Melanie Connor. 2023. Chapter 6: From Science to Policy: Sustainable Rice Production in the Mekong Delta, Vietnam. In Thanh Tam Ho (ed.), *Toward Sustainable Agriculture of Rice in Asia: Economic Challenges and Policy Implications*. Osaka: Asia-Japan Research Institute, Ritsumeikan University. ISBN 978-4-910550-47-3

Chapter 6
From Science to Policy: Sustainable Rice Production in the Mekong Delta, Vietnam

Melanie CONNOR

Abstract: Over the last decades, Vietnam has benefited from a rapid intensification of rice production that has led to environmental degradation and adverse health effects. As a result, complex sustainable rice farming packages such as the national program "One Must Do, Five Reductions" (1M5R) have been introduced, but adoption still appears to be low. The technology package includes the reduction of fertilizers, pesticides, post-harvest losses, water use, and seed rates. An additional requirement is the use of certified seeds. This chapter will cover the diffusion and adoption process and will specifically focus on adoption constraints, and how they can affect policy outcomes and adaptations. The chapter will highlight the outcomes from various policy-supported initiatives and unpack plausible pathways that generated the widespread adoption of 1M5R in different provinces.

1. Introduction

There are a lot of different ways that we engage knowledge of science with policy. There is a great deal of literature in different modes explaining how policymakers use that scientific knowledge to create various interdisciplinary themes, not only in economics. In this chapter I would like to discuss the "Knowledge supply mode." (Figure 6.1)

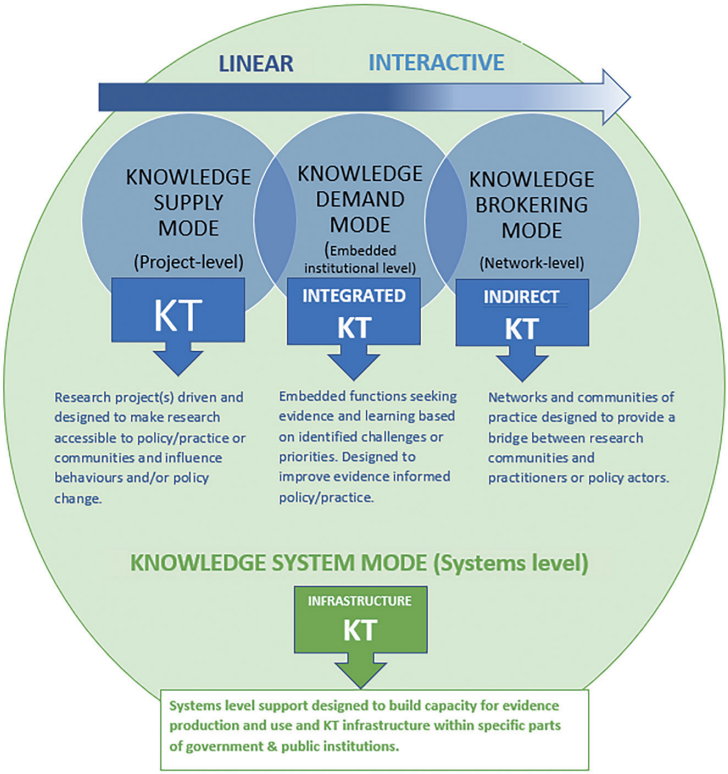

Figure 6.1 Engaging evidence with policy. Source: Author

At the International Rice Research Institute, we provide a lot of information to policymakers and expect them to use that knowledge to make new policies. For instance, how will this knowledge influence farmers to implement that policy and change their behavior? As a psychologist, I am interested in studying farmers' behavior, behavioral change, and how behavior affects their decision-making.

What we need to have to make effective policy is useable evidence. Here I would like to show you some case studies in the past seven years

with the Closing Rice Yield Gaps in Asia with Reduced Environmental Footprint Project (CORIGAP) (Figure 6.2). CORIGAP aims to improve food security and gender equity, and to alleviate poverty by optimizing yield and sustainable rice production in China, Myanmar, Thailand, Indonesia, Sri Lanka, and Vietnam. Especially, the CORIGAP program aims to explore how to: (a) Reduce yield gaps with the aim to strengthen future food security and (b) Increase environmentally sustainable rice production in intensive lowland systems.

