Inclusive Green Growth: The Sustainable Livelihood of the Mekong Delta in Vietnam

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Abstract

This study analyzes farmer ability and willingness to adapt to more sustainable farming models in the Mekong River Delta, specifically the Dong Thap and An Giang provinces, in Vietnam, with the goal of finding behavioral patterns based on socioeconomic characteristics. These behavioral patterns will then make it possible to predict the responses of certain types of farmers throughout larger areas outside of the ones studied. Descriptive statistics and logistic regressions are conducted in order to uncover these patterns. It is concluded that the most significant socioeconomic factors in predicting farmer ability and willingness to adapt to more sustainable farming models is economic well being and living standards. This finding will hopefully contribute to the inclusive green growth discussion by aiding in the development of predictive models of farmer behavior and adaptation.

Keywords: Mekong River Delta, sustainability, inclusive green growth, and predictive models

List of Abbreviations:

IGG	Inclusive Green Growth
MD-ICRSL	Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project
IUCN	International Union for the Conservation of Nature
WACC	Center of Water Management and Climate Change
NWO	Netherlands Organization for Scientific Research
WU	Women's Union
FU	Farmer's Union

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1. Introduction

The idea of inclusive green growth (IGG) models has presumably not been around for more than a decade; the term itself was coined by the World Bank in a report published in 2012 (Berkhout, Bouma, Terzidis, & Voors, 2018). The term can be broadly defined as "the economics of sustainable development," (Berkhout et al., 2018, p 51). In this context, 'inclusive' can be understood to mean that it aims at economic growth without increasing inequality between the richest and the poorest, and 'green' can be understood to mean that it aims at taking into account the environmental needs of future generations (Berkhout et al., 2018). IGG models have increasingly become topics of research, both at a local and international level due to the increasing pressures economic growth has put on the environment. The World Bank (2012) report argues that although throughout the last thirty years of economic growth, more than 600 million people have been lifted out of poverty, this has come at the serious cost of more than 250 years of environmental damage. The irresponsible management of the environment is of global concern since deteriorating environmental conditions have now reached a scale where economic and social growth are both threatened (World Bank, 2012). According to the World Bank (2012), more than one billion people are still living in poverty. This makes it clear that further growth is needed. However, this growth should be done sustainably, responsibly, and inclusively so as to not perpetuate past errors.

Yet, not everyone agrees with the idea that even more growth is needed. Some literature, instead, advocates for the increasing need for the redistribution of wealth (Victor, 2008; World Bank, 2012). Layard (2005) and Easterlin (1995) point out that a country average income above

$10,000 to $15,000 per capita does not equate to greater happiness; these claims are known as the 'happiness literature,' and strongly advocate for the redistribution of wealth instead of economic growth in light of its findings. Although this might hold some significance in developed countries where average per capita income is above $36,000 a year, it does not hold any merit in developing countries where the average per capita income is still around $3,500 (World Bank, 2012). In order to alleviate poverty and spur social development, developing countries must still undergo considerable economic growth (World Bank, 2012). With that said, it is a known fact that the beginning of economic growth is almost always synonymous with increased environmental pressures and damage (Herrmann, 2014; World Bank, 2012). It is the beginning of the economic growth, presumably the stage where many developing countries currently still are, that posses the most threat to the environment as the environmental Kuznets curve has shown that the turning point where economic growth decreases environmental degradation, instead of increasing it, does not come until after considerable growth. It has now become clear that these environmental pressures and damages have reached such a scale where business as usual is not an option, we must adapt more IGG alternatives or risk our livelihoods as well as those of future generations (Fay, Hallegatte, Bangalore, Kane, Rozenberg, Adrien, Narloch, 2015; Herrmann, 2014; The World Bank, 2012; Walker, Haasnoot, & Kwakkel, 2013).

Business as usual is no longer an option due to two factors: the unproportional effect environmental damage has on already poor or disadvantaged populations, and the unsustainability of further environmental mismanagement. The Mekong River Delta is an iconic example of unsustainable economic growth practices that have had severe negative consequences for the natural environment. The Delta, known for its agricultural productivity and producing

more than half of Vietnam's total rice production, has seen tremendous economic growth in the last three decades (IUCN, 2016). The International Union for the Conservation of Nature (2016), reports that the Delta produces five times more rice than it did just thirty years ago. This increase in production was partly brought about by the government implementation of high dyke rings that either delay or prevent the Delta from flooding; the delay or complete prevention of flooding allows for more rounds of rice to be cropped (Tong, 2017). Although unequal, this intensification of agriculture has given way to growth in the Delta as well as environmental decay. In the IUCN 2016 report, an array of negative environmental factors currently affecting the Delta are explained, these range from soil salinization to worsening floods. These unsustainable agricultural practices coupled with climate change threaten the livelihood of areas such as the Mekong River Delta. The Vietnamese government has taken notice of its responsibility to promote, elaborate and safeguard IGG models in the Delta given the need for more economic growth as well as climate change resilience plans.

This study is a statistical analysis of close-ended household questionnaires distributed in the Mekong River Delta in the Dong Thap and An Giang provinces. The aim of the questionnaires was to identify the ability and willingness of the farmers in the Delta to adopt government-recommended alternative farming practices, intended to be more sustainable and inclusive. This study will look for significant socioeconomic markers that would make it possible to anticipate whether or not a farmer would be willing to adopt the alternative farming practices. It is anticipated that high living standards and hence high incomes will be markers for high willingness and ability to transition to the alternative practices. This is due to the financial uncertainty and risk that transitioning to a new business or farming model poses. It is also

anticipated that a higher education level and worsening environmental risk perceptions will result in a higher willingness to transition. Although it has not been found that higher education levels directly correlate to more environmentally responsible behavior, a World Values Research reported finding that higher education levels do translate to a higher concern for the environment (Running, 2012). Worsening environmental risk perceptions could mean more willingness to transition as the current farming practices could be seen as unsustainable in the long-run. If these assumptions prove to be true, being able to extrapolate data from smaller provinces to greater parts of the Mekong Delta will contribute to the IGG discussion by aiding in the development of predictive models of farmer behavior and adaptation.

2. Research Context

This section will discuss the current state of the Delta as well as the relevant studies that have been recently conducted. This will be done by highlighting the recent developments in the Mekong Delta, such as the continuously large increase in food production, how it has come to be and how different independent actors have aided the farmers in this production increase. Alongside this, the growing evidence for unsustainability such as soil depletion, contamination, and growing inequality will be illustrated. The section will conclude by discussing the studies that have taken place in the Delta as well as the research gap they have left.

In both the Dong Thap and An Giang provinces, high dyke rings that prevent the natural flooding of the area or change flood patterns have been introduced by the government, as part of an effort to prevent severe flooding incidents and provide year-round irrigation to crops (Chapman, Darby, Hồng, Tompkins, & Van, 2016; International Union for Conservation of

Nature, & Vietnam Academy for Water Resources, 2016; The Center of Water Management, 2016). In the IUCN 2016 report, these dykes are portrayed as a a great benefit that has enormously enlarged suitable cropping land and irrigation capability. The report also notes that the dykes have made it possible for the Delta to increase its production from 4.75 million tons of rice in 1976 to 24.6 million million tons in 2012. This immense increase in productivity due to the dykes have made the Mekong Delta one of the most productive agricultural areas in the world, one of the top exporters of rice world wide, and has greatly aided in Vietnam's food security (IUCN, 2016). And while the economic and social benefits of the high ring dykes cannot be denied in the face of such enormous growth, the negative environmental effects cannot be either.

The Delta has fallen victim to unsustainable growth practices and is being simultaneously affected by climate change. Double and triple rice-cropping has become increasingly common, as the implementation of the dykes intended it to be; double and triple rice-cropping are terms used to describe the practice of planting rice twice or three times a year in the same plot of land. The popularity of these farming practices is economic in nature; triple rice-cropping is more productive, in the short-term, than double rice-cropping, which is in turn more productive than single rice-cropping, fishing, floating rice, shrimping, and upland crop farming; upland crops being crops that are planted in higher altitudes, during the off-season and are purely rainfed (Chapman et al., 2016; The Center of Water Management, 2016). However, Chapman et al. (2016) finds that just the change from double to triple rice-cropping calls for unsustainable fertiliser use as well as finding that the long-term economic losses of the change are valued at around 15 million USD, annually. According to Tong (2017), these economic

losses are due to the higher fertilizer use, which means more money spent, and lower yields per hectare. Every time an area is double or triple cropped, the yield of the field is lower and the demand for fertilizer higher. Tong (2017) concludes that farmers who double and triple crop their fields have a lower net income per crop than farmers who only plant their fields once per season. This is in accordance with the findings of Chapman et al. (2016).

