CLIMATE - SMART AGRICULTURE IN VIETNAM: OVERVIEW AND POLICY ORIENTATION

Assoc. Prof. Dr Dinh Duc Truong
dinhductruong@gmail.com

Ph.D Candidate. Le Huy Huan
huan.huy.le@gmail.com
Faculty of Urban & Environmental Economics and Management,
National Economics University, Hanoi, Vietnam

Abstract

Climate change (CC) has been seriously affecting the agricultural production in Vietnam. Due to that, agriculture needs various methods to deal with the problem and some of which are applying Climate - Smart Agriculture (CSA) models vastly, using Ecosystem - based Adaptation (EbA) models, and integrating climate change adaptation in the orientation of agricultural restructuring towards value added and sustainable development. This article refers to the scientific basics of improving and broadening CSA models as well as how they are put into practice in Vietnam; at the same time, an overview of climate change policies in the agricultural sector has been issued and orientations for integrating the CSA into future Policy Frameworks and Action Plans.

Key words*: Food Security, Climate Change, Climate - Smart Agriculture.*

1. Introduction

Food security and climate change are increasingly closely linked, as they are both influenced by a number of factors, including (i) population growth pressures, (ii) the demand for food, and (iii) the depletion of natural resources. Therefore, the difficulties and challenges in ensuring food security are increasing (FAO, 2011a). According to FAO estimates, agricultural output needs to increase by 60% by 2050 to meet world food demand (FAO, 2013). In order to address the above-mentioned pressures, agricultural production requires a shift to more productive production systems, the efficient use of inputs, less variability and the stabilization of factors. Outcome, resilient to risks, shocks and climate change in the long term. At the same time, reducing greenhouse gas emissions per unit of land or agricultural products, creating carbon sinks, contributes to mitigating the effects of climate change (FAO, 2013).

Climate-Smart Agriculture (CSA) is an approach that involves a variety of factors, such as enhancing technical and policy conditions and promoting investment to achieve sustainable agricultural development in specific contexts and localities. The CSA aims at simultaneously achieving all three pillars: (i) ensuring food security through increased productivity and income, (ii) increased adaptation to climate change in agricultural production systems, (iii) reducing / eliminating greenhouse gas emissions where feasible (FAO, 2010). Unlike traditional farming strategies and management, the CSA seeks to

integrate climate change responses into agricultural development plans and strategies, in particular seeking opportunities for short-term adaptation and long-term mitigation (Lipper et al., 2014). The issue is how a CSA model is appropriate to the local / regional ecological conditions, as well as what policies and measures need to be taken to effectively implement these models.

The government has approved the importance of connecting actions towards climate change, sustainable development, low carbon economical and agricultural development at the policy level. Many policies and strategies has been given in order to tackle national and regional situations. However, the difficulty in spreading CSA models is considerably great. This research will give the general basics of the theory and the practice of CSA development as well as agricultural policies dealing with CC. The obstacles in developing CSA and suggested plans for the future are also mentioned.

2. Research methods

Methods used in the research consist of data gathering and consulting. Summarized information through reports and studies from companies and organization, NGOs, news from national magazines of FAO, CGIAR, CIAT, ICRAFT are also included in order to generate the overall view of CSA in both theory and practice in Vietnam. At the same time, in order to identify gaps in knowledge, resources, policies and institutions that inhibit the development of CSA models in Vietnam.

The consulting method is also used in order to select the fitting agricultural models based on three pillars aims mentioned above; discuss directly the current situation, shortcomings, policy gaps, and measures in broadening agricultural models for CC.

3. Results

3.1. Climate - Smart Agriculture

3.1.1. Concept

CSA is accepted by FAO since 2013 as an approach to maintain the food security for an expectation of over 9 billion people on the planet in 2050. The most commonly used definition is provided by FAO, which defines CSA as *"agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals"*. In this definition, the principal goal of CSA is identified as food security and development (FAO 2013a, Lipper et al., 2014), while productivity, adaptation, and mitigation are identified as the three interlinked pillars necessary for achieving this goal. In terms of Vietnam, with the *"No Regrets"* approach, it is not necessary at all times, all three pillars are aligned when selecting CSA practices.