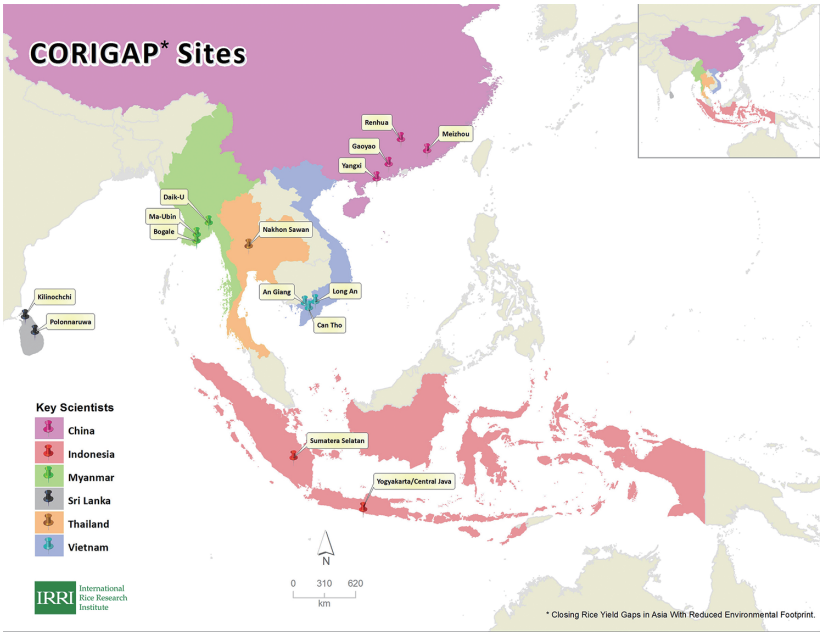

Figure 6.2 CORIGAP Sites. Source: https://ricetoday.irri.org/wp-content/uploads/2017/02/CORIGAP-map.jpg

2. The Approach of Adaptive Research

The study uses an adaptive research approach. Farmer participatory

research needs assessment, field plots, adaptive research, and cross-site visits. Especially, for the bottom-up approach to provide recommendations to policymakers and all farmers, we use disciplinary knowledge produced by scientists from the International Research Rice Institute (IRRI).

Aligned with national best management initiatives for lowland irrigated rice, we assisted with rice farm development in Vietnam (1 Must Do, 5 Reductions), Myanmar, Thailand, Indonesia (Best Management Practices (BMP)); China (3 controls technologies + Alternate Wetting and Drying (AWD) for irrigation water saving). This study is focused on the Mekong Delta of Vietnam (Figure 6.3).

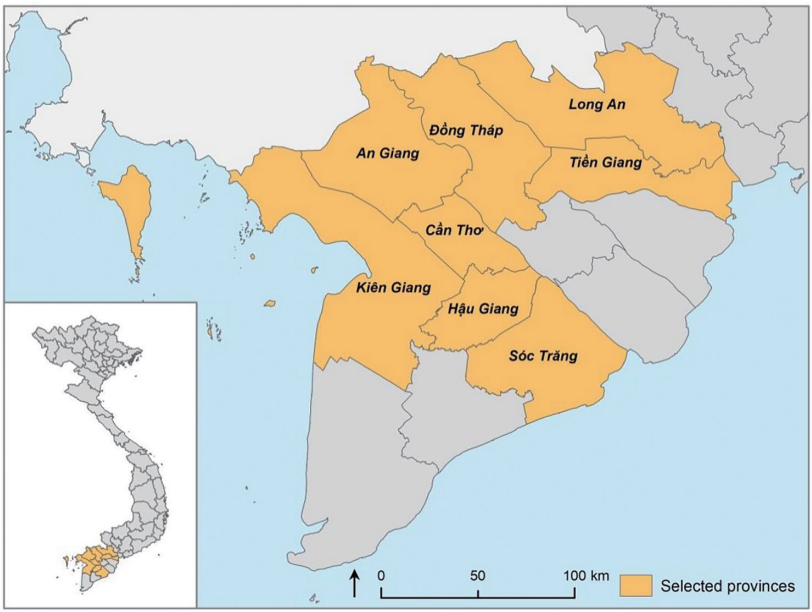

Figure 6.3 Map of research area, Mekong Delta of Vietnam. Source: Author

3. Challenges and Research for Development

(1) Current Challenges

There are some challenges in rice production in the Mekong Delta, Vietnam, including: input overuse and environmental degradation, climate change and increased natural disasters, rising sea levels and soil salinization, particularly in the Mekong River Delta, and increasing crop residue and rice straw.

(2) Research for Development and Activities

The program introduces new sustainable, climate-smart technologies and practices, and hopes that farmers can adopt these technologies (Figure 6.4). In detail, these technologies and practices include using a drum seeder, alternate wetting and drying (AWD), a flatbed dryer, laser land leveling, ecologically based rodent management, HYVs, IRRI, a super bag, a mechanical transplanter, a solar bubble dryer, IRRI Rice Knowledge Bank, a lightweight thresher, and a combine harvester.

