies, policies related to SI, and statistical yearbooks.

Five meetings with key people at the district and commune level were done to understand the SI status and how local farmers have reacted to SI. Two focus group discussions have been conducted to collect information related to the group adaptation to SI, formation process, the farmer's advantages and disadvantages when joining the adaptation group. It also sought out the people's wishes and explored the local authorities' support in case of facing SI.

Seventy questionnaires were conducted to survey those coastal farmers who have been living in these areas for more than ten years. The questionnaire searched for knowledge of farmers, ways of collective responses, and the factors affecting farmers' action to adapt to SI. This interview questionnaire was designed in 3 parts: farm information and their experience of SI, impacts, and adaptation to SI, and collective adaptation influences. The questionnaire was tested and revised before used widely.

Methods of data processing

The KIP and group interview results were recorded, transcribed, and then categorized into the group of issues of forms and factors affecting the group's adaptation. Quantitative data was coded and analyzed using descriptive analysis to indicate the SI, forms, and factors affecting the coastal farmers' group adaptation response.

RESULTS AND DISCUSSION

Impact and adaptation to saline intrusion

The result showed that farmers in the study site had experienced SI differently due to settling places averagely for 10.25 years. Farmers in the Dong Thai commune (far from the sea) got affected by SI for about 9.31 years, and farmers in the Nam Yen commune (near the sea) experienced a similar impact for a longer time (11.32 years). The number of years affected by SI can be explained by distance from the sea, so farmers in Nam Yen commune were more aware of SI than those living in Dong Thai commune. Le Dang (2014) has found that farmers who have experienced some climate change phenomena in their lifetime perceive higher risks (Le Dang et al., 2014). This explains why

knowledge about SI of farmers living in Nam Yen commune has been longer than those living in Dong Thai commune.

The impacts of SI on the farmers' livelihoods in the study area are various, causing difficulties for agricultural production and daily activities, especially in the dry season. SI becomes more and more complicated. The research results are presented in Table 1, showing the impact of SI on households' livelihoods in the study site.

Table 1: Saline intrusion affects the livelihoods of households

Affect	Dong Thai (%)	Nam Yen (%)	Average (%)
Lack of fresh water for agricultural production	32,97	39,66	35,57
Lack of fresh water for living	38,46	15,51	29,53
Water is too salty to raise shrimp	15,38	36,21	23,49
Increase household spending (purchasing fresh water)	12,09	8,62	10,74
Social conflict (between 2 rice crops and rice-shrimp farming households)	1,10	0	0,67



Figure 2. Rice death due to saltwater in An Bien district, Kien Giang province, 2018

Adaptive actions are various. Table 2 shows that 66.36% of people choose to change from double rice crops to shrimp- rice model. Changing rice varieties with salinity tolerance accounted for 15.45%. Technical change accounted for 14.55%. Besides, fallow land accounted for 3.64%.

Table 2: Adaptive action to saline intrusion

Adaptive way	Dong Thai Commune (%)	Nam Yen Commune (%)	Average (%)
Double rice crops to shrimp- rice model	67,24	65,38	66,36
Applying rice varieties with salt tolerance	12,07	19,23	15,45
Technical change	17,24	11,54	14,55
Fallow lands	3,45	3,85	3,64

In adapting to SI, changing the farming model from double rice crops to shrimp-rice model has been considered as a smart decision dealing with a change of water resource. However, there are many difficulties in applying this process (Information Box 1).

Box 1: Difficulties of shifting to a rice-shrimp model

Difficulties in changing from double-crop rice to shrimp-rice are because people, in some areas, do not agree to switch according to the plan use policy, a sharp conflict between shrimp farmers and rice farmers, most of them are afraid of them to fear about the economic efficiency brought. The reason people do not convert is mainly due to the difficulty in terms of water quantity. Second, the area is small and fragmented. Third, several households cannot afford to change the rice production to shrimp production because the cost of dredging canals and soil reclamation is very high (about 50 million). And, fourth, in the long run, will it ensure a sustainable environment, fewer epidemics, and stable income?

Source: Interview with KIP, 2018

Forms of forming the adaptive response

The shifting of the farming model to adapt to the SI has faced many difficulties. To overcome the present challenges, farmers participated in many groups, both formal and informal. Two forms of group exist due to the political system in Vietnam, including a formal and informal group which is used in this study regarding the two definitions below:

Formal group: the organization which has been formed based on governmental instruction. The roles of members are clear because they follow governmental instructions.