The three pillar of CSA consist of:

Productivity: Increases productivity and income in a stable way from cultivating, raising to fishery without damaging the environment. This, in turn, will raise food and nutritional security. A key concept related to raising productivity is sustainable intensification.

Adaptation: CSA aims to reduce the exposure of farmers to short-term risks, while also strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the ecosystem services which ecosystems provide to farmers and others. These services are essential for maintaining productivity and our ability to adapt to climate changes.

Mitigation: Wherever and whenever possible, CSA should help to reduce and/or remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each calorie or kilo of food, fibre and fuel that we produce. That we avoid deforestation from agriculture. And that we manage soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO_2 from the atmosphere.

CSA are not only technological measures applying on a nationwide scale, they are also multifactor and attach to regional conditions. CSA mention courses of action in both inside and outside farms which are in chains. This is based on general views of including technic factors, policies, institutions and investment in order to reach the stable goal in agriculture and food security given the presence of CC. Below are some examples in operating CSA and the three main pillars on different scales.

Table 1: CSA practice on different scales

Scale	***Productivity***	Adaptation	Mitigation
Household	Subsistence, food, nutrition and income for each and every family member.	Altering and increasing the ability to withstand bad weather conditions in different regions.	Absorbing and storing CO2 on farms, decreasing fossil fuel's input.
Region	Various land using systems provide subsistence, safety food and help maintaining ecological function and decreasing disaster's effects.	Maintaining ecological function: controlling water, protecting land and preventing erosion, contributing to forest services.	Contributing to REDD+ program, green growth, planting and recovering forests.
Nationwide (Vietnam)	Reassuring agricultural GDP, national food security aims, stable development aims.	Green adapting measures, reducing disaster's risks. National adapting plans.	Green growth policy contributes to NDC, lower carbon emission.
Global	Assuring food security for 9 billion people in 2050. Achieving the aim of balanced development for centuries.	Stable change. Achieving the aim of balanced development.	Keeping the rise of the Earth's temperature below 2 degree Celsius.

Source: Synthesized by ICRAF, 2017.

3.1.2. The main features of CSA

CSA addresses climate change: Contrary to conventional agricultural development, CSA systematically integrates climate change into the planning and development of sustainable agricultural systems (Lipper et al., 2014).

CSA integrates multiple goals and manages trade-offs: According to the theory, CSA have to aim at 3 main goals, which are productivity increase, withstanding improvement and emission deduction. On the way of deploying CSA, there is often a trade in selections. Accordingly, it is important to detect overall factors, consider the cost and effect of each choice based on the aim wich is decided (FAO 2012b; FAO 2013a).

CSA maintains ecosystems services: The ecology provides humans with services such as manufactures, foods and clean air. CSA use scenery approach based on rules of stable agriculture, however, they manage and plan in an overall way.

CSA has multiple entry points at different levels: CSA should not be perceived as a set of practices and technologies. Moreover, they include input points from the process of developing practice and technologies to the process of forming models and climate change's background, insurance mechanisism, value chain and improvement for policy and institution. Therefore, CSA are not only the technology at general level but also the synthesis of a number of invading methods for the food system, scencery, value chain or the policy.

CSA is context specific: What is climate-smart in one-place may not be climate-smart in another, and no interventions are climate-smart everywhere or every time. Interventions must take into account how different elements interact at the landscape level, within or among ecosystems and as a part of different institutional arrangements and political realities. The fact that CSA often strives to reach multiple objectives at the system level makes it particularly difficult to transfer experiences from one context to another.

CSA engages women and marginalised groups: To achieve food security goals and enhance resilience, CSA approaches must involve the poorest and most vulnerable groups. These groups often live on marginal lands which are most vulnerable to climate events like drought and floods. They are, thus, most likely to be affected by climate change. Gender is another central aspect of CSA (Huyer et al., 2015).