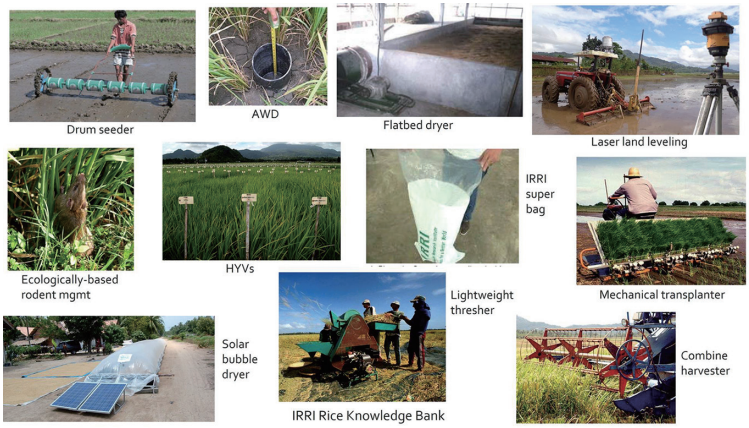

Figure 6.4 The development of integrated programs that use new technologies and practices to increase sustainability. Source: Author

The Vietnam Government has introduced a national policy, namely "One Must Do – Five Reductions," which aims to promote the use of best management practices in lowland rice cultivation. This includes the use of certified seeds as well as the reduction of seed rates, fertilizer use, pesticide use, irrigation water use, and post-harvest losses (Figure 6.5). However, it can be clearly seen that there are different values. For instance, seed rates are sometimes set at a maximum of 100 kg per ha but can increase to 120 kg per ha. This is because farmers could apply these different seed rates for different rice crop seasons. The adoption can be seen as a function of Yes vs. No, or Adoption vs. No adoption. Therefore, our study focuses on how we can specifically define the adoption at a specific level for each category. The reduction of fertilizer use, defined as adoption 1M5R, is set at the level of 100–110 kg per ha. The adoption of pesticide reduction is defined as: i) the use of a maximum 1–3 insecticide application(s) and no insecticide before 40 days of seeding (DAS), ii) the use of maximum 3 fungicide applications and none within 20 days before harvesting, iii) the use of maximum 2 fungicide application and none after flowering. Regarding the reduction of water use, the adoption is defined as a minimum of two dry-downs in the Dong Xuan (Winter-Spring) crop season, a minimum of one dry-down in the He Thu (Summer-Autumn) crop season, or the use of safe AWD with water tubes.

Figure 6.5 One must do – five reductions and adoption of innovation (1M5R). Source: Author

Figure 6.6 shows the framework for the adoption of innovation (1M5R) and its process.

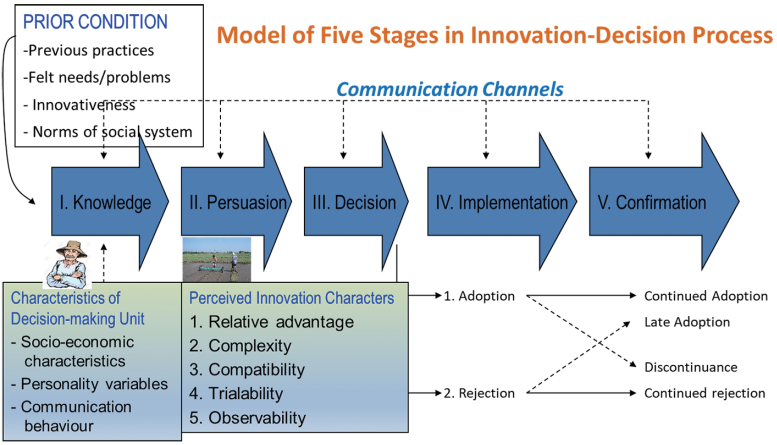

Figure 6.6 Adoption of an innovation (1M5R). Source: Author

4. Case Studies in Vietnam

(1) Case 1: Qualitative Analysis of the Diffusion and Adoption Constraints in Vietnam

1) Data Source

Data was collected from 155 farmers and extension officers from MARD in 17 focus group discussions and analyzed by thematic content to know how those different stakeholders perceive the adoption of the 1M5R. Almost all farmers followed all requirements, especially fertilizer and pesticide reduction, and post-harvest loss reduction. However, farmers meet difficulties in applying AWD and reducing the seed rates.

There are some influencing factors mentioned in the group discussions:

- Social networks including other farmers, friends, millers, and traders can influence their willingness to adopt in practice.
- Information access such as weather forecasts, pest forecasts, access to markets, cropping calendar and extension services can influence farmers' adoption.
- Farming systems such as soil type, access to irrigation, and transportation methods might have a big influence on farmers' adoption or non-adoption.
- Access to equipment such as drum seeders, laser levelers, and combine harvesters might negatively affect the post-harvest losses.

