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Contents

Research article

Impact of Modernization on Disaster-prone Regions as Factor of Increasing Vulnerability: Case of Ishinomaki and Kesennuma, Miyagi, Japan

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Abstract Natural disasters have caused many impacts on the modern society mainly in disaster-prone regions. Although modernization has improved disaster prevention measures based on science and technology, it has also changed the human lifestyle from the traditional to the modern way, which may increase the disaster risks. This paper studies the relationship between modernization and its adverse effect on a disaster-prone region from the sociological and geo-historical approach to analyze the root cause of disaster. It takes up the case of rural area, Ishinomaki and Kesennuma cities, Miyagi Prefecture, Japan - where are historically vulnerable to geophysical disasters such as earthquake and tsunami. Both cities were significantly damaged by the Great East Japan Earthquake in 2011 despite the modernized society. The study is based on the qualitative method which mainly constitutes of literature analysis. The main conclusion is that the Japanese modernization started since 1868 entailed increased risks for the society. Modernization has certainly produced effective disaster prevention measures based on advanced science and technology and centralized measures led by the government and economy-oriented development. However, the modernization which brought from the West where natural disasters are not as critical as Japan was not always prioritized over the political and economic competition. Hence, it caused the disaster-prone area more vulnerable when a disaster topples the capacity of such modern system by increasing the exposure to hazards under diplomatic and security issues and economy-oriented development.

Keywords natural disasters, modernization, vulnerability, root-cause, historical geography

INTRODUCTION

Modernization or 'developmentalism' has been regarded as production of wealth and improvement of living condition under capitalism diffused by the West. However, according to Smith (2004), the trend of disaster in the modern society is resulted from the exploitation of nature, the rapid population growth, urbanization, social and economic inequality, climate change, political change, economic growth, technical innovation, social expectations and global interdependence, as the consequence of modernization. Modernization has certainly brought a great improvement in disaster prevention measures with the advanced science and technology. However, the modernization have also deprived the societies in disaster-prone regions of the community-based adaptation based on their local cultures and environment. Therefore, several sociologists and anthropologists have criticized the Western-centric view of development for such byproducts. These locally adapted measures are considered more effective prevention measure than transferring the Western technology based on the centralization and economic development (Smith, 2004).

Although Japan has developed with the world-leading technology, it was not able to prevent huge earthquake disasters, such as the Great Hanshin Earthquake in 1995 with 6,437 deaths, and the Great East Japan Earthquake in 2011 with 15,883 deaths and 2,676 missing (Japanese Cabinet Office, 2011a). Most of the casualties in the latter case were caused by tsunami disaster despite that the region is historically prone to tsunami and has been equipped with the world-leading hard measures. Even the government and researchers had predicted 88 percent of possibility of the occurrence of

great tsunami triggered by a huge earthquake in the Miyagi off-coast by 2023 and they had been warning the local people and improved evacuation measures (Imamura, 2013, pp. 50). The cause of the disaster has been attributed to several reasons in the previous studies, such as the failure of tsunami warning system (Japanese Cabinet Office, 2011b), the insufficient evacuation road (Sekiya, 2011), the loss of culture of disaster in the society (Sekiya, 2011; Yoshihara, 2013; Tanaka, 2013), and the loss of the local community ties (Yoshihara, 2013). However, there has been no study which looked into the root cause of the disaster. As "human sensitivity to environmental hazards is a combination of physical exposure, or the range of potentially damaging events and their variability at a particular location" (Smith, 2004, p. 10), it is important to investigate the cause why the society was developed in the vulnerable locations.

OBJECTIVE

The overall research aim of this paper is to study whether the modernization of the Japanese society led to increased vulnerability to natural disasters by the time of Great East Japan Earthquake in 2011. It applies sociological and geo-historical approach to analyze the root cause of the disaster. The history of modernization in Japan starts in 1868 and entails not only development of economy, science and technology but also diplomatic or security issues. The study takes up the tsunami disaster and focuses on geographical location of affected areas as the main risk factor in Ishinomaki and Kesennuma cities, Miyagi Prefecture. To limit the study, the research question puts an emphasis on why and how the population had located themselves in such vulnerable area in the process of modernization by the time of the disaster.

METHODOLOGY

This study applies a qualitative method which constitutes literature and data analysis. In order to understand the impact of modernization of Japan in the target areas, it studies their historically and socially significant phenomena during the modernization. Sources of literature, map and population census are collected from the official documents and reports published by both city and national governments and other Japanese authorities as well as the literature about the Japanese history from both Japanese and foreign authors for the accuracy and objectivity of historical events. Based on the collected data, the cause of increased disaster risks by developing along the coastal areas was. Kesennuma and Ishinomaki cities, Miyagi Prefecture were chosen as case study as they suffered the most and the third largest respectively among all the devastated municipalities in the disaster.

RESULTS AND DISCUSSION

At first, the old maps and the post-disaster maps are compared as seen in Fig. 1 and 2. The old map of Kesennuma is from 1916 (GSI, 1916) and the one of Ishinomaki from 1929 (GSI, 1929) on the left side of both figures. In the old maps, the darkened part is mainly populated area inside the circle. The rest parts are mainly paddy fields or agricultural lands, and few houses for both areas. In the post-disaster map, red color indicates the limit of tsunami invasion, blue is heavily damaged residential area created by Tsunami Damage Mapping Team, Association of Japanese Geographers (2011).

As observed from the map comparison, most parts of the heavily damaged area (marked by blue in the post-disaster map) were not neither populated nor developed at all in the initial stage of modernization in both cities. They were mainly unused land, paddy fields, agricultural land, or even the sea.

Fig. 1 Maps of Kesennuma in 1916 (left) and the post-2011 disaster (right)

Source: The 1916 map of Kesennuma is a scale of 1:50,000 from Geographical Information Authority of Japan (GSI) (1916), and the post-disaster map is "Tsunami Damage Map" from the Tsunami Damage Mapping Team, Association of Japanese Geographers (2011)

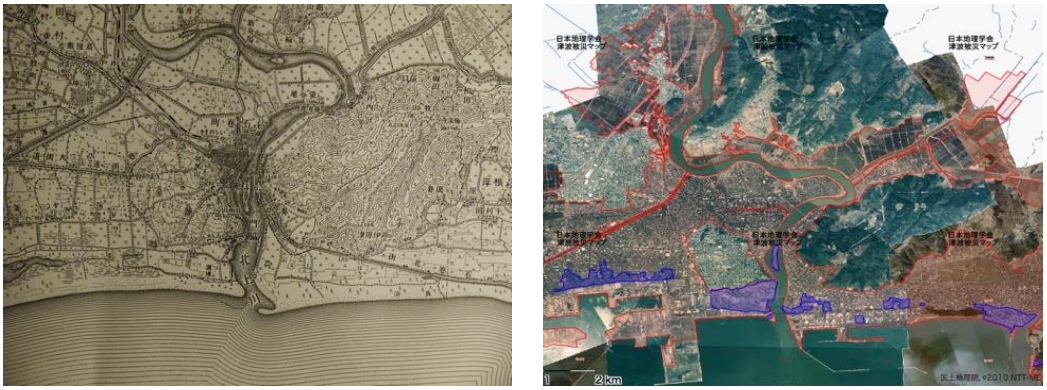

Fig. 2 Maps of Ishinomaki in 1929 (left) and the post-2011 disaster (right)

Source: The 1929 map of Ishinomaki is a scale of 1:50,000 from GSI (1916), and the post-disaster map is "Tsunami Damage Map" from the Tsunami Damage Mapping Team, Association of Japanese Geographers (2011)

Table 1 Population changes in Kesennuma and Ishinomaki from the early modern period

Kesennuma			Ishinomaki		
Year	Total population	Kesennuma Town	Year	Total population	Ishinomaki Town/City
1882	17,411	N/A	1889	N/A	18,573
1920	43,824	9,788	1920	102,953	22,067
1940	63,656	17,973	1940	137,327	36,442

Note. Total population for Kesennuma and Ishinomaki contains population of municipalities which had not been merged with both cities in these periods but were a part of both cities as of the time of disaster occurrence, 11 March 2011.
Source: Data for population of Kesennuma city in 1882 from Kesennumashi-shi-hensan-iinkai (1990); for population of Ishinomaki city in 1889 from Ishinomakishi-shi-hensan-iinkai (1998); adapted for population of Kesennuma and Ishinomaki in 1920 and 1940 from the 1920 and 1940 Population Census (Statistics Bureau, Ministry of Internal Affairs and Communications of Japan [MIC]), URL: https://www.e-stat.go.jp/en. accessed on 12 October, 2013.

Table 2 Population changes in Kesennuma and Ishinomaki Cities for the post-1945 period

Kesennuma City			Ishinomaki City		
Year	Population	Population density (per km^2)	Year	Population	Population density (per km^2)
1920	43,824	131.5	1920	102,953	185.2
1950	76,391	229.5	1950	176,925	318.5
1980	92,246	276.6	1980	186,094	333.5
2010	73,489	220.4	2010	160,826	289.4

Note. Total population for Kesennuma and Ishinomaki from 1920 to 1980 contains population of municipalities which had not been merged yet with both cities in the periods but were a part of both cities as of the time of disaster. Population density in 1920 is calculated by using the area of each city as of 2010.
Source. Adapted from the 1950, 1980, and 2010 Population Census (Statistics Bureau, MIC), URL: https://www.e- stat.go.jp/en. accessed on 16 October, 2013.

The population increase in both cities occurred since the late nineteenth century through modernization as seen in Table 1 and 2. Based on these facts, the vulnerable coastal areas were significantly developed and populated, increasing the exposure risk to hazards during the process of modernization. Both cities also developed their urban area and increased land development for housing and commercial use. In Kesennuma, the urban area increased from 3.2km^2 in 1975 to 6.4km^2 in 2005. In Ishinomaki, the population in the urban district was 61,573 in the district area of 6.60 km^2 in 1960. It increased up to 103,518 and 23.40km^2 respectively by 1995 and 94,342 people and 25.89km^2 in 2010 by the time of disaster.

The next section looks into the historical causes of these increased risks. Firstly, it discusses the early modern period from 1868 to 1945, and then the post-1945 period up to 2011.

The Early Modern Period (1868-1945)

Since modernization started in 1868 in Japan, its economy-oriented development in the country was launched under the pressure of the West, especially the U.S. which was seeking for more capital resources in the East Asia at that time. Although there was a strong domestic resistance to the US demand for opening the Japanese market to the West in the beginning, the Japanese leaders finally gave in. The main terror was the Western military and armed forces as well as the strong industrial economy which were too strong for then Japan. By concluding unequal treaties with the West, Japan undertook modernization quickly, aiming to catch up with the industrialized nations. Political, economic and cultural modernization occurred hand in hand with militarization and industrialization. In this way, Japan started modernization following the Western technological model, though the aim was to abolish the unequal treaties and establish an equal relationship with the West under the slogan of 'fukoku-kyohei' (literally rich country, strong country). (Duus, 1998; Cullen, 2003; Kito, 2010)

Under such circumstance, Kensennuma and Ishinomaki which were mere small villages at the initial stage of modernization were soon included in a part of the national modernism plan and encouraged to increase the fishery activity as a means of capital industrial economy. As well as other industries, fishery and its related industries were rapidly modernized by the lead of the central government. The intention was to resist to the western fishing in the Japanese adjacent waters. As the West advanced in the Japanese adjacent water, the U.S. and the U.K. were overfishing whales and Russia was hunting sea otters and fur seals to a significant extent. The then Japanese government was afraid of drying up of her natural resources by the West. Although the people in the area mainly produced crops and only engaged in coastal fishery just for a self-sufficient living in the pre-modern period, they were urged to shift to the pelagic fishery under the governmental plan. In 1897 Pelagic Fisheries Encouragement Act was issued by the central government to subsidize fishery boats, fishery tools and crews. The government encouraged economic activity by forming the fisherman's union. Fish processing industry became the main industry in the area and a number of factories were constructed in both coastal cities. Such industry was also important to supply to the military during the war period to feed the people in the battle fields. Besides the fishing industry, sericulture industry

developed in both cities and the number of its factories rapidly increased. Because of the Western demand, silk was the pivotal source of the Japanese exports to them during the time under the unequal treaties and helped Japanese modernization. In this way by the end of the Meiji era (1868-1912), the whole town of Kesennuma and Ishinomaki became a place of production. As both cities were engaged in the primary industry, the development in the coastal area was highly important for the convenience of transportation. With such changes, the population grew rapidly in both cities as seen in Table 1.

To conclude this period, development and urbanization of both cities were primarily attributed to the country's security and diplomatic issues under the threat of the West and the capitalistic competition with them. Vulnerability of the area to tsunami disaster seems to have not been prioritized at all by the then government because the security issue is a more urgent issue for the country's survival than natural disasters. Therefore, even after the case study area experienced the 1896 Meiji-Sanriku Earthquake which caused 21,959 deaths, the both cities kept developing.

Post-1945 Period

With the loss in the WWII, Japan launched a policy of 'economism' under the US support by the Liberal Democratic Party (LDP) which stayed at the first position in the parliament for a long time in this period. The country was initially put under the control of the Supreme Commander for the Allied Powers, the US occupant authority. The occupation aimed to transform Japan into an ally of the U.S. Although the U.S. aimed to restrain Japan from her economic development as a punishment of the WW II, they decided to make Japan "the chief factory of Asia" as the Cold War loomed problematic for them (Duus, 1998, p. 272). Japan aimed to be independent of the US occupation, to return to the international community, and to reconstruct the country. For these, the people were united and worked hard which led to the rapid reconstruction and high economic growth since 1950s. With technological improvement, the Japanese farming was mechanized and thus increased its productivity and efficiency. It led to a substantial decrease of rural population with a labor force increasing in service industries in cities. However, to secure the parliament seats by collecting more votes the LDP distributed money to the countryside, main industries and powerful corporations. This caused excessive land development and promoted industries in the countryside. For the U.S. it was important to decrease anti-US sentiment to make Japan a good ally under the Cold War. Under the Eisenhower's "New Look" and "Atoms for Peace", the U.S. accelerated nuclear energy production in Japan with advertisement of good images of the U.S., and economic development with cooperation of Japanese corporations. (Duus, 1998; Cullen, 2003)

Based on the economism, the fishing industry was also promoted to expand its economy further. Since 1951, "*gyokoseibichokikeikaku*" (literally, long term project of fishing port arrangement) was launched as a national policy, and the Kesennuma port was selected as one of the targets. Since then the area of the Kesennuma port was developed with a large investment by the government. Since 1969, the national budget was used for the Kesennuma port selected as a port which needs a 'special development'. With the development plan, the area around the port became filled with industries and residential houses and the land was extended by reclamation of the sea. (Kesennumashi-shi-hensan-iinkai, 1993)

Ishinomaki fishing port was also selected as a 'special development' was needed in 1973. After the WW II, Ishinomaki also followed a national policy that focuses on the economic growth. Ishinomaki city planned to develop the Ishinomaki port and offered industries in the hinterlands of the ports along the coast, aiming for a 'marine products city'. The city organized the inter-industrial relationship for marine products industries and eventually many manufacturing industry and factories were built in the coastal industrial zone. (Ishinomakishi-shi-hensaniinkai, 1998)

As the result of economism, economic development in the coastal areas, where are vulnerable to tsunami disaster, was significant in both cities. It led to the population growth and construction of factories or any other economic activities along the coastal area.

To conclude this period, the causes of increased risks in the both cities by developing in the vulnerable area are mainly attributed to the US occupation and their political and economic strategy

as well as the global economic competition, continued from the pre-war period. They were more critical and certain issues for the Japanese over unpredictable natural disasters. In addition, the economic development was important for the Japanese people to recover their confidence after the loss and collapse in the war. It led to the further economic development, losing the local adaptation skills to natural hazards. The absence of huge natural disasters or tsunami in Japan during the economic growth period might also promote the people to lose consciousness of the disaster risks.

CONCLUSION

The main driving force that led to the population increase in vulnerable areas in both cities was the diplomatic and security issues for Japan and economy-oriented development caused by the Western occupation and the global economy. Under such circumstance, both cities were assigned to develop the fishery and silk industries for the country's survival. It led to the population increase and land reclamation along the coast. Even after the WW II and the modern technology and science developed, the people kept developing in the vulnerable area under the economism. For the generalization of the result of this study, because the diplomatic, security and economic issues can be more urgent and critical than natural disasters for a country's survival, such pressure can lead a country in disaster-prone region to increasing disaster risks, thus vulnerability. Therefore, dispute settlement and peace building are important matters than employment of modern technology or economy to achieve sustainable and resilient society. The current global economy standardize the way of living and the competitiveness regardless of whether a country is in a disaster-prone region. There is a need for system which can prioritize disaster risk reduction and mitigation over profit-maximization.

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Research article

Efficacy of the Entomopathogenic Fungus *Nomuraea rileyi* in the Biological Control of Vegetable Pest *Spodoptera litura* (Lepidoptera: Noctuidae)

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Abstract Eight strains of the entomopathogenic of the fungus *Nomuraea rileyi* were screened for control of the common cutworm, *Spodoptera litura*. The results showed that *N. rileyi* was pathogenic to *S. litura*, and that pathogenity significantly varied among the strains. The mortalities ranged from 2.5 to 92.5% at 7 d after inoculation. The strains tested were classified into three groups according to mortality percentage. High pathogenicity level was defined as a mortality greater than 75.79%, moderate pathogenicity was a mortality between 75.79 to 49.50%, and low pathogenicity level less than 49.50% mortality. The high pathogenicity level contained two strains, BCC 14653 and BCC 14671, which were identified as highly virulent and used in a secondary bioassay against various larval stages. *Nomuraea rileyi* could become an important biopesticide agent in an integrated pest management program for insect pest control.

Keywords *Nomuraea rileyi*, *Spodoptera litura*, Entomopathogenic Fungi, Biological control

INTRODUCTION

The common cutworm, *Spodoptera litura* F (Lepidoptera: Noctuidae), is a highly polyphagous migratory lepidopteran pest species. This insect is also known as the tobacco budworm, oriental leafworm moth, tropical armyworm, and taro caterpillar. It causes extensive losses in over 120 different plant species including many vegetables, fruits and ornamental crops. Some examples are: asparagus, beets, broccoli, cabbage, carrots, chrysanthemum, corn, cruciferous crops, eggplants, grapes, lettuce, orchid, potatoes, radish and sunflowers.

Insecticides for control *S. litura* have become ineffective because of the development of resistance, and cause toxic residues in the crops.(Rajan and Muthukrishnan, 2009). Insecticide resistance and the demand for reduced chemical inputs in agriculture have provided an impetus for the development of alternative methods of pest control. Biological control offers an attractive alternative or supplement to the use of chemical pesticides. Microbial control agents are naturally occurring organisms and perceived as being less damaging to the environment. Furthermore, their generally complex mode of action makes it unlikely that resistance could develop to a bio-pesticide. Biological pest control agents include viruses, bacteria, fungi, and nematodes. The use of microorganisms as selective pesticides has had some notable successes (Hong Wan, 2003).

Nomuraea rileyi is an important naturally-occurring, mortality-causing agent of many lepidopterous pests in a variety of crop ecosystems throughout the world (Vimaladevi et al, 1996). Natural occurrence of *N. rileyi* has been widely reported. *N. rileyi* has occurred in epizootics on *Spodoptera exiqua* in black gram, *S. litura* in tobacco, *Tricoplusia ni* and *Heliothis zea*

(Srisukchayakul, 2005). Furthermore, its occurrence has been reported on *Helivoverpa armigera* in tomato and on *S. litura* in soybean, potato and cabbage (Patill and Abhilash, 2014).

OBJECTIVES

The objective of this study was to determine the pathogenicity of *Nomuraea rileyi* strains on larvae of *Spodoptera litura* under laboratory conditions.

METHODOLOGY

Insects

Spodoptera litura populations including egg masses, larvae and adults were collected from cruciferous vegetable crop plantations in Chiang Mai, Thailand. All stages were maintained under laboratory conditions. The pupae were kept and used as a stock to build up new colonies. The adults were reared in cages and fed with a 5% honey solution.