3.2. Chalenges of agriculture given the context of Climate change in Vietnam

3.2.1. Effects of Climate Change in Vietnam

According to the average emission scenario RCP 4.5 (similiar to B1 scenario) of climate change and higher sea level set up for Vietnam by the Ministry of Natural Resources and Environment, average temperature per year all over the world in 2050 will increase 1.3 - 1.7 degree Celsius, and until 2100 this figure would go up 1.7 - 2.4 degree Celsius. Overall annually rainfall tend to increase from 5 - 20 degree Celsius. Average sea level rise worldwide measured around the coast in Vietnam would be 23 cm (increases from 14cm to 34 cm) in 2050. This number would reach 55cm (increases from 33cm to 75cm) in the year of 2100.

Climate change is the most visible when viewed from the increase of extreme weathers and disasters, moreover from numbers and intensity. Many storms have bizarre trajectories so it is considerably hard to predict and rainstorms seasons would end later than usual. Droughts happen regularly in the Central regions in Vietnam affecting larger area with higher intensity. According to a report of The Centre Steering Committee in Preventing Disasters, many disastrous events have happened continuously from the beginning to the end of 2016. Not only that, they were reported in all regions throughout the nation with great intensity, broad area, unusual and severe. For instance, icy weather in the Northern provinces, droughts and soil salinity with history's highest record in the Mekong River Delta, South Central Coast and Central Highlands. 10 storms and 7 tropical depressions went into the South China Sea, 6 of which directly hit the land causing serious floods together with some other weather forms. These events happened continuously throughout the Central Regions and especially severe at Quang Ninh (2015 - thunderstorms, high winds and heavy rains), the Northwest Regions (2017 - effects were similar to that of Quang Ninh), the Mekong River Delta (rains against the season).

3.2.2. The effects of Climate Change on food production and food security

Food security in Vietnam at present or in the future is based on agricultural activities, especially the rice plants. However, in the following year not only agricultural activities but also crops production will encounter problems due to the fact that the need for food security will increase, effects from CC will worsen and natural resources will degrade.

CC are causing more damages to the ecologies, food production, food in general and making it more difficult to approach food sources. Food security will be seriously threatened if no measures are taken into account.

Effects of CC can be direct or circumstantial when bringing in agricultural production. That in Vietnam can be reduced 2 - 15% (Zhai and Zhuang, 2009). Severe weather conditions like floods, droughts, salinization… could reduce about 2.7 tons of rice per year in 2050 (Yu et al., 2010). Agriculture in the Mekong River Delta and North Central Coast would be heavily affected by rise in the sea level (Nguyen Huu Ninh et al., 2007). Effects from higher sea level would be mostly on rice production, fishery, lower but still considerable on industrial crops and grazing in Vietnam. With the appearance of CC, broadening production and food export will meet higher risk from unusual weather, especially severe ones.

3.2.3. The importance of improving CSA development in Vietnam

Nowadays, in order to adapt to severe weather, people from many regions have had some adjustments in cultivating times and technologies to help crops yield. They have also reduced damages from bad weathers by using plant types which can withstand severe conditions. Some reliable methods in irrigations, composts and fertilizers have been carried out. With mangrove lands, apart from choosing plant types, efforts in dredging trenches

and desalination have been increased. There has also been an increase in technologies to prevent epidemics, changing diets and adjusting the scales. In particular, many synthetic production systems together with a variety in types of plants and cattle are being recovered and developed.

Therefore, with CC and natural resources degradation, it is essential to replace old – fashioned systems. This will ensure productivity growth and economic efficiency, decrease greenhouse gas and strengthen adapting ability.

Putting CSA into practice at different levels and regions in Vietnam will bring certain effective outcome:

(1) CSA brought about a sustainable frame in agricultural production for farmers even with the clearer presence of CC. In developing countries such as Vietnam, agricultural productivity tends to be lower and riskier due to shocks and CC. Consequently, CSA bring about an approach that can increase productivity despite higher risks from CC.

(2) Available methods in agriculture are highly competitive in abatement cost compared to other industries like energy, transportation and forestry. Therefore, the benefits exist for a long time and it is highly likely to reach the aims.

(3) CSA have many commons with sustainable agricultural approaches. This means dealing with CC does not requires eliminating or reinventing everything we have made in recent decades. In particular, CSA are based on a majority of existing technologies and sustainable agricultural measures (sustainable agriculture, sustainable intensification, conservation agriculture).