2) Summary of Results

A multi-stage process consisting of several workshops for multiple stakeholders and several farmers' focus groups is important for the

effective implementation of the 1M5R in order to bring beneficial results. The qualitative analysis shows that external factors seem to be the main barriers. In the case of water reduction and reduction of seed rate, external factors such as the geographical location of the farm, land preparation, and access to machinery must be addressed further by the government and public-private partners. Knowledge provision, demonstration fields, and access to extension services are important to increase the adoption of sustainable rice farming practices.

(2) Case 2: Vietnam – Adoption of 1M5R

1) Data Source

Adoption and barriers to adoption of the five reduction requirements and the use of certified seeds specified under 1M5R were investigated by means of a survey questionnaire created using CommCare (Dimagi), a widely used data collection platform, predominantly for monitoring health information in developing countries (Agarwal et al. 2016). There was a total of 465 participants — 94% male with a mean age of 50.9 (Standard deviation = 12.4). In addition, there was a training session for enumerators to use the survey application before conducting the survey.

According to surveyed data (Figure 6.7), 91% of farmers have been using certified seeds with 37% using high-yielding varieties. Farmers have also reduced their seed rate (86%). However, considering a seed rate of ≤100kg/ha, only 4.7% (n = 22) of the farmers applied that. There are a number of farmers who reported that they have reduced their pesticide use (74.4%), including fungicides (88%), herbicides (94%), insecticides (90%), rodenticides (62%), and molluscicides (93%). 74% of participants reported that they reduced their fertilizer use, but only 45% of the participants reported reducing

their water use and 35% of the farmers reported to be applying AWD in their fields.

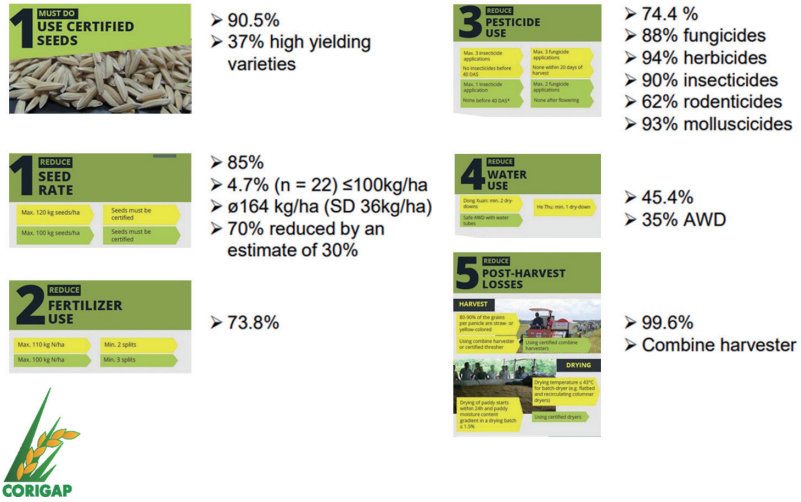

Figure 6.7 Summary of surveyed data on 1R5M adoption in the study sites.

Source: Author

All farmers who adopted practices were still using them in 2019 and reported to be willing to continue using them.

2) Benefits and Barriers

Rice farmers perceived a variety of benefits when adopting the single requirements specified under 1M5R. Most of the farmers perceived for each requirement that "it is easy to apply 1M5R," "Labor costs are lower," "It is less expensive," and "It fits my crop pattern" (Figure 6.8).