The unsustainable fertilizer use caused by double and triple rice-cropping arises from the loss of sediment deposits; sediment deposits are lost due to the prevention or change of flooding caused by the dykes (Chapman et al., 2016; International Union for Conservation of Nature, & Vietnam Academy for Water Resources, 2016; The Center of Water Management, 2016). Even more worrisome, in 2016 the Center of Water Management and Climate Change (WACC) found that the prevention or change of flooding also prevents the soil from washing out pollutants, which causes the soil to become organically poisoned and hence poorly adequate to be used for farming or as a fishing ground. The continued loss of sediment deposits, increased fertilizer use, and increased soil toxicity is what is projected to lead to the loss of income in the long-run when triple and double cropping practices are uninterrupted (Chapman et al., 2016; WACC, 2016). The soil is not the only environmental factor that is negatively affected by the dykes, the IUCN (2012) has also reported that underground aquifers now have reduced recharge rates because seasonal flood plain area has been greatly reduced. The aquifers are important for access to safe drinking water year-round. To compound to the loss of flood area, mangroves, vital for aquaculture, fisheries, and storm and erosion protection have also been lost due to lack of water and the encroachment of shrimp farms (IUCN, 2015).

As these farming practices and impressive economic growth demonstrate, the Mekong Delta has tended towards an agribusiness industrialization, independent of the size of the farms, that has been enabled by the dykes financed by the government (Tong, 2017). However, it might soon become apparent that the agribusiness benefits cannot be reaped for long without serious socioeconomic stresses. The IUCN (2015) report claims that the rice yields of the Delta, which holds 17.5 million people, have began to steadily decrease as the land has become depleted of sediments. However, the national data of how much rice per hectare is produced in the Delta, published by the Vietnamese government does not support this claim (Vietnam Basic Statistics of Rice Yield). Still, the evidence of environmental degradation in the Delta is strong and economic consequences of unsustainable farming practices are to be expected if the degradation is allowed to continue. Not only will the Delta likely face these harsh consequences, but it will also soon face the bleak realities of climate change. According to the IUCN (2015), coastal populations are projected to see sea-level rises and an increase in tropical cyclone intensity and rice yields are expected to further decrease 6-12% due to floods that will result in high water salinity. This expectation of worsening floods brings into question Chapman et al. (2016) and Tong's (2017) call to disrupt the construction of higher dykes.

The grim projected conditions and widening income gap between the rich and the poor in the Delta have led its population to follow the global trend of outward migration towards the neighboring cities (World Bank, 2014; IUCN, 2015). In the face of deteriorating socio-economic conditions, the role of the active Women's Union (WU) and Farmer's Union (FU) and other social structures in the Delta has become increasingly important (IUCN, 2015). Although the WU is open to all women of all socioeconomic backgrounds, it is mainly the poorer women who

benefit from this organization. The WU offers access to various initiatives that support poverty reduction, micro-credits, income generation, job creation, and women's health. On the opposite spectrum, the FU attracts well-off, land-holding head of households who are able to apply the agricultural techniques taught through the workshops and classes offered by the Union. Poor farmers have little to nothing to gain from these classes as they lack the financial freedom to apply the learned knowledge. Apart from the unions, a large amount of farming cooperatives are active throughout the Delta. In Dong Thap alone, there are about 36 of them (IUCN, 2016). According to the International Union for the Conservation of Nature (2016), the most notable form of social structure aimed at supporting livelihoods are the various credit schemes offered throughout the Delta. The Social Policy Bank and Bank of Agriculture and Rural Development offer micro-credits either independently or through the WU. Credits for buying seeds and the such are available through these micro-credits. However, the IUCN (2016) reports that a high number of these farmers are already indebted, suggesting the need for other investment capital.

The potential benefits and contributions to IGG initiatives and goals that local unions and social structures, such as the ones previously described, are clear. The aid to the less advantaged farmers looks after the inclusivity of the programs, while the longevity and robustness of the structures look after the socio economic aspect. Still, Berkhout et al. (2018) finds that although strengthening local institutions helps in increasing satisfaction with the local government and improves the delivery and target of public services, there is no clear direction or goal for local structures. The organizations that make up the structures do not asses the final outcomes of their contributions, such as agricultural productivity or annual income and hence do not have a

coherent assessment of their impact. There is no way to know just how much or how little these local structures aid in the end goal of building inclusive green growing societies.

In order to develop and better understand how IGG models and initiatives can benefit the Mekong Delta, the Vietnamese Ministry of Agriculture and Rural Development, the International Union for the Conservation of Nature (IUCN), and the Center of Water Management and Climate Change (WACC) at the Vietnam National University have developed the Mekong Delta Integrated Climate Resilience and Sustainable Livelihoods Project (MD-ICRSL) in which various recommendations for a transition to more sustainable farming practices are given. The MD-ICRSL, otherwise known as the Mekong Delta Plan, was drafted between 2011 and 2013 in cooperation with the Dutch Delta Commission. The plan was presented in December 2013 and focuses on actively adapting overtime to cope with uncertain changing conditions, such as climate change. Under the plan, research was conducted from 2014 to 2015. In this time frame, a careful literature review and analysis of available statistics on the area were reviewed; field-based focus groups and open-ended interviews were conducted; and close-ended household questionnaires were distributed in the area. From these research methods, recommendations on to which sustainable farming methods each area of the Mekong should transition were made. The Dong Thap province was recommended to change from double and triple rice cropping to rice-shrimp, rice-fish, and rice-lotus. These three alternative suggestions are forms of farming rice while simultaneously building trenches in the rice paddies to cultivate shrimp, fish, and lotus (WACC, 2016). The An Giang province was recommended to change from double and triple rice cropping to rice-shrimp, upland cropping and floating rice; floating rice refers to a type of rice that can grow and thrive in conditions with water more than 50 cm deep for at least a month

(WACC, 2016). The WACC (2016) report also measured the ability and willingness to transition of areas in the Dong Thap and An Giang provinces. For both the Dong Thap and An Giang provinces it was concluded that half of the respondents did not have a willingness to change due to 'inappropriate conditions'; the other half who did have a willingness to change were after an 'increase in income'. Their financial ability to change was measured as low and as the main reason why they could not change.

These findings are valuable as they provide a better understanding of why farmers do or do not adopt the recommended farming models. However, there is still a research gap to be explored. It is not yet known how certain behavioral patterns based on socioeconomic characteristics can be used to better predict the responses of certain types of farmers pertaining to policies, hazards, price changes etc. Uncovering and understanding these patterns would help to upscale the farmer behavior to other areas of the Mekong River Delta. The patterns should also be looked at alongside the social sustainability and inclusiveness concept of IGG models to better reflect how these patterns uphold or go against these concepts. Upscaling and better predicting farmer responses can prove a valuable tool to better implement the proposed alternative farming models. Apart from farmer behavior, it is also important to remember that these adaptation plans and transitions must be made under deep uncertainties about the future since weather conditions have become progressively unpredictable due to climate change (Dessai, Hulme, Lempert, & Pielke, 2009; Walker et al., 2013). Still, even if weather conditions cannot be predicted, actions in the face of certain triggers could be better evaluated and accounted for.

3. Methods

The data that will be used to analyze what socioeconomic characteristics can predict the willingness of farmers to adapt to more sustainable farming models consists of close-ended household questionnaires prepared and distributed by the WACC and the National University of Ho Chi Minh City in Vietnam (2016), as part of the Mekong Delta Plan. The questionnaires were made by adopting the MOTA method (Phi, Hermans, Douven, van Halsema, & Khan, 2015). The framework of this method was developed to measure the feasibility of a long or short term plan by finding the gaps between the expected outcome of a plan and the potential outcome of a plan resulting from the collective action of the stakeholders during the implementation process of the plan; a diagram of the method can be seen in *Figure 1* (WACC, 2016). Phi et al. (2015) explain how the MOTA method uses the correlation between trigger-ability-motivation to assess different potential outcomes. The interactions between the three components point to possible influences that need to be accounted for and adjusted in order to be able to narrow the gaps between expected outcomes and potential outcomes (Phi et al., 2015).

