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The Impact of Agricultural Technology Adoption on Poverty Reduction in Phu Tho, Vietnam

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Abstract

Poverty alleviation has become a heated issue of developing nations over the world. There is the relationship between agricultural technology and poverty in most developing countries. Clearly, Viet Nam is a traditional, agricultural nation having 70% of its population in rural areas (CIA, 2014). The selected province, Phu Tho, highlighted the importance of agricultural technology in economic growth as well as poverty eradication. Additionally, there are few studies elaborating on this issue in the context of Phu Tho, Vietnam. The paper argues that applying the agricultural technology is the main solution accompanying with some effects. To be specific, technologies can be developed with the active participation of farmers and understanding of the context of their application. Using OLS regression analysis and the double difference method to estimate the unconditional treatment effect of new agricultural technology on incomes approves that technology adopters received a statistically substantial large growth in agricultural income from irrigation more compared to the non-adopters on average even in the presence of key factors that determine the income. Additionally, the paper conducts various focus group discussion sessions with the respondents to highlight key constraints while applying agricultural technology. In sum, this research suggested that farmers need to enrich their understanding of the technological expertise of new agricultural technologies.

Keywords: Poverty Alleviation, Agricultural Technology, Phu Tho (Vietnam)

Introduction

Undoubtedly, the conventional interpretation of agricultural improvement withdraws agriculture as the prime engine of growth and poverty alleviation in developing nations. The perspective emphasizes that small farm agriculture growing modern variety of agriculture products in relatively high potential and well-connected areas agricultural development are related to increasing productivity of smallholder producers of essential foods. Vietnam is the nation, which is basing on the agriculture. Particularly, Viet Nam is a traditional agricultural nation having 70% of its population in rural areas (CIA, 2014). The selected province, Phu Tho, highlighted the importance of agricultural technology in economic growth as well as poverty eradication. Seen the agricultural technology, Phu Tho province has some constrains from solving economic growth and poverty eradication. This paper proposes a series of technology management and expertise technology indicators to be used in assessing evolution in meeting the poverty-reduction targets in Vietnam. The purpose of this study is to investigate the influence of agriculture technology into the use of poverty alleviation in a context of Phu Tho province, Vietnam. The research also elaborates on the limitation and the issue of technology; thereby, it helps the companies to reduce the risk of technology application. The empirical studies support a basic process of implementing agriculture; thereby, it favors the farmers and agriculture industry in Vietnam, which have a plan to apply the new model to reduce poverty. Although previous papers have been mentioned about the benefit of technology for poverty eradication, limited evidence directly evaluates the relationship between technology application and poverty. Therefore, using OLS regression analysis and the double difference method to estimate the unconditional treatment effect of new agricultural technology on incomes approves that technology adopters received a statistically substantial large growth in agricultural income from irrigation compared to the non-adopters on average even in the presence of key factors that determine income. Additionally, the paper conducts various focus group discussion sessions with the

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respondents to highlight key constraints while applying agricultural technology.

Literature review

The Relationship between Agriculture Technology and Impact on Rural Poverty

The research adopts the livelihood-framework approach developed by DFID, (2001) which is based on evolving thinking about poverty reduction, the way the poor and vulnerable live their lives and the importance of structural and institutional issues. The approach suggests development activities that are people-centered, responsive and participatory, multilevel, conducted in partnership with both the public and private sectors, dynamic, and sustainable.

Agricultural growth is essential for fostering economic development and feeding growing populations in the most less-developed countries. Area expansion and irrigation have already become a minimal source of output growth at a world scale. Agricultural growth will depend more and more on yield-increasing technological change (Datt and Ravallion, 1996; Hossain, 1989).

In case of this context, Vietnam narrows Phu Tho as the reflecting example of poverty reduction by utilizing the new agriculture technology as well as the expertise technique. Expectedly, Phu Tho has been influenced by exogenous factors such as agro-climatic conditions and diseases, which prevent the productivity.

As noted by Lipton and Longhurst (1989) and Rosegrant and Svendsen (1993), the reason is the massive investment in agriculture technology in Asian nations in 1960s and 1970s have been effective in feeding growing populations and boosting the economic growth. Certainly, the recent years have observed serious transformation of technology in agriculture in Asian nations accompany with food sufficiency and rural development and hunger reduction.

Agricultural System Grows in Developing Nations and Vietnam context

In the context of this paper, the theoretical framework is applied to the agricultural sector in developing countries. Forest and foremast, the agricultural innovation system can be conceived not only as ensuing from, but also as an integral part of, the agriculture productivity.