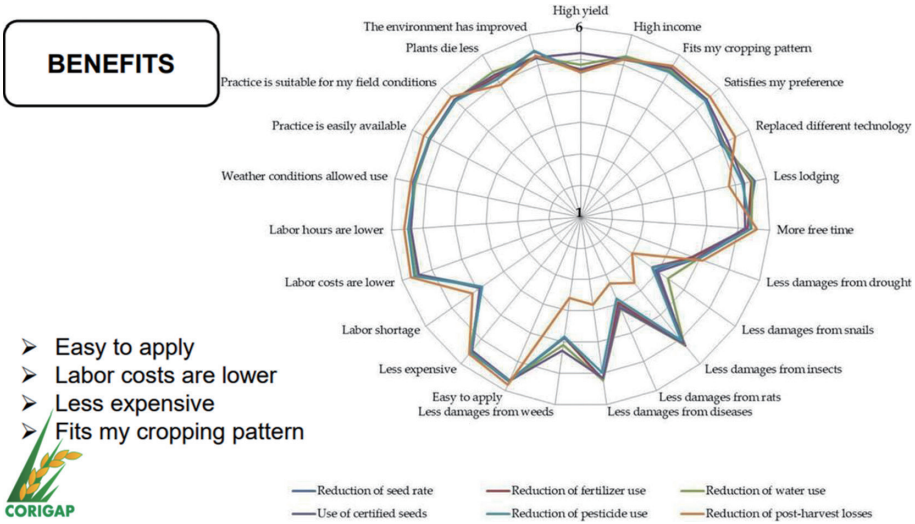

Figure 6.8 Benefits of 1M5R adoption. Source: Author

Farmers also perceived some barriers to adopting the 1M5R. The main barriers to using certified seeds were "Technology is not suitable for my field conditions," "It's too expensive," and "It doesn't satisfy my preferences." Farmers reported several barriers to reducing seed rates and fertilizer use including "Weather conditions do not permit it," "It doesn't fit my cropping pattern," and "It produces a low yield." Barriers to reducing water use were "It doesn't fit my cropping pattern," "It's too difficult to apply," and "Weather conditions do not permit it" (Figure 6.9).

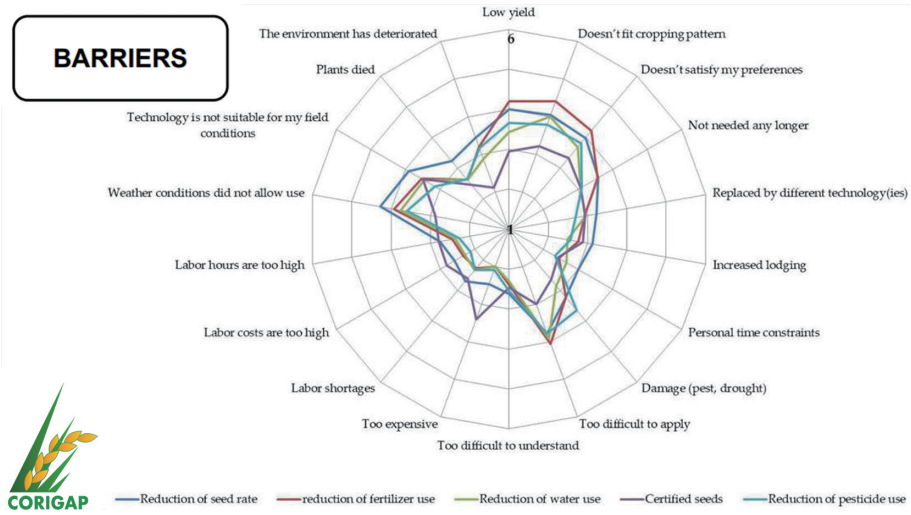

Figure 6.9 Barriers of adoption 1M5R. Source: Author

3) How often were Certain Combinations Adopted?

When analyzing the requirements using AWD and a seed rate of ≤100kg/ha, the use of certified seeds occurs more often in combination with the reduction of fertilizer and pesticides, and the use of a combine harvester, whereas the use of AWD (water use reduction) and the reduction of seed rate remain separate and, therefore, used less frequently in combination with the other requirements (Figure 6.10).

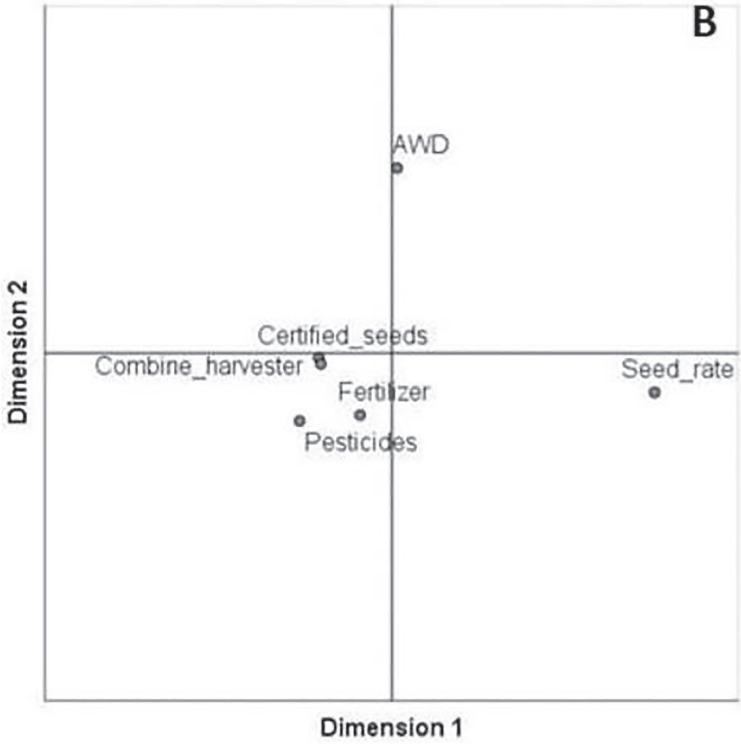

Figure 6.10 Combination adopted. Source: Author

4) Factors Influencing the Adoption of 1M5R

A linear regression model was used to investigate the factors influencing how many elements of 1M5R were adopted by rice farmers. For the adoption analysis of generally phrased requirements, farmers' satisfaction, the ease of 1M5R, non-rice income, and education were significant predictors. Meanwhile, for the adoption of the requirements using AWD and a seed rate of 100kg per ha, farmers' years of farming become an additional predictor apart from three predictors of the ease of 1M5R, non-rice income, and education (Table 6.1).