Informal group: is a group of people who have been working together to achieve specific benefits without any linkage to the state¹

The two groups appear after being affected by the SI as the case site, including one official group (Bao Tram cooperative) and one informal group (Ut Nho waterway group). In fact, collective adaptation has been formed in the West of the Delta to solve the problems created from the shifting process.

Ut Nho waterway group

Since 2006, the Ut Nho water group was formed in Yen Quy hamlet, Nam Yen commune, An Bien district because of the changes in water demand. This is an area of 23 ha consisting of eleven farms (eight members are kindred, and three are outsiders). The local canal was large enough to provide water for the rice fields. After changing farming systems from double-rice to the shrimp-rice practice (which needs more water), the canal needed to be modified to meet water demand. To solve the problem, all members had agreed to offer money and land to modify the canal system, which was 1-meter wide at the double-rice time, and now it is more than 3- meters wide and 500-meter in length. The gate which could control the water in and out of the fields was also repaired. Mr. UN was selected to be the group leader in managing the system, so he takes responsibility to make the decision when the gate should

¹ It is different from association form groups' members (not stamped by the state). as association can get little support from the Government and it can be formed base on the Governmental request.

be opened to get saltwater in the dry season or closed to prevent saltwater in the rainy season. Because of their cooperation, this group has remained for almost 14 years. The diagram of the Ut Nho water group is in figure 3.

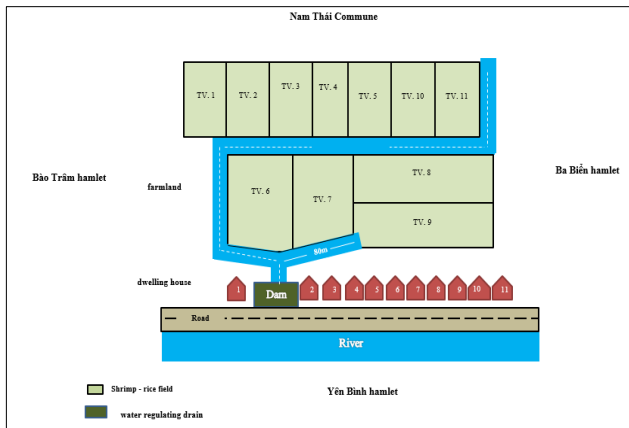


Figure 3. Waterway diagram of Ut Nho group

Bao Tram shrimp- rice cooperative

The cooperative was established in 2005, including 46 farmers who were cultivating double- rice with the aim to improve water service by reducing the cost of water pump service. Recently, the members have been significantly increased up 146 farmers, including both double- rice farms and shrimp- rice farmers.

In 2015, water had been turned salty in Yen Quy hamlet, where the rice fields were no longer be used for growing rice. Because of the difficulty, the cooperative's members had sent a letter to the Nam Yen commune headquarters to ask for changing the system from rice monoculture to the rotation shrimp-rice system. The Nam Yen Commune People Committee had considered and allowed the hamlet to shift to the shrimp- rice system that is acting as a sub-group in the Bao Tram cooperative, including 38 members for an area of 82 hectares. Currently, its aims are not only to reduce the cost of water supply, but also to establish a list of activities such as technical sharing, water management, buy inputs, and sell products which could be performed collectively by the group members.

Factors affecting collective adaptation

Formal group

The positive factors that affect a formal group's participation are primarily the rational policy and the leader's role. Group policies (reduction of production costs, support of disease outbreaks, etc.) will attract