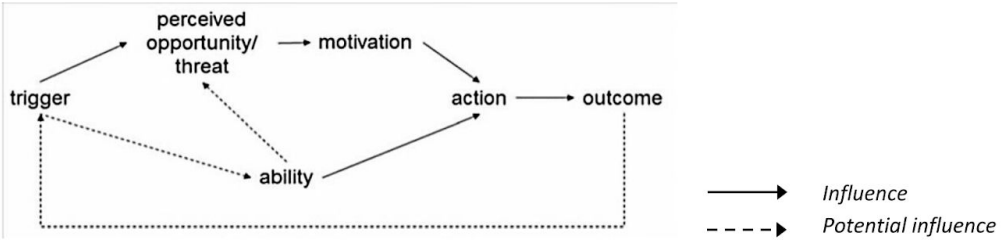

Figure 1: MOTA framework. Adapted from 'Final report: Mekong Delta Community Motivation And Adaptive Ability To Livelihood Change,' by The Center of Water Management and Climate Change, 2016, p.2

For this study, the expected outcome was determined to be the government-recommended alternative farming practices. The MOTA framework assessed potential alternative outcomes. The MOTA conducts this assessment in three steps: (1) defines sub-components of Perception, Motivation and Ability; (2) scoring and plotting are based on the analysis of motivation and ability; and (3) analyzes the correlation between Perception-Motivation and Perception-Ability (WACC, 2016). Information regarding the perception, motivation, and ability of stakeholders can be collected through social surveys, which is why the WACC has developed and distributed close-ended questionnaires in different provinces of the Delta, namely the Dong Thap and An Giang provinces are of interest for this paper. The survey questionnaire design can be found in Appendix 1. The conclusions drawn from these questionnaires were that about half of the households questioned do not have a willingness to transition, and their financial ability to do so is also low.

These close-ended household questionnaires distributed by the WACC were used to attempt and close the previously identified research gap. However, not all the questions included in the questionnaire were taken into account. Questions aimed at measuring the institutional and technical abilities of the farmers were omitted from this study as it had already been determined by the WACC that almost all farmers had sufficient institutional and technical abilities to transition. A hundred and fifty observations were collected from both the An Giang and Dong Thap regions. These observations represent 150 households, of which only the answers given by the head of the household were taken into account. The data from the questionnaires was edited so that the excel files would only reflect the answers to the questions that were deemed relevant

for this study. Once this was done, the table had a total of eighty-one variables, or eighty-one questions.

The first analyses that was conducted were conducted were descriptive statistics, this was performed in SPSS IBM. This helped give a more complete account of the overall socioeconomic conditions of the Dong Thap and An Giang provinces. Percentages were chosen as the most fitting statistical output as they are clear and familiar to most. For questions where the responses were given in scale measurements, since there were some outliers, both the mean and the mode were given.

The second analysis that was conducted was through binary logistic regressions also using SPSS IBM. Binary logistic regressions were used since their ability to predict a case based on independent variables. Multinomial regressions were not carried out since the sample size is relatively small and this would have made it more challenging to uncover significant relationships in the data. The dependent variable in the analysis is the willingness of each farmer to transition to the recommended farming mode. This was measured on a likert scale with the possible responses ranging from one to four, stating “No interest,” “Interest,” “Want to change,” and “Will change.” The question also asked for a reason for the given answer, but these answers could not be coded. Since dichotomous dependent variables are needed to perform logistic regressions, the willingness scale was recoded to fit this requirement. Since only the option “No interest” was a clear denial of interest in the suggested transition farming model, this was recoded into 0, which stood for ‘No interest’. All three of the other options were recoded into 1, which stood for ‘willing to transition’. This made the variable a dichotomous dependent variable and suitable to be used in a logistic regression. Five different logistic regression models were

made and analyzed but only one was used for discussion purposes. As it was expected that the variables that would best explain the willingness to transition to new farming models were variables that measured financial ability, five out of the seven variables that make up the models are a measure of this. Education level and perception of annual flooding were also included to tests whether higher education levels resulted in higher willingness to transition and if a perception of worsening annual flooding also resulted in a higher willingness.

4. Results

The descriptive statistics pained a very clear socioeconomic picture. Tables 2-4 in the appendix show all of the descriptive statistics. Only the results that stand out will be discussed in this section. As expected, almost all the respondents were farmers, with only three of them reporting different occupations as their main profession; and all of them own their own land. The first striking outcome was that the education level is very low throughout both provinces. Exactly half of all respondents did not continue their education past primary school. This means that only half of the respondents attended school past age eleven, as primary school in Vietnam ends at eleven years old. However, the respondents do not think that the government's main priority of investment should be education. Instead, a little over half of them think that the main priority should be roads. Another striking outcome were the relatively high living conditions that these farmers enjoy. The majority of the farmers reported having 'medium' conditions, while only 10% of them reported being poor. It should be mentioned that living standards were self-reported and subject to the respondents assumptions. The tables also demonstrate that a majority of the respondents have a debt which accrues interest and that almost all debts have

been amassed in order to cover agricultural expenses. When asked about their income for the past two years, 42% of them reported decreasing income levels.

The farming practices of the respondents were also examined and it was found that the vast majority of them double crop their rice fields, as was to be expected. When the yields of each round of rice are compared, the tables show that each yield is lower than the last. Overall, the farmers report better farming techniques, quality of seeds, farming material, and farming equipment and mechanisms in the last two to five years. The tables also demonstrate that the farmers expect their current farming practices to continue being sustainable in the long-term. Still, over half of them agree that adopting the government-recommended alternative farming practices will likely increase the sustainability of their livelihood.

In stark contrast to their optimistic responses pertaining to farming practices and farming techniques, the respondents gave very negative perceptions for their environmental risk. Almost all of them reported worsening tropical storms, more severe droughts, increasing temperatures, more common pests and crop diseases, decreased fertility, and more severe floods. Despite these worsening environmental risks, most respondents reported having no willingness to transition to the suggested alternative farming methods. When asked why their willingness to transition was low, the respondents most often cited lack of agricultural technique and inappropriate conditions; the inappropriate conditions were stated to be too small land areas, underdeveloped irrigation systems, land too far from the main road, or insufficient income to borrow more money from the bank (WACC, 2016). As expected from the WACC (2016) report, more than half said that they had very low to no financial ability to afford the transition.

	Model 1	Model 2	Model 3	Model 4	Model 5
Education level	X	X	X	X	X
Annual flood	X	X	X	X	X
Credit	X	X	X	X	X
Afford transition	X	X	X	X	X
Farming profit	X				
Living conditions				X	X
Household assets		X	X	X	

Table 1: Shows which variables were included in each logistic regression model that was constructed.

Five different models of logistic regressions were constructed. In the end, only model 5 was used due to its comparatively high R^2 and significance levels of the variables included. The full statistical results for each model can be found in the appendix in tables 5-9. Model 5 had an R^2 of 0.234 along with reasonably low p-values for annual flooding, credit debt, affordance of transition, and living conditions. Education level and farming profit were insignificant. The correlation table of all the variables can be found in the appendix in table 1. Living conditions and household assets had a high correlation, and hence the final model used only included one of them. Although household assets were measured in a more objective way, by counting the physical assets inside of the home of the respondent, living conditions had consistently lower p-values and increased the R^2 of the model more than assets did. Living conditions were

self-reported and are hence subject to the interpretation of the respondents. This, however, does not necessarily cause an issue since it is the willingness and ability of each respondent is also based on self-evaluated answers.

5. Discussion

This section will be divided into three sub-sections: descriptive statistics, logistic regressions, and limitations. The descriptive statistics section will highlight findings that fall in line as well as contradict the already published reports and papers pertaining to the Mekong Delta; it will also attempt to explain why these findings came to be. The logistic regressions section will explain in detail what model five of the logistic regressions found and how this is relevant to the area. Finally, the limitations section will discuss the shortcomings of this study.

5.1 Descriptive Statistics

Most of the descriptive statistics of this population sample fall in line with previous findings for the whole of the Mekong Delta. It was already known that double and triple cropping was widespread and that the farmers had relatively low poverty levels. The Mekong Delta enjoys lower poverty levels and income inequality than the rest of Vietnam (IUCN, 2016). According to the IUCN report (2016), as of 2012 the Delta had a 10.1% poverty level while the national average was 11.1%; the gap between the highest and lowest incomes in the Delta is of 7.7 times while the national average is of 9.4 times. Still, in 2012 the Delta had a lower overall income than the national average; residents of the Delta earn about 1.8 million VND per month while is almost 2 million VND per month (IUCN, 2016). The descriptive statistics also found

that every additional round of rice yields less than the last, this agrees with other literature that points to double and triple cropping as unsustainable practices (IUCN, 2016; Chapman et al., 2016; Tong, 2017).

Still, some findings differ from the overall findings from previous studies in the Delta. The descriptive statistics show that the head of households who answered the household questionnaires, for the most part, do not intend on leaving their farms. Only 1.3% of them will stop farming and leave their land behind, the rest will either continue farming with their current farming models or they will transition to the government-recommended ones. This is contrary to worldwide patterns reported by the World Bank report (2012) and to the Delta wide patterns reported by the IUCN (2016), where large parts of the rural population were moving to urbanized areas. This does not mean that the observations reported by the World Bank and the IUCN are erroneous or that there is an anomaly in the sample size questioned in the Dong Thap and An Giang provinces. This disparity can likely be explained by the age of the heads of the households. With the average age being around 58 years of age and identifying as heads of household, a younger generation, namely their children or grandchildren, can be expected to be the ones migrating to the urbanized areas. With steady a steady population growth in the Delta of below 1% but with decreasing populations of an average of -6.7% in rural provinces, the outward migration to urbanized areas is clear (IUCN, 2016). This migration is, however, not being undertaken by the older generation, the heads of the households.

