



Sustainability Assessment of Peri-urban Vegetable Cultivation Systems in Red River Delta, Vietnam



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INTRODUCTION

Urbanization and industrialization leads to rapid changing environmental conditions along urban-rural interfaces. In some places in Vietnam was found contamination of waters, soils and agricultural products due to heavy, or inappropriate use of fertilizers, pesticides. Toxic pesticides have caused many food poisoning scandals in Vietnam (involving 33,168 people, causing 259 deaths in 2010). Specially, in peri-urban areas such as Hanoi where the majority of vegetables are produced, over-use of chemical fertilizers and pesticides as well as toxic waste from large industries has resulted in severe soil contamination and environmental pollution.

The aim of this research is to investigate the characteristics of the existing vegetable cultivation systems, and to evaluate the sustainability of those systems in terms of economic, social, and environment. The results from this research will support for farmer and policymaker to achieve the goal of increasing vegetable production without polluting and destroying the natural resource base.



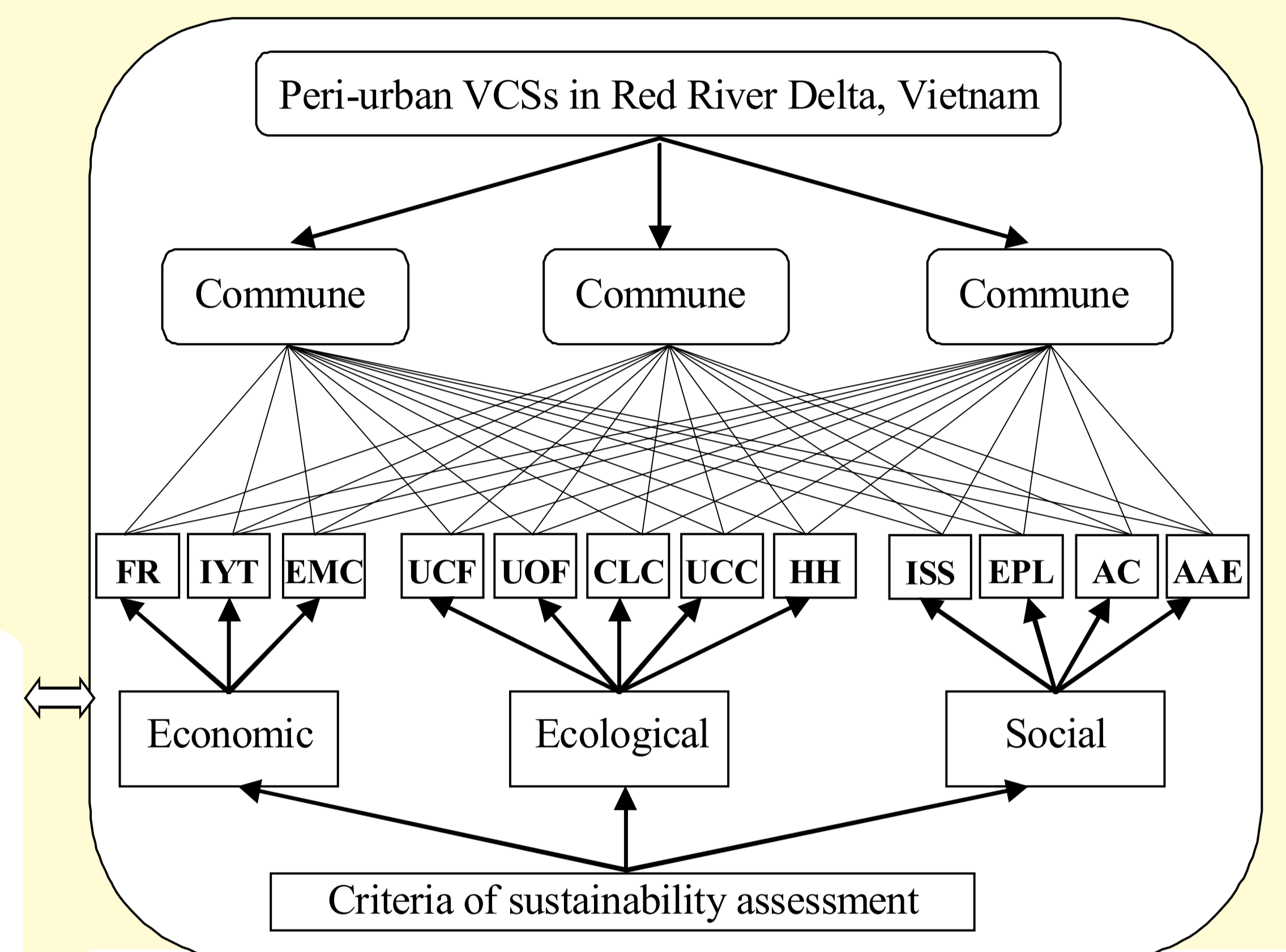
RESEARCH METHODS

Case study:

The case studies were conducted in three communes in peri-urban areas of Thanh Tri district in Hanoi in Red River Delta, Vietnam. In the communes of this district are two types of Farming Systems - small-scale vegetable and/or mixed vegetable-rice farms. They are using high inputs of soil amendments and pesticides for their cropping systems. The mean annual rainfall in this region from 2000 to 2008 is 1733 mm, with more than 50% of the rainfall occurring in the period July to September. The mean temperature varies between 16.7°C - 29.9°C, with the warmest period during June to August and the coldest during December and February. The relative humidity was between 74-82.5% (HSO, 2010). The soils are classified as Alluvial soil.

Data analysis:

To achieve the objective of the study, multi-criteria analysis were used. Twelve indicators were used such as financial return (FR), index of yield trend (IYT), efficiency of market channel (EMC), use of chemical fertilizer (UCF), use of organic fertilizer (UOF), cultivation of legume crop (CLC), use of chemical control (UCC), human health (HH), input self sufficiency (ISS), employment (EPL), access to credit (AC), and access to agricultural extension (AAE). Instead of using the raw data for each indicator directly, the data were normalized to obtain a common scale and allow statistical aggregation. The raw values were converted to common membership grades (from 0 to 1.0). The method for aggregation of all indicators was chosen as proposed by Allard et al., 2004.