Fungal Preparations and Pathogenicity

Nomuraea rileyi strains from adult insects in the order Lepidoptera collected in natural environments of Thailand were obtained from the BIOTEC Culture Collection (BCC), National Center for Genetic Engineering and Biotechnology (BIOTEC), Pathum Thani, Thailand. (Table 1). The fungal strains were cultured on SMAY (Sabouraud's maltose agar medium supplemented with 1% yeast extract) in 90 mm Petri dishes and incubated for 12-15 d at 25±1°C (Fig. 1). Conidial suspensions were prepared by scraping conidia from petri plates into an aqueous solution of 0.002% Tween 80. The conidial suspension was filtered through several layers of cheesecloth to remove mycelial mats. Viability of conidia was assessed by germination tests before preparation of suspensions. The concentration of conidia in the final suspensions was determined using a hemocytometer. The conidial suspension used for the bioassays was adjusted by diluting conidia with the Tween 80 solution to final concentrations of 6x107, 6x108 and 6x109 conidia/ml. To determine pathogenicity, each of the conidial suspensions were sprayed on larvae of different instars (I-III). Three replications were used with 10 larvae per replication including a non-treated control. The larval mortality was recorded at 7 d after inoculation.

Table 1 Strains of the entomopathogenic fungus *Nomuraea rileyi* collected from Thailand and used in pathogenicity tests against larvae of *Spodoptera litura*

No	Strain number	TNCC number:	Fungus species	Host insect
1	BCC 14653	4522	*Nomuraea rileyi*	Lepidoptera - adult
2	BCC 14658	4685	*Nomuraea rileyi*	Lepidoptera - adult
3	BCC 14659	4686	*Nomuraea rileyi*	Lepidoptera - adult
4	BCC 14660	4687	*Nomuraea rileyi*	Lepidoptera - adult
5	BCC 14670	4327	*Nomuraea rileyi*	Lepidoptera - adult
6	BCC 14671	4328	*Nomuraea rileyi*	Lepidoptera - adult
7	BCC 14672	4329	*Nomuraea rileyi*	Lepidoptera - adult
8	BCC 14673	4318	*Nomuraea rileyi*	Lepidoptera - adult

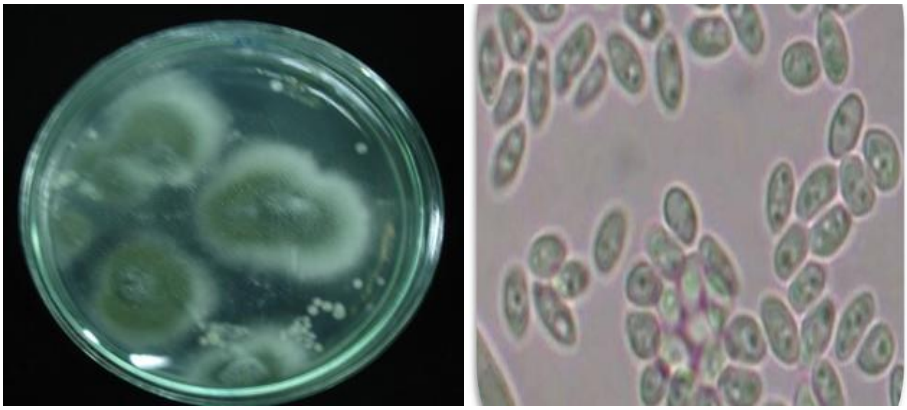

Fig. 1 Colony and conidial characteristics of *Nomuraea rileyi*

RESULTS AND DISCUSSION

The results showed that *N. rileyi* was pathogenic to *Spodoptera litura*; the cumulative mortalities ranged from 0 to 92.5% at 7 days after inoculation (Table 2). The corrected mortalities significantly differed ($P \leq 0.05$) between strains (Fig. 2).

Table 2 Cumulative mortality of the entomopathogenic fungus *Nomuraea rileyi* on each instar of *Spodoptera litura* at 7 d after inoculation

Nomuraea rileyi)conidia/ml(		% Mortality		
		I instar	II instar	III instar
Strain 1	$6x10^7$	82.5	72.5	72.5
	$6x10^8$	85.0	77.5	55.0
	$6x10^9$	92.5	92.5	70.0
Strain 2	$6x10^7$	35.0	20.0	20.0
	$6x10^8$	30.0	30.0	37.5
	$6x10^9$	37.5	32.5	32.5
Strain 3	$6x10^7$	2.5	7.5	7.5
	$6x10^8$	2.5	2.5	2.5
	$6x10^9$	0	0	0
Strain 4	$6x10^7$	7.5	10.0	10.0
	$6x10^8$	10.0	25.0	5.0
	$6x10^9$	5.0	22.5	2.5
Strain 5	$6x10^7$	47.5	30.0	2.5
	$6x10^8$	40.0	25.0	7.5
	$6x10^9$	40.0	25.0	25.0
Strain 6	$6x10^7$	87.5	77.5	75.0
	$6x10^8$	92.5	87.5	67.5
	$6x10^9$	92.5	80.0	82.5
Strain 7	$6x10^7$	47.5	32.5	12.5
	$6x10^8$	35.0	15.0	15.0
	$6x10^9$	50.0	10.0	10.0
Strain 8	$6x10^7$	7.5	17.5	7.5
	$6x10^8$	17.5	7.5	2.5
	$6x10^9$	17.5	10.0	12.5
Control		0	0	0

In support of the present investigation, Padanad and Krishnaraj, (2009) observed that all ten isolates of *N. rileyi* were active against third instars of *S. litura*, resulting in 85 to 97% mortality. Patil et al., (2014) stated that early instars were highly susceptible with a mortality of 70.17 percent, which decreased significantly as the age of the larvae advanced. However, there were statistically no significant differences among the strains with respect to the pathogenicity levels. The strains tested could be classified into two groups according to mortality percentage (Table 3). Fungal strains BCC

14653 and BCC 1467 were identified as highly pathogenic and were used in the secondary bioassay against various larval stages. The remaining strains were characterized as having low pathogenicity (Table 4).

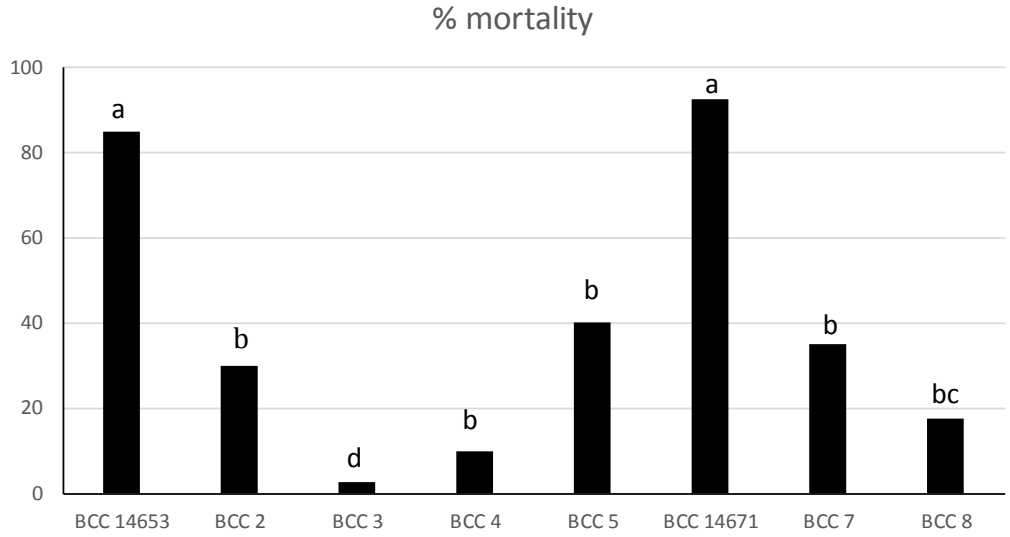

Fig. 2 Percentages of corrected mortality of *Spodoptera litura* treated with different strains of *Nomuraea riley* at a concentration of 6x108 conidia/ml at 25 ±1°C

Table 3 Pathogenicity levels of different strains of *Nomuraea rileyi* toward *Spodoptera litura* as expressed by percentage mortality

Pathogenicity level	Mortality (%)	Strain No.
High pathogenicity	>75.79	BCC 14653, BCC 14671
Moderate pathogenicity	75.79 – 49.50	-
Low pathogenicity	<49.50	BCC 14658, BCC 14659, BCC 14660, BCC 14670, BCC 14672, BCC 14673

Table 4 shows the efficacy of two strains of *Beauveria bassiana* against various larval stages of *Spodoptera litura*. All strains tested were effective against all larval stages of *Spodoptera litura*, but the effectiveness varied with larval stage. There were significant differences ($P \leq 0.05$) among different larval stages. No significant differences were found among concentrations.

Means in columns with different small letters indicate significant differences among different concentrations of *Nomuraea rileyi* (one way ANOVA, $P \leq 0.05$; Duncan's multiple rang test). Means in the same row followed by the different capital letters indicate significant differences between instars of Spodoptera litura at $P \leq 0.05$ (T- test).

Table 4 Efficacy of two strains of *Nomuraea rileyi* against various larval stages of *Spodoptera litura*

Strains no.	Conc.	Corrected mortality of 1st instar (%±SE)	Corrected mortality of 2nd instar (%±SE)	Corrected mortality of 3rd instar (%±SE)
BCC 14653	$6x10^7$	82.5 ±5.77 bA	72.5±3.33 bB	72.5±5.77 aB
	$6x10^8$	85.0±8.81 bA	77. ±5.77 5 bB	55.0±8.81 bC
	$6x10^9$	92.5±3.33 aA	92.5±5.77 aA	70.0±5.77 aB
BCC 14671	$6x10^7$	87.5±6.67 bA	77.5±5.77 bB	75.0±5.77 abB
	$6x10^8$	92.5±0.00 aA	87.5±8.81 aAB	67.5±13.33 bBC
	$6x10^9$	92.5±5.77 aA	80.0±5.77 abB	82.5±5.77 aB

CONCLUSION

Research is needed to further characterize the use of *Nomuraea rileyi* as an effective biocontrol of *Spodoptera litura* in vegetable crops. The results presented here suggest that some strains of this fungus are effective in causing high mortality levels and (at sufficient dosages) could become an important part of an integrated pest management program. *Nomuraea rileyi* treatment could be useful in preventing the development of resistance if used in rotation with other effective therapeutic agents.

ACKNOWLEDGEMENTS

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Research article

Competency Level Development in Business Operations of Young Smart A-SMEs

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Abstract There were a large number of young generation farmers in Thailand who were an agricultural entrepreneur, and needed to develop their competency level in business operation. The aims of this research were 1) to determine the competency of Young Smart A-SMEs, 2) to make plans for developing their competency level in business operations, 3) to reinforce and develop their competency level in business operations, and 4) to study their opinions on the reinforcement and development of their competency level in business operations. This investigation was conducted as a research and development study. The sample population was 215 Young Smart A-SMEs. The data were collected by group discussions, training course procedures and a questionnaire survey. Quantitative data were analyzed using descriptive statistics and qualitative data were analyzed through content analysis. The findings were as follows: 1) Most of the Young Smart A-SMEs had bachelor degrees, IT skills and were united as 10 groups. 2) Two training course curriculums at national level were required; a curriculum on the development of packaging and label designing, and a curriculum on media technology for online marketing. Also, 38 curriculums were necessary at provincial level covering eight issues: (i) self-learning development, (ii) production resource management, (iii) production management, (iv) product value-added management, (v) product standard management, (vi) marketing and product distribution management, (vii) network group management, and (viii) coordination and communication management. 3) The training courses achieved the needs of members and adhered to the planned itineraries. 4) Young Smart A-SMEs were, on average, high satisfied of benefit (Mean = 4.16), with the training courses. Their knowledge before training was low level (Mean =2.52) but improved to highest level (Mean =4.49) on average after training.

Keywords competency level development, business operation, young smart A-SMEs

INTRODUCTION

Thai farmers tended to decrease in numbers and most of them were elderly. However, many of the young generation educated at bachelor degree level switched their careers from office jobs to be an agricultural entrepreneur. They were known as "Young Smart A-SMEs" (Young Smart Agricultural Small and Medium Enterprises). These people mostly had high competency in creativity,

communication technology and social networking, so they could be easily developed to be a farmers' leader who played a great role in pushing agricultural SMEs in the future. Furthermore, most had experienced in business operations and understood the aspects of production, marketing, and farmer's uniting. They mostly had new ideas in production and marketing which differed from the outdated methods of elderly farmers. Importantly, they were motivated to succeed in business to increase production through marketing plans and to unite as one network. However, to develop their competency levels in business operations and network linking procedures, their competency should be reinforced to compete in the production management and product/packaging development. Therefore, this research on "Competency Level Development in Business Operations of Young Smart A-SMEs" was conducted to develop competency in production procedures, value added to agricultural products, marketing development, and finally, to develop network management skills.

OBJECTIVES

The purposes of this research were as follows: 1) to determine personal state of Young Smart A-SMEs, 2) to make plans to develop the competency level in the business operations, 3) to reinforce and develop the competency level in business operations, and 4) to study the opinions on the reinforcement and development of their competency level in business operations.

METHODOLOGY

Research design: This investigation was conducted as a research and development study.
Population/sample: The sample population was young generation farmers aged under 45 years around Thailand. The sample size was specified and 215 samples were selected by using purposive sampling methodology by an application form. The qualification prerequisites were as follows: 1) being an agricultural SME entrepreneur and a registered community enterprise member, and 2) having the intention to develop their enterprise systematically and become a professional entrepreneur in the future.
Research instruments: The research instruments were selected to achieve the objectives as follows:
- Studying the personal state of Young Smart A-SMEs through group discussions
- Formulating plans to develop competency levels in business operations through group discussions
- Reinforcing and developing competency levels in business operations though several method based on plan setting
- Studying opinions on the reinforcement through a questionnaire survey

Data analysis: Content analysis followed objectives 1-3. Descriptive statistics were used in objectives 4 to analyze mean, percentage, maximum value, minimum value, and standard deviation data.

RESULTS AND DISCUSSION

1. Personal State of Young Smart A-SMEs

The personal competency of Young Smart A-SMEs was identified for three issues as follows:
1.1 Fundamental Personal Competency of Young Smart A-SMEs
1) Most of the entrepreneurs had bachelor degrees to master degree level. 2) They had a continuous and stable income. They mostly had their own asset such as land and agricultural equipment. They also united to be 10 groups adhering to the region of their agricultural area. 3) They farmed several agricultural products including organic rice, mushrooms, hydroponic/local vegetables, strawberries, fruits, bamboo, bananas, seedless grapes, melons, mulberries, limes, garlic, chilies, passion fruits, avocados, organic papayas, earthworms, fish, cattle, processed food (bananas/mushrooms), and biological/organic fertilizer. 4) Farming was integrated/mixed/organic/safety adhering to Sufficiency

Economy Philosophy, and 5) the quality/standard of their products was guaranteed by GAP Standard, and organic farming standards.

1.2 Entrepreneurial skills

Young Smart A-SMEs had entrepreneurial skills as follows: 1) IT usage, 2) understanding the principle and guidelines on self-development, 3) understanding group procedures and methods for improving production, 4) knowledge of community enterprise operations and adherence to the Community Enterprise Reinforcement Act of 2005.

1.3 Management skills

Young Smart A-SMEs had management skills as follows: 1) uniting as 10 groups representing the regions of their area, 2) coordinating their network and alliances, 3) setting rotating meetings at regional level every two months, or setting meetings within their province/area, and 4) making plans to learn and exchange knowledge and new ideas with each other regularly.

To make a discussion, Young Smart A-SMEs had their own assets such as land and agricultural equipment, and united to be 10 groups adhering to the region of their agricultural area consistent with Sawatdiphab Keeratiya (2011) who stated that 81.25% of young generation farmers had their own occupied agricultural area, and 75.00% of them were a member of a farmer group. The findings of this research showed that the farmers would be more confident and feel secured if they had their own land. Being a farmer group member made them develop their competency level to compete with others, exchange their knowledge and new ideas, and properly practice based on the innovations.

2. Making Plans to Develop the Competency Level in the Business Operations of Young Smart A-SMEs

Young Smart A-SMEs made competency development plans for eight issues and curriculums to develop their members. The curriculums were divided into national and provincial network levels with the responsibility of academics/proficient persons in each subject. Several methods were used for knowledge transfer such as lectures and field studies.

2.1 The competency development included eight issues as follows: self-learning development, production resource management, production management, product value-added management, product standard management, marketing and product distribution management, network group management, and coordination and communication management.

2.2 Curriculums to develop the members were divided into two levels as follows:

2.2.1 Curriculums at national level: These covered the development of 1) packaging and label design, 2) media technology for online marketing.

2.2.2 Curriculums at provincial level: Young Smart A-SMEs designed these *"curriculums adhering to their members' needs and set the training courses accordingly. The curriculums were correlated with the plans to develop the network of Young Smart A-SMEs in the eight issues mentioned previously."*

To discuss, Young Smart A-SMEs designed the training course curriculums taken responsibility by academics/proficient persons in each subject. They used several methods for transferring the knowledge such as lecturing and field studying consistent with Pongkarunyaphat Krtisada (2007) who studied "Need for Farmer and Proper Syllabus Design for Future Farmer in Phrae Province" and found that young generation farmers needed proficient academics in universities who had knowledge and experience to lecture and gave them a chance to have field studies and real practice. These findings could be discussed that effective strategy to transfer knowledge for Young Smart A-SMEs should be conducted from proficient academics. Also, the method should be selected and based on Young Smart A-SMEs decision which helped the training be more effective.

Young Smart A-SMEs needed to be trained on media making for communicating with consumers and online marketing which were curriculums at national level. This finding could be discussed that Young Smart A-SMEs needed to communicate their products directly to the consumers using online media as marketing channels. Considering the findings of this study on general state of Young Smart A-SMEs, it was found that most of them had skillful use of IT consistent with Schroer (2016) who stated that Generation Y were the people who were born during 1977-1994 while

technology was progressing. It implied that Young Smart A-SMEs which were in Generation Y, tended to use IT to run their business operations. Furthermore, the researchers realized that online marketing would be used in business operations successfully if Young Smart A-SMEs communicated their marketing via IT to the young generation consumers consistent with Srisroi Mayvadee (2011) who studied "The Effect of Online Advertising on the Perception of Marketing Information of Working People", found that technology factor affected the perception of marketing information of young generation people at 0.05 statistical significance.

3. Reinforcing and Developing the Competency Level in Business Operations

Young Smart A-SMEs set the training courses according to the designed curriculums as follows:
3.1 Curriculums at National Level
3.1.1 The Curriculum on the Development of Packaging and Label Designing
Young Smart A-SMEs produced practical packages, developing and designing 23 labels for 23 agricultural products to attract the attention of consumers. Some samples of the labels developed for the agricultural products were shown in Table 1.
3.1.2 The Curriculum on Media Technology for Online Marketing
After development, the Young Smart A-SMEs accrued knowledge regarding communication with consumers and online marketing. They could develop media technology for themselves and communicate directly with consumers through online channels. This greatly increased public awareness of their products through advertising.
3.1.3 Curriculums at Provincial Network Level
Young Smart A-SMEs set schedules for the training courses adhering to the 38 curriculums at provincial network level and operated their training courses as planned.

Table 1 Output of the Training Course on Packaging Development and Original Label Designing for Agricultural Products

Products	Before development	After development	Development details
Three-flavor dried tomato			Labels were developed to be waterproof and attractive to customers with more information regarding the products. Packages were transparent, sealed for product visibility and had longer life which added value to the products. The packages were also reusable to reduce waste.
Fresh Mangoes			The new packages were designed with a handle to make them portable and suitable as a gift/souvenir.

4. Studying the Opinions on the Reinforcement and Development of their Competency Level in Business Operations

4.1 The Outcome of benefit level evaluation Young Smart A-SMEs evaluated each development curriculum at provincial network level together with the benefit level in the eight aspects of self-learning development, production resource management, production management, product value-added management, product standard management, marketing and product distribution management, network group management, and coordination and communication management. Results showed that the average benefit level was high (Mean = 4.16). The highest benefit level was achieved in the four aspects of production resource management, production management, product value-added management, and marketing and product distribution management.
4.2 The outcome of knowledge level evaluation Young Smart A-SMEs evaluated their knowledge levels before and after development in eight aspects. Knowledge levels before development were at a low level (Mean = 2.52). After development, knowledge levels were highest in all aspects (Mean = 4.49), except for marketing and product distribution management.