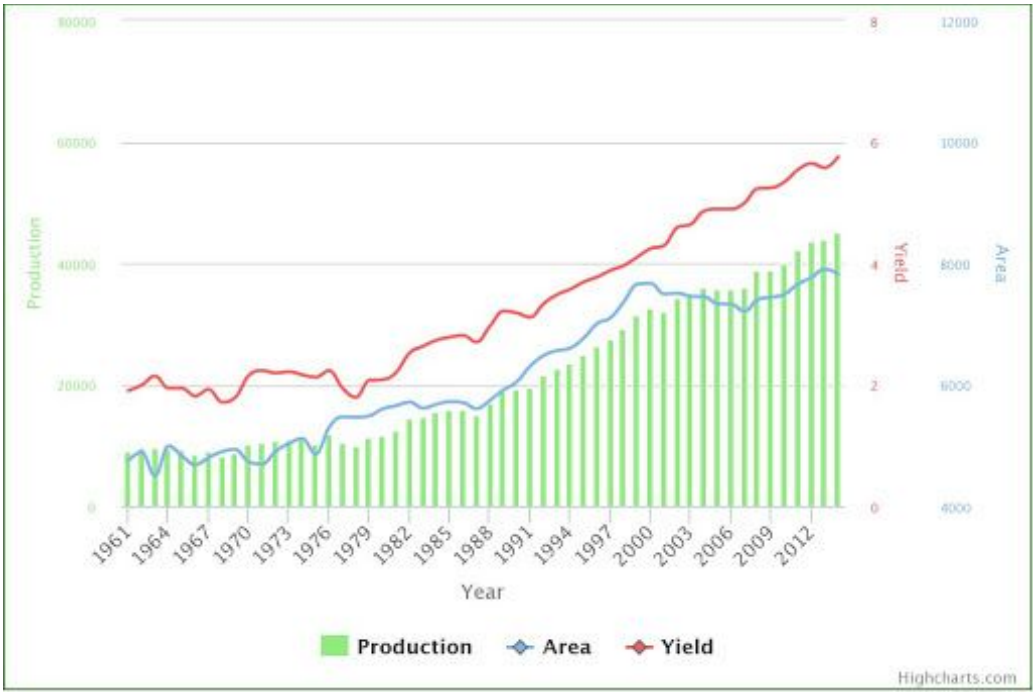

Figure 2: Rice yields for all of Vietnam. Adapted from 'Vietnam Basic Statistics of Rice Yield,' by ricepedia.org, 2019

Something noteworthy that the descriptive statistics uncovered were the inconsistencies along farmers' perceptions of their surrounding natural environment and their own farming models. Although farmers persistently reported worsening environmental conditions, such as worsening droughts and monsoon winds, they also simultaneously reported, 66% of them, believing that their current farming practices could sustain their livelihood well into the future. The farmers' perception that their current farming practices could sustain their livelihood well into the future is not without grounds. For the last three decades, the Vietnamese government has reported consistently higher annual rice yields in the Delta, see figure 2 (Vietnam Basic Statistics of Rice Yield). With ever increasing yields, the farmers have little to no reason to think their current farming practices are unsustainable in the long-run. When asked whether the market or their yields posed a bigger threat to their incomes, the majority of farmers identified the market

to pose a bigger threat. However, when asked about their farming profit for the past 2-5 years, the majority of farmers reported declining profits. The reported increasing yields, the perceived high market risk, and the declining profits along with the farmers' consistent answers of bettering farming technologies and techniques all point to the conclusion that the worsening environmental conditions in the Delta have led farmers to compensate higher temperatures, more severe floods and droughts, and declining soil fertility with more advanced farming technologies such as stronger pesticides and fertilizers. In any case, productivity has not been compromised but instead bettered.

Nonetheless, the fact that productivity has continuously improved does not mean that the current farming models are sustainable or inclusive. If the farmers continue to compensate deteriorating environmental conditions with farming technologies, their profits will likely continue decreasing and the environment will continue deteriorating. With income inequality already widening in the Delta, more pressure on the farmers to acquire farming technologies will assumably put unproportionate strain on the less-advantaged farmers, allowing for the inequality to grow even more. Though, if the environmental conditions are allowed to worsen, the farmers will have no other alternative than to continue compensating for these until their livelihood is severely threatened.

In spite of the farmers compensating for worsening environmental conditions with better farming technologies and hence perpetuating the damaging cycle of environmental decay, almost half of them, 47.3%, reported believing that their current farming practices did not affect the natural environment. Even though this perception might seem fallacious at first, it is not entirely incorrect. Although the current farming practices do indeed negatively affect the natural

environment, not all the damages have been inflicted by these alone. Climate change has likely also contributed to the worsening natural conditions in the Delta. The farmers' perception that their own farming practices do not negatively affect the natural environment but instead, that the natural environment is changing on its own accord independent of their actions, is not completely erroneous. A change in farming practices in the Mekong Delta alone would not stop the negative effects of climate change.

Although there seem to be low levels of education in the An Giang and Dong Thap provinces, they are not lower than the national averages. According World Bank reports, only 31.63% of females and 24.57% of males twenty-five years of age and older have completed secondary education (Vietnam Literacy Rate). In the An Giang and Dong Thap provinces, 50% of all respondents had completed secondary school. As previously mentioned, although it has not been found that higher education levels directly correlate to more environmentally responsible behavior, a worldwide survey reported finding that higher education levels do translate to a higher concern for the environment (Running, 2012). In the survey, when respondents were forced to choose between protecting the environment versus boosting the economy, respondents who had completed at least secondary education favored protecting the environment more than boosting the economy. In the context of the Mekong Delta, it could be argued that bettering education levels so that at least most farmers completed secondary school, could help increase their awareness and concern for the natural environment. However, when asked where they would prefer to see the government investment, most farmers' first choice was the road system. This answer does not come as a surprise, as one of the mentioned 'inappropriate conditions' that lowered the willingness of farmers to transition was being far away from the main road.

With only 37.7% of the respondents reporting a willingness to transition, and with past reports citing this low willingness as a result of low economic ability, logistic regressions models were constructed to see which financial markers significantly impacted the farmers' willingness to transition to the recommended farming models. Education levels and the deteriorating environmental conditions were also taken into account in these models.

5.2 Logistic Regressions

Five logistic regression models were constructed to check if education levels, worsening floods, and financial markers proved to be significantly impact the farmers' willingness to transition. Out of these five, the fifth model was chosen as the best one. In this model, education levels and farming profits were insignificant but annual flooding, whether or not the household had debts, the affordability of transitioning, and living conditions were significant. All of the significant variables were measures of the household's financial status with the exception of the perceived risk of the annual flood.

Flood patterns play an important role in determining how and what farmers in the Delta farm. This can be easily observed by the government's decision to build high ring dykes throughout the Delta. Changing flood patterns so that less land was flooded made more land available for cropping for longer periods of time. It is not unexpected that worsening annual floods make farmers more willing to change to the suggested alternative farming models. If the floods continue to worsen and more or better dykes are not built to contain the water, double and triple cropping will no longer be possible. This however, leaves policy makers in a conundrum. The dykes have provided more arable land in the Delta but have simultaneously deteriorated the

natural environment. Building higher or more dykes will again provide the farmers with more land to farm but will in turn further deteriorate the environment. Looking at the suggested alternative farming models, which suggest upland crops and floating rice as more sustainable alternatives, it is likely that these alternatives are better suited to worsening annual floods.

Whether or not the household had debts with accruing interest also proved to be a significant factor when determining farmers' willingness to transition. The households were less likely to be willing to transition to the alternative farming methods if they had debts still to be paid off. This affects a large part of the respondents, as 56.7% of them are in debt. With the WU and FU highly active in the Delta, providing necessary micro-credits to the farmers to cover agricultural expenses, a decline of number of households in debt seems unlikely. Having to compensate for deteriorating environmental conditions by purchasing better farming technology likely forces farmers to take out these micro-credits. All the same, these micro-credits only ensure the short-term livelihood of the area and, by decreasing the willingness to transition, endangers its long-term livelihood.

Farmers' increased perceived ability to afford the recommended farming models simultaneously increased their willingness to transition. If a farmer found its household to have a high ability to transition, they were more more willing to transition. This falls in line with the WACC (2016) report, which reported financial risk and low financial ability to be the biggest hindrance to the willingness to transition. The risk of adopting a new farming model is high. As has been pointed out before, these transitions must be made under deep uncertainties about future weather conditions, as well as economic uncertainties of how well the recommended farming models will work and how much the yields will produce. With the current farming models, even

if the sustainability and financial growth and inclusion of the farmers is at risk, they are at least familiar with the risks that are to be taken.