Table 6.1 Influencing factors on 1M5R adoption

	(A) Adoption generally phrased requirements, r2 = 24.9%			(B) Adoption for requirements using ADW and a seed rate of 100kg/ha. R2 = 23.5%		
	Beta	t	p	Beta	t	p
Total area	0.008	0.521	.603	0.010	0.852	.395
Years of farming	0.008	1.787	.075	0.007	1.913	.056
Expectations	0.016	0.188	.851	0.086	1.242	.215
Saticsfaction	0.206	2.280	.023	0.065	0.879	.380
Ease of 1M5R	0.530	6.462	.000	0.418	6.163	.000
Average yield	0.089	1.610	.108	0.038	0.828	.408
Non-rice income	0.470	4.194	.000	0.006	3.680	.000
Province	0.093	0.789	.431	-0.024	-0.243	.808
Education	0.218	3.173	.002	0.130	2.298	.022
Member of cooperative	0.184	1.481	.139	0.005	0.048	.961
Subjective knowledge	-0.126	-1.008	.314	0.018	0.170	.865

Note. N = 464. Variable province was coded 1 = An Giang, 2 = Can Tho. Variable non-rice income was coded 0 = no, 1 = yes.

Source: Author

The results from seven logistic regression models for seven rice farming practices were summarized in Figure 6.11. The use of certified seed was significantly affected by farmers' education and the ease of 1M5R, while the reduction of seed rates was significantly influenced by their satisfaction and the ease of 1M5R. In addition, the ease of 1M5R strongly affected their willingness to reduce fertilizer use, pesticide use, water use, and AWD. Moreover, the higher the percentage of their non-rice income, the more their willingness to reduce fertilizer use, pesticide use, water use and AWD. Meanwhile, satisfaction and average yield are influencing factors in the reduction of fertilizer use, while expectations and satisfaction are other key factors in the adoption of AWD.

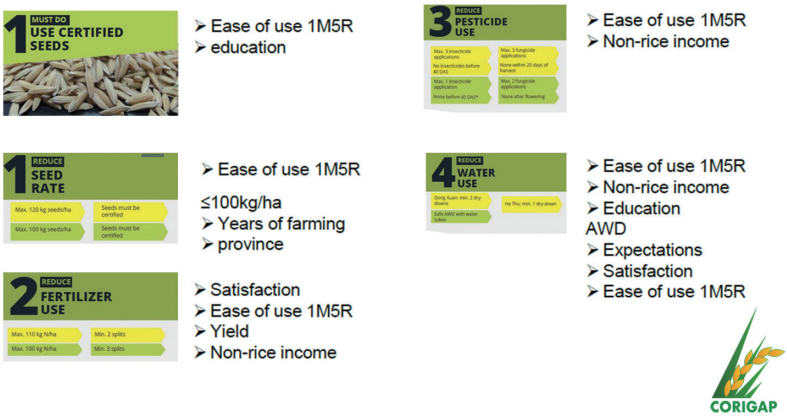

Figure 6.11 Summary results of the regression model. Source: Author

(3) Case 3: Vietnam – Psychological Factors Influencing the Acceptance of Sustainable Farming Practices

1) Household Survey 1

a) Study Site and Data Collection

The survey was conducted in three provinces of the Mekong Delta — An Giang (n = 38, 17 cooperative farmers), Can Tho (n = 35, 10 cooperative farmers), and Tien Giang (n = 38, 18 cooperative farmers) in 2018. The majority of participants were male (91%). The mean age was 51.5 years.

b) Sustainable Farming Practices

A total of eight sustainable farming practices with respect to rice straw were introduced to farmers for assessing their acceptance. They include on-field practices and off-field practices (Figure 6.12). Regarding on-field practices, there are two main managements: 1) the incorporation of rice straw into the field which can improve soil

fertility and nutrient balance. However, the speed of degradation can vary, and an increase in organic matter in irrigated soil can increase GHG emissions; and 2) rice straw burning which is a quick, simple, and affordable method of reducing biomass quantities in the field, but this causes GHG emissions and release of pollutants. Meanwhile, the off-field practices involve composting rice straw, rice collection methods, anaerobic digestion – biogas production, mushroom production, and cattle feed.