Table 1

Poverty Estimates for 2010 by Region and Urban/Rural Areas

	GSO-WB Poverty Rate		Official Poverty Rate	
	Incidence (%)	Contribution to total (%)	Incidence (%)	Contribution to total (%)
All Vietnam (national)	20.7	100	14.2	100
Urban	6.0	9	6.9	14
Rural	27.0	91	17.4	86
Red River Delta (Hanoi)	11.4	12	8.4	13
East Northern Mountains	37.7	21	24.2	20
West Northern Mountains	60.1	9	39.4	9
North Central Coast	28.4	16	24.0	20
South Central Coast	18.1	7	16.9	10
Central Highlands	32.8	10	22.2	9
Southeast (HCMC)	8.6	7	3.4	4
Mekong Delta	18.7	17	12.6	17

It is highlighted that Vietnam is still an agricultural country. Agriculture plays an important role in the country's economy, with the sector contributing 24% to national GDP, accounting for nearly 30% of the total export value, and employing over 60% of the country's economically active population.

Vietnam has changed from being a net importer of rice in the late 1980s to becoming the second largest rice exporter in the whole world, and exports large quantities of commercial crops including the commodities – rubber, tea, coffee, pepper, groundnuts, and cashew nuts – with the average annual growth rate of 4% in agriculture.

Vietnam has set up poverty reduction as a major development policy. To achieve this goal, Vietnam has maintained an extensive public safety net and launched a large number of poverty-reduction programs. Statistically, province poverty has been withdrawn in Vietnam; in particular, it majors in remote and highland areas. The nation has a forecast that around 11% in 2002 and 85% of the poor stay in rural area. These people are lack of accessing the productive assessment such as knowledge, information capital and good weather conditions as well as they suffer vulnerable nature disaster including flood and drought. Highlighted from this country, more than 70% population in rural areas faces difficulty in economic transformation and food security.

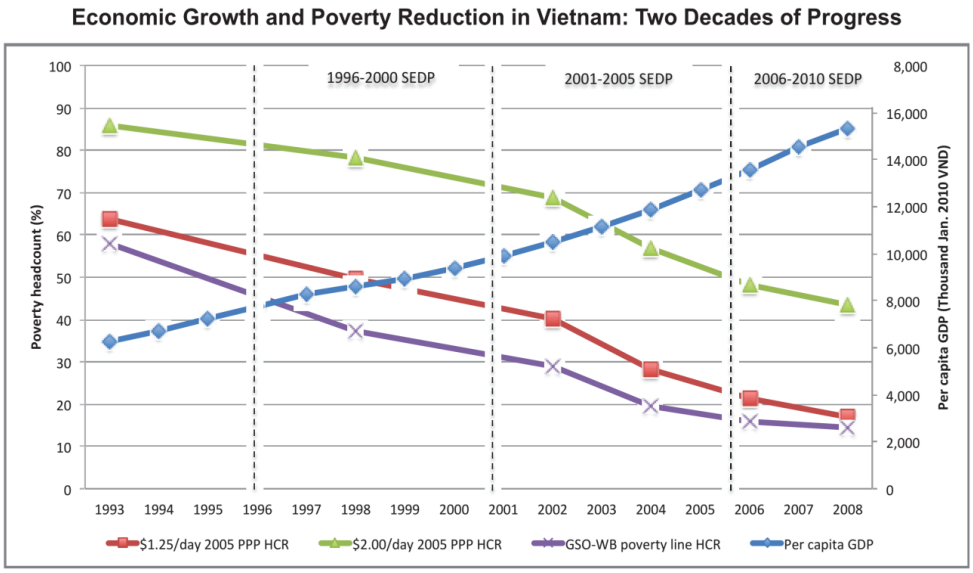

Fig. 1: Economic Growth and Poverty Reduction in Vietnam: Two Decades of Progress

The paper reveals that one approach to reduce poverty in rural areas is to assist the research, extension, and vocational training system in Vietnam, thereby improving the mechanism for transferring new technologies and good established practices in a two-way directed linkage between agricultural scientists, extentionists, and farmers. The current technology transfer from research institutions to farmers in Vietnam, presented in Figure 1, reflects the linear model of technological innovation with one way of communication from research institutions to farmers (Nguyen Van Phu. 2003).