The living conditions of the farmers were a self-assessed measurement of how well-off they were. The model showed that higher living conditions translated to a higher willingness to transition. This is in accordance with the findings of the of the WACC, the significance of the farmers' perceived ability to afford the recommended farming models, and with the initial hypothesis of this paper. When higher living standards are enjoyed, the financial risk for attempting and failing at new farming models possess a lower threat to one's livelihood.

5.3 Limitations

The first noticed limitation of this research is the lack of background knowledge that there exists for how each question was assessed. Although the manual for the MOTA assessment and questionnaire are available, some of the questions are subject to the perceptions of the interviewer or interviewee, without a defined baseline of what is considered to be, for example, rich or poor. A good example of this can be given with the question that measured living standards. The question simply states: "Level of living conditions criteria" and then proceeds to give the options of 1. Rich, 2. Fairly Rich, 3. Medium, 4. Poor, 5. Very poor, hungry. No further explanation is given. The actual difference between 'rich' and 'fairly rich' is not known. Furthermore, the questions that give the option of 'other' allow this answer to be open-ended, making it difficult to code the answers and statistically analyze them.

Another limitation in this research is its lack small sample size. The Mekong Delta has thirteen provinces and a population of about 17.5 million people. This means that 150

households can be considered a very small sample size. With such a small sample size in comparison to the actual population of the Delta or just the An Gian and Dong Thap provinces, a small effect size is unsurprising. A small effect size does not come as a surprise because it is statistically more difficult to detect effect sizes in small sample sizes; just as the exact opposite is true, a large enough sample with make small effect sizes seem unproportionately large. Additionally, not all questions in the questionnaire were answered by the participants and this resulted in certain questions, or variables, having up to a hundred missing responses, rendering the variable useless.

In this study, the effect size was measured using a Nagelkerke R^2 and this demonstrates another potential limitation of the results. The R^2 for both statistically significant logistic regressions is low, well below 50%. Still, the results can be considered valuable for two reasons. First, low R^2 values when attempting to predict human behavior can be expected due to the unpredictable nature of humans (Hill, Ross, & Low 1997). Everyone responds to stressors differently and hence models have a harder time predicting outcomes. Second, even if the R^2 values are low, the low p-values, which make the relationships statistically significant, can still offer valuable conclusions from the data since the coefficients of the independent variables still, nonetheless, explain a mean change in the response for a unit of change in the dependent variable.

Lastly, the single most significant limitation in this research are the relatively high p-values of the logistic regressions being reported. The cut-off for the p-values considered statistically significant in this research was set at 0.200. This was not done in an effort to report meaningless data but instead, in an effort to report complete findings that might aid future

researchers focus in areas where more answers are to be found. It was also deemed appropriate to do this due to the fact that a significance level below a p-value of 0.05 is an entirely common but yet arbitrary cutoff point of significance. Dahiru (2011), goes into great detail in order to explain how this convention came to be through medical and statistics books but how it does not stem from the statistic schools that introduced the concept of p-values, the Fisherian and Neyman-Pearson schools. According to Dahiru (2011), neither school advocated for the cutoff point of significance to unquestionably be 0.05. How to fix this discrepancy and point of contention amongst statisticians and researchers is beyond the scope of this research paper. Still, the liberty of increasing the cutoff of the p-values due to a small sample size, missing responses, and the overall unpredictability of human behavior, has been taken.

6. Conclusion

With annual flooding, household debt, perception of affordability of transition, and living standards being predictors of willingness to transition, it can be said that the Mekong Delta, or at least the An Giang and Dong Thap provinces, are facing the same struggle at a local level that the world is facing on a global level. The achieved economic growth has come at the cost of the environment and has been attained through unsustainable farming models that should not be followed. This has widened the rich and poor gap in the two provinces and throughout the Delta. With presumably only well-off, top-earning farmers in the provinces being willing and able to afford the suggested farming models, the question of how the remaining farmer population will manage to achieve the economic status that will allow them to also make this transition remains. Still, if the government does not find a way forward with the implementation

of the more sustainable, alternative farming models the income inequality and environmental degradation will only grow. The high-ring dykes built throughout the Delta which are now negatively impacting the flood patterns and underground aquifers, although well-intentioned, negatively affect the livelihood of the Delta. The continuatinuous building of these dykes will guarantee more arable land but it will come at the high cost of environmental degradation. A cost-benefit analysis of the further development of dykes in the Delta would likely prove that it is in everyone's long-term interest to avoid further developments of high-ring dykes.

The descriptive statistics of this study confirm some of the already found patterns throughout the Delta but also question the claims made that the negative effects of the environmental degradation of the area has already impacted the rice yields. The reported rice yields of the Delta have not yet decreased, and on the contrary, its productivity has steadily increased for the last thirty years. Still, the farming profits have steadily decreased, as reported by the farmers. This decrease in profits can be the first sign of the coming decreasing rice yields if farming technologies are to one day stop compensating for the deteriorating environmental conditions.

The logistic regressions of this study were expected to demonstrate that higher education levels, worsening environmental conditions and high economic ability would increase farmers' willingness to transition. All of these proved to be true with the exception of education levels, as they have not proven to impact farmers' willingness to transition. Yet, these findings likely do not greatly aid the predictability of farmer behavior throughout the Delta as it was already known that what affects their willingness the most is their financial ability. Nonetheless, policy makers and other stakeholders can now focus on increasing the financial ability of the farmers, as it is

now clear that the farmers are willing to transition as long as they are able to do so. The results of this research could greatly benefit from further study. More careful and widespread data collection of living conditions, for example, would aid in providing more accurate results.

Notwithstanding, the wicked problem of unsustainable growth within the Delta is still the hardest point to tackle. Those who have not reached the sufficient economic status can fully argue that it is unfair to impose IGG models on them when their richer counterparts did not have this burden and increased their wealth through cheaper, unsustainable farming models. The journey to finding an answer to this is something the Delta is not alone in; the rest of world is attempting to answer the same question.

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Appendix:

Table 1: Correlations

		Education level	Total household assets	Can you afford to transition?	Living conditions	Are you willing to transition?	Annual flood	Does your family borrow on credit?	Farming profit
Education level	Pearson Correlation	1	.179*	.195*	.371**	-.024	.063	.007	.034
Total household assets	Pearson Correlation	.179*	1	.085	.434**	-.117	-.152	-.099	.004
Can you afford to transition?	Pearson Correlation	.195*	.085	1	.180*	.300**	.050	-.013	-.083
Living conditions	Pearson Correlation	.371**	.434**	.180*	1	-.119	-.049	.037	-.178*
Are you willing to transition?	Pearson Correlation	-.024	-.117	.300**	-.119	1	.129	-.075	.054
Annual flood	Pearson Correlation	.063	-.152	.050	-.049	.129	1	.029	.158
Does your family	Pearson Correlation	.007	-.099	-.013	.037	-.075	.029	1	-.044

borrow on credit?									
Farming profit	Pearson Corre-lation	.034	.004	-.083	-.178*	.054	.158	-.044	1

* Correlation is significant at the 0.05 level
** Correlation is significant at the 0.01 level

Table 2: Descriptive Statistics

Variable	N	Mode	Std. dev.	Mean
Hectares of rice	150	3	2.13	2.49
How many rounds of rice per year?	150	2	0.52	2.21
Yield of round 1 (ton)	150	9.29	3.15	7.98
Yield of round 2 (ton)	150	7.71	2.61	6.57
Yield of round 3 (ton)	40	5.29	1.09	5.95
Total annual rice production (kg)	150	4,200	46474.28	42,090.31
Average yield season per hectare (ton)	150	7	2.82	7.37
Annual rice income (vnd) (đ)	150	50,000,000	173782472.00	186,248,058.00
Percentage of rice income (%)	150	100	23.57	81.57
Total annual expenses	150	49,200,000	31030657.70	55,546,272.00
Total household assets	150	13	4.47	13.01
Total farming assets	150	2	1.45	2.12
Age of head of household	150	46	14.62	58.60

Table 3: Descriptive Statistics

Variables (%)	Serious shortages *Never went to school* **Very poor** *No* **Worse**	Insufficient *Primary school* **Poor** *Low* **Similar**	Slightly insufficient *Secondary school* **Medium** *Medium* **Better**	Sufficient *Tertiary school* **Fairly rich** *Medium high* **No idea**	Surplus **Rich** *High*
Ability to afford expenses	2.6	16.6	23.2	38.7	18.7
Income to expenses relationship	16.6	2.7	23.3	38.7	28.7
Education level	10.7	50.0	28.7	10.7	N.A
Living conditions	0.7	10.0	52.7	31.3	5.3
Afford to transition	26.7	24.7	22.7	12.0	14.0
Farming profit	38.9	34.2	22.1	4.7	N.A
Farming technique	1.3	13.3	85.3	N.A	N.A
Seed source	0.7	9.3	90.0	N.A	N.A
Farming material source	4.0	23.3	71.3	1.3	N.A
Farming equipment	3.4	20.1	75.8	0.7	N.A