These positive findings from the outcomes of benefit level and knowledge level evaluation regarding the development of the competency of Young Smart A-SMEs in business operations could be discussed that allowing members of Young Smart A-SMEs groups to design curriculums to train themselves was an effective strategy. This made them realize the benefit/advantages of the training courses. The pattern of training courses also gave them the opportunity to discuss issues with each other and exchange knowledge to increase their competency in business operations. These results were consistent with Maiese Michelle (2005) who stated that discussing with each other would reinforce the information and experience exchange, network uniting and able to enhance competency. Furthermore, to develop competency level must be covered all aspects of competency; knowledge, skills, and attribution (McClelland, D.C.,1973). This pattern of training courses could claim that competency level were developed at all aspects of competency. The aspect of knowledge were developed by curriculums at national level, and provincial network level. The aspect of skills were visibly noticed by packaging, labeling and IT media made. Lastly, the aspect of attribution could be seen from their evaluating the benefit and knowledge.

CONCLUSION

The competency level development in business operations for Young Smart A-SMEs allowed them to design the curriculums they needed for training. These were divided into national and provincial network levels. There were two curriculums at national level on the development of packaging and label designing, and the curriculum on media technology for online marketing, and 38 curriculums at provincial network level. The evaluation of benefit/advantage was generally at a high level. The evaluation of knowledge level before development was low; however, after development this was at the highest level.

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Research article

Small Scale Farmers' Perception of Soil and Water Conservation Practices -The Case of Budalangi Area, Kenya

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Abstract Soil and water conservation; a process of minimizing the effects of land degradation, is necessary for sustainability of food production aimed at feeding the rapidly increasing global population. Soil erosion and subsequent transfer of the eroded particles have been seen as a major cause of land degradation. Budalangi area in Kenya is mainly flat with poor drainage and alluvial or black cotton soil with minimal tree cover. Flooding in the study area is believed to be as a result of sediments accumulating in the bed of River Nzoia over the years, making the river course channel to be above the general level of flood plain, resulting to overbank flow across the dykes. The study is to discuss the understanding of small scale farmers and their motivation on soil and water conservation practices. Qualitative and quantitative methods were used. Data collection was mainly through questionnaire survey, both formal and informal interviews together with field visits. The sample was selected by simple random sampling technique from the entire study area. From the general outcome, majority of farmers could attribute the condition of their farm fertility to deposition of top soil from upstream. Respondents also related low productivity to floods and unreliable rainfall pattern in the area. The results showed that about 74.3% of the farmers in the study area are familiar with soil and water conservation with 42.6% of them putting to practice at least one measure to conserve soil and water. About 68.5% of the farmers are not practicing any soil and water conservation measures. Hence, there is need to strengthen small scale farmers` knowledge and adoption of soil and water conservation such as rainwater harvesting to augment overreliance on direct rain for production and sustainable agriculture.

Keywords soil erosion, deposition, soil fertility, farmer perception, and soil and water conservation

INTRODUCTION

In many developing countries, programs to mitigate land degradation have been initiated but with minimal success due to poor user adoption and lack of adequate technology transfer, (Aklilu and Jan, 2007). According to McDonald and Brown, (2000), technical interventions brought to farmers by external agencies are always not sustainable unless attention is paid to both socio-economic and cultural aspects of the community in question. Therefore, in order to enhance sustainability of projects meant to intervene in a particular problem in a community, full community participation is necessary. This way, technology transfer will be meaningful and sustainable.

Decision by farmers to practice or adopt soil and water conservation (SWC) strategies is heavily influenced by personal, socio-economics and technological factors among others. Personal factors of age and level of education determines a farmer`s ability to relate problems associated with erosion to their consequences on productivity, (Woldeamlak, 2007). Inherent land properties such as slope and soil type determine vulnerability of soil to agents of erosion. Land tenure system, family size as well as level of income can be categorized as socioeconomic factors influencing adoption and practice of SWC measures.

Kessler, (2006) reported that in order to understand what motivates human beings to behave in a given way in relation to adoption process, there is need to put into consideration the logics behind the motivating factor which can either be self-driven through personal interests or externally driven by an expected reward or outcome. For SWC activities, self-motivation is important due to their long term nature of payback.

OBJECTIVE

The objective of this study is to discuss the understanding of small scale farmers and their motivation on soil and water conservation practices in Budalangi area, Busia County, Kenya.

METHODOLOGY

Study Area

The study area lies between longitudes N 0° 7′ 0″ to N 0° 9′ 0″ and latitudes E 34° 1′ 30″ to E 34° 3′ 30″. The research was conducted within Budalangi area, Busia County, which forms part of the lower catchment of river Nzoia watershed. Budalangi area is mainly flat with poor drainage, alluvial or black cotton soils with minimal tree cover and thus vulnerable to floods, (Alfred, 2013). The area receives mean annual rainfall amount of about 600 mm. Despite this manageable rainfall amount, the area is prone to floods during rainy seasons and suffers severe water scarcity during other seasons. To address these extreme challenges of excess water and water scarcity, there was need to study the understanding of small scale farmers and their motivation on soil and water conservation practices.

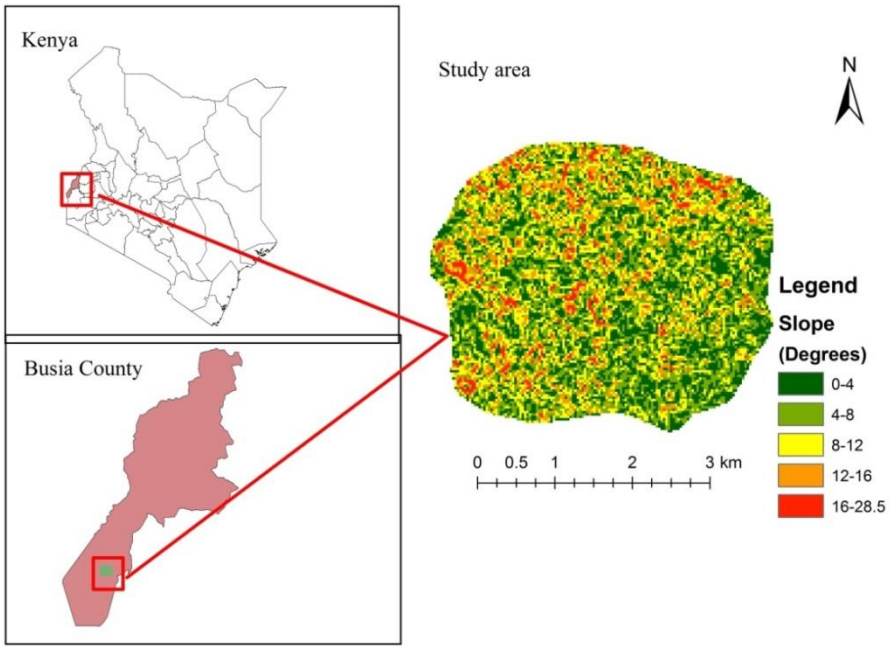

Fig. 1 Map showing location and slope of study area

Methods Applied

A total of 35 household representative farmers were randomly selected as the key informants for interviewing with the assistance of area extension officer. Randomization was to get a good representation of socio-economic characteristics of the target group. The data was collected in August 2016, which corresponded to land preparation period in the study area. Data collection was mainly through questionnaire survey, both formal and informal interviews together with field visits. The

questionnaire was designed consisting of both closed and open ended questions in order not to limit or restrict the response in a given way; this was meant to allow full expression among the respondents and the researchers to understand the respondents` perceptions relating to the mentioned issues.

Land tenure systems, past and present practices on the farms, yield per season, their understanding of soil fertility, erosion and conservation strategies were some of the issues included in the questionnaire. Questions relating to soil fertility changes, soil erosion perception and soil and water conservation strategies were open ended in structure to enable respondents to identify various visual indicators and give possible reasons for their observations.

Descriptive statistics especially tabulation and simple graphics were used to summarize the data. To determine the factors that influenced decline in agricultural production and influencing SWC practices, average ranking for each of the ranked causes was used to determine the most influential factors using the formula;

$$\text{Average rank } P_a = \frac{X_1P_1+X_2P_2+X_3P_3+\cdots+X_nP_n}{Total\ response\ count} \quad (1)$$

Where Xi is the response count for each choice and Pi is the ranked position.

Table 1 Contents of the questionnaire sheet

Category	Related question	Details
Basic information of respondent	General information	Name, age, gender, level of education, occupation
Topography	Farm position in relation to hillside	Location, slope
Security of tenure	Land tenure system	Type of land ownership, previous land use
Cultivated crops and production levels	Type of crop , yield	Maize, beans, potatoes, groundnuts, cassava and millet
Land degradation	Soil erosion severity, soil and water conservation measure	Level of damage and perceived causes, knowledge of SWC measures, adoption level of SWC measures.

RESULTS AND DISCUSSION

Land Tenure System and Preparation

Security of tenure is an important factor in determining whether a farmer is willing to practice soil and water conservation measures on their farmland, (Asrat et al., 2004). If the land belongs to the farmer and he/she is sure of using it for a long period of time, say, lifetime, the farmer has expectations of deriving benefits from the farm for a longer time and hence, he/she is most likely to invest in soil and water conservation measures on the farmland.

Unlike, when the farmer is not certain about the security of tenure, i.e. when the farm is leased or hired for a short period of time, the farmer may not be willing to invest in soil and water conservation measures.

Table 2 Farmers' responses on land ownership

Land tenure system	Number of respondents in percentage (%)
Individually owned (inherited/given/bought)	80.0
Communally owned	11.4
Others (leased or hired)	8.6

From the results on Table 2, majority of respondents either owned their farms through buying or inherited from the family lineage. Minority leased or hired their farms for a short period of time. This could mean there is relatively a higher security in terms of land ownership among the farmers in the study area and hence, a positive willingness to adopt and practice soil and water conservation strategies. This finding is also in agreement with Desalew and Aklilu, 2017, who observed that among other factors, plot ownership type had a significant influence on farmer's perception on soil and water conservation.

Farm Fertility Status

Proper soil and water conservation measures are important in maintaining and improving soil fertility. Deposition especially during heavy rains and flash floods from upstream was identified by the respondents as a possible cause of soil fertility in the area. Most farmers do not use either organic or inorganic fertilizer on their farms; probably due to deposition of top soil and other organic materials on some farms and high cost of farm inputs making it impossible for most small scale farmers to afford. As shown in Fig. 2, 40% of the farmers perceived deposition from upstream as a cause of their farm fertility status.

Farmers' Perception of Soil Erosion and its Severity

The concept of soil erosion is not a new term among the farmers in the study area. Majority of the respondents were able to identify the effects of soil erosion with its magnitude.

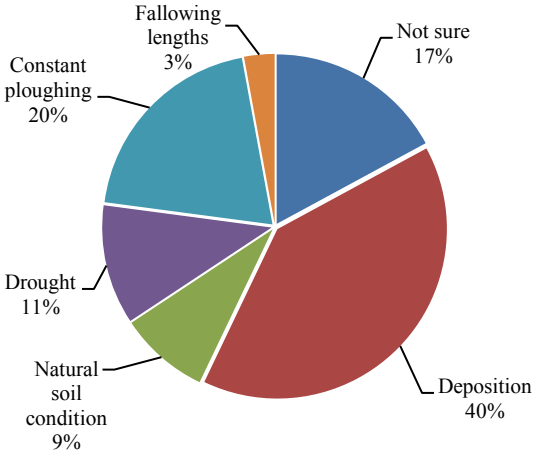

Fig. 2 Perceived cause of soil fertility status magnitude

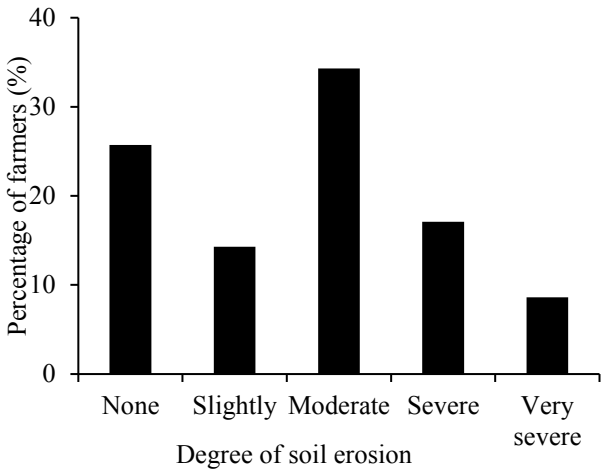

Fig. 3 Perceived soil erosion

Results on Fig. 3 shows 34.3% of the respondents considered soil erosion magnitude as being moderate with 17.1% and 8.6% mentioning severe and very severe respectively.

On the effect of erosion on soil fertility status, 48.6% confirmed it affected it negatively with 28.6% observing no relationship between erosion and soil fertility. This perception is in agreement with finding by Lal, 2003 that erosion has negative impacts on the environment as it reduces soil fertility of arable lands. The 22.8% observed positive effects of erosion; probably as a result of deposition from upstream.

Farmers Understanding of Causes of Decline in Production

From the results, all respondents were able to identify a decline in level of production and recognized possible causes in order of rank from 1 to 6. Where; 1 represented the most likely cause of decline and 6 the least likely contributor to the decline.

As in Table 3; flooding, income levels and water scarcity were identified as the major causes of decline in agricultural production in the area as most of the respondents were ranking them from first to second as shown in their average rank. Thus, the perception of causes leading to decline in production is important in determining the possible levels of adoption of any conservation strategy to be recommended in addressing challenges facing crop production and sustainable agriculture wholesomely. According to Enyew et al., 2013, soil and water conservation leads to improved crop productivity. Their study focused mainly on terraced fields for teff, barley and maize production. Each field showed a significant increase in yield per hectare.

Table 3 Crop production decline and prioritized causes

Cause	Rank by respondent (%)						Average rank
	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*	
Soil erosion	31.4	28.6	-	5.7	34.2	-	**2.8**
Water scarcity	54.2	25.7	8.6	5.7	5.7	-	**1.8**
Flooding	68.6	25.7	5.7	-	-	-	**1.4**
Size of farmland	25.7	2.9	5.7	22.9	34.2	8.6	**3.6**
Income levels	60.0	22.9	17.1	-	-	-	**1.6**
Wild animals	28.6	17.1	5.7	20.1	17.1	11.4	**3.1**

Soil and Water Conservation Strategies

SWC measures are normally put in place to control surface runoff and harvest rainwater. From the survey, it showed that about 74.3% of the respondents were familiar with SWC measures with about 42.6% doing something towards SWC in their farms. As in Fig. 4, out of 42.6% respondents who were able to identify some problems of surface runoff and water ponding, 51.4% and 31.4% used trenches and waterways as conservation measures, respectively in an attempt to control water movement within their farms. Figure 5 shows some of the soil and water conservation practices within the study area.

Some farmers were unable to respond to whether they practice SWC measures on their farms or not. According to Kessler, (2006), farmers may decide not to adopt any SWC measure even after perceiving a given problem and have an idea on how to solve it. This is due to various constraints to adoption, ranging from personal factors to technological aspects. From the survey, flooding especially during heavy downpour and water scarcity during dry seasons was identified as top constraints to production.

Therefore, there is need to bridge these extremes through rainwater harvesting and storage during heavy rains for use in dry seasons. To attain this, a deeper understanding of factors influencing farmers' perception and willingness to adopt any sustainable SWC measures is important (Derajew et al., 2013).

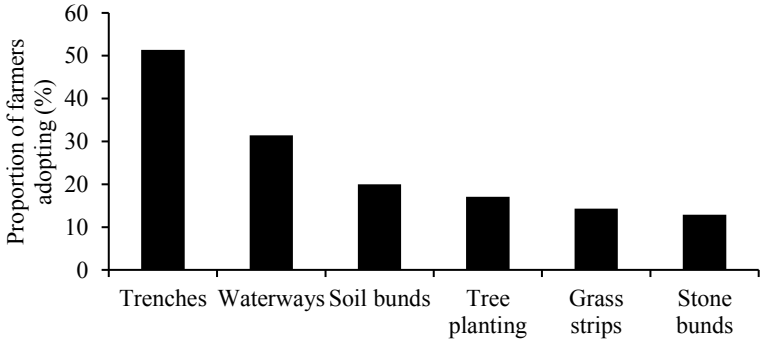

Fig. 4 Adoption levels of each SWC measure

Fig. 5 Soil and water conservation practices in the study area

CONCLUSION

This study aimed at discussing the understanding of small scale farmers on soil and water conservation practices in Budalangi area of Busia County, Kenya. From the results of the survey, it is demonstrated that majority of small scale farmers in the study area are aware of soil and water conservation measures and practices. About 74.3% are familiar with soil and water conservation with 42.6% of them putting to practice at least one measure to conserve soil and water. It is clear therefore that 68.5% of farmers, despite having the information, they are not putting to practice any soil and water conservation measure in their farmlands. Hence, there is need to strengthen small scale farmers` knowledge and adoption of soil and water conservation through training and extension services in order to realize a more sustainable land and water management practices and subsequently, sustainable agriculture.

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Research article

Waste Characterization, Quantification and Residents' Perception towards Solid Waste Management in Ubay, Bohol

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Abstract This study aimed to determine the percentage composition of the waste generated, the per capita waste generated per day, perception towards solid waste management practices of the residents of Ubay and the problems encountered in implementing the Solid Waste Management during the year 2015. This study employed descriptive-survey methods in determining the perception of the residents towards solid waste management and the problems encountered. As to the percentage composition, the researcher conducted documentary analysis from the data generated by the Solid Waste Management Office of the Local Government Unit (LGU) of Ubay, Bohol. A first-income class municipality in the island province of Bohol, Philippines. It is in the northeast of the province, and has an area of 335.06 square kilometers (129.37 sq. mi.) with 61 km (38 mi.) of coastline. It has 44 barangays. The Local Government Unit (LGU) of Ubay. One of the mandates of the government is to take care of the environment and protect the residents from various risks of environmental degradation. Findings showed that over fifty percent (50%) of the waste generated were biodegradable (organic) materials. The per capita waste generation was 0.065 kg. Residents had a moderately positive attitude towards solid waste management. The researches recommended that the LGU-Ubay, together with the barangay units, schools, NGO's and other responsible persons, may find more effective and efficient ways of increasing residents' participation level in solid waste management. The Solid Waste Management Board of Ubay may prioritize in strengthening the area of education and training to increase awareness of the residents regarding solid waste management. Further studies may be conducted formulating models that will show the solid waste flow of Ubay, Bohol (or other municipalities). An impact analysis of the strategies employed by municipalities in addressing problems of solid waste may be included.

Keywords attitude, biodegradable waste, Per Capita Waste Generation, perception, waste characterization, waste quantification

INTRODUCTION

In the midst of rapid development and industrialization, proper solid waste management practices play a vital role in maintaining the ecological balance of the country. Solid waste constitutes a major problem in most developing countries. Garbage is becoming a big problem in many places of the world and Ubay is no exception. Ubay, the research locale of this study, is a first-income class municipality in the island province of Bohol, Philippines. It is in the northeast of the province, and has an area of 335.06 square kilometers (129.37 sq. mi.) with 61 km (38 mi.) of coastline. It has 44 barangays. Local Government Unit (LGU) of Ubay. One of the mandates of the government is to take care of the environment and protect the residents from various risks of environmental degradation.

Waste management is one of the most intractable barrier in which administrators and environmental agencies are facing today. Ogwueleka (2009) reported that solid waste management is by far one of the greatest challenges that the country is facing. Human activities generate wastes, and the way these wastes are handled, stored, collected and disposed off can pose risks to the environment and to public health. Problems and issues of Municipal Solid Waste Management (MSWM) are of immediate importance. Ogunyanwo, (2014). This has been acknowledged by most governments, however rapid population growth overwhelms the capacity of most municipal authorities to provide even the most basic services Zurbrugg (2000). Due to their busy schedule, they just want to dispose their waste out the house. Unfortunately, public agents and urban authorities do not have adequate capacity to handle the increasing solid wastes mainly due to limited public budgets. A consequence of failure to remove solid waste are healthy hazards like tetanus, water contamination, sanitary and environmental problems such as pollution. In most developed countries, solid waste is disposed off in sanitary landfills. The buffering capacity of soil makes it possible for landfills to hold waste and prevent pollution of surrounding environment Carlson (1976); as cited by Kaluli (2011).It was provided in Article 11 of the Philippine Constitution, that the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature. Thus, the Philippine government takes into consideration the promulgation of various Presidential Decrees and the enactment of several Republic Acts which took direct action on solid waste management.