The framework for suitability assessment in this study

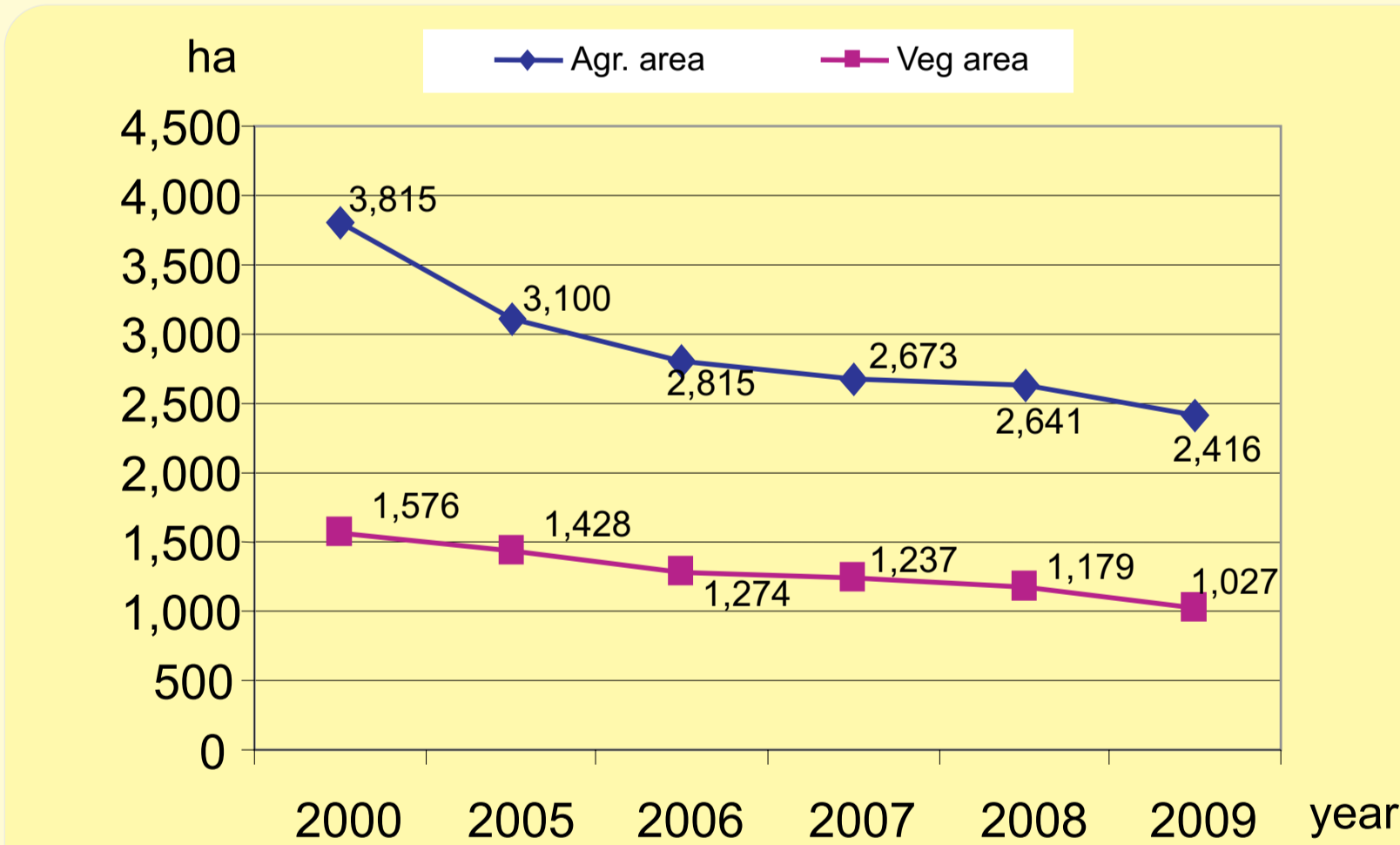
$$I_{sus} = \sum_{i=1}^n I_i * w_i$$

where: the overall sustainability indicator (I_{sus}) is the result of the weighing average of all the normalized indicators I_i . w_i represents the weight of the i_{th} indicator.

RESULTS

The land for agricultural crop and vegetable cultivation in the study area had significant changed from 2000 to 2009. The agricultural land decreased by 36.7% from 2000 to 2009. The vegetable area in 2009 decreased by 34.8% compared with the year 2000. The agricultural land have been moved to other land use purposes, e.g. residential land, land for business premises, land for public works.

Vegetables grown in the study area included cabbage, bean, cucumber, leafy cabbage, cauliflower, tomato, kohlrabi, cauliflower, and water morning glory. The average of farm size was 0.152 hectares in which 0.1 hectares for vegetable production, the number of plot was 5.7 and plot size was 0.027 hectares.



The agricultural area and vegetable area in Thanh Tri district

The results showed the access to agricultural extension indicator (AAE) was the lowest sustainability index, and the financial return indicator (FR) was the highest sustainability index among the indicators. The sustainability index of EPL, AC, UCF, UOF, CLC, UCC were low as 0.39, 0.44, 0.36, 0.29, 0.38, and 0.36 respectively.

The weight factor was estimated by pair-wise comparison method (Saaty, 1980) based on a number of indicators. After structuring the problem as a hierarchy, workshops were organized and the matrix of pair-wise comparisons was established, checking consistency and ranking the weight of the factors were done.

The aggregate value for **environmental** sustainability indicators was 0.42, **social** sustainability indicator was lowest (0.37), **economic** sustainability was highest (0.74). **overall sustainability** was (0.52)

therefore we can conclude that the overall sustainability for this cropping system is acceptable, but should be improved.



Indic.	Unit	min(s)	max(s)	T(v)	data (v)	N (v)
FR	Million VND/ha	0	max	50	55.872	1.00
YT	Yield trend	-1	+1	max(s)	0.1818	0.59
ECM	Market channel trend	-1	+1	max(s)	0.5455	0.77
ISS	Input self sufficiency	0	+1	max(s)	0.6034	0.60
EPL	Labor involved trend	-1	+1	max(s)	-0.212	0.39
AC	Access to credit	0	0.5	max(s)	0.44	0.44
AAE	Access to agricultural extension	0	0.5	max(s)	0.24	0.24
UCF	Use of chemical fertilizers trend	-1	+1	min(s)	0.2727	0.36
UOF	Use of organic fertilizers trend	-1	+1	max(s)	-0.4242	0.29
CLC	Cultivation of legume crop	0	5,022	max(s)	1,908	0.38
UCC	Use of chemical control trend	-1	+1	max(s)	-0.2727	0.36
HH	Household health status trend	-1	+1	max(s)	0.1818	0.59

Note: min(s) = minimum values, max(s) = maximum values T(v) = target values, data(v) = data values, and N(v) = normalized value., 1 USD = 19,700 VND (June, 2010)

Normalization of sustainability indicators in the study area

CONCLUSION

- ★ The agricultural land and vegetable area of the farm household in peri-urban Hanoi were small and fragmented and threatened by urbanization.
- ★ The trend of organic fertilizer usage declined and the trend of chemical fertilizer usage increased, farmer's usage of pesticide are in unsustainable manners, farmer's concern just is the income from their farm and has limitation access to the credit and also limitation access to agricultural extension service.
- ★ The overall sustainability of peri-urban vegetable cultivation systems in Hanoi was assessed and it was conditional sustainability.

ACKNOWLEDGMENT:

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