Tropical storm rainfall	89.3	7.4	3.4	N.A	N.A
Drought	84.1	14.5	0.7	0.7	N.A
High temperature	89.3	10.0	0.7	N.A	N.A
Pests and diseases	71.1	18.1	10.7	N.A	N.A
Annual flooding	80.5	11.9	5.1	2.5	N.A
Soil fertility	56.8	27.7	15.5	N.A	N.A

Table 4: Descriptive Statistics

Variables (%)	Roads *Remain the same* *Yield* **Yes**	Irrigation *Leave farm* *Market* **No**	Bridges *N.A (will change)* *Both but yield is higher* **No answer**	School *Both but market is higher*	Clinics *No idea*	Agriculture
What areas do you want the government to invest in?	52.7	8.0	5.3	6.7	8.7	6.0
If you do not follow the suggested transition, what will you do?	74.0	1.3	24.7	N.A	N.A	N.A
Do risks occur most often in the yield or in the market?	13.3	11.3	36.0	36.7	2.7	N.A
Does your family borrow on credit?	56.7	43.3	N.A	N.A	N.A	N.A
Are you willing to transition?	37.7	62.3	N.A	N.A	N.A	N.A
Will your livelihood be more sustainable if you apply any transition on farming	58.0	30.7	11.3	N.A	N.A	N.A

practice?						
Will your future livelihood be sustainable if you keep chasing the current farming practice?	66.0	28.7	5.4	N.A	N.A	N.A
Will maintaining the current farming practice affect the natural environment?	45.3	47.3	7.3	N.A	N.A	N.A
Would intensive production on the same farming practice degrade the soil quality?	68.0	29.3	2.7	N.A	N.A	N.A
Would intensive production on the same farming practice deplete the fresh water source?	46.7	48.7	4.7	N.A	N.A	N.A
Do you own your land?	100.0	00.0	N.A	N.A	N.A	N.A

Table 5: Logistic Regressions Model 1

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
138.889[a]	.142	.192

	B	S.E.	Wald	df	Sig.	Exp(B)
Education level	-.387	.248	2.431	1	.119	.679
Annual flood	.585	.409	2.046	1	.153	1.795
Does your family borrow on credit?	-.621	.425	2.136	1	.144	.537
Can you afford to transition?	.534	.159	11.261	1	.001	1.706
Farming profit	.350	.262	1.781	1	.182	1.419
Constant	-2.917	1.397	4.361	1	.037	.054

Table 6: Logistic Regressions Model 2

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
139.245[a]	.152	.205

	B	S.E.	Wald	df	Sig.	Exp(B)
Education level	-.198	.260	.579	1	.447	.821
Annual flood	.527	.393	1.802	1	.179	1.694
Does your family borrow on credit?	-.592	.426	1.930	1	.165	.553
Can you afford to transition?	.538	.161	11.199	1	.001	1.713
Living Conditions	-.685	.326	4.408	1	.036	.504
Constant	-.003	1.582	.000	1	.998	.997

Table 7: Logistic Regressions Model 3

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
142.112[a]	.131	.177

	B	S.E.	Wald	df	Sig.	Exp(B)
Education level	-.305	.249	1.493	1	.222	.737
Annual flood	.472	.398	1.404	1	.236	1.602
Does your family borrow on credit?	-.570	.419	1.856	1	.173	.565
Can you afford to transition?	.488	.153	10.111	1	.001	1.629
Total household assets	-.067	.049	1.883	1	.170	.935
Constant	-.971	1.481	.430	1	.512	.379

Table 8: Logistic Regressions Model 4

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
134.285[a]	.175	.237

	B	S.E.	Wald	df	Sig.	Exp(B)
Education level	-.207	.265	.610	1	.435	.813
Annual flood	.546	.418	1.703	1	.192	1.726
Does your family borrow on credit?	-.735	.442	2.760	1	.097	.480
Can you afford to transition?	.592	.170	12.163	1	.000	1.808
Total household assets	-.030	.055	.301	1	.583	.970
Farming profit	.339	.273	1.543	1	.214	1.404
Living conditions	-.581	.364	2.548	1	.110	.559
Constant	-.745	1.758	.179	1	.672	.475

Table 9: Logistic Regressions Model 5

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
134.588[a]	.173	.234

	B	S.E.	Wald	df	Sig.	Exp(B)
Education level	-.215	.264	.664	1	.415	.806
Annual flood	.587	.410	2.048	1	.152	1.799
Does your family borrow on credit?	-.711	.439	2.619	1	.106	.491
Can you afford to transition?	.593	.170	12.218	1	.000	1.809
Farming profit	.313	.268	1.364	1	.243	1.367
Living conditions	-.663	.332	3.980	1	.046	.515
Constant	-.944	1.712	.304	1	.581	.389

Annex

A1a. Name of answerer: ……

A2a. Are your the head of this household? (specified in the Registered family record)

1. Yes 2. No

A3a. Where was the head of HH born?

1. In this locality? 2. Come from other place? When? …….

A4a. What is the ethnic identity of the head of HH?

A5a. Hamlet/village ……

A6a. Commune ……..

A7a. District ……

A8a. Province ……

A9a. Date of interview: date month year

A10a. Name of interviewer:

A11a. Name of supervisor:

A12a. Level of living conditions per commune's criteria

1. Rich	2. Fairly rich	3. Medium	4. Poor	5. Very poor, hungry

A13a. Code of this questionnaires?

Project	Province	District	Commune	HH

A. GENERAL INFORMATION ABOUT YOUR HOUSEHOLD

A1. Information about your household member

Ref	1.1. Sex 1. male 2. female	1.2. Year of birth	1.3. Marital status	1.4. Education level (highest)	Job				1.9. Place of work (main job)	1.10. Distance from house to work place (km) (main job)
					1.5 Main job (>50% time for this job) (specify)	1.6 Working status of main job	1.7 Sideline (secondary job)	1.8 Working status of sideline		
1										
2										
3										
4										

1.3. Marital status	1.4. Education level	1.5 Main job & 1.7 Sideline	1.6 & 1.8 Working status of main job and sideline	1.9. Place of work (main job)	1.10. Distance from house to work place (km)
1. Single 2. Married 3. Divorced 4. Separated 5. Widow/	0. Never go to school 1. Primary school 2. Secondary school	1. Agriculture (cultivation, husbandry) 2. Forestry (planting, caring, protecting, exploiting forests) 3. Catching aqua-products 4. Aquaculture (shrimp, crab, fish, etc.)	1. Steady 2. Non steady 3. No idea *98. KTH,*	1. At home 2. In commune 3. Outside the commune but	*98. KTH, person in code 1 in item 1.10 and code 12, 13, 14 and 98 in Item 1.6.* 99. If working in a non-

widower *98. KTH, Below 18 years old*	3. Tertiary school 4. College/university or higher level *98. KTH, Below 6 years old*	5. Trade, services 6. Government officers, staffs 7. Workers 8. Commune/village officers 9. handicraft men 10. Hire-labour 11. Other jobs (specify) 12. Pupil/student 13. Not to work because of retired/old/weak 14. Jobless, no employment, not learning *98. KTH, Below 6 years old*	*person in code 12, 13, 14 and 98 in Item 1.6 & 1.8*	within the district 4. Outside the district 5. No fixed place *98. KTH, person in code 12, 13, 14 and 98 in Item 1.6*	fixed place.

A2. Since 2011, are there any people in your family of labour age that changed his/her main jobs?

1. Yes (clearly state job and code in table below) 2. No (**move to B1**)

Series No. in list of HHs	Main job in 2011	Main job in 2012	Main job in 2013	Main job in 2014	Main job in 2015

A3. Why did he/she change the main job (*select one or more than one appropriate options*)

1. loss of land
2. change living place
3. New job is more suitable
4. new job is better paid.
5. have economically convenient location (trading, production, etc.)
6. others (specify): ……..

B. ASSETS

Land

B1. Does your family have any land?

1. Yes. 2. No (**move to B3**)

B2. How do you use your land (excluding resident land)?

Ref	Type of land	1.1. Agricultural land		1.2. Forest land		1.3. Pond, surface land		Total land holdings
		Nrs. of Cong (1 cong = 1000m^2)	Present land use*	Nrs. of Cong (1 cong = 1000m^2)	Present land use*	Nrs. of Cong (1 cong = 1000m^2)	Present land use*	
1	Land given by parents							
2	Land allocated/lease							
3	Land hired or lease							
4	Land purchased from other							
5	Land reclaimed							
6	Other							
	Total							

** Code of land-use: 1. under cultivation 2. bare land 3. Semi cultivated and left bare*
4. for lease 5. mortgage

B3. Do you obtain Land-use rights for the land you have?