The most recent act is the Ecological Solid Waste Management Act of 2000 (RA 9003) which was signed into law on January 26, 2001. The law mandates all, and specifically the local government units (LGUs) "to adopt a systematic, comprehensive and ecological SWM program". RA 9003 adopts a community-based approach. As an alternative, sanitary landfills should be developed as a final disposal site but they should be operated in accordance with the guidelines presented in the act Bernardo (2013).

OBJECTIVE

This study aimed to assess the solid waste management practices of the residents of Ubay, Bohol, Philippines, in the aspect of waste quantification and characterization, as well as their perception towards their attitude in solid waste management practices during the year 2015.

METHODOLOGY

This study employed descriptive-survey method in determining the perception of the residents towards solid waste management in terms of attitude, and the problems encountered. As to the percentage composition, the researcher conducted documentary analysis from the data generated by Local Government Unit of Ubay, Bohol, Philippines.

The instrument of this study is fivefold which consist the following aspects, namely: Percentage Composition of Waste Generated, Per Capita Waste Generation per Day, Strategies in Reducing Solid Waste, Attitude of the residents towards waste management, and Problems Encountered During the Implementation of Solid Waste Management. This study was conducted in Ubay, Bohol, Philippines. This is a first- class municipality in the northeast of the province of Bohol with an area of 335.06 square kilometers (129.37 sq. mi.) and 61 km (38 mi.) of coastline with 44 barangays.

There were the three hundred sixty four (364) randomly selected respondents who were official residents of nineteen (19) randomly selected barangays of Ubay, Bohol. This number was the result after using Slovin's formula in determining the appropriate sample size.

RESULTS AND DISCUSSION

Table 1 shows the percentage composition of waste generated per day. It discloses that among the four (4) classifications of solid waste, biodegradable materials generated got the highest weight

composition of 214.29 kg or 52.77%. This is marginally higher than the country's average percentage composition of organic waste (bio-degradable) which 50% (Gapuz, 2011). These wastes include food/kitchen waste (vegetable and fruit residues, fish cleanings and animal carcasses) yard wastes (grass, twigs, and leaves) and agricultural waste.

Table 1 Percentage Composition of Waste Generated Per Day

Classification of waste	Weight composition (kg)	Percentage composition	Sample size	Per capita waste
Biodegradable	214.29	52.77		
Recyclable	82.07	20.21		
Residual	60.99	15.02		
Special	48.73	12.00		
Total	406.08	100.00%	6,258	0.065

The least generated waste was the special waste with 48.73 kg or 12 %. This waste refers to household hazardous wastes. This includes empty cans/containers of paints and thinners, household batteries, spray canisters and the like. Wastes may be hazardous wastes if they exhibit any of the four characteristics of a hazardous waste (ignitability, corrosivity, reactivity, and toxicity) as defined in Article 3 of Chapter 11 of the hazardous waste regulations (Sections 66261.21 to 66261.24). These four characteristics are: Ignitability – Ignitable wastes can create fires under certain conditions, undergo spontaneous combustion, or have a flash point less than 60°C (140°F). Examples include waste oil and used solvents. The characteristic of ignitability is defined in section 66261.21 of the hazardous waste (Gyambrahg, 2016).

This agrees to the study of Oluwaleye (2012) that hazardous wastes which can stem from any of the above sources. Therefore it will not be taken as a part of the classification of wastes by source, rather as a cross-cutting character for all these wastes (UNESCAP, 1993). Moreover, the amount of waste generated in either developed or developing countries depends on the population, degree of urbanization and industrialization, and intensity of agricultural activities.

Typical hazardous waste routinely generated at offshore facilities include waste oil, oil contaminated rags, hydraulic fluids, used batteries, empty paint cans, waste chemicals and used chemical containers, used filters, fluorescent tubes, medical waste and among others. All operators of fixed and mobile units must submit a Waste Management Plan (WMP) showing roles and responsibilities, a list of expected waste streams generated and a Waste Location. (Gyambrahg, 2016) Recycle/ Compost Recycling is a process to convert waste materials into reusable material to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling) by reducing the need for "conventional" waste disposal and lower greenhouse gas emissions as compared to plastic production.

Table 2 Per Capita Waste Generation per Day of Ubay, Bohol

Total waste composition (kg)	Sample size	Per capita waste
406.08	6,258	0.065

Table 2 reflects the per capita waste generation per day of Ubay, Bohol. The per capita waste generation per day was based on the total weight composition (in kilograms) divided by the six thousand two hundred fifty eight (6,258) sample size of the solid waste characterization conducted by the Solid Waste Management Office of the Local Government Unit (LGU) of Ubay, Bohol. As shown in Table 2, total waste composition is 406.08 kg with 6,258 sample size, the per capita waste generated is 0.065. It is below the average waste generation which is 0.3 kg per person per day in the rural areas (Atienza, 2011).

Table 3 manifests the residents' perception towards solid waste management practices. It can be noted that Item number 2 or "Environmental education should be taught in schools" ranked first

among the items. This means that the residents still need to be educated about the environment and how to take care of it.

Table 3 Residents' Perception on their Attitude towards Solid Waste Management Practices (*n=364*)

Statements	WM	DV	Rank
1. I play an important role in the management of garbage in my community.	5.30	STA	4
2. Environmental education should be taught in schools.	5.57	STA	1
3. The purchase decisions that I make can increase or decrease the amount of garbage.	4.87	MA	9
4. I'm concerned that burning garbage can be bad for my health and…others.	5.10	MA	7
5. People who throw garbage on the streets and in the drains and gullies lack willingness.	4.14	SLA	12
6. The government is doing enough to fix the garbage problems.	4.27	SLA	11
7. Correct garbage management should be taught in schools.	5.12	MA	5.5
8. Other personal issues (like crime, unemployment, and cost of living) are more important to me than a garbage-free community.	4.32	SLA	10
9. Regular collection of garbage is not the only solution to garbage problems.	4.99	MA	8
10. Picking up garbage around my community is my responsibility as a citizen.	5.12	MA	5.5
11. Public education about proper garbage management is one way to fix the garbage crisis.	5.34	STA	3
12. It is very important that the government of Philippines put recycling laws and programs in place.	5.37	STA	2
Composite Mean	4.96	MA	

Legend:

Range	***DV***	***Level of Attitude***
5.16 – 6.00	*- Strongly Agree (STA)*	*Highly Positive*
4.33 – 5.15	*- Moderately Agree (MA)*	*Moderately Positive*
3.50 – 4.32	*- Slightly Agree (SLA)*	*Slightly Positive*
2.67 – 3.49	*- Slightly Disagree (SLD)*	*Slightly Negative*
1.84 – 2.66	*- Moderately Disagree (MD)*	*Moderately Negative*
1.00 – 1.83	*- Strongly Disagree (STD)*	*Highly Negative*

Item number 5 "People throw garbage on the streets and in the drains and gullies because of lack of education regarding proper solid waste management practices" obtained the lowest weighted mean of 4.14 (slightly agree). In the absence of a basic facility of collection of waste from source, citizens are prone to dumping waste on the streets, open spaces, drains, and water bodies in the vicinity creating unsanitary conditions (Kumar and Nandini, 2013). This mind set is primarily responsible for the unscientific systems of waste management in the country. The relevance of the study has direct relation to the present environmental issues. There is a global awakening on the issue by the world leaders. Most often the present efforts are disproportionate because all the stakeholders want others to control the contamination.

Citizens assume that waste thrown on the streets would be picked up by the municipality through street sweeping. In this wise, individual's perception will influence the cultural values, responses, and success of the solid waste management system.

Table 4 shows a composite mean of 3.28 that implies very serious problem encountered during the implementation of SWM. In particular, item number 12 "Health problems (presence of dengue)" got the highest weighted mean of 3.54 (very serious). Meaning, there is considerable potential for health hazardous exposure that occurred during the implementation of solid waste management. Therefore, the implementation of SWM takes into consideration through rigid process, monitoring and evaluation in order to lessen uneasiness about the potential health effects of waste management processes, particularly within communities living in the proximity to relevant sites.

On the other hand, item number 7 "Lack of trained personnel" obtained the lowest weighted mean of 3.08 (serious). Without adequately trained personnel for solid waste policy making and implementation, sustainable solid waste management planning and implementation is not realizable.

Table 4 Problems Encountered in the Implementation of Waste Management (*N=364*)

Statements	WM	DV	Rank
1. Public indifference (public don't care)	3.22	S	9
2. Inefficient collection of garbage	3.25	S	8
3. Lack of financial resources	3.19	S	11.5
4. Lack of authority to make financial decision	3.19	S	11.5
5. Non-operation of good disposal	3.18	S	13
6. Lack of trained personnel	3.08	S	15
7. Lack of enforcement measure and capability	3.16	S	14
8. Foul odor of the dumpsites…	3.36	VS	3
9. Lack of awareness among the people….	3.37	VS	2
10. Lack of training on proper….	3.34	VS	5
11. Health problems (presence of dengue)	3.54	VS	1
12. Lack of collecting vehicle….	3.31	VS	6
13. Open burning	3.35	VS	4
14. Lack of leadership and commitment….	3.26	VS	7
15. Lack of training and non-existence of SWM ….	3.21	S	10
Composite Mean	3.28	VS	

Legend:

Range		***DV/Level of Seriousness***	
3.26 – 4.00	-	*Very Serious*	*(VS)*
2.51 – 3.25	-	*Serious*	*(S)*
1.76 – 2.50	-	*Not so Serious*	*(NS)*
1.00 – 1.75	-	*Not a Problem*	*(NB)*

CONCLUSION

There is an increased organic materials generated, with less per capita waste a day. This means that residents had moderately positive attitude towards solid waste management. As the result community awareness and mobilization is important in addressing problem and appropriate plan of action to direct the goal on solid waste management.

RECOMMENDATIONS

It is recommended that the local government unit (LGU), together with the barangay units, schools, NGO's and other responsible persons, may find more effective and efficient ways of increasing residents' participation level in solid waste management. Individual household in barangay level and all other sources such as markets, commercial buildings, institution, schools, hospitals and agricultural industry must implement multi-stream waste-sorting and collection of garbage. The Solid Waste Management Board may prioritize in strengthening the area of education and training to increase awareness of the residents regarding solid waste management. The community shall continue designing and implementing strategies to reduce the generation of waste and to promote awareness among people.

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Research article

Farmers' Perception on Existing Problems of Soil Fertility Management in Mid-Hills of Nepal

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Abstract Maintaining soil fertility is essential for prosperity and sustainability of any agricultural system. Nepal is facing major issues in maintaining soil fertility in agriculture sector mainly in mid-hills. Mid-hills, which accounts for more than 37% of total agriculture land has upland terrace farming system, which is intensively cultivated, with high labor input and high degree of subsistence. With the rise in population and increase in food demand soil fertility management is essential. The farmers are engaged in traditional farming practices which has evolved into complex system where livestock, husbandry, crop production, forestry are practiced together. The undulating topography, climatic condition, unavailability of fertilizer is some of the key factors causing land degradation and low productivity. Accordingly, the objective of this study is to identify farmers' perception on existing problems of soil fertility in mid-hills of Nepal. This study was conducted on the basis of questionnaire surveys and field visits. Questionnaire surveys were conducted among households in eastern mid-hill region of Dhankuta District, Nepal. The results showed that farmers possessed indigenous knowledge for identifying and characterizing fertility of soils. Farmyard manure was used widely in maintaining soil fertility. Generally, farmers responded that soil erosion and low fertility was major problems faced in agriculture. Lack of resources and proper soil and management strategies was the main cause of the problem resulting in soil degradation and thus nutrient loss and decrease in productivity. To overcome such problems scientific approach on understanding the physical and chemical characteristics of soil should be applied to propose suitable sustainable conservation practices.

Keywords Nepal, mid-hills, soil fertility management, soil erosion, land degradation

INTRODUCTION

Soil fertility is the ability of soil to receive, store and transmit energy to support plant growth. It is important component for overall development of plants and crop productivity. For an agrarian economy maintaining soil fertility is very important to sustain agriculture.

Nepal is a small agrarian country, which lies in South Asia and is divided into 3 major physiographic regions, mountains, mid-hills and the lowlands. The mid-hills region of Nepal consists of 37% of total land area with rugged mountain topography and the altitude can vary considerably with a short horizontal distance. Thus, the mid-hills include deep river valleys well below 1000 m, and the nearby ridges can rise to more than 3000 m. Accordingly, climate and vegetation shows great vegetation over a very short distance, and give rise to great ecological diversity and complexity. In general, farming is rain-fed which is traditionally practiced in innumerable terraces. The terraced farms are not properly maintained and are extensively cultivated. Farming in mid hills is a complex system characterized by crop production, livestock, and forestry; where forests provides bedding material and fodder for livestock, which in turn provides with draft-power and manure. Depletion of soil nutrients, water shortage and soil erosion are some the main cause for land degradation. Due to the topography and economic conditions of the farmers access to chemical fertilizers and other

technologies are very limited. Soil fertility is largely maintained through the application of compost and manure but in recent years a decline in soil fertility has been reported (Shrestha et. al., 2000). Even though over the years, research in enhancement of soil fertility and conservation has been done (Keatinge et al., 1999; Acharya et. al., 2000) and in addition significant amount of relevant indigenous knowledge has been recorded (Thapa et. al., 1997), there has been decrease in soil fertility and is a major concern for the farmers (Turton et. al., 1995). There has also been limitation of farmers in adoption of new techniques by farmers (Shrestha et. al., 2000).

Therefore, the objective of this study is to discuss the understanding of farmers' perception on soil fertility, soil management and conservation strategies in the research site.

METHODOLOGY

Site Description

This study was conducted from September to November 2016 in 5 different VDC (Village Development Committees) of Dhankuta district. The five VDC were Dandabazar, Budhimorang, Pakhribas, Hattikarkha and Batah. These VDC were chose on the basis of agricultural land area, population engaged in agriculture and agricultural productivity importance The topography of Dhankuta district is hilly with minimum elevation at 120 m to highest at 2702 m. Dhankuta district is a major agricultural region with more than 83.45% of people engaged in agriculture whereas the national average is 65.6%. The agricultural land has been categorized into khetland (irrigated lowlands) and bariland (upland) and the district's major crops are maize, paddy, wheat, potato, millet, legumes, ginger, tea, cardamom, sugarcane, vegetables, orange etc. depending on the type of land. Livestock forms an important part of agriculture with different animals like cows, buffalo, pigs, goat, sheep, chicken etc. been reared. Livestock is an important income source and makes significant contribution to GNP in agricultural sector. The soil of the district is defined as the alluvial, residual and clay mixed sandy soil according to the elevation as well as the topographic physiology**.**

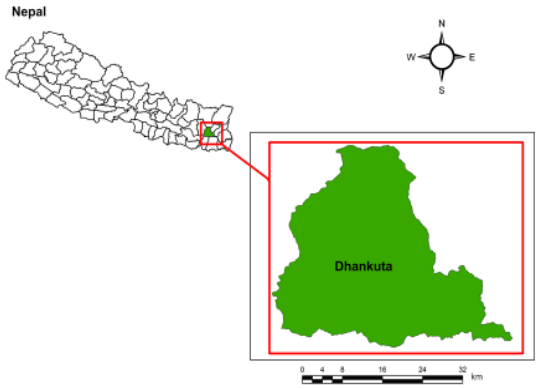

Fig. 1 District map of study area

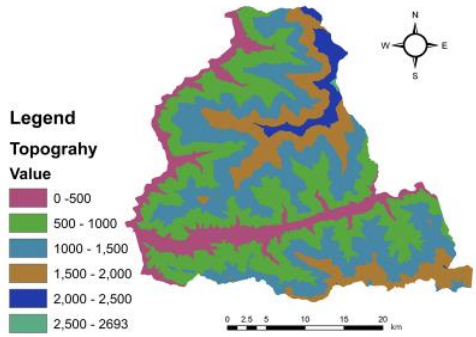

Fig. 2 Topography map of study area

Table 1 Topography distribution of study area

Elevation (m)	0-500	500-1,000	1,000-1,500	1,500-2,000	2,000-2,500	2,500-2,693
Area (ha)	11823	30998	29002	13915	13.31	78
Area (%)	13.31	34.91	32.66	15.67	3.36	0.09

Household Interviews

Interviews were conducted in five VDC of Dhankuta district. Total of 35 farmer representatives of 5 villages were selected for the interview. To minimize the errors due to possible lack of knowledge in managing the fields, only those farmers who owned the field were interviewed excluding farmers working in rented fields. Questionnaire was designed to understand farmers` perception on fertility of soil, soil fertility management and problems faced in agriculture and conservation practices.

In this study descriptive statistics, graphic analysis and simple tabulation were used to summarize the data observed.

Table 2 Questions in the questionnaire sheet

Category	Related questions	Details
Basic information of household	-General information	Name, Age, Gender, Numbers of family members and Address
Farmers' perception of soil fertility	-Degree of soil fertility	Physical characteristics (color, hardness etc.)
Crop cultivated	-Types of crop	Rice, wheat, maize, tubers, vegetables
Water resources	-Source of irrigation water	Rainwater, river, springs, groundwater
Soil fertility practice	-Kinds of practice	Fertilizer, farmyard manure, compost, green manure etc.
Soil degradation	-Soil erosion effect -Severity	Decrease in land productivity, nutrient loss, sediment yield
Soil erosion management	-Erosion management practices and conservation measures	Terracing, buffer strip, mulching etc.

RESULTS AND DISCUSSION

Problem of Soil Erosion and Soil Erosion Management Practices

According to Turton et. al., (1997) soil erosion is one of the major causes that threaten soil sustainability in Nepal. Also, soil loss through surface erosion from hilly agricultural land varies from less than two tons per hectare per year to a high soil loss of 105 tons per hectare (Acharya et. al., 2007). Due to mountainous physiography, poorly managed sloppy terraces, and degraded rangelands, erosion on these lands are highest. Interviews with the farmer shows different problems faced in agriculture in the research site (Fig. 3). 45% and 25% of respondent answered that soil erosion and low fertility respectively were the major problem faced. Other problems such as, landslide, disease and pest were also observed. Annual loss of soil from soil erosion in Nepal is estimated to range between 182 to 708 ton/year (MOEST, 2006). The forest area has been converted into degraded lands and the vegetation cover is extremely low in some areas. Also, landslides are common phenomena in the geologically fragile hills thereby increasing the area of degraded lands.

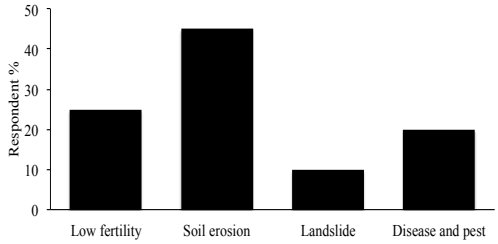

Fig. 3 Different kinds of problems faced

Figure. 4 show farmers perception on the severity of soil erosion in the research site. The results show that severity of erosion is not alarming. But, the study of Turton et. al., (1997) suggested that although farmers responded unchanged or increased soil fertility, soil analysis showed critical level

of soil fertility. Therefore, there is need to know the amount of erosion and the factors contributing to it so that required conservation strategies could be applied. Most of the respondent answered that soil erosion led to decrease in productivity followed by soil degradation, nutrient loss and sediment yield (Figure. 5)

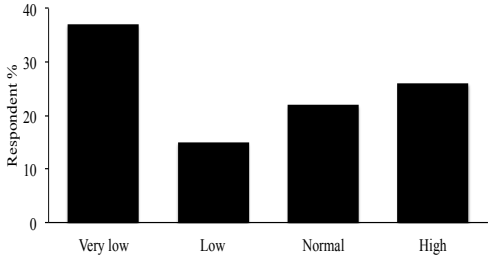

Fig. 4 Severity of soil erosion

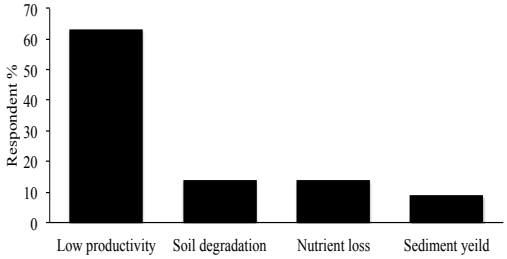

Fig. 5 Effects of soil erosion

High soil erosion and low fertility can be result of soil conservation and soil fertility management practices. Farmers did have the concept and understanding of soil erosion and practiced various soil erosion management practices (Fig. 6). Due to topography, 69% of the farmers replied that they were practicing terrace farming where steep slopes were converted into terraces. These slopes were not properly made and managed which further increases the possibility of soil erosion.