(4) Moreover, CSA are differentiated from other methods by focusing on CC, specific in dealing with challenges in adaptation and deduction and at the same time maintaining food security for everyone. In general, CSA is sustainable agriculture together with the recovery ability. They also find ways in reducing greenhouse gas emission. (CSA = Sustainable agriculture + Recovery ability - Emission).

(5) Different from general intensive agriculture, CSA will (i) reduce cost, increase efficiency, decrease pollution and greenhouse gas, (ii) recover and protect lands and forests, (iii) save water, increase plant productivity, decrease soil deficiency, (iv) raise the ability to cope with disasters, epidemics and disadvantages of the climate, (v) and finally prevent the situations where production cannot be consumed, improve profits and productivity (Pham Thi Sen el at., 2015).

3.3. Policy orientations and guidelines to actuate CSA in Vietnam

3.3.1. CSA in national policy frames

Up to this point, Vietnam has issued many documents directly or indirectly relating to coping with CC. This is to reduce and adapt to climate change, sustainable development, include economic and society into protecting the environment.

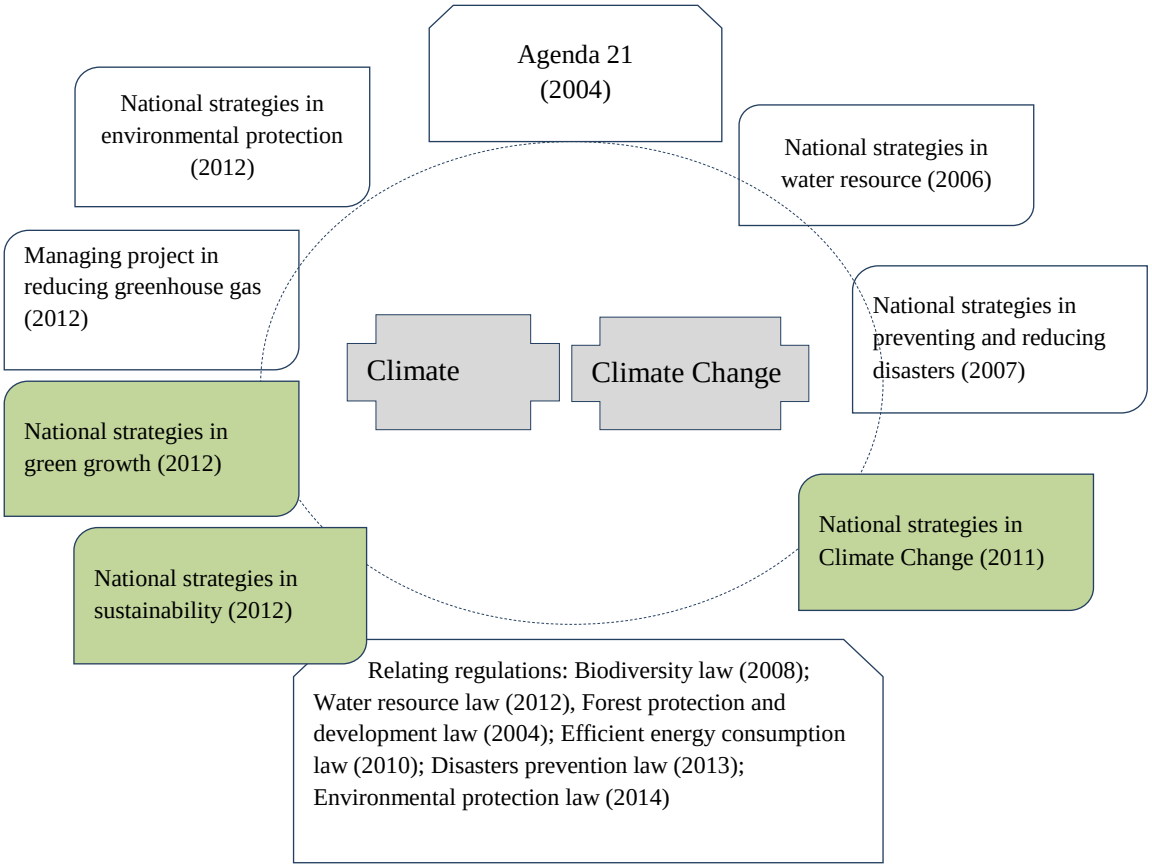

Figure 1: Strategies frame for dealing with Climate Change in Vietnam

Source: Synthesized by IPSARD, 2016

The national strategies to deal with Climate Change and Green Growth Strategy (GGS) are the two main policy frames coping with CC in Vietnam. Strategies and measures in agriculture are becoming more specific, synchronous and complete. They aim at both adaptation and mitigation. The course of actions of the Ministry of Agriculture & Rural Development to deal with CC from 2011 to 2015 focused on (i) effects of CC assessment, rise in sea levels and (ii) inclusion of Climate Change into plans, policies, strategies to develop branches, aspects and regions. The priority projects were (1) building constructions for preventing salinity in cities, populated areas (25 thousands billion dong as a cost), (2) improving dam systems (10 thousands billion dong as a cost). Together with the plans for courses of action, Ministry of Agriculture & Rural Development also launched a scheme for cutting down greenhouse gas in farming. Farming accounts for 43.1% of total greenhouse gas pollution in Vietnam (MONRE, 2010). The aim of this scheme was to move agricultural production into a green, safe and less emission way, at the same time maintain sustainable development and national food security, reduce poverty and effectively prevent CC. All the activities to reduce greenhouse gas emission included in the scheme are specific for each branches of agriculture, raising, fishery, forestry, irrigation and farming.

Table 2: Policy frame of agriculture for dealing with Climate Change

Times	Documents' names	Proof for enforcement	Applied periods