Research Methodology

The investigation applies monomenthod studies, which is one popular methods for quantitative research (Tashakkori & Teddlie, 1998, p.17), because this choice is appropriate with time limitation and cost saving. Furthermore, respondents are online shoppers and willing to do online survey rather than other choices. The quantitative choice is vital to use statistics and computers and it follows positivism. While the qualitative research indicates the "attitude, feelings and motivations" of a small number of respondents, quantitative approach is collecting data in larger numbers and reach conclusion from statistics, numerical results. According to Jupp (2006), quantitative research is the "research involving the collection of data in numerical form for quantitative analysis." The quantitative research has several advantages than qualitative research. First, the reliability of the quantitative result examines a large number of respondents and is based on the computers to analyze (Veal, 2005). This method also explores causes of phenomena and is less subjective to an individual. It conducts the study of human behaviour as well as can analyze the controlled variables. Secondly, the quantitative research is based on quantifiable data and categorical data, which are more precise, accurate, and have a wide range of statistics (Saunders et al., 2007). This approach could reflect more objective opinions and reliable results compared to qualitative paradigm (see Table 3.1). Furthermore, the quantitative approach is appropriate to collect information concerning the influences of factors on customer behaviour when purchasing product online. Based on the literature review, the investigation is to choose quantitative research as well as qualitative research in this context. Prior the real investigation, the pilot study is conducted with open questions, which offer participants to gain more perspectives, viewpoints, and personal attitudes, which are difficult to obtain through questionnaires (Dorofeev and Grant, 2006).

Research Hypotheses

There are two main challenges to prevent from looking for an understanding of agricultural technology and poverty linkages. The first and foremast is paradigmatic – to

conceptualize the agricultural technology-poverty relation and seizure the poverty issue. The second fact is regarding a welter of interpretations and interventions to evaluate the effect of agricultural technology on poverty eradication. In this paper, the two groups are indexed by treatment status, $T = 0, 1$ where 0 indicates non- adopters, *i.e.,* the control group, and 1 indicates adopters, *i.e.,* the treatment group. Estimated data were collected on the observed individuals in two time periods, *i.e.,* before and after the introduction of new agricultural technology; $t = 0, 1$ where 0 indicates a time period before the treatment group adopted the new agricultural technology, *i.e.,* pre-treatment, and 1 indicates a time period after the treatment group adopted the new technology, *i.e.,* post-treatment. Every observation is indexed by the letter i = 1, ..., N; individuals (each of the adopters and nonadopters) will typically have two observations each, one pre-treatment and one post-treatment. More formally, the full model to estimate the true unconditional treatment effect of agricultural technology on poverty can be expressed as:

$$Yi = \alpha + \beta Ti + \gamma ti + \delta (Ti * ti) + \varepsilon i \qquad (1)$$

where the coefficients given by the Greek letters α, β, γ, and δ are all unknown parameters and e*i* is a random, unobserved "error" term, which contains all determinants of poverty, *Yi* omitted by the model. Note that the coefficients have the following interpretation: α = constant term

- Using OLS regression analysis and the double difference method - estimate the unconditional treatment effect of new agricultural technology on incomes approves.
- Various focus group discussion sessions highlight key constraints while applying agricultural technology.
- More formally, the study highlights the true unconditional treatment effect of agricultural technology on poverty:

$$Yi = a + bTi + gti + d (Ti * ti) + eI$$

α = constant term

β = specific effect of the treatment group, which account for average permanent differences between the treatment and control groups.

γ = time trend common to both the treatment and control groups.

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The "difference-in-difference" estimator is the estimate of δ, the coefficient on the interaction between *Ti* and *ti*. Please note that δ is the coefficient that measures the effect of the dummy variable, which takes the value 1 only for the treatment group in the post adoption (post-treatment) period. This is because *Ti* is a dummy variable taking the value 1 if the individual is in the treatment group and 0 if the individual is in the control group, while *ti* is also a dummy variable taking the value 1 in the post treatment period and 0 in the pre-treatment period. The purpose of the estimation is to find a "good" estimate of δ, given the available data. The sign of δ will indicate if the treatment group had a bigger or lesser change in observed outcome than the control group, while the size of δ will indicate what extra change in observed outcome the treatment group had. In the situation where the dependent variable, *Yi* is a continuous variable like income, the "difference-in-difference" estimator will be the OLS estimate of δ and T- statistics will indicate if the coefficient δ is statistically significant different from 0 or not.

Since numerous factors condition whether agricultural technology will benefit the poor, interact in complex ways, and poverty has many determinants, the paper takes an important step further in the agricultural technology-poverty linkage by identifying those factors and characteristics, which somehow alleviate or elevate poverty, and pinpointing the relative importance of each of those factors in affecting poverty status.