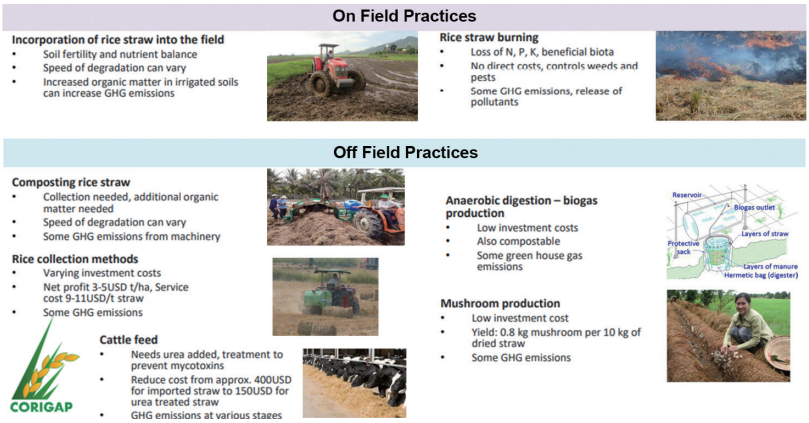

Figure 6.12 On field and off field practices. Source: Author

c) Method – Fact Sheets

All fact sheets regarding rice straw management had the same format and started with a short introduction to the management practice. After this short explanation, a colored picture of the management practice followed. The second half of the fact sheet showed the specific features of the straw management practices in bullet-point format which include benefits, risks, costs, and GHG emissions (Figure 6.13).

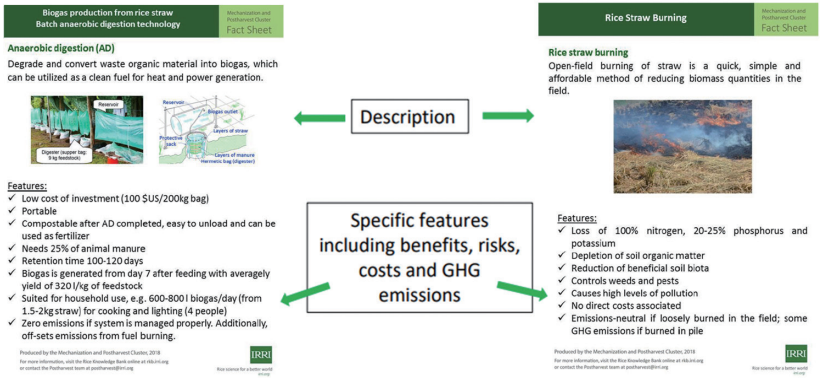

Figure 6.13 Fact sheets. Source: Author

d) Theoretical Framework

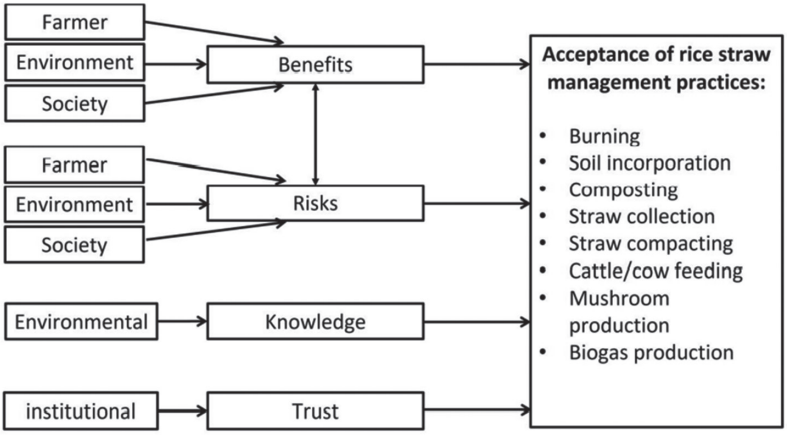

Figure 6.14 Theoretical framework. Source: Author

e) Results

Results show that farmers often burn their rice straw even though

they perceive high risks, few benefits, and expressed low levels of acceptance for rice straw burning. However, acceptance of rice straw management practices differs between practices, and their behavioral intentions are high. All other management practices are perceived to have high benefits and relatively low risks — practice depends on, and whether farmers know about the management option.

The perceived benefits were a strong predictor for farmers' acceptance of all other rice straw management practices. The results of the study also show that risk perceptions were weak but a significant predictor for the acceptance of rice straw incorporation into the soil, straw burning, biogas production, and cattle feed.

Furthermore, knowledge about climate change was also a predictor for the acceptance of straw incorporation into the soil, composting, cattle feed, baling, compacting, and mushroom production.