2008	Agricultural *action frame* adapting to Climate Change from 2008 to 2020	Report from steering committee of Agricultural Climate Change adaptation plans program	From 2008 to 2020
2011	*Action plans* of Agriculture & Rural Development dealing with Climate Change from 2011 to 2015 and visions for 2050.	Climate Change in National Environment program (2008)	From 2011 to 2015 with visions of 2050
2011	*Instruction for including Climate Change* into building; launch strategies, plans, programs, schemes to develop Agriculture & Rural Development from 2011 to 2015	Action frame in 2008 and agricultural plans for action dealing with Climate Change in 2011	From 2011 to 2015
2011	*Reduce greenhouse gas* in agriculture and farming until the year of 2020.	Agricultural plans for action dealing with Climate Change in 2011	From 2011 to 2020
2013	*Climate Change National plans of action* of Ministry of Agriculture & Rural Development from 2012 to 2020	Climate Change National plans for action from 2012 to 2020	From 2012 to 2020
2016	*Plans of action* dealing with Climate Change in Agriculture & Rural Development from 2016 to 2020, with visions of 2050[1].	Decision 2139/QĐ-TTg; Decree 08/NQ-CP Decree 24-NQ/TW by Central Executive Committee XI	From 2016 to 2020 with visions of 2050

Source: S*ynthesized by IPSARD, 2016.*

3.3.2. Some drawbacks in agricultural policy to deal with Climate Change

Despite the fact that including CC in policy frames has become a crucial factor in planning actions and choosing priorities for adaption in regional economic development, there are still problems remain. Moreover, "CSA" is a new term for policy planners and scientists. Many industries and public societies are also unfamiliar with this. IPSARD (2016) has pointed out some drawbacks in completing the agricultural policies for coping with Climate Change.

• Lacking the budget current has lowered the ability in local government to actively tackle CC;

[1] According to decision 819/QĐ-BNN-KHCN date 14/03/2016 of Ministry of Agriculture & Rural Development approved *Plans of action* dealing with Climate Change in Agriculture & Rural Development from 2016 to 2020, with visions of 2050

• Vertical and horizontal coordination have not been effective as there were overlaps in responsibilities between ministries and departments. Employees taking part in CC aspects have been concurrently holding many positions due to business or job change;

• Raising awareness of CC for relating parties has not been adequate, therefore measures for dealing with Climate Change are considered too passive;

• Including CC into projects and plans for developing economic and society has not received enough attention. Not only that, it misses specific directions;

• Adapting methods on a large scale for severe weather conditions and soil salinity are absent;

• Forecasting, predicting activities and warnings were not highly reliable.