1. Yes. When? 2. No

B4. Since 2010, have your family sold any land (including resident land) to others?

1. Yes. How many 'Cong'… 2. No (**move to B6**)

B5. What do you spend the money gained by selling land? (*Select appropriate options*).

1. Daily expenses
2. Purchasing furniture
3. Building, repairing house
4. Investing in trade, services, non-agricultural production
6. Investing in agriculture, forest, aquaculture?
7. Investing in education of the children
8. Depositing in bank as savings
9. Distributing to children or others

5. Paying debts 10. Other (specify)

B6. Since 2000, have your family bought any land (including resident land) from others?

1. Yes. How many 'Cong'… 2. No (**move to B8**)

B7. How do you use on that land? (*Select appropriate options*).

1. Build workshop
2. Using in trade, services
3. Build house
4. Build house for rent
5. Cultivating, husbandry (livestock, aquaculture)
6. Forest planting
7. Other (specify

Houses and living conditions

B8. Which grade does your house belong to? *Select appropriate options*).

1. Permanent house, one or more than one storied
2. Semi-permanent house (brick wall, tile roof)
3. Temporary house (thatched, tent)
4. Other (specify)

B9. How large is your resident land (how many square meters?) ……. m^2

Of which: Main house: ……. m^2

Kitchen, store, temporary house: ……. m^2

Yard, garden, pond: ……. m^2

Other: ……. m^2

B10. Where do you get water from for drinking and washing in dry season and in rain season (*select 1 main water sources)*?

		In dry season	In rain season
10.1.	Water for drinking		
10.2.	Water for washing		

Code of water source:

1. Family –scale tap water
2. Public tap water
3. Dug well, drill well, earth well
4. Tank of rain water
5. Lake, pond, river, canal, stream
6. Other source:

B11. Which type of latrine does your family use? (*select 1 option*)

1. Have no private latrine
2. Toilet with septic or semi-septic tank
3. Double-tank composite toilet
4. Simple latrine (dug a hole in garden)
5. Latrine built over pond, river, stream, canal
6. Other (specify)

B12. At present, which type of the energy does your family use to light (*select 1 option)*

1. Gasoline
2. Gas
3. National gridline
4. Battery, generator, mini-hydropower
5. Other type of energy (specify)

Long-term assets

B13. What type of long-term assets does your family have (*only count for usable assets)*?

Ref	Type of assets	Quantity	Ref	Type of assets	Quantity
1	Expensive furniture		9	Washing machine	
2	Fridge		10	Hot-water tank	
3	Electric fan		11	Motorbike	
4	Black and white, color TV		12	Computer	
5	Radio cassette		13	Gas-table	
6	VCD/video		14	Sewing machine	
7	Megaphone		15	Electric rice cook	
8	Telephone		16	Microwave oven	

Ref	Production means	Quantity	Ref	Production means	Quantity
1	Truck		6	Motorized pesticide sprayer	
2	Pump machine		7	Electric generator	
3	Motorized rice husking machine		8	Fish net	

4	Milling machine		9	Vehicle	
5	Grinding machine for animal feed		10	Motor boat	

C. PRODUCTION ACTIVITIES

Cultivation

C1. In the last 12 months, have you cultivated on your land?

1. Yes (fill in table below) 2. No

Ref	Main crops	a. Cultivated area in last 12 months (Cong)	b. Production gained in last 12 months
1	Rice		Kg
2	Maze, potato, cassava		Kg
3	Vegetables		Kg
4	Beans (all kinds)		Kg
5	Sugarcane		Kg
6	Fruit-trees (coconut, pineapple, mango, jack-fruit, grapefruit, longan, etc.)		Kg
7	Fish		Kg
8	Shrimp		Kg
9	Forest/Mangroves		Tones
10	Others (specify)		Kg

Husbandry

C2. In the last 12 months, has your family raised livestock or poultry?

1. Yes 2. No

Ref	Type of animals	Quantity (head)
1	Cow, buffalo	
2	Horse	
3	Goat	
4	Pig	
5	Chicken, ducks, grooves,	
6	Other (specify)	

C3. In the last 12 months, has your family practiced in fishing?

1. Yes 2. No (**move to question C5**)

C4. How many kilograms of products has your family caught in the last 12 months?

Ref	Products	Quantity (kg)
1	Fish	
2	Shrimp	
3	Other aqua products: (trionychid turtle, crab, etc.)	

C5. In the last 12 months, has your family practiced in aquaculture?

1. Yes 2. No (**move to question C7**)

C6. How many kilograms of products has your family harvested in the last 12 months?

Ref	Products	Quantity (kg)
1	Fish	
2	Shrimp	
3	Other aqua products: (trionychid turtle, crab, etc.)	

Forestry

C7. How many hectare of forest does your family have?

1. Natural forest: ha 3. Caring forest: ha
2. Planted forest: ha 4. Protecting forest: ha

C8. What are main types of plants in your forest? ……..

C9. In the last 12 months, what benefits has your family gained from the forest?

0. No benefits
1. Timber
2. Firewood
3. Rubber latex
4. Forest products as food
5. Other benefits (specify). ……

C15. How long is the distance from your house to your furthest forest? ……. Km.

Handicrafts

C16. In the last 12 months, are there any people in your family practice handicrafts?

1. Yes
2. No (**move to question D1**)

If yes, how many people in your family involve in handicraft? (record number of people in the following tables responding to the activities) …….. people

Ref	Type of handicrafts	Of which labours are:		
		a. male	b. Female	c. Children (10-14 years old)
1	Manufacturing building materials			
2	Building worker, brick layer			
3	Timber processing, carpenter.			
4	Ceramic, glass, porcelain			
5	Bamboo, rattan knitting			
6	Knitting (cloth, carpet, mate)			
7	Garment			
8	Metallic works			
9	Food and foodstuff processing			
10	Leather (tanning)			
11	Other jobs (specify)			

D. IRRIGATION AND DRAINAGE SCHEME

D1. What kind of water sources do you use for irrigating in dry season? (*Select 1 main water source)*

0. No source
1. Water from canal system runs to field gravity
2. Water from canal system pumps to field
3. Water from river, pond, lake, stream
4. Water from dug/drilled wells
5. Other source (specify)

D2. In your opinion, how sufficient is the water supplied from the present irrigation scheme in the commune in dry season?

1. Abundant
2. Sufficient
3. Insufficient
4. Lack seriously
5. No idea

D3. If the newly developed irrigation scheme supplies sufficient irrigation water in dry season, what do you plan to do?

1. Aquaculture
2. Extending cultivated land
3. Intensifying crops
4. Raise livestock, poultry
5. Other (specify)

D4. In your opinion, what type of management of irrigation scheme below is the most effective?

1. *Commune or water-use cooperative-based management (commune or cooperative signs contract for water supply with the irrigation and drainage management company).*
2. *Water user group-based management (a group of HHs who use water from the irrigation canal serving in a certain area shall sign the contract for water supply directly with the irrigation and drainage management company).*
3. *All irrigation and drainage infrastructures shall be managed by the irrigation and drainage management company.*

E. CREDIT

E1. At present, does your family borrow on interest?

1. Yes. How much is the credit in VND?
2. No (**move to question E4**)

In credit is in gold or US dollars, exchange rate: 850,000 VND = 1 'chi', 1 USD = 15,900 VND

E2. What does your family use the credit for?

1. Agriculture production (rice, vegetable, upland crops)
2. Horticulture
3. Husbandry
4. Aquaculture (farming, catching)
5. Forestry (planting)
6. Non-agricultural production
7. Procuring long-term use furniture
8. Daily expenses
9. Health treatment
10. Other purpose (specify)

E3. Who do you borrow from? And how much is the monthly interest rate?

Ref	Fund sources	Interest rate (monthly) (%)

1	Relatives, close friends, neighbors	
2	Usurer	
3	People's credit fund, Credit cooperative	
4	Bank for agriculture and rural development	
5	Bank for the poor (social policy)	
6	Other banks	
7	Development programs (e.g. Job promotion program 120, etc.)	
8	Poverty reduction and hunger elimination	
9	Women's unions, other associations, etc.	
10	Other (specify)	

E4. Why doesn't your family borrow in the last 12 months? (*select 1 option)*

1. No need
2. Need, but do not know where to borrow
3. Need, but no fund source available
4. Want to borrow but do not have enough conditions to borrow (specify).
5. Other reason (specify).

F. INCOMES AND EXPENSES

F1. Please, specify your incomes in the last 12 months from the various sources below?