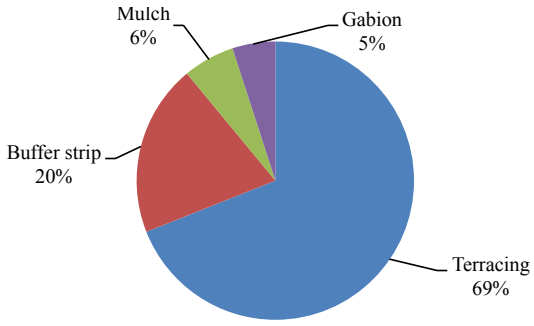

Fig. 6 Soil erosion conservation practices

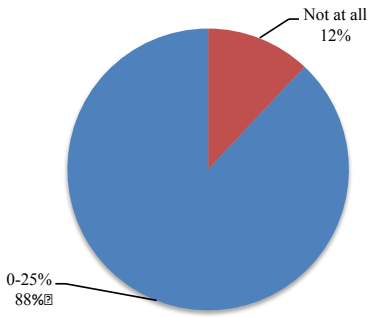

Fig. 7 Land area under conservation

Farmers also practiced the construction of buffer strips to minimize the soil erosion and loss of nutrients. Mulching using crop residues were also observed. Most of the farmers understood the importance of conservation of their fields, but only small part of their fields was under conservation. 88% of farmers replied that they have some kinds of conservation strategies applied in 25% of their land area, whereas 12% replied that they did not had any conservation methods applied (Fig. 7).

The reason for low conservation practices can be related to weak economic conditions, lack of knowledge and training in conservation strategies among the farmers. When asked, only 23% of the farmers had any or some kind of training participation in conservation strategies.

Dependence on Rainwater

Water is an essential factor in maintaining soil fertility and increasing the productivity. Nepal is rich in water resources with series of rivers and streams flowing down from the mountains, but due to lack of infrastructures farmers have to depend on rainwater for agriculture. 60% of farmers replied that they were dependent on rainwater for irrigation (Fig. 8). Dhankuta district receives an avg. rainfall of 2100 mm with rains at peak between the month of June and July (Fig. 9). Apart from the rainy season there is scarcity of water. Erratic pattern of rainfall is also a concern for the farmers. Water conservation strategies should be adopted for supply of water during the dry seasons.

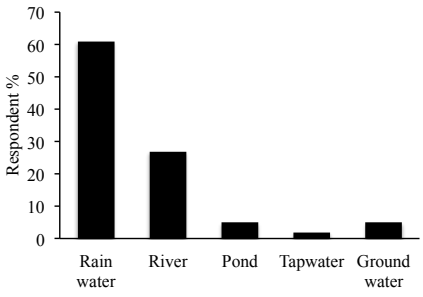

Fig. 8 Different sources of irrigation water

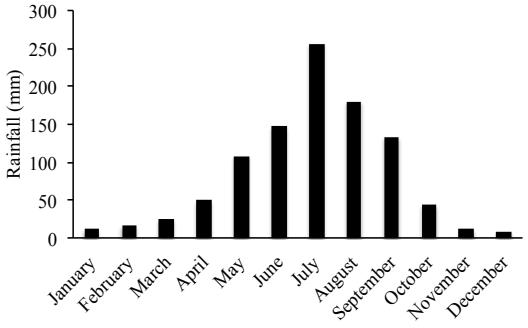

Fig. 9 Average annual rainfall (1989-2016, DHM)

Soil Fertility Management Practices

Farmers indicated using conjunction of farmyard manure (FYM) and chemical fertilizer as a major supplement for managing soil fertility. Other practices, such as green manure, legumes were also used (Fig. 10). Farmers for making farmyard manure used indigenous method. Table 3 shows the amount of FYM applied, application frequency and preparation period of FYM. Farmers used leaves, shrubs, and other organic material together with crop residues and bedding material to make farmyard manure. Manure from cows, buffaloes, pigs, goat, poultry were widely used. Due to deforestation and lack of fodder for the livestock, the quality and the quantity of farmyard manure have decreased. Also, the amount of farmyard manure applied was directly related to the number of livestock owned. The improper handling and making of farmyard manure has resulted in loss of nutrients. Shrestha et. al., (2009) suggested that soil fertility is largely maintained through the application of compost and manure but in recent years a decline in soil fertility has been reported. Also, improper handling of manure can lead to environmental and health problems through surface runoff and leaching of nutrients and pathogenic microorganism (Ishikawa et. al., 2012).

The most common form of chemical fertilizers used were urea and DAP (Di-Ammonium phosphate). Although farmers considered chemical fertilizers easy to transport, store and use, cost and availability was a major concern. Farmers were unaware of appropriate timing and amount of fertilizers applied.

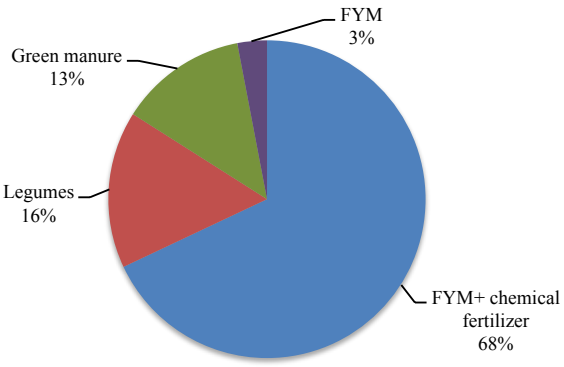

Fig. 10 Different soil fertilizer application

Table 3 Respondent % for application amount, frequency and preparation period of FYM

FYM (ton/ha)		Application of FYM	(times/year)	Preparation period	
Less than 1 ton/ha	55%	1 time/year	20%	3 months	10%
1-2 ton/ha	18%	2 times/year	60%	6 months	61%
2-3 ton/ha	20%	3 times/year	17%	9 months	19%
Not available	7%	4 times/year	13%	12 months	10%

CONCLUSIONS

Soil erosion was a major problem faced by farmers, which led to depletion of nutrients, thus decrease in productivity. Farmers used various kinds of soil management practices with farmyard manure the most dominant kind. Improper handling in preparation, storing and application resulted in low productivity. Farmers were also using chemical fertilizers, but it was restricted to availability and economic condition of farmers. Landslides, sediment yields diseases and pests were other problems, which existed. Soil conservation strategies were performed, but in very small portion of the field. Lack of irrigation facilities and dependence in rainwater was major concern. All this conditions had effect on the productivity. To better understand and overcome such problems scientific approach should be applied and suitable sustainable conservation practices should be proposed.

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Research article

Development of Distance-Learning Curriculum Model on Food Safety and Organic Agriculture Developed from the Sufficiency Economy Philosophy for the ASEAN Community

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Abstract The Distance-Learning Model on Food Safety and Organic Agriculture Developed from the Sufficiency Economy Philosophy for the ASEAN Community was designed by selecting relevant topical video recordings and translating the contents into nine languages mostly used in the ASEAN region. Which used to educate the farmers regarding food safety, supply chain, and organic farming, and to promote the implementation of sufficiency economy into the ASEAN region. The aims of this research were: 1) to develop a distance-learning curriculum model on food safety and organic agriculture following the sufficiency economy philosophy for the ASEAN community, 2) to develop learning materials to accompany the program, and 3) to evaluate the benefits and success of the learning program. Research, development and evaluation were all administered. Both qualitative and quantitative data were collected. Seminars were organized to garner information from 10 qualified experts in model development processes and procedures. A questionnaire survey was used to gather data from 70 participants of different nationalities to evaluate the learning program. Quantitative data were analyzed using descriptive statistics and qualitative data were evaluated using content analysis. The findings were as follows: 1) one remarkable feature of a distance-learning curriculum was the use of video recordings as a major tool in the learning process, and learning by doing through group study by people living in adjacent communities, 2) the learning materials accompanying the program were available in nine ASEAN languages (Thai, Lao, Cambodian, Vietnamese, Malay, Indonesian, Burmese, Chinese and English), and consisted of: (i) instructional videos covering 15 subjects including Sufficiency Economy Philosophy, Paradigm Shifts, Food Security, The Way of Organic Farming, Household Budget and Information Management for Planning, Knowledge Management, Soil and Water Management, Genetics Management, Alternative Energy, Safety and Organic Food Production, Food Safety Assurance, Packaging Design, Group Management, Distribution Management, and Edutainment, (ii) curriculum documents, handbooks and a list of selected media, and 3) the designated learning program was perceived to be of the "highest" value. The learning materials were rated "highly" appropriate but with the "highest" usefulness, and the designated learning program was perceived by the group to be at a "high" level.

Keywords model development of distance-learning curriculum, distance-learning curriculum, food safety, organic agriculture, sufficiency economy philosophy, ASEAN community

INTRODUCTION

Data retrieved from the AEC Information Center (2015) indicated that most people in the ASEAN region earn their living through agriculture. Gardening, farming, and fishery are the main occupations of Malaysians while plantation, forestry, fishery, and animal farming are followed among Indonesians. Eighty percent of Vietnamese people earn their livelihood from agriculture. In Laos, Myanmar, and the Philippines agriculture is also the main occupation. However, workers in the agricultural sector are facing health problems and marketing constraints resulting from inappropriate production methods involving the overuse of pesticides. The chemical contamination is transmitted from the crops to the farm workers and thence to the consumers. To resolve these problems, several countries have implemented national policies to promote safety awareness in agriculture. In Thailand, the government has attempted to control pesticide imports and the use of non-standard paraquats. The system of chemical substance registration has been revised, and many hazardous substances are now banned or have restricted use in several countries. The Thai Government has also controlled advertising and selling which contravenes the ethically responsible dictates of the Food and Agriculture Organization. The use of organic substances has been promoted to improve the safety of agricultural producers and consumers. However, unsafe crop practices are still widespread (Office of Agricultural Economics, 2012).

Government sectors have implemented policies promoting learning to farmers; however, the curriculum management seemed to fulfill the aims of organizations rather than the needs of learners. In other words, the learning lacked integration regarding the contents and management. The curriculum was often organized for short time periods of 3 - 4 days and this was not sufficient for the learners to achieve meaningful results. In addition, there was no communication between the learners, or networking to develop and sustain change within the community and society.

Therefore, Sukhothai Thammathirat Open University (STOU) initiated the Center of Distance-Learning for Sufficiency Economy (2010) to provide community services by inculcating the Sufficiency Economy Philosophy or SEP into real-life practices. SEP stresses the importance of human development at all levels and value the need to strengthen community's capacity to assure a balanced way of life and resilience, with the respect for environment. In 2014, the model of distance-learning on harmless and organic agricultural practices was developed following the sufficiency economy ideals. The management at the center focuses specifically on learning, allowing learners to study by themselves. Furthermore, the distance-learning can be accessed by learners with diverse backgrounds. The learning program is safe and can be used to increase learner knowledge regardless of their previous educational levels (Keowan et al., 2015).

STOU realized that agriculture is the spine of the ASEAN region, and its people desperately want to learn from each other to prepare for being a part of the ASEAN community and cooperate regarding agricultural safety. The university, therefore initiated The Distance-Learning Model on Food Safety and Organic Agriculture Developed from the Sufficiency Economy Philosophy for the ASEAN Community by selecting relevant topical video recordings and translating the contents into nine languages mostly used in the ASEAN region: Thai, Lao, Cambodian, Vietnamese, Indonesian, Malay, Burmese, Chinese, and English. Moreover, the distance-learning model will be used to educate Thai farmers and also farmers in neighboring countries with the knowledge and efficiency of Thailand regarding food safety, supply, and organic farming, and to promote the implementation of economy sufficiency into the ASEAN region.

OBJECTIVES

The purposes of this research were as follows: 1) to develop a distance-learning curriculum model on food safety and organic agriculture, following the sufficiency economy philosophy for the

ASEAN community, 2) to develop learning materials to accompany the program, and 3) to evaluate the benefits and success of the learning program.

METHODOLOGY

Research, curriculum development, and curriculum evaluation were utilized for this research project. Both quantitative and qualitative data were collected throughout three stages as follows:

1. Curricular Model Development Processes

(1) collect, analyze, and synthesize the body of knowledge,
(2) design the core structure of the curriculum, courses, and learning management, and
(3) organize seminars to collate the information on model development procedure from 10 qualified experts.

2. Learning Materials Development Processes Accompanying the Learning Program

(1) produce and translate the contents of the video recordings into nine languages with 15 topics available for each language, and
(2) produce a set of curricular learning documents in each target language consisting of the curriculum papers, teaching handbooks for management, and a list of the selected media.

3. Curricular Evaluation Processes

Data were collected from 70 research participants from diverse countries to evaluate the achievements of the designed curriculum model of the Distance-Learning Project on Food Safety and Organic Agriculture Developed from the Sufficiency Economy Philosophy for the ASEAN Community. A questionnaire was circulated and a seminar was organized for 10 qualified experts to assess the learning achievements of the curriculum. The experts aired their opinions on the working processes both within and outside the countries regarding production procedure and curricular development.

The quantitative data was analyzed using percentage, mean, and standard deviation. Qualitative data was assessed using content analysis.

RESULTS AND DISCUSSION

The model development of the distance-learning curriculum on food safety and organic agriculture developed from the sufficiency economy philosophy was developed base on the notions of various scholars. For instance, the ideas of Saylor, Alexander and Lewis (1981: 28-29) were as follows: (1) model development should initially determine goals, objectives, and domains of the curriculum, (2) curriculum design, (3) curriculum implementation, and (4) curriculum evaluation. The notions of Chompoolong (2002: 53) on local curricular development consisted of (1) analyze basic information, (2) create a curricular draft, (3) examine the curricular draft, (4) implement curriculum sampling, (5) evaluate the curriculum sampling, and (6) improve and revise the curriculum. The notions of Wongyai (1990: 19) on integrated curriculum development consisted of (1) drafting a curriculum, (2) curriculum implementation, and (3) curriculum evaluation. This research followed three stages of model curriculum development as follows.

1. Model Development Processes of a Distance-Learning Curriculum on Food Safety and Organic Agriculture Developed from the Sufficiency Economy Philosophy

1.1 Analyze and synthesize the body of knowledge: The body of knowledge was analyzed and synthesized by organizing a meeting of the curriculum development committee and experts to define and determine the aspects of the curriculum. The model development of this distance- learning curriculum on food safety and organic agriculture developed from the sufficiency economy philosophy was different from other typical formal educational programs. The differences were as follows.

1) *Videos were used as a major tool* in creating the learning process which proceeded within budget and achieved high levels of learning advancement. This success was because learners were able to learn from the real-life experiences of individual models, groups, communities, and networks regarding their agricultural practices. The villagers did not have to spend time on traveling, with the flexibility of managing and adapting their own learning schedules to their individual lifestyles and occupations. In addition, the villagers were able to learn continually and gained knowledge in packing. This was important and necessary for agriculturalists to solve their problems following the philosophy and ideas of management, objectives, learning standards, and learning systems. Time management for learning, evaluation, and achievement relied on the qualifications of both learners and learning facilitators.

2) *Focus on self-learning* concentrated on gathering local people together to share their problems on individual, family, and community scales to discover solutions through doing projects. These learning practices allowed learners to learn with happiness.

1.2 Design and draft the curriculum: The curricular structure and implementation of the learning process were achieved by organizing meetings between the local committees and the experts. Teaching documents were created. The first two documents created were (1) curriculum papers comprising details such as curricular name, certificate name, responsible organization, philosophy and notions in the learning process implementation, learning schedule, learning system, learning time allotment, evaluation of learning achievement, learning facilitators, places and learning materials, resources and budgets, expectation from the curriculum, and learning curriculum, and (2) a handbook for learning management and a list of the selected media included in the learning system and learning allotment, evaluation and aims of learning, places and learning materials, learning facilitators, roles of learning facilitators, implementation of learning facilitators, learning management plans, plans of group seminars, memos of learning facilitators, facilitator's opinions on the process of learning, and a list of selected media and evaluation of curricular achievements.

1.3 Organize a seminar for learning model development: A seminar for learning model development was organized with the committees and the 10 experts. Based on the meeting, the draft curriculum was approved together with 15 subjects including Sufficiency Economy Philosophy, Paradigm Shifts, Food Security, The Way of Organic Farming, Household Budget and Information Management for Planning, Knowledge Management, Soil and Water Management, Genetics Management, Alternative Energy, Safety and Organic Food Production, Food Safety Assurance, Packaging Design, Group Management, Distribution Management, and Edutainment.

2. Learning Materials Development Accompanying the Learning Program

The curriculum development committee created learning materials comprising (1) instructional videos covering the 15 subjects and video recording for learning orientation of the curriculum, and (2) curricular documents including curricular papers, handbooks for teaching management, and a list of selected educational media. These curricular documents were originally written in Thai and later translated by the native language experts into the nine languages Thai, Lao, Cambodian, Vietnamese, Malay, Indonesian, Burmese, Chinese, and English.

3. Curricular Evaluation

Once the learning materials were created in each target language, the committee administered the materials to 70 participants and then evaluated the curriculum of food safety and organic agriculture developed from the sufficiency economy philosophy for the ASEAN community. For of the research

participants, 62.9 percent were male with average age 35.91 years. The participants evaluated the curricular structure in the following areas.

3.1 The appropriateness of the designed curriculum: The participants perceived that the curriculum was at the highest appropriate level (mean = 4.28).

3.2 The appropriateness of the learning materials: The participants perceived that the designed learning materials were at the high appropriate level (mean = 4.24).

3.3 The usefulness of the learning materials: The participants rated the usefulness of the designed materials at the highest level (mean= 4.24).

3.4 The satisfaction of students toward learning through the designed curriculum: The participants were satisfied with the learning through the designed curriculum as a group at a high level (mean= 3.64).

CONCLUSION

The process of model development of distance-learning curriculum on food safety and organic agriculture for the ASEAN community followed three stages as follows: **(i) curricular model development**, including the analysis procedure, synthesize the body of knowledge, design and draft the curriculum, and organize a meeting to develop the curricular model, **(ii) learning materials development accompanying the learning program**, the committee developed the learning materials into nine languages, and **(iii) curricular evaluation**, the designed curriculum was administered to the participants from the determined countries. They perceived that the designated learning program was very highly appropriate and highly useful. They were satisfied with the learning procedure during the designated learning program as a group at a high level.

ACKNOWLEDGEMENTS

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Research article

An Assessment of Village Type Pottery Industry

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Abstract A village type pottery industry was operating in a village of Talibon, in northern Bohol, Philippines which existed for quite sometime and was observed to be very slow in its improvement in terms of number and design of products, number of workers and the facilities remained obsolete. This study was conducted to determine the features of the village type pottery industry in terms of the beginnings of industry, the management structure, how pottery craft was learned, the process followed to produce a product, the source of raw materials, facilities and equipment used, designs of the products, the customers and the workers of the pottery. This was also conducted to determine the contribution of the industry to the local community. Further, the study was conducted to identify the level of satisfaction of the customers in terms of the product quality, quantity and timeliness of delivery of the product and to recognize the problems met by the industry. This study used descriptive survey method utilizing questionnaire, interview and actual observation. The result shows that this industry started in 1970s by the great grandparents of the present proprietors, the products were only limited to cooking pots, flower pots, and stove. Presently, this industry is managed by a couple, the husband as the manager and the wife as assistant manager. It has 5 workers in the production area, 3 males and 2 females who are daughters of the couple managing it. There were additional 2 workers, one helped in getting raw materials and the other one in selling the product. The result also shows that the raw materials were taken from the area near the pottery. It can be noted that improvised facilities and equipment were used in this pottery industry. Their customers were composed of walk-in customers and wholesalers. The result in the level of satisfaction on the products in terms of quantity, quality and timeliness in product delivery, revealed that the customers were Satisfied and Very Satisfied. The top three problems experienced were lack of capital, obsolete technology and lack of diversification. These results challenged the state university in Bohol and gave it the opportunity to use their capacity of helping this pottery industry in those aforementioned problems.