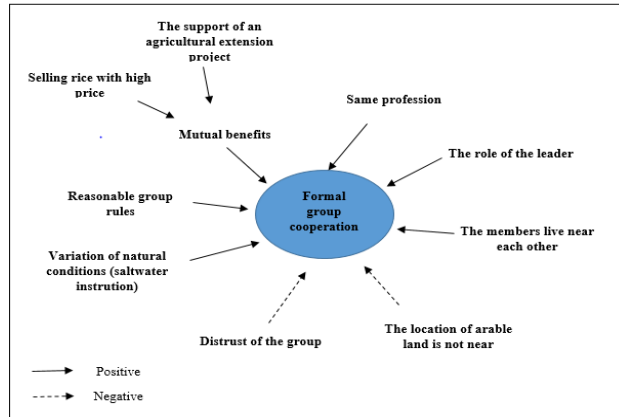


Figure 4. Diagram of factors affecting informal group adaptation

participants if these policies benefit them. As a formal group, more support and incentive policies are offered for group activities than informal groups. Besides, the team leader also plays an important role in forming and developing the group, and the leader needs to have prestige and a good working style to be trusted and respected by the members of the group. Factors such as natural conditions, reasonable regulation, and the same career also influence joining the group.

In addition to the positive factors, two negative factors affect group participation, unfavorable farm location, and distrust. These factors constrain the adaptive group members' participation. A diagram of factors affecting informal group adaptation is in figure 4.

During the group's activities, the group members became closer and more united due to frequent meetings, seminars, technical training on shrimp farming. Besides, cooperative members and management often share their experiences with each other and help remove difficulties encountered in farming or life. According to Boi (2010), the important factor determinant group's long-term operation is that members must interact, contact, and communicate with each other regularly. Contact and interaction will influence each other among members, and this impact will motivate group development (Boi, 2010).

Informal group

According to the study of Lan (2014), factors affecting group participation, group members with close proximity to each other, are important in promoting the join group, acting as a strong social binding basis. It is entirely consistent with the research results on factors affecting group adaptation in the study area.

The factors that affect informal group participation are the close relationship between the members, siblings, houses, and land. Because they are members of the same lineage, their bonds are closer, and group activities take place easily and conveniently. The members are groups of people living in the same community, houses and land near each other, the communication and meeting more often so joining the group, the exchange and cooperation will be more convenient. At the same time, factors such as nature, the same career, reasonable regulations² also affect group participation. However, the unfavorable farm location is a negative factor that constrains participation in the group.

CONCLUSIONS

SI has affected people's livelihoods and social life in the Mekong Delta of Vietnam, especially the coastal areas. The impacts mainly cause the shortage of fresh water in agricultural production and the lack of fresh water in daily life. To adapt to SI, people have chosen many different adaptation pathways. The method of changing the farming model from double rice crops to the shrimp-rice model is the most typical. The conversion of farming models also brought many difficulties for people due to not grasping farming techniques, high initial investment costs, and higher water demand. To solve the difficulties, the people have joined together in formal and informal groups to facilitate and help each other in agricultural production to adapt to SI.

Groups, in general, have a primary role of helping and supporting each other among team members in adapting to SI. For the formal group (Bao Tram Co-operative), the role is clearly shown in reducing production costs, technical assistance on rice shrimp farming, and helping

² The regulations are created by the discussion and agreement of the group members. With these rules, group members very satisfied and agree to group activities according to these regulations

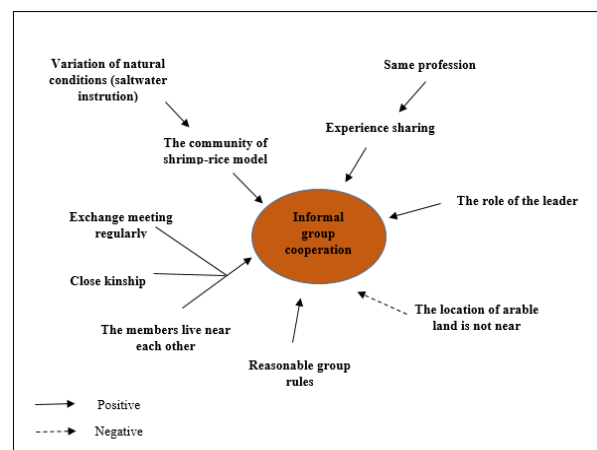


Figure 5. Diagram of factors affecting informal group adaptation

each other. For the informal group, the group's main role is to help the members have waterways to facilitate shrimp-rice models. A group is also a place where members share production experiences and difficulties in living together.

There is a difference in participation between formal and informal groups: in the formal group, the majority of members participate for the benefits that the group brings, and the role of the leader is also an essential factor in participating activities; For the informal group, the relative and close relationship of members is a necessary factor in forming the group, but the formal group does not affect much.

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