Data Analysis and Finding

Data from Quantitate Research

The previous section presented the theory and literature that identifies the relationship between poverty

eradication and technology. To examine the assumption in Phu Tho (Vietnam), the paper needs to conduct not only quantitative research, but also qualitative research. For the analysis in the paper, both adopters and non-adopters of the agricultural technologies were selected from the same geographical location, same geographical proximity, same production system, and same weather conditions and altitude. They are all farmers as well as they share the same culture.

Table 2: Age and Home Composition of Respondents

Basic Characteristics	*Adopters*	*Non-Adopters*
Number of Observations	200	200
Average Age	48.5	48.1
Number of Respondents of Ages 21 -30	2	2
Number of Respondents of Ages 31 -40	30	38
Number of Respondents of Ages 41 -50	98	86
Number of Respondents of Ages 51 -60	48	56
Number of Respondents of above Age 60	22	18
Number of Respondents of Household Size 11 and above	117	100
Average Number of Adult Males in the Household	2.0	1.9
Average Number of Adult Females in the Household	2.5	2.3
Average Number of Children in the Household	8.0	7.4

Most of the respondents and their corresponding home members are likely to live in groups related to farming conventional practices and family. Many of the respondents are of the opinion that large household sizes are better than small household sizes. In particular, the farmers in Phu Tho province are likely to have the extended family members to take advantage of labour force due to the traditional culture and ethics, which enables them to dwell in groups. The following part is to elaborate on character of the relationship between agricultural technology and income, which reveals the unconditional treatment effect of technology on incomes. OLS regression analysis and "difference in difference" model will be presented though an equation.

The following table indicates that the logarithms of income portfolios are used because of their very likely non-linearities between incomes and the independent variables. The coefficient of the unconditional treatment effect of the agricultural technology is positive and statistically significant using farm income from irrigation.

The result indicates that those respondents adopting agricultural technology perceived approximately 30% of agriculture income from irrigation more than the non-adopters on average. Adoption of new agricultural technology tends to have led to a large increase of agricultural income from irrigation of the adopters than the non-adopters.

Table 3: Estimation of the True Effect of Agricultural Technology on Incomes

	Dependent Variables			
	Log of Total Income	***Log of Farm Income from Irrigation***	***Log of Farm Income from Rainfed Farming***	***Log of Non- farm Income***
Treatment Status (Ti) = 1 if the individual is in the treatment group and 0 if the individual is in the control group	-0.061 (-0.75)	-0.029 (-0.34)	-0.023 (-0.28)	-0.028 (-0.32)
Time Period (ti) = 1 in the post- treatment period and 0 in the pre- treatment period	0.044 (0.53)	-0.089 (-1.05)	0.148* (1.76)	0.135** (1.58)
True Effect of the agricultural technology = 1 only for the treatment group in the post-treatment period	0.089 (0.77)	0.314*** (2.63)	0.042 (0.35)	-0.211* (-1.71)
Constant Term	11.568*** (199.77)	10.553*** (179.18)	10.473*** (176.87)	10.367*** (170.37)
R-squared	0.004	0.016	0.010	0.011
Number of Observations	400	400	400	400

Note: *T*-statistics are in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%.

Similarly, the coefficient of the unconditional treatment influence of the agricultural technology is negative and statistically significant using non-farm income. This result indicates that farmers who did not adopt agricultural technology received approximately 21.1% of non-farm income more than the adopters on average. Although the coefficients of the unconditional treatment effect of the agricultural technology are statistically insignificant using farm income from rainfed farming and total income, the positive sign associated with these coefficients illustrates that the adopters had a bigger change in farm income from rained farming (4.2%) and total income (8.9%) than the non-adopters.

The Forecast Effect of Agricultural Technology on Poverty in Terms of Poverty Determinants

When all other characteristics and factors that may affect the poverty status of the respondents are included in the logit model, it becomes evident that although the difference in poverty outcomes of the adopters and non-adopters groups are insignificant, the explanatory variables tend to show that the adopters witnessed more poverty reduction than the non-adopters. This is because the coefficient of the conditional treatment effect of the agricultural technology is still negative using the poverty headcounts.

All in all, although these variables are included in the logit model, those variables or factors were negative such as, markets, harvests, income from irrigation, non-farm income, age and numbers of adult males and females in the household. Though none of them are statistically significant, it is noteworthy that the agricultural technology directed to the reduction in poverty among adopters than the non-adopters.