Ref	Income sources	Income (VND)	Compared with the last 2 years, how is your income change? 1. Higher, 2 Similar, 3. Lower, 4. No answer
1	Farming rice		
2	Vegetables and upland crop		
3	Fruit-trees (orange, jack-fruit, coconut, etc.)		
4	Industrial crops (sugarcane, pepper, cashew, rubber, coffee, etc.)		
5	Husbandry (animal, poultry)		
6	Aquaculture		
7	Fish catching		
8	Hire-labour		
9	Salary, retired salary		
10	Handicrafts		
11	Forestry (planting, caring, protecting)		
12	Other (specify)		
	Total		

F2. How much are your expenses in the last month in each category?

Ref	Expense item	Amount (VND)	Ref	Expense item	Amount (VND)
1	Rice		6	Traveling cost	
2	Daily food		7	Education fee for children	
3	Fuel		8	Health examination, treatment	
4	Electricity		9	Tip for wedding, funeral, etc.	
5	Domestic water cost		10	Other …	
				Total	

F3. Does the income of your family afford such expenses?

1. Surplus2. Sufficient 3. Lightly insufficient 4. Serious shortages

G SOCIAL ACTIVITIES

G1. Which association do you or any member of your family participate? (*>=14 years)* ***If nobody participates, move to question G2.***

Ref	Order	Association	Benefits gained from participating in such association?

	number in list of HHs	participated	Association 1	Association 2	Association 3	Association 4
1						
2						
3						
4						
5						

Code of association:

1. Women's union
2. Youth's union
3. Veteran's association
4. Farmers' association
5. Aged people's association
6. Horticulture's association
7. Religious group
8. Communist party
9. Other association (specify)
10. No participating in any association or union.

Code of benefits obtained:

1. Advice, spiritual, motional benefit
2. Material, money support
3. Social interchange
4. Obtaining credit
5. Learn to earn money

G2. At present, who do you usually ask for help when you are in trouble or need?

1. Parents
2. Brothers and sisters
3. Children
4. Relatives
5. Neighbors
6. Friends
7. Local government, association at working place
8. Local government, association at living place
9. No need from others
10. Others (specify)

H. OVERALL ASSESSMENT

H1. In your opinion, what aspects have been changed in your locality in the last 5 years?

Ref	Factor	1. Better	2. Similar	3. Worse	4. No idea
1	Infrastructures (electricity, road, school, clinic, water supply and sewage, communication)	①	②	③	④
2	Transportation services	①	②	③	④
3	Agricultural extension	①	②	③	④
4	Employment opportunity	①	②	③	④
5	Ability to access to credit	①	②	③	④
6	Income and living conditions	①	②	③	④
7	Irrigation and drainage system (canal)	①	②	③	④
8	Natural benefits (fish, shrimp, etc.)	①	②	③	④
9	Sanitation and environment	①	②	③	④
10	Other (specify)	①	②	③	④

H2. What areas do you want the government to invest in in the coming years? (*Select 3 options in priority order, 1 is the first priority*)

Ref	Area	Priority
1	Roads	
2	Irrigation and drainage system	
3	Electric supply	
4	Bridges	
5	Domestic water supply	

6	Sewage	
7	School	
8	Kindergarten, pre-school	
9	Clinic, healthcare center	
10	Agricultural extension	
11	Recreation and entertainment	
12	Other (specify)	

I. FARMER ECONOMIC PERCEPTION

I1. In your opinion, how is your HH farming livelihood in the last 5 year (including cultivation, husbandry/livestock and aquaculture)?

Ref	Factor	1. Better	2. Similar	3. Worse	4. No idea
1	Selling price on farm	①	②	③	④
2	Selling price at the market/food processor	①	②	③	④
3	Purchasing system and distribution of farming products	①	②	③	④
4	Farming profit	①	②	③	④
5	Market demand on organic/biological products	①	②	③	④
6	Other (specify)	①	②	③	④

I2. Considering agriculture and aquaculture, how are the farming conditions in the last 5 years?

Ref	Item	1. Better	2. Similar	3. Worse	4. No idea
1	Farming technique	①	②	③	④
2	Seed/Fingerling source	①	②	③	④
3	Farming material source (agrochemical, feeding, etc.)	①	②	③	④
4	Farming equipment (mechanism)	①	②	③	④
5	Seasonal labour source	①	②	③	④

J. RISK PERCEPTION

J1. In your opinion, how are the biophysical conditions to facilitate farming practices in recent years? (check out the event occurred only at your local)?

Ref	Event	1. Better	2. Similar	3. Worse	4. No idea
1	Rainfall, tropical storm	①	②	③	④
2	Drought	①	②	③	④
3	High temperature	①	②	③	④
4	Monsoon wind	①	②	③	④
5	Pests and diseases	①	②	③	④
6	Annual (upstream) flood	①	②	③	④
7	Saline intrusion	①	②	③	④
8	Water quality	①	②	③	④
9	Groundwater level	①	②	③	④
10	Soil fertile	①	②	③	④

J2. Regarding your HH main farming practice, what type of risks occurs more often?

1. Yield risk (loss of yield caused by natural events or diseases, etc.)
2. Market risk (loss of price, price squeeze, etc.)
3. Both but Yield risk is higher
4. Both but Market risk is higher
5. No idea

K. FARMER ATTITUDES

	Question	1. Yes	2. No	3. No answer
K1	Do you know that intensive production on the same farming practice would degrade the soil quality?	①	②	③
K2	Do you know that intensive production on the same farming practice would deplete the fresh water source?	①	②	③
K3 *	Do you know that mangrove forest plays an important role to protect coastal land from erosion?	①	②	③
K4	Would you think that maintaining your current farming practice will not affect the natural environment?	①	②	③
K5	Would you think that your future livelihood will be sustainable if you keep chasing the current farming practice?	①	②	③
K6	Would you think if applying any transition on farming practice, your livelihood will be more sustainable? (e.g. reduce number of crops, technology application, or transform to another farming pattern)	①	②	③

* applied in Ca Mau only

K7.The following table indicate several current livelihood and transition livelihood accordingly. Please choose the one applied to your HH current situation and check out your opinion about its transition trend.

	Current landuse/ livelihood*	Transition or enhanced landuse/livelihood	1. No interest	2. Interest	3. Want to change	4. Will change	Reason why?
Dong Thap	3 rice crops / 2 rice crops	Rice-aquaculture (fish and shrimp) Lotus	①	②	③	④	
An Giang	3 rice crops / 2 rice crops	Rice-aquaculture (fish and shrimp)	①	②	③	④	
An Giang	3 rice crops / 2 rice crops	Floating rice	①	②	③	④	
Ben Tre	3 rice crops / 2 rice crops	Intensive shrimp	①	②	③	④	
Ben Tre	Rice-shrimp	Rice-shrimp	①	②	③	④	
Soc Trang	Sugarcane	Intensive shrimp	①	②	③	④	
Ca Mau	Mangrove-shrimp	Organically certified mangrove-shrimp	①	②	③	④	
Kien Giang	Rice-shrimp	Rice-shrimp	①	②	③	④	

**only choose which applied to your HH*

K8. Beside the suggested transition, do you have any other option to sustain your farming livelihood? Please specify and give the reason.

……

……

K9. If you do not want to follow the suggested transition, what would you do?

1. Try my best to maintain the current farming system
2. Land for sale/for lease/leave empty, looking for non-farm job, or job elsewhere if necessary

98. no answer because agree to change

L. PERCEIVED FARMER ABILITY

L1. Do you think your HH can afford to change to the transition indicated in the previous question?

1.No 2.Low 3.Medium 4.Medium high 5.High

L2. Please indicate your HH ability in terms of the following sectors:

	Low	*Medium*	*High*
Financial Ability			
1. Self-capital	①	②	③
2. State-owned credit	①	②	③
Technical Ability			
3. Farming techniques and skills	①	②	③
4. Availability of seed/fingerling source and farming material			
5. Suitability of edaphic conditions (soil, elevation, weather)	①	②	③
6. Availability of irrigation system	①	②	③
7. Access to electricity	①	②	③
8. Convenience in transporting harvested products	①	②	③
9. Availability in mechanism	①	②	③
10. Access to farming-related information and news via Tivi	①	②	③
11. Access to farming-related information and news via newspaper, radio	①	②	③
12. Access to farming-related information and news via Internet, mobile SMS	①	②	③
Institutional Ability			
13. Probability to cooperate with family, relatives	①	②	③
14. Probability to cooperate with neighbors, friends, acquaintances	①	②	③
15. Availability of agricultural extension	①	②	③
16. Connections with traders	①	②	③
17. Connections with dealers of farming material	①	②	③

L3. What and how should the government do to support your HH towards the suggested transition for a sustainable livelihood?

……

……