Keywords pottery, local community, pot designs, improved facilities

INTRODUCTION

Pottery is a ceramic material which makes up potterywares that include earthenware, stoneware and porcelain (Dinsdale, 1986). It is also defined as a clay that is modelled, dried, and fired, usually with a glazed or finished into a vessel or decorative object. The term "clay" refers to a naturally occurring material composed primarily of fine-grained minerals, which is generally plastic at appropriate water contents and will harden with dried or fired. Although clay usually contains phyllosilicates, it may contain other materials that impart plasticity and harden when dried or fired.

Pottery in Bohol utilized clay found in the locality where the pottery operated. It is unique because the clay was first stamped by the workers using their feet to make it fine, it was also moulded

by the hands of the workers without the aid of any tool or moulder except for hollow blocks and fire bricks. It was observed that it existed for quite sometime but was noticed to be very slow in its improvement in terms of the operation, number of products and product quality. It is in this context that the researchers were encouraged to conduct an assessment about this industry.

OBJECTIVE

This study was conducted specifically to determine the features of the village type pottery industry in terms of the beginnings of industry, the management structure, how pottery craft was learned, the sources of raw material, the process followed to produce a product, facilities and equipment used, and the designs of the products. This study was also conducted to determine the contribution of the industry to the local community. Further, the study was conducted to identify the level of satisfaction of the customers in terms of the product quality, quantity and timeliness of delivery of the product and to recognize the problems met by the industry.

METHODOLOGY

This is qualitative and quantitative study using descriptive survey method utilizing questionnaire and reinforced by interview and observation during the actual pottery operation. There were 42 respondents of the study broken down as follows; 2 owners (husband and wife), 5 workers, 25 customers and 10 wholesalers. The researchers used both convenient sampling and snowball techniques in identifying the 25 customers and ten wholesalers. This study was conducted in Talibon, the northern part of Bohol, Philippines.

Fig. 1 Map of the Philippines and Bohol

The responses of the walk-in customers and the wholesalers on the satisfaction level used the scale of 1 to 5, 5 as the highest level of satisfaction/ highest gravity of the problem and 1 as the lowest. For analysis of the data, the following ranges were used 4.24 - 5.00 Very Satisfied/ Very Serious problem, 3.43 - 4.23 Satisfied/ Serious Problem, 2.62 - 3.42 Moderately Satisfied/ Moderately Serious Problem and 1.00 - 1.80 Dissatisfied/ A Problem but did not greatly affect the operation.

RESULTS AND DISCUSSION

For the profile of the village-type pottery industry, the result of the interview shows that the pottery started in operation in 1970s by the great grandparents of the present owner, when their children were still young. During that time they only used a piece of wood like a paddle in de-airing and kneading the raw materials, they only used their hands in making pots, flower pots and cooking stoves. It was

only his grandmother who made the products, travelled to different towns during scheduled market days to sell them. They discovered that pot making helped much in their livelihood.

In the present time, it is managed by the grandson of the previous owner and his wife, they have only five workers, which include their two daughters, and three male workers who were also their close relatives. The males are between 20 to 40 years of age. They learned the craft through experience without proper training. As of the present time nothing much was changed although changes in the operation was noticeable. In the interview with the workers, they said, they still got the raw material near the place where the pottery house was erected. It can be observed that several holes were already made which shows that they got the raw materials in these areas.

The village type pottery industry adopted the some steps in the making of pots. It started with the gathering of raw materials from the main source just in the vicinity of the building, then de-airing followed which was done only by using their feet or stepping on the raw materials done several times. It was followed by kneading using their hands. These steps only indicated that they still need facilities for de-airing and kneading. When the raw materials were already ready, these were placed near the potter's wheel ready for the mass production.

For facilities and equipment, they already have the potter's wheel, which made their work a bit easier. They also have improvised moulders for fire bricks and hollow blocks, ovens small and big were also available. The small oven can bake 600 products fired in 6 hours, while the big one can bake 2000 products in 18 to 24 hours. Small oven was only used when there was an emergency order while the big was used in the normal operation. The ovens were fed with firewood, ordinary firewood with dried leaves of coconut to start the fire. There was also a building made of native and light materials used to air dry the products before baking and which also served as their display area before delivering the products to the customers or while waiting for the customers to pick them up.

As observed in the actual visit to the village type pottery industry, the designs of the products had already improved. In addition to the usual cooking pots, flower pots and cooking stoves, additional products were already produced such as the new designs of pots, flower pots of different sizes, vases with stand, haron jar, water jar, montabana, plant stand, bonsai pots, fire bricks and hollow blocks. But when the workers were interviewed, they said, that they wanted to learn more designs and more techniques in pot making.

In the result of the interview with the proprietor, he said that the village-type pottery industry became their means of livelihood until the present time. This is also where their workers earned a living. The community was also benefited because of the taxes they paid to the government.

For the satisfaction level of the customers in terms of quantity, quality of the products and the timeliness of product delivery, Table 1 shows, the products that ranked first in the level of satisfaction in quantity were the Fowls' Feeders with a weighted mean of 4.92 or Very Satisfied. It was followed by flower pots with the weighted mean of 4.85 and 4.385, Very Satisfied for cooking pots. It means that these products were always available in the display area. The customers said they can immediately buy these products anytime with the quantity they need. However, hollow blocks, fire bricks and flower vase with stand were the last three products in the rank as to quantity with a rating of 2.61 or "Moderately Dissatisfied" for hollow blocks, and 2.63 and 3.11" Moderately Satisfied" for both fire bricks and flower vase with stand respectively. These are made-to-order products, so nobody can just go to the pottery and buy the product but they need to put an order because these stocks were not always available. The potters will only manufacture these products when there are orders, so customers have to wait if they need the products.

Table 1 also manifests the respondents' satisfaction level as to the quality of the products. It shows that the top three products which the respondents rated "Very Satisfied" with a rating of 4.91, 4.88 and 4.8 were Fowl Feeders, Cooking pots, and Flower Pots respectively. The workers or the potters were already experts in producing fowl feeders, cooking pots and flower pots because these were the first products they produced since the beginning of the pottery operation. On the other hand, the last three products in the rank were Bonsai Pots, Plants Stand and Hollow Blocks. These products were rated 3.97 Satisfied, 4.32, Very Satisfied, and 4.54 Very Satisfied respectively. When the customers were asked further why they ranked these products in the lowest three ranks, they said they oftentimes saw cracks in the products, although the potters can also remedy the cracks by putting

additional clay on the cracks but the more it made the product not presentable anymore because the cracks were still evident.

The customers further commented that there were products which need glazing which the workers had no knowledge yet on how to do it. The workers started painting some products like the Montabana and Haron Jar but these products will look much better if these will be glazed according to the customers in the interview. The customers suggested that these workers be educated/ trained further on some techniques to produce better products.

Table 1 Respondents' Satisfaction level on the Quantity, Quality and Timeliness of the Delivery of the Products

Products	Quantity			Quality			Timeliness			Ave.	DR	R
	NR	DR	R	NR	DR	R	NR	DR	R	WM		
Cooking Pots /Stoves	4.85	VS	3	4.88	VS	2	4.85	VS	3	4.85	VS	3
Flower Pots	4.85	VS	2	4.80	VS	3	4.93	VS	2	4.86	VS	2
Flower Vase with Stand	3.11	MS	9	4.60	VS	7	3.46	S	9	3.72	S	9
Haron Jar	3.83	S	6	4.61	VS	6	3.84	S	6	4.09	S	5
Water Jar	4.69	VS	4	4.69	VS	4	4.72	VS	4	4.7	VS	4
Montabana	3.41	S	8	4.55	VS	8	3.43	S	11	3.79	S	8
Plant Stand	3.82	S	7	4.32	VS	10	3.84	S	7	3.99	S	6.5
Bonsai Pots	3.97	S	5	3.97	S	11	4.03	S	5	3.99	S	6.5
Fire Bricks	2.63	MS	10	4.68	VS	5	3.45	S	10	3.57	S	10
Hollow Blocks	2.61	MD	11	4.54	VS	9	3.47	S	8	3.54	S	11
Fowl Feeders	4.92	VS	1	4.91	VS	1	4.97	VS	1	4.93	VS	1

In terms of the satisfaction level on the timeliness of the delivery of products, it was also included in this study because it can affect the operation if the products were not delivered on time. The result shows that all items to be delivered were rated from Satisfactory to Very Satisfactory. On the same table, it clearly discloses that the first three items in quantity and quality were also the first three in the timeliness of delivery. It was obvious that since these items were readily available then, it can be delivered on time. However, hollow blocks, flower vase with stand, fire bricks and Montabana were the last in terms of timeliness in the delivery since these were made- to- order products. The potters will only manufacture these products when there are orders. So it took time for the potter to deliver and customers have to wait after making the order.

Per observation, the researchers noticed that this pottery industry has problems just like any other endeavours and so they included these in the study to find out the seriousness of the problems they meet in running the pottery industry. Three groups were asked to answer the questionnaires on the seriousness of the problems; the proprietors, the workers based on their experience; and the customers based on their perception and observation in the operation.

The proprietors' top three problems in managing the pottery were marketing mechanism which they rated 4.8 "Very Serious" Shortage of working capital with a rating of 4.24 "Very Serious" and Lack of Diversification 4.20 "Serious". It can be gleaned that marketing mechanism was really important to make the industry more productive. The two problems on shortage of working capital and the lack of diversification were interrelated because any industry can have the difficulty of diversifying the products if there is shortage of capital which usually lead to lesser productivity. The findings are in consonance with what Kasemi (2014) stated, that lack of diversification of the product also accounts for slow growth of the pottery sector.

Table 2 Problems Experienced by the Proprietors and Workers and as Perceived by the Customers

Problems	Proprietor			Workers			Customers			Ave. WM	DR	R
	NR	DR	R	NR	DR	R	NR	DR	R			
Shortage of working capital	4.24	VS	2	4.8	VS	2	4.24	VS	6	4.43	VS	2
Low investment in fixed capital	3.44	S	7.5	4.24	VS	4	4.4	VS	4.5	4.03	S	5
Obsolete Technology	4.0	S	4	5.0	VS	1	5.0	VS	1.5	4.67	VS	1
Lack of diversification	4.20	S	3	4.6	VS	3	4.8	VS	3	4.5	VS	3
Competition of other pottery industries	3.46	S	6	3.48	S	6	4.0	S	7.5	3.65	S	8
Management Problem	3.48	S	5	4.0	S	5	4.0	S	7.5	3.83	S	7
Lack of Research and Development Effort	3.44	S	7.5	3.48	S	8	5.0	VS	1.5	3.97	S	6
Marketing Mechanism	4.8	VS	1	3.46	VS	8	4.4	VS	4.5	4.22	S	4

On the other hand, on the workers' part, their first three problems were obsolete technology which they rated 5.0, Shortage of Working Capital, 4.8 and lack of diversification, 4.6 all were of descriptive rating "Very Serious". Since the workers were the front liner of production, they really felt that the facilities used were already obsolete, in the interview they said, they can have better product and improved productivity if the new facilities will be given to them. It can be understood that the problem on the obsolescence of the facilities can be attributed to shortage of working capital which also affected the diversification of the products.

On the part of the customers, they really felt that the industry were having that problem on obsolete technology which got a tie in rating with lack of research and development efforts, both got a rating of 5.0 or Very Serious. Through research and development effort, the lack of diversification problem can be addressed which they also rated as the third problem of the industry.

For the overall rating, it shows that the first problem was the obsolete technology, followed by shortage of working capital, lack of diversification; marketing mechanism followed closely then low investment on fixed capital. The last three among the identified problems were the lack of research and development effort, management problems and competition among pottery industry. It shows that though the pottery industry felt there were competitors in the business, they did not consider it as a very serious problem that could greatly affect the operation.

CONCLUSION

The village type pottery industry despite being run by family members who lacked proper training with limited experience and resources and using obsolete facilities, was able to survive for many years in operation. The industry slowly improved its operation, the product quantity and quality and most of all on how to satisfy the needs of the customers.

RECOMMENDATION

It is recommended that the LGU of the village may consider looking for financial institutions which can provide additional capital because if the pottery can have additional capital other problems can be solved. The state university through its extension mandate, has to work closely for the improvement of the product quality, teach additional designs and techniques for diversification and advancement and help produce better facilities and equipment of the pottery in the village

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Research article

Group and Network Management: Lessons Learned from the Solar Energy Group of Pesticide Free Vegetable Growers in Phutthaisong District, Buriram Province

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Abstract The Solar Energy Group of Pesticide Free Vegetable Growers was organized to collaboratively solve problems and manage a water-sharing system using solar energy and land management to grow pesticide free vegetables. The achievements of the administration of the group and network were truly astounding. Therefore, a study was undertaken to investigate the following: 1) the group and network management, 2) the factors contributing to the success of the group, and 3) the lessons learned and recommendations made for managing groups and networks. Qualitative data were collected from the group chairman, group committees, and 40 group members during an organized forum. Additional data were collected from the group chairman and three committees using in-depth interviews and this was analyzed for content. The results of the study were as follows: 1) The administrative structure of the group was based on community enterprise. The group planned their operations, especially activities in an appropriate production system and special rules for vegetable planting activities to control safety standards. They also followed regulations for water-sharing in vegetable production and met regularly once a month to discuss problem issues and group planning. They raised money from their members to establish funds for the operations and coordinated with other groups and agencies regarding support and joint activities. 2) Factors contributing to the success of the group were: (i) the unity of the members, (ii) the moral of the members, (iii) the self-sacrifice of the group with a patient, knowledgeable, and strong leader, (iv) the facility of joint production, land and water use management, (v) producing vegetables together which created a sense of pride and ownership, and (vi) operating a network and coordinating with outside agencies for support, especially to fill knowledge gaps. 3) The lessons learned and recommendations were seamlessly integrated and assimilated through group management using both informal and formal mechanisms. Knowledge network with information sharing among members derived from direct learning or real experiences through practical problem solving.

Keywords group management, network management, lessons learned, pesticide free vegetable growers, pesticide free vegetable, Buriram province

INTRODUCTION

Due to the critical water shortages which restricted agricultural activities, Phutthaisong Sub-district Administrative Organization collaborated with the Energy Office of Buriram to establish the Solar Energy Group of Pesticide Free Vegetable Growers. The necessity of social learning development was considered with the aim of mobilizing activities to empower negotiability and widen visions and worldviews through the exchange of knowledge, abilities, and experiences to solve problems and develop the effectiveness of the group (Phuttakosa, 2011). The Solar Energy Group of Pesticide Free Vegetable Growers was organized to collaboratively solve problems and manage a water-sharing system using solar energy and land management to grow pesticide free vegetables. The group was adopted by several sectors including government, private sectors, private development organizations, and the interested general public. Once a week, various sectors made study trips to observe the group activities. In addition, the success in overcoming the critical drought experienced by the community became a water management model for others to follow. The collaboration among the group members resulted in several advantages including strengthening the resolve of the people, to build a strong community culture and improving the standard of living and health with safe food to consume in a secure environment without toxic contamination.

The achievements of the administration of the group and network were truly astounding. Therefore, a study was undertaken to examine the process of group administration of the Solar Energy Group of Pesticide Free Vegetable Growers, especially regarding group and network management factors to generate a model for the safe production of pesticide free vegetables. Lessons learned and recommendations for group management and networks were made to promote water management in drought areas through the administration of local agricultural groups.

OBJECTIVES

This research investigated the following issues: 1) the group and network management, 2) the factors contributing to the success of the group, and 3) the lessons learned and recommendations for managing groups and networks.

METHODOLOGY

Research approach: An evaluation research was administered in the case study.
Population / Sample of the research: The research population consisted of the group chairman, committees, and 40 members of the Solar Energy Group of Pesticide Free Vegetable Growers in Phutthaisong District, Buriram Province.
Data collection: The data collection was conducted as follows.
1) Forums were organized to assemble the qualitative data from the group chairman, the group committees, and 40 group members.
2) Semi-structured in-depth interviews to collect data were conducted with key informants involved in group and network management, including the group chairman and three committees.
Data analysis: The data were evaluated using content analysis.

RESULTS AND DISCUSSION

Background of the Case Study

A brief history

1) Lack of water: The group of pesticide free vegetable growers was organized because of the shortage of water. People in the area require water for daily consumption and little remained for agricultural purposes. Therefore, the Buriram Office of Energy selected Phutthaisong Subdistrict Administrative Organization as a group to join the alternative energy project to propose solutions to

the water problem and increase the income of the people. With support from the Buriram Office of Energy, a project to produce vegetables was initiated using solar energy. The project began with the recruitment of volunteers and 40 interested people. The volunteers held a meeting and formulated a plan for project operations. Initially, 20 rais of wasteland in the community was set aside for vegetable planting. In Phutthaisong, vegetable plantation areas were small and most used a lot of pesticides. Members of the group agreed to plant pesticide free vegetables in the wasteland.

2) Collective investment on groundwater system with solar energy: The project did not have an operating budget so conditions for members to join were established. Members were required to invest some money and become seriously involved in the management processes as well as accepting the risks of loss. As a result, 40 members decided to initiate sustainability of living in this drought area, and they applied for an agriculture credit loan of 20,000 baht for each household to use in the operations of the project from the Bank of Agriculture and Agricultural Cooperatives (BAAC). The 40 members who invested the money were given ½ rai (1.600 Sqm.) of plantation with enough amount of water delivered. The groundwater supply system was operated using solar energy from the available budget. The process began by drilling large boreholes and installing the solar powered system, pumping machinery, water supply network, and a pressure-controlled tank to supply water to the vegetable plot.

3) Formation of the group planting pesticide free vegetables using solar power: The members of the group had planted vegetables since 2011. The project group was supported by many sectors including government, private sectors, private development organizations, and many other interested people. Every week, study trips were organized to observe activities within the project.

Group and network management

The group and network management of the Solar Energy Group of Pesticide Free Vegetable Growers were operated as follows:

1) Specify the structure of administration: The group followed administrative management in the form of a community joint enterprise. The chairman played an important role in group organization. Fourteen group representatives were chosen from 40 households and given responsibility for various jobs such as secretary, treasurer, and assistant treasurer. The remaining committee members were responsible for other jobs within the group.

2) Plan the working process system: The group operated a systematic plan following land management, water management, human resource management, and administration of the production. The group initially set guidelines and prepared an effective production system. They agreed to plant pesticide free vegetables and produce safe food for their community which was harmless to consumers and the environment, and also made their vegetable products unique.

3) Determine the regulations of the group: The group identified the regulations of the project as follows.

3-1) Regulations for vegetable plantation: To control the safety standards and product quality of the group the use of hazardous chemicals and insecticides was prohibited. However, chemical manure could be mixed with farmyard manure. If insects and worms were found in the vegetable plots, then the insects and worms had to be removed as quickly as possible.

3-2) Regulations for water-sharing in vegetable production: Because of the limitation of water, the members could not produce enough vegetable products to satisfy the market needs. Therefore, regulations were set out to control water use through proper equipment maintenance by individuals or the groups. Soil management followed safety standards which prohibited the use of hazardous substances or planting vegetables that required excessive water (i.e., lotus, water mimosa, etc.). Every group member respected the rules and followed them seriously. For example, a timetable of water use for each vegetable plot was set in advance. As a result, there was no problem regarding water sharing.

Data obtained from interviews also revealed that since the first year when the group was established, none of the members had broken the rules. This was because everybody aimed to improve their standards of living and did not want other problems to hinder their community development.

4) Organize the group activities: The group regularly organized meetings. An official meeting was held once a month to discuss any problems and formulate future group planning.

The group members learned together about pesticide free agricultural practices through study visits and training sessions operated by several organizations. The group made organic substances for soil improvement from local commodities, sought and shared seeds, and communally planned the production process so that a variety of vegetables could be sold to suit market needs.

The mixed production of the group consisted of over 70 varieties of vegetables. Before planting, a survey was conducted so that each household grew different kinds of vegetables. The group planted seasonal vegetables which took 14 days to mature. They achieved income of approximately 18,000 baht for each household. During the rainy season there were floods in other areas and the group gained higher incomes. Moreover, the group also collected local vegetable seeds such as Pak Choi Cilantro and local vegetables.

5) Financial management of the group: The group raised money from the members to fund the operations. Each member invested 20,000 baht for installing the groundwater system and solar energy panels. This cooperative management enabled the members to gain advantages with low risks. A study by Kaewpan (2015) regarding the financial analysis of the project showed that investment in solar energy for vegetable production in an area of 20 rais was a low level risk.

6) Networking: The networking is constituted internal and external group networks as follows.