3.3.3. Decisions and policies to actuate CSA in Vietnam

Policies for actuating CSA must be set upon specific principles. Firstly, they must assure the effective use of natural resources without depleting them. Secondly, agriculture must be smartly developed alongside CC. Moreover, this development needs to be green growth and contributive to providing food, materials, woods and fabric for people, at the same time contributive to economic development, porvety reduction, ecology endurance and Climate Change prevention. CSA are methods which can effectively make use of resources and endure unfavorable weather. Additionally, they emit less carbon dioxide into the environment.

The key factor in implementing suitable policies and strategies, broadening technologies and practices for CSA is the ability to understand obstacles in applying them. This includes tradeoffs between investment cost in short term to bring effects in the long run and both distinct and mutual benefits. There are obstacles in managing policy and finance, together with restriction in the ability to approach input resources and output markets (FAO, 2012). Various crucial requirements are set for an environment that can improve CSA and closely coordinate with CC, agricultural development and food security building process (FAO, 2010). Consequently, CSA need to be included in important adaption program launched by the government and Ministry of Agriculture & Rural Development. The priorities are suitable with the agreement and support of the society for CSA development. This process needs to match with national view of countering Climate Change in the long run. Some examples are National Adaption Programs (NAP), Nationally Determined Contribution (NDC).

According to Tran Dai Nghia (2017), the process of inserting CSA into policy frames and action plans should be done in the following steps:

- Step 1: Checking plans, schemes and policies relating to Climate Change Adaption (CCA) and CSA in order to point out the suitable policy frame, gaps and relationship between agents taking part in building key policy frames.

- Step 2: Preliminary investigation: from canvass results, planners from local areas gather general data and information on the process of building the policy frame decided in the above step.

- Step 3: Choose the most suitable frames for including CCA and CSA in local areas. Next, agents enrolling in building those frames are analyzed for the inclusion based on given data and information.

- Step 4: Analyze details of the content, build procedure for policy frames, digitize related parties as well as roles, duties, subjects enrolled, problems and challenges, drawbacks and opportunities for inserting CCA and CSA into this policy frame, especially with projects which are currently carried out or will be carried out in the future.

- Step 5: Based on the results from step 4 the main subjects enrolling in building the frames will discuss to (i) identified problems, gaps, challenges and opportunities investigated from step 1 to step 4 then (ii) compare reality with the procedures carried out according to the regulations in building policies. Finally, the aim of the discussion is to (iii) identify specific steps for building suitable policies, find out priorities for CCA and CSA's inclusion.

- Step 6: Give out proposals for CSA's inclusion activities as well as time frames and subjects taking part in the activities.

3.4. Typical CSA models in Vietnam

A research done by Caitlin Corner - Dolloff et al., (2016) used Climate-Smart Agriculture Prioritization Framework (CSA-PA) process in Vietnam. They investigated 807 farms and used 111 practice situations in all over the country. The practice situations were analyzed twice by a CSA dataset. In the first period, specialists evaluated, scored and picked out 13 situations with the most potential (11 of which were on plants, 2 of which were on cattle) then in the second period they carried out detailed investigations to fully understand the selections. 8 practice situations were chosen to analyze the cost and effect which were being studied by the Institute of Policy and Strategy for Agriculture and Rural Development in period three. Economic evaluation was made in specific production systems in regions with great importance to agriculture and vulnerable with CC. Some examples are Red River Delta, Mekong River Delta and South Central Coast. The research showed shrimp and crop rotation model, overall planning for rice, a combination of growing crop and growing mushroom were among the most effective and least risky selections. In the fourth period, which are currently being carried out, agents will be drawn towards making investment lists in priorities and plans of action for CSA.