Data from Qualitative Research

The results from the quantitative research point out differences in poverty consequences between two groups while the focus group is conducted to explore farmers' opinions regarding applying technology in agriculture. Other practical research question is the reason of differences among these applying technologies in agriculture and those who do not apply. A further central research question to answer is, "why is the difference between the technology adopters and the non-adopters so little in terms of poverty reduction"? Specifically, data on the constraints faced by the adopters from realizing enough benefits from the adoption of new technology.

Through the various focus group discussion sessions with the respondents, there are distinct local categorizations of poverty, such as conflict over natural resource use; natural resource problems; and lack of access to complementary agricultural inputs and services. Additionally, the conflict over natural resources and technology skill as well as know-how are the essential issues, which impact poverty eradication.

Conclusions

In sum, this research suggested that farmers need to enrich understanding the technological know-how of new agricultural technologies. Finally, continuing improvements are needed in Vietnam's poverty-monitoring technology in the system so that it provides a reliable source of information for policy making in a rapidly changing economy.

An effort announcing new agricultural technologies in Phu Tho is necessary to process systematically with increasing access of specific technology adopters and the popularity of agriculture technology. To persuade the farmers utilize the sustainability of new agricultural technologies in Phu Tho, it is vital to broaden the understanding of farmers about the technological know-how of new agricultural technologies.

APPENDIX

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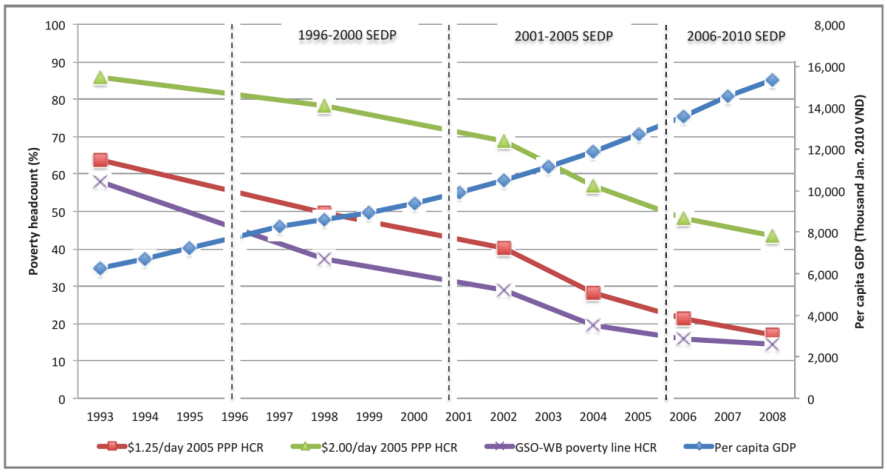

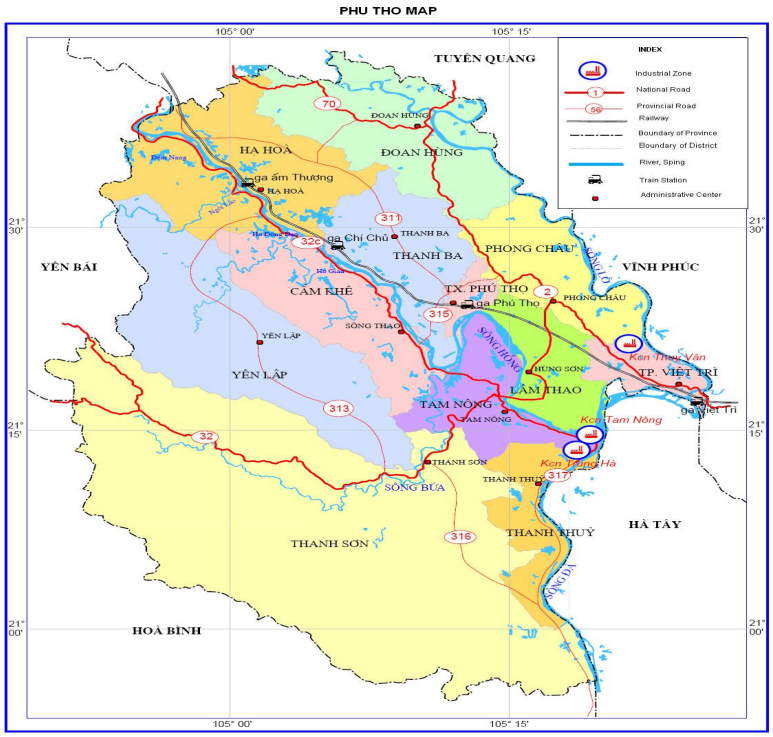

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