6-1) Internal group network: The group regularly organized monthly meetings as a tool to strengthen relationships. The members also frequently exchanged knowledge socially at the vegetable garden. In other words, this kind of networking allowed the members to learn and do activities together.

6-2) External group network: The group made contact with external organizations related to the field such as the Office of Energy of Buriram, the Phutthaisong Subdistrict Administrative Organization and the Population and Community Development Association of Phutthaisong to ask for help or support in their operations. Also, the group engaged in networking for learning with the Somboon Agriculturist Group, Tamiang, Phanom Dong Rak, Surin, and the Baan Rong Laew Border Patrol Police School, Lahansai, Lahansai, Buriram.

Factors Contributing to the Success of the Group

Factors contributing to the success of the group were as follows.

Internal factors

1) The unity of members: The members cooperated in solving problems.

2) The moral of members: As mentioned earlier, none of the members broke the rules or regulations. This was because every member desired passionately to develop their standard of living.

3) Having a patient, knowledgeable and strong leader

4) Having joint production, land and water use management

5) Working together which created a sense of pride and ownership of the group

6) The members produced products based on their experiences through exchanging knowledge at the vegetable garden.

Group factors

1) Obvious goals: The group members set goals as follows:

1-1) to learn and exchange experiences between members in terms of production, administration, review and analysis of previous problems and solutions,

1-2) to empower negotiability of the group and network with others in production, marketing, bargaining and buying the products,

1-3) to be the center of development for the members and networks, and to promote the members' capacities through organized study trips and meetings to provide and exchange ideas.

2) Upstream, midstream, and downstream management: The group collaboratively managed the land, water resources, production plan for the whole year, and inexpensive innovations for production by volunteers. The group also had a systematic marketing plan, collecting enough crop products for customers' needs, and operating green marketing management by monitoring members' selling following the regulations of the group.

Networking factors

1) Having a network and coordinating with agencies for support and especially for knowledge.

2) Depending on each other to help and solve problems, such as collecting standard products to sell in the market as a community joint enterprise related to customer requirements. Moreover, their internal management controlled the standard of products, process, and qualifications.
3) Having an effective coordinating center. The group had space for discussion and coordinators who effectively offered knowledge or clarified the processes and problems of operations.

Lessons Learned and Recommendations

Lessons learned and recommendations generated from this group management and network of pesticide free vegetable growers using solar energy were as follows.

Natural and formal mechanisms employed

Both informal and formal mechanisms were compatibly employed in group management. Informal mechanisms included chatting in the vegetable gardens and visiting. This allowed members to monitor each other's products and also to discuss problems encountered during work, leading to better of ways management. Formal organized meetings were conducted once a month. These mechanisms empowered the group to succeed.

Sharing the same problems through cooperation of the group and network

The drought crisis obstructed the development of the community and reduced their standard of living. Thus, the members cooperated to solve these problems. Cooperation led to achieving many good things, including establishing a group and network system in the community for healthier lifestyles. More importantly, the community now enjoyed a better standard of living, with healthy food and a safe environment free from toxic contamination. Moreover, the water management of the group became the model for other areas facing drought crises. This concept agreed with the ideas of the Health Education Division (2013) that working in a network significantly led the group to achieve its goals through communication techniques and strategies to exchange knowledge and experiences, and cooperate together to increase negotiating power. Networking was not only important for group members to share interests and ideas; it also established interrelationships among groups, bringing the members together to do activities and accomplish team goals.

Knowledge network

The members planted vegetables regularly and had a chance to talk and exchange knowledge and ideas in the vegetable gardens. This led to a knowledge network with information sharing among members derived from direct learning or real experiences through practical problem solving. The members shared knowledge, skills, and experiences to discover correct, feasible and reasonable solutions to their problems (Chareonwongsak, 2015).

Organizing activities among groups and networks to respond to needs and solve problems

The activities were organized concretely and completely to respond to the needs of the members by employing the appropriate technology; this was a major factor leading to group success. Activities within the group were appropriate, and responded to the members' needs, thereby allowing management within the organization without dependence on external factors (Phuttakosa, 2011).

CONCLUSION

The Solar Energy Group of Pesticide Free Vegetable Growers was organized to solve the problems experienced by drought. The administration of the group management and network used both informal and formal mechanisms. The administrative structure of the group was based on a community enterprise. The group planned its operations, especially activities related to appropriate production systems and selected individual members to produce safe food. The group set regulations for vegetable plantations to control and monitor safety standards and the quality of the products. They also followed regulations for water-sharing in vegetable production. The group met regularly once a month to discuss problem issues and group planning. They raised money from members to establish funds for the operations. The group coordinated with various external organizations and agencies for support and organized learning activities through networking.

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Research article

Contribution of Organic Agriculture towards Achieving Sustainable Development in Samrong, Kampong Cham, Cambodia

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Abstract Sustainable development is one of the most important achievements in developing countries. Organic agriculture is one of the factors contribute to achieve sustainable development. However, implementation rates of organic agriculture are low in South East Asia. Several international organizations have been intervening in the agricultural sector in Cambodia. Interventions conducted by non-profit organization play a key role in the implementation of organic agriculture by farmers. However, previous studies have not thoroughly described the economic contribution of these interventions regarding organic agriculture in Cambodia. In Samrong Commune, Kampong Cham Province, a five-year longitudinal project was conducted to reduce financial losses in agriculture through interventions including implementation of organic agriculture and improving the agricultural skills of farmers. This study is aimed to determine the economic contribution of the interventions. Sample data from 64 farmers were collected through a questionnaire survey during the harvest season. Moreover, the amount of *E. coli*, which is an environmental indicator, was measured in compost boxes and vegetables in a farmland. The results showed a significant correlation ($P<0.05$) between the interventions and household income. This study provides evidence that the implementing of organic agriculture resulted in increased rural household income. However, *E. coli* from immature compost was found in 90% over their compost boxes and farmland. It implies that knowledge and proper techniques for increasing quality of organic fertilizer are needed to be emphasized.

Keywords sustainable development, sustainable agriculture, organic agriculture, household income

INTRODUCTION

With regard to food supply and economic growth, sustainable development will be a major global concern in the coming decades (Research Institute of Organic Agriculture FiBL, 2016). Organic agriculture is defined by the Food and Agriculture Organization (FAO) as a production management system for promoting and enhancing agro-ecosystem health through the reduction of chemical inputs and modified seeds (FAOa, 2016). Organic agriculture is necessary to achieve sustainable development in the agricultural sector and can benefit both developed and developing countries (Research Institute of Organic Agriculture FiBL, 2016). Studies have indicated that organic agriculture has positive environmental effects, and its implementation has therefore become an urgent task (Pimentel et.al.2005). Furthermore, organic agriculture reduces expenditure costs of agriculture (i.e. fuel cost, chemical fertilizer, etc.) in local households (FAOb, 2001; United Nations, 2009). It also contributes to an increased profit margin for farmers (Kilcher, 2007). However, implementation rates of organic agriculture are low in Asia, especially in some developing countries in Southeast Asia (Will & Yussefi, 2004). On the situation, nonprofit organizations (NPOs) or other

international organizations play an important role in introducing organic agriculture to local farmers (Bebbington, 2004). For example, in Cambodia, international organizations have been intervening more in the agricultural sector than in any other sector (Chanrith, 2002). Limited studies focusing on the relationship between organic agriculture and local household income have been carried out, while many studies focusing only on the relationship between organic agriculture and their effect on the environment in Cambodia (Bunthan & Siriwattananon, 2009, Vathana et.al.,2002). Therefore, this study aims to determine the economic contribution of organic agriculture in Cambodia.

OBJECTIVE

The objective was to determine of the relationship between organic agriculture and farmer's household income. In Cambodia, non-profit organizations (NPOs) encourage farmers to conduct organic agriculture and improving agriculture skills. In this study, the intervention of one NPO was focused on.

METHODOLOGY

Study Site and Characteristics

This study was conducted in October 2016 in Samrong Commune, Prey Chhor District, Kampong Cham Province (Fig. 1). Prey Chhor district is located around 90 km from Phnom Penh, the capital of Cambodia. Rainy season in Kampong Cham starts from April to November. The average rainfall was 22.1mm. The mean minimum and maximum temperatures were 23 and 30 degree Celsius respectively. The total population is 1,673,390 in 2011, according to economic census (Statistics Japan).

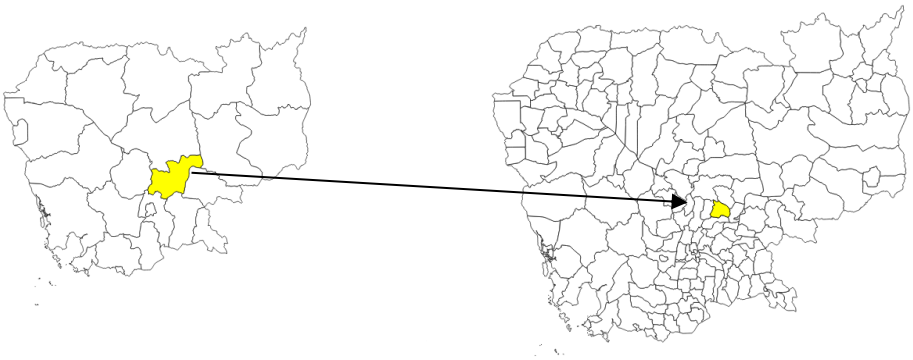

Fig. 1 Location of Kampong Cham Province (left) and Prey Chhor District (right)

Intervention Methods

The NPO conducted a five-year project supported by the Japan International Cooperative Agency (JICA) from April 2011 to March 2016. The goal of this project was to persuade local farmers in Province to practice sustainable, recycling-based agriculture. The project area conducted in 11 villages in Prey Chhor District, Samrong Commune. The five-year long interventions involved the implementation of organic agriculture and the impartment of agricultural knowledge related to the use of organic fertilizer such as compost, recommendation of seeds, etc. (Fig. 2).

Fig. 2 The interventions of NPO (left: compost box, right: liquid fertilizer)

Qualitative Survey (Questionnaire Survey and *E. coli* Survey)

A Questionnaire survey was conducted in Khmer (Cambodia's official language) by Cambodian staff working at the Institute of Environmental Rehabilitation and Conversation (ERECON) as shown in Fig. 3. The data were collected from 64 participants in intervention and non-intervention groups (Fig. 4). Most of the participants were men, as Cambodian women tend to be involved in other activities (Meinzen-Dick et. al., 2011). The objective was to ascertain whether farmers perceived an increased income over the course of five years. The questionnaire was based on a publication in the Independent Evaluation Group of the World Bank (2011). The indexes of the questionnaire included basic demographic information (sex, age, and location), agricultural style (labor involved, crop type, and number of crops), and participant income. Moreover, the conditions of organic materials (compost box) were checked directly. Organic agriculture should have the advantage of environment (Meinzen-Dick et. al., 2011). However the making organic compost requires proper way (Taiwo, 2011). In this study, organic compost in the compost box was target for the measurement of organic agriculture. Subsequently, Petan Check 25 was applied in compost boxes, and on the farmland and crops of the participants to help detect and measure *E. coli*, an indicator of prevailing environmental conditions.

Fig. 3 Questionnaire survey

Data Analysis

A generalized linear model (GLM) was used to examine the measurements organic agriculture contributes to the increased household income. In the analysis, the response variable was whether farmer felt that there was increased income in five years. The accurate income was difficult to be measured because of the answers are all approximations made by the farmers. The criteria of P value were under 0.05. The explanatory variables were shown as Table 1. All statistical analysis was done using R (R project 3.2.3).

Fig. 4 Black dots as the location of respondent with Google Earth

Table 1 Index of questionnaire

	Index
Response variable	Whether you perceived an increased income over the course of five years
Explanatory variables	Are you a member of the intervention group
	Personal information (age)
	Is your family working only in agriculture
	What kind and how many amount of vegetable for sell
	Do you use organic fertilizers and how many times in one term
	How large is your land (total, rice, vegetable)
	How many cattle do you have
	How many people support your work
	How much is your income (total, only agriculture, non-agriculture)
	Do you talk about ERECON in daily conversation

RESULTS AND DISCUSSION

Characteristics of the Respondents

In this study, 41 or respondents are men (64%) and 23 are women (36%). The numbers of participant from treatment group are 40 (62.5%) and from non-treatment group are 24 (37.5%). Minimum age is 29, and maximum age is 70. Subsequently, median age is 52. Total annual income is 170 USD as minimum, 6000 USD as maximum. Median income is 875 USD. Average income is 1137 USD. Before this intervention, the average income was 943 USD from baseline data.

Result of a Generalized Linear Model

A generalized linear model (GLM) analysis is shown as Table 2. The relation between ERECON's interventions and their increased income in five years has significant. Moreover, the relation between the number of crops in a year and their increased income in five years has significant. According to the GLM, the co-efficient of ERECON's interventions and the number of crops is positive. It means that people will feel there will be increased income when people involve in the intervention group and have a opportunity to cultivate more the number of crops as before. Recommendation of seeds for cultivation and sell is one of the interventions conducted in five long years projects. From that intervention, farmers know the type of vegetables that have market demand.

Table 2 GLM of whether farmers perceived an increased income over the course of five years

	Coefficient	P value
Intercept (whether farmers perceived an increased income over the course of five years)	-0.238600	0.662390
Are you a member of the intervention group	0.563400	0.01309*
Personal information (age)	0.000113	0.984330
Is your family working only in agriculture	0.023630	0.881900
What kind of vegetable for sell	0.193900	0.00552*
How many amount vegetables for sell	-0.000024	0.367320
Do you use organic fertilizers	0.382900	0.153380
How many times do you use organic fertilizers in one term	0.032080	0.773790
How large is your land (Total)	-2.392000	0.619190
How large is your land (Rice)	2.407000	0.617430
How large is your land (Vegetables)	1.906000	0.681770
How many cattle do you have	0.059860	0.084020
How many people support your work	-0.003814	0.136000
How much is your income (Total)	-0.005797	0.071710
How much is your income (only agriculture)	0.005408	0.076660
How much is your income (non-agriculture)	0.005939	0.068400
Do you talk about ERECON in daily conversation	-0.867400	0.056620
Are you a member of the intervention group×talk about ERECON	0.571800	0.237480

** P<0.05*

Quality of the Compost

From the investigation, *E. coli* exists in 39 compost boxes and farmer's land belong to treatment group (n=40). The detection using Petan Check 25 is shown (Fig. 5). *E. coli* is green colony found on the medium. If farmers make compost properly, *E. coli* will not be found in compost box and land. However, a result of Petan Check 25 is shown farmers do not conduct proper method to make compost.

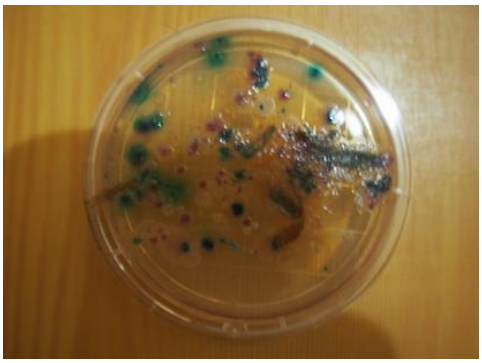

Fig. 5 Detection using Petan Check 25

DISCUSSIONS

This study confirmed the economic contribution of organic agriculture in Cambodia, which can to help toward the sustainable development. The results showed that both the interventions and the type of vegetables have the contribution of farmer's household income. However, according to a report of the independent evaluation group of World Bank (2011), the number of labors and cultivated acreage, and some indexes have the relationship with farmer's household income (Taiwo, 2011). These variables did not have significant in this study. Given the possibility that the number of the collecting data was quit few, as there were only 64 respondents in this study. Therefore, these

variables did not have significant. Moreover, the other interventions were not confirmed whether it have positive effect. The results of quality check of the compost box showed that farmers did not clearly replicate the proper way to make organic compost. Because of this, next intervention should focus on the long term education of making organic compost.

CONCLUSION

This study finds there is the economic contribution of organic agriculture in Cambodia. From this finding, organic agriculture have the advantages both environmental (Bunthan & Siriwattananon, 2009, Vathana et.al.,2002) and economic aspects (Ibrahim, 2008). In conclusion, organic agriculture achieves sustainable development in Cambodia.

ACKNOWLEDGEMENTS

We wish to thank the Institute of Environmental Rehabilitation and Conversation (ERECON) for supporting to conduct this study.

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Research article

Synthesis of Graduation Theses in Agricultural Commodity Production Adhering to Government Designated Standards

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Abstract The objectives were to analyze 1) the research methodology of graduation theses, 2) the result of graduation theses, 3) problems on commodity production adhering to government designated standards, and 4) synthesis of guidelines on the development of commodity production adhering to government designated standards. The sample population was 58 graduation theses agricultural extension and development in agricultural commodity production adhering to government designed standards. Twenty-six samplings were determined using purposive sampling methodology.The findings were as follows: 1) All the research methodology of the graduation theses followed quantitative research. Seventy percent studied by determining the sampling, and all the theses followed sampling methodology using Taro Yamane formula. Ninety-five percent selected sampling using the simple random sampling methodology. 2) Fifty percent of the theses were completed during the academic years 2001-2005, 34% were completed during years 2006-2010, and 16% were completed during years 2011-2015. Ninety-two percent studied good agricultural practice (GAP). Regarding agricultural commodities, 38.5% studied the production standards of fruit plants, 26.9% vegetables, 15.4% cattle, 11.5% rice and corn, and 7.7% flowering plants. In the academic aspect of agricultural extension and development, 38% studied the usage of agricultural production standards, 30% studied the adoption process, and 15% studied the learning process. 3) Regarding problems, most were at low level with agricultural commodity production adhering to the designated standards, and 4) To syntheses guidelines, related sectors should transfer knowledge and examine production regularly to comply with designated standards and reinforced them to create brand recognition and increase market opportunities.

Keywords synthesis of graduation theses, agricultural products production, standards

INTRODUCTION

Agricultural Extension and Development course opened for Graduate School in the year 2000. Graduate research relating to agricultural commodities production adhering to government designated standards such as GAP (Good Agricultural Practice) and export standards has been published in national and international documents and accepted worldwide. Further, research results were beneficial for agricultural extension, learning management and curriculum development and improvement.

However, the research results have never been categorized or synthesized to determine the direction of the results, the background of the theories, the categories and variables, variable definitions and research methodology. Therefore, the researcher was interested in analyzing and synthesizing graduation theses in agricultural commodity production adhering to standards that would be of use in advising students and scholars interested in research on agricultural development. Moreover, the results will comprise a database for teachers and a reference source for students.

OBJECTIVES

The purposes of this research were as follows: 1) to examine the research methodology of graduation theses, 2) to examine the results of graduation theses, 3) to examine problems regarding commodity production adhering to government designated standards, and 4) to synthesize guidelines on the development of commodity production adhering to government designated standards.

MATERIALS AND METHODS

1. Research design: This research was designed as survey research.
2. Population/Samples: The population was 58 graduation theses on agricultural extension and development in agricultural commodities production adhering to government designated standards, 26 samplings were determined using purposive sampling methodology.
3. Research instrument: Survey was used as the research instrument.
4. Data analysis: Descriptive statistics and content analysis were used to analyze the data.

RESULTS AND DISCUSSION

Research Methodology of Graduation Theses

All the research methodology of the graduation theses followed quantitative research. Seventy percent determined the sampling, and all researchers determined their sampling using the Taro Yamane formula. Ninety-five percent selected sampling using simple random sampling methodology. Most research methodologies used quantitative research because this determines factual knowledge from research results which has the least error. Thus, data collection was designed as number and variables were controlled. Instruments for data collection, data analysis and evaluation were prepared systematically. Kijpreedaborisut (2008) explained that the advantage of quantitative research was that it looked for the facts systematically, applied predictions and searched for correlations between variables, considered each variable rationally, applied statistical analysis and referred the results to the population group. However, the researcher considered that research on agricultural extension and development related to Social Science which studied social phenomena. Inferences from quantitative research were unable to deal with phenomena and consequently qualitative research was required.

Result of Graduation Theses

Analyzing the time spans of the graduation theses, 50% were completed during the academic years 2001-2005, 34% during 2006-2010, and 16% during 2011-2015.