The results show that support from institutions is a significant predictor for baling and compacting rice straw. Farmers need support from different actors; especially from the government and research institutions to have access to straw collection machinery since participants are all small-holder farmers and have limited access to machinery.

Farm size has a negative impact on the incorporation and composting, while only rice yield had a positive significance for biogas production. Therefore, it is necessary to carefully take into account different factors for different practices and policies.

2) Household Survey 2

a) Data collection

Data were collected from 180 farmers twice (in 2015 and 2019) using a tablet-based questionnaire. They were classified into a project and a control group. The sampling is by purposive geographic selection,

and project farmers were selected randomly from the farmers' list, and control farmers were purposively matched. Especially, the selection of farmers was based on the local extension staff's network of farmers who proactively participated in commune-level farming activities such as training facilitated by the extension staff.

b) Results

- There were no sociodemographic and farm-specific differences between the farmer groups in both survey years.
- Adoption rate was high for combine harvesters, drum seeders, AWD, and improved varieties → there were no significant differences between farmer groups.
- Farmer profitability increased by 5.7% and rice yield by 4.7%.
- Socioeconomic and agronomic differences between farmer groups in both survey areas: (1) project farmers applied lower quantities of inputs, (2) project farmers' yield and rice income were also lower.

(4) Case 4: Consumer Acceptance and Willingness to Pay for Sustainably Produced Rice

The Sustainable Rice Platform (SRP) standards—the world's first sustainable production standard for rice—has recently been introduced in Vietnam, but the market demand and potential for price premiums for SRP-certified rice are not known (My et al. 2018, 2021). This study aims to examine the relationship between climate change knowledge and consumer willingness to pay for SRP-certified rice in Vietnamese supermarkets. Data for the study was collected from 410 consumers through a questionnaire survey. Most participants were female (86.3 %), and the average age was 41.7 years.

1) Theoretical Framework

The conceptual framework for this study is presented in Figure 6.15. This study attempts to investigate the influence of knowledge (i.e., about climate change and of sustainably produced rice), attitudes towards sustainable production, and socio-demographic and economic variables on consumers' willingness to pay for sustainably produced rice. Especially, consumer's evaluations of three different attributes of the SPR standard will be investigated, namely consumers' perception of ecological production, ethical production, and low-emission production.

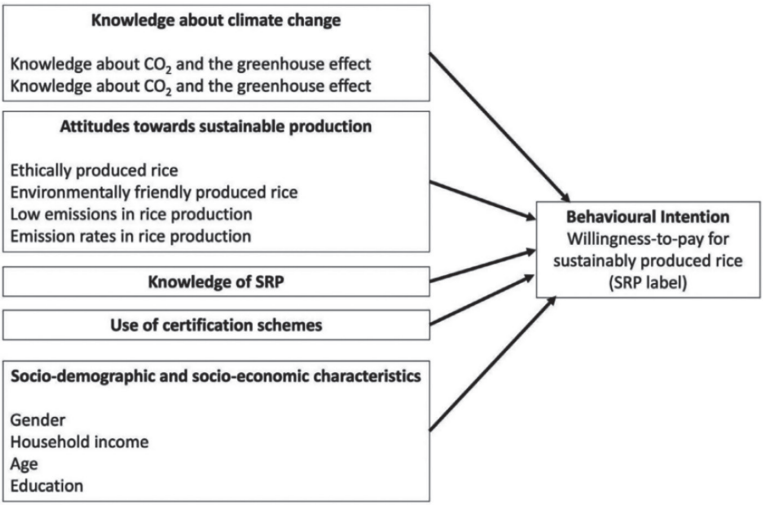

Figure 6.15 Conceptual framework of the study; determinants of consumer's willingness to pay for SRP labelled rice (adapted from My et al. 2018; 2021)

2) Results

The results of this study show that consumers are willing to pay a 29% price premium for sustainably produced rice. Knowledge about climate change and its impacts positively influenced willingness to pay.

Especially, focusing on the country's contexts is extremely important for policy implications and finding some similarities for applying in the Vietnamese context. Moreover, household income positively influenced willingness to pay. If consumer demand for sustainably produced rice can be increased, production will need to follow. The findings of this study are important for policymakers to increase the inclusiveness of SRP rice by creating an enabling environment for investment in the supply and demand for SRP rice.

5. Conclusion

In summary, the 1M5R program is suitable for farmers' conditions in the Mekong Delta. This program has been strongly and consistently supported by MARD, particularly by the Department of Crop Production and Plant Protection. The program is now a provincial regulation and policy and has also been modified for application in Lao PDR and Thailand.

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Chapter 6. From Science to Policy: Sustainable Rice Production in the Mekong Delta, Vietnam

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