3.4.1. Rice-Shrimp rotation model in Soc Trang

Rice-Shrimp rotation is a popular CSA model in the Mekong River Delta. Shrimp farming takes place in dry seasons from Febuary to August while crop farming is done in rain seasons from September to January yearly. Soc Trang province in My Xuyen district has the largest areas for Rice-Shrimp. The result of cost - effect analyse of the two crops model and the Rice-Shrimp rotation model was negative in the Net Present Value (NPV) of rice crop while NPV of shrimp - crop was positive, given that domestic labour was considered. Howerver, if domestic labour was cropped out, NPV for both choices would be positive. Despite that the Internal Rate of Return of the rice crops system was relatively lower than that of the shrimp - crop one (IPSARD, 2016). In addition, Rice-Shrimp

rotation model can provide lots of benefits for the environment and the economy due to sustainable rise in income and food security. For the environmental espect, this system helps decrease the amount of fertilizer used in crops and reduces risks of epidemic for shrimp. Moreover, it improves the efficiency of land use and it posesses higher ability to withstand risks. Not only that, this system can maintain crops even when salt concentration in land reaches 6% and 10% for shrimp's growth.

3.4.2. ICM[2] in rice using 1M5R model in Nam Dinh province

This CSA model is popular among Giao Hai in Giao Thuy province, Nam Dinh. This model was developed folowing the success of 3G3R[3] campaign. This model encourages farmers to use the 'must' seeds. 'Five reduce' means readucing water, materials and loss after cultivation or fertilizer and pesticide use. In this model crops are grown in 2 seasons per year, which are Winter - Spring season from Febuary to June and Summer - Autumn one from July to October. 1M5R[4] has been applied for 15 households in the province since 2015. One of the benefits was fertilizer, water and labour reduction. However, rice production has only increased slightly compared to the original cultivating method.

The results from currency analyse between the original model and 1M5R were positive for the NPV of 1M5R system and negative for the original one since the amount of seeds, fertilizer, pesticide as well as labour used in 1M5R model is less than that of the original one. Apart from that, using 1M5R model has decreased greenhouse gas emission by 5.3 billions CO_2 per ha per year, which equals 588.000 vnd, compared to original cultivating methods.

3.4.3 Mushroom from rice straw in Soc Trang province

Hay after cultivation is usually burnt on farms when using original method, as a result the amount of greenhouse gas in the atmosphere increases. However, hay on farms in the Mekong Delta has been collected to grow mushroom recently. This act provides icome for households and reduces emission at the same time. Soc Trang has wide areas for cultivating mushroom.

According to IPSARD's results in 2016, currency between original two - season cultivating methods and mushroom from rice straw model in Chau Hung in Thanh Tri province, Soc Trang was positive for NPV of both mushroom - crop and crops model. In practice, the mushroom - crop model has higher IRR. Additionaly, with the variation of crops and mushroom products the farmers are less likely to receicive damages from severe climate (droghts, salinity). Using hay for mushroom will contribute to the process of reducing greenhouse gas and managing pollutants.

4. Discussion and conclusion

It can be considered that there are many science acts in climate change adaption and mitigation in the agricultural aspect these days. CSA is a new term in the world as well as in Vietnam, even though agricutural models relating to CSA have been carried out in

[2] ICM: Integrated Crop Management

[3] 3G3R = Three Gains and Three Reductions (also known as 3G3T)

[4] 1M5R = One Must Do and Five Reductions (also known as 1P5G)

Vietnam for a long time. Many researchers, policy planners, agricultural employees and farmers themselves tried to include CSA into agriculture in the past, but they have difficulties in understanding and isolating them from other related terms. Awareness of CSA is relatively low at both national and regional level, especially at specific aims and policies for carrying out CSA, cultivating acts, encouraging investment and using new technologies. Therefore, it is important to connect researchers and scientists' work based on scientific proof. These policies can create operation structure to help the models, or give out guidance for farmers who take this into account. Using and handing over new technologies and CSA has brought about great disadvantages to the farmers like agricultural products not being balanced and missing their output markets. Finance investment in new technologies is no doubt too low. Moreover, there were not enough written documents for changing into smart agriculture systems from original ones and the intensity of carrying out CSA is not high enough has made CSA models more difficult to be broaden.

With given situations, some suggestions for applying CSA into practice are (i) building understanding of CSA through researches and evaluations in the past and possible ones, (ii) improving skills for policy planners, researchers, agricultural employees through training programs, (iii) building the frame for CSA's course of action at national level so as to merge knowledge and action of agents, (iv) institutionalizing the enrollment of factors contributing to finance and technology, (v) encouraging finance for broadening the use of CSA and tackling CC, and finally (vi) creating opportunities for local investment into activities for CC adaption.

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