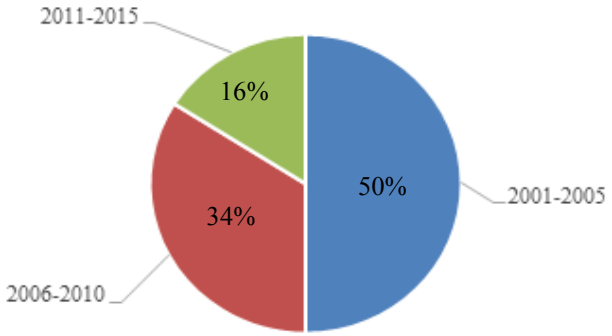

Fig.1 Time spans of the graduation theses

To analyze the type of product standards, 92% studied good agricultural practice (GAP). Results concurred with the declaration of GAP following the National Bureau of Agricultural Commodity and Food Standards (ACFS) (2016). The Thai agricultural standard TAS 9001-2009, good agricultural practices for crops was first announced as an Act on 6 November 2003, with an amendment in the GAP manual 2007. This inspired student interest in conducting theses on Agricultural Commodity Production Adhering to Designated Standards, particularly in regard to GAP. However, research on GAP declined because the subject had been sufficiently covered. Students emphasized on other topics consistent with the changing areas of interest.

To analyze the type of agricultural products, 38.5% studied the production standards of fruit plants, 26.9% vegetables, 15.4% cattle, 11.5% rice and corn, and 7.7% flowering plants. Results were consistent with the types of plant that required GAP certification. From GAP information, there were 24 standards regarding plants which accounted for 63%, whereas only 24 relating to animals at 37% (ACFS, 2016). Therefore, the majority of researchers emphasized on the study of plants.

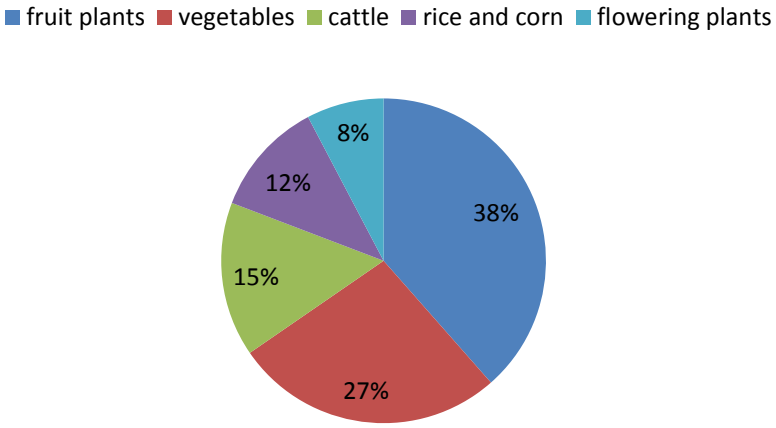

Fig.2 Type of agricultural products studied in graduation theses

To analyze the graduation theses in the academic aspect of agricultural extension and development, 38% studied the usage of agricultural production standards, 30% studied the adoption process, and 15% studied the learning process. The results could be explained by the agricultural extension concept; to transfer knowledge to agriculturists to accept innovation to make positive economic, social and environmental change. The 5 step adoption process postulated by Rogers and Shoemaker (1978) consists of awareness step, interest step, evaluation step, trial step, and adoption step. Agricultural Commodity Production Adhering to the Standards was the research on the first step, the awareness step, and accounted for 15%. The researcher considered that research on step 1 or the awareness step was only a preliminary study or the first step of the adoption process that required further research to study step 5, adoption step. However, results showed that many researchers studied from to step 1 through to step 5, which was called in this research as the usage of agricultural production standards and accounted for 38%. Thus, the research should emphasize on the study to achieve step 5, or the adoption step of the study through all 5 steps.

Problems on Commodity Production Adhering to Government Designated Standards

To analyze the problems, most had difficulties at a low level with agricultural commodity production adhering to designated standards. Results indicated that agricultural commodity production adhering to designated standards in Thailand had been applied for a long time with the use of GAP since 2003. Agricultural commodity production adhering to designated standards was constantly promoted to the agriculturists. As a result, the problems eventually decreased.

Synthesis of Guidelines on the Development of Commodity Production Adhering to Government Designated Standards.

To synthesize guidelines based on the result of graduation theses, related sectors should have transferred knowledge and examined production regularly to comply with designated standards and reinforced them to create a brand symbol and increase market opportunities. Findings were in line with the report of a seminar on the guidelines of GAP projects in 2013. One of the problems of commodity production promotion adhering to GAP since the Act came into force was the lack of agricultural extension staff and consultants. Most were new staff who had less experience and knowledge (Department of Agricultural Extension, 2013). Therefore, this research reflected the guidelines of agriculturists that transferred knowledge and examined production regularly to comply with designated standards and promoted the brand symbol to increase market opportunities.

CONCLUSION

This research on Synthesis of Graduation Theses in Agricultural Commodity Production Adhering to Government Designated Standards illustrated that all the research methodologies of the theses followed quantitative research methods which determined factual knowledge with the least error. Qualitative research should also be applied since research on agricultural development and extension was a social science that studied social phenomena that changed continuously. Findings showed that research into the possibility of the change in Agricultural Commodity Production Adhering to Government Designated Standards was during 2001-2005 and 2006-2010. These were periods when Thailand announced that agricultural commodity production should adhere to designated standards. Most researchers focused on plant products rather than animal products since there were more agricultural commodity production standards for plants than for animals. Researchers emphasized on the study on the 5 steps of the adoption process, particularly steps 1 and 5. Research should focus on the study of step 5, adoption process or study through all the steps. The problem of agriculturists in production adhering to standards was at a low level. However, there was the problem of transferring knowledge of production adhering to standards because of staff insufficiency. As a result, the guidelines of knowledge transfer development which agriculturists require and need to create the brand symbol of standards and increase market opportunities is lacking.

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Research article

Evaluation of Participatory Irrigation Management Introduced into Dry Land Agriculture in Turpan, China

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Abstract A stable supply of irrigation water is essential to ensure agricultural productivity in arid regions. To efficiently use the limited water resources, upgrading of hard infrastructure, such as reducing leakage from channels and installing drip irrigation, and of soft infrastructure, such as introducing irrigation management involving local farmers, is being pursued. This study reviewed the rationality of participatory irrigation management (PIM) in Turpan, Xinjian, China. Turpan depends for its irrigation water on streams, pumped groundwater, and karez (qanat). PIM mainly involves management of irrigation water supplied from streams. Between 2013 and 2015, interviews with Turpan City's Water Management Agency (WMA) branch office staff, PIM staff, and local farmers were conducted to collect information on water management. The findings showed that the founding of PIM organization resulted in the following benefits: (i) reduction of governing agency's burden: PIM is now in charge of work that used to be performed directly by staff of the WMA branch office (ii) Prevention of illegal practices: PIM staff are elected from among local farmers, so there is a system of mutual surveillance. (iii) Smoother implementation of water management: Previously, there were conflicts between local farmers and staff from other regions, who were unaware of the local situation. Since establishment of the PIM, local farmers have taken charge of the water management, which facilitated communication between the water administrator and farmers. (iv) Enhanced interest in water conservation: Because farmers now directly manage their water distribution and maintain their infrastructure, they are more aware of the importance of conserving water. Regarding the disadvantages, during seasons with a risk of drought, water management requires operations 24 h a day and there are many housekeeping issues, so labor shortages are a problem. This latter issue occurred because the main source of finance is from water fees, which are set by a governmental agency. As a result, the PIM team could not secure a sufficient budget to hire more staff.

Keywords participatory irrigation management, agricultural water use, interview survey, water shortage

INTRODUCTION

Irrigated agriculture is employed in the dry climate of Turpan, China. In this area, oasis agriculture was undertaken before the 1960s. After the 1960s, many dams and irrigation canals were constructed, and water was taken from many rivers for agricultural use. In addition, modern irrigation agriculture spread via the use of groundwater obtained by digging wells. However, recently, securing irrigation water has been difficult due to the increasing demands from industry and domestic users. Water shortages have also occurred because of inadequate cooperation between the sectors of land development and water resource development in China (Yamamoto et al., 2006). To prevent water shortages, the delivery rate of water has been improved by lining irrigation canals, and more water resources were developed by digging more wells (Jalaldin et al., 2005). Recently, in addition to such infrastructure, participatory irrigation management (PIM) by farmers has been introduced in this region due to the expectation that it would improve awareness of the importance of conserving water. Its introduction in this region occurred later than in other parts of China

In general, PIM aims to involve farmers themselves in irrigation operation and maintenance (Tanaka & Sato, 2003). PIM is a tool to manage irrigation water or irrigation systems to increase the efficiency of their use (Rattanatangtrakul, 2005). It can reduce government costs by reducing the number of staff (Raby, 2000). However, Pathasarathy (2000) indicated that although PIM has indeed led to better and smoother resolution of irrigation-related conflicts, reductions in government expenditure have not materialized. Many studies have analyzed the effect of PIM in these locations in monsoon areas, but the results have varied according to differences in the study area. In addition, few studies on the effect of PIM in semi-arid areas have been performed.

Moreover, there are many karezes around Turpan. A karez is a traditional groundwater system like a qanat, as found in the Middle East. The old karezes in this region were constructed 300 years ago and were used for agriculture and for water for daily uses for a long time. However, many karezes have now been abandoned due to the depletion of groundwater as a result of the digging of wells. In particular, farmers' own wells were dug haphazardly and the owners pumped up excessive groundwater. This excess water intake has also caused degradation of the regional ecology around outward flow of karezes.

OBJECTIVE

To maintain a sustainable regional community and agriculture in this area, there is a need to construct an agricultural water use system in consideration of sustainable irrigated agriculture by conservation of traditional groundwater use system. To conserve groundwater resources, improvement of water management is required in this area. And it has been widely expected that PIM can improve issues in water management. Thus, the goals of this study are to understand the situation of agricultural water use and to evaluate the effects of PIM introduced recently via a case study based on Turpan.

METHODOLOGY

Turpan district is located in the east of Xinjiang Uyghur Autonomous Region, in northwestern China, and is in a basin surrounded by mountains. This investigation focused on Meijiaoqou and Taerlang river basins in Turpan, a prefecture-level city. The climate in this location is considered to be BWk according to the Köppen-Geiger climate classification. The average annual temperature is 13.9°C, with a maximum of 49.6°C and a minimum of -28.7°C (Turpan Hydrology and Water Resources Observation Station HP, 2012). The annual discharge of each river is 80 million m3. Annual rainfall is under 50 mm, and the potential evaporation is 2,845 mm (JICA, 2006). Irrigation water depends on river intake, groundwater in wells, and karezes, the water of which is meltwater from snow and glaciers of Mt. Tienshan located to the north of the city. Irrigation methods are border and drip irrigation. The main crops are cotton, grape, corn, and wheat. Field surveys with interviews to understand changes of water supply and influence on water management by PIMs introduction were conducted from 2013 to 2015 in representatives of the water management agency, PIMs in Qiatekale Township on Meijiaoqou river basin and Yar Township on Taerlang river basin, and farmers (Fig.

1). In the interviews, in addition to above contents, we researched irrigation area, crop, problems on PIMs and etc.

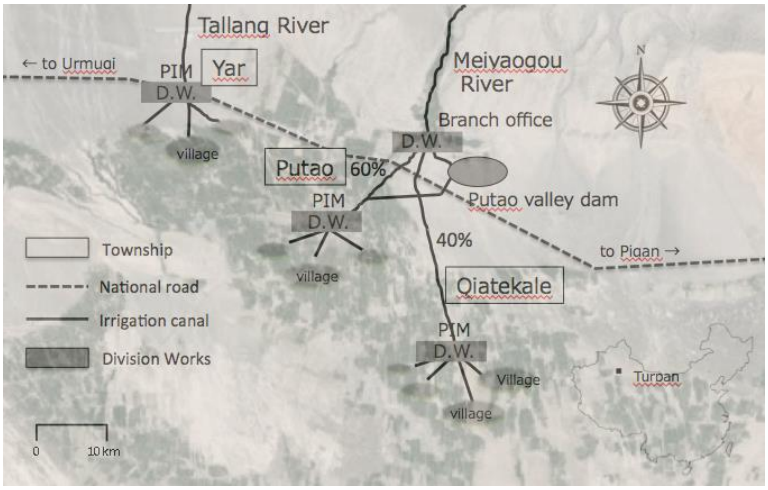

Fig. 1 Investigation area

RESULTS AND DISCUSSION

Changes of the Water Management Organization

Figure 2 shows the common water management system for intake from a river in Xinjiang. This system matches that in Turpan. Before early 2000, the branch office of the WMA had managed the water supply from water resources to each township, and a representative farmer in the township and the branch office staff had conducted water distribution in the township. After late 2000, PIM gradually became involved in terminal water management. Before introduction of PIM, branch offices at the township level had managed the water supply from large canals - primary or secondary - to farming blocks, and branch office staff and a representative farmer performed the water supply from small canals - tertiary and terminal canals - to each piece of farmland. After introduction of PIM, the branch offices managed only primary canals and each PIM managed secondary canals. PIM staff and a representative farmer dealt with the terminal water supply. In other words, farmers performed a key administrative role on behalf of government staff regarding the terminal water supply.

Crops and Water Resources

The main crops cultivated in this area are grapes, corn, cotton, and wheat. The supplied water for agriculture consists of 44% river intake and 56% groundwater from wells and karezes. The river water is mainly used for grape irrigation. The groundwater is basically used for cotton, corn, and other crops, except grapes. Farmers do not use water by mixture of groundwater and river water even if they can use both resources. The reason for this is that the groundwater is not appropriate for growing grapes due to its higher salinity than river water, and its temperature is lower than that in this area. In addition, the wholesale price of grapes is higher than for other crops. Thus, farmers can obtain an adequate profit even if they pay the fee to use river water. This fee was 0.164 CNY (approximately \$0.027)/m^3 in 2011, which consists of 0.136 CNY for the water resource fee and 0.028 CNY for the management fee. This water resource fee is a flat fee in this district, while the management fee is decided by Turpan WMA, along with the benefit area of the water facilities, length of the irrigation canal, and scale of division works of each PIM or branch office.

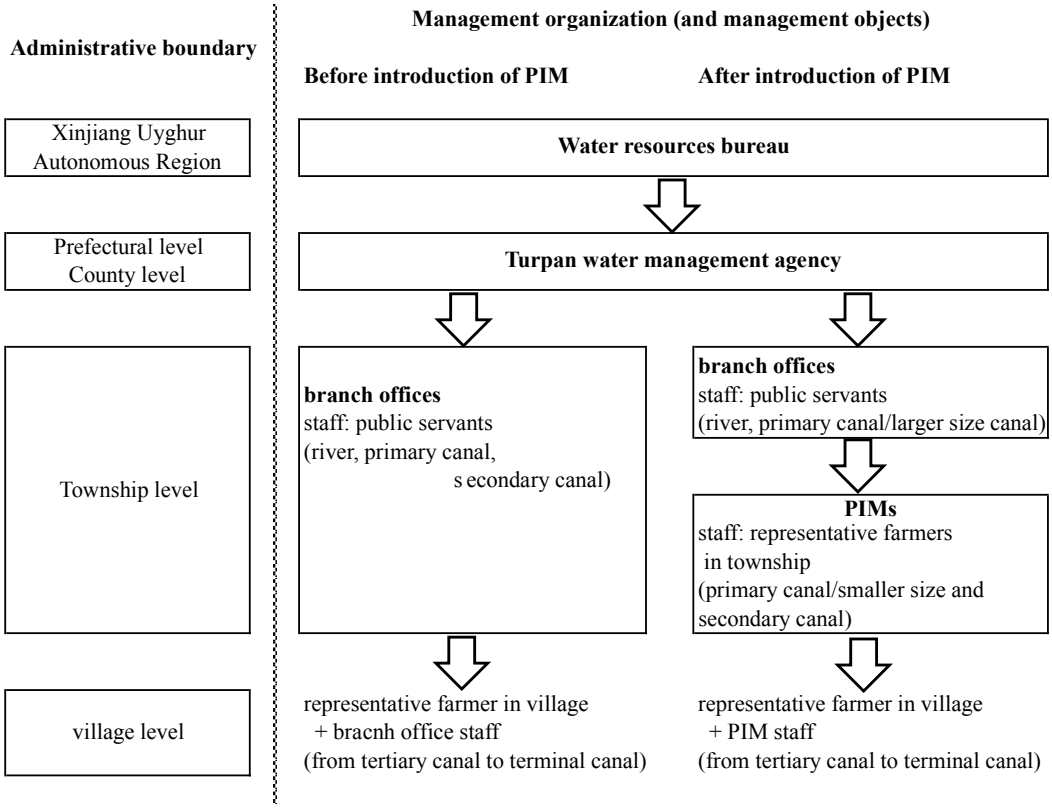

Fig. 2 Changes in water management organization before and after PIM introduction

Table 1 Outlines of each PIM

Land use system	Yar PIM	Qiatekale PIM
Established	2003	2007
Irrigation water supply river	Taerlang	Meijiaoqou
(Intake water rate to river discharge)	(100%)	(40%)
Cultivated area (ha)	5,467	6,667
Number of villages in PIM	22	12
Number of PIM staff	13 (Two vacancies)	11
Monthly salary ($)	240	240
Main crops	Grapes (90)	Grapes (30)
(% of total cultivated area)	Vegetables (10)	Corn & cotton (70)

Concerning groundwater use, the water management organization has managed only public wells and has deregulated private wells. Therefore, there was no water fee for groundwater use, and farmers only had to pay for the electricity to pump up the water. However, to protect groundwater resources, from 2011 the local government decided to prohibit the digging of new wells and to charge a property fee for those with existing private wells.

Outline of PIM in Turpan

Each PIM is an agricultural water management association operated by representative farmers in each town. Table 1 shows the outline of each PIM. Branch offices of the WMA are higher-level components of the organization of PIMs (Fig. 2). There are currently 13 staff members at Yar PIM and 11 at Qiatekale PIM. Each PIM also has a public servant from Turpan WMA acting as an accountant. Except for the loaned staff, the others are elected by farmers at the town level National People's Congress. The term of PIM chairman lasts for five years, but the chairman can be dismissed regardless of the term if they do wrong.

The main duties of PIM are to manage the water supply to villages via smaller canal, secondary or tertiary canal, to record the quantity of supplied water, to maintain water supply facilities, and to collect water fees. PIM manages only the river water and has no involvement in groundwater use. During summer, when water shortages are more likely, PIM supplies water to each village by rotation supply. The rotation system and the supplied water volume are decided in consideration of the number of wells, cultivated area, and growth situation in each village. PIM records the supplied water volume and collected water fee, as calculated by a specific method. The water fee and supplied water volume are determined each month. Some of this collected water fee is allocated for the salary of PIM staff and administrative expenses to maintain the water supply facilities. PIM has no right to decide the water fee; it is instead decided by a higher-level organization, Turpan District WMA. Moreover, it is a custom that the loaned staff from the WMA is in charge of accounting.

Merits of PIM in Turpan

PIM has attracted attention as intangible methods of rationalization of agricultural water management in China. This is because it is thought that the introduction of PIM can increase efficiency in water management by promoting voluntary irrigation management by farmers (Drainage and Rural Water Division, 2007). We identified four merits of PIM from interviews with PIM staff and farmers.

(a) Decreasing government expenditure: Before PIM establishment, each branch office of Turpan WMA had been in charge of water management in each town. Since PIM establishment, representative farmers have performed some of the management that was previously conducted at town level by the branch offices. This could allow local government to reduce personnel expenses by reducing the number of government workers.

(b) Prevention of illegal practices: Farmers were aware of cases of branch office staff undertaking illegal practices before PIM establishment. However, if such practices are identified now, farmers can remove the staff from their post because the PIM staff are representatives of the farmers and elected by a congress. In addition, it is indicated that PIM staff have less incidence of illegal behavior because they have neighborly relations with the farmers in their controlled area and are under mutual surveillance. This follows the finding in a previous study by Hui et al. (2007).

(c) Facilitating water management: Conflict about the distribution of water can more easily arise between users in arid areas where there is a chronic water shortage. In Turpan, such conflict also occurred between farmers and water management staff before PIM was established. Many staff members came from other areas and did not understand the typical water use in the townships or villages. However, establishment of PIM provided opportunities for greater understanding and contributed to smooth water use management. This effect is accepted in a previous study by S. Shindo and K. Yamamoto (2017). One identified merit was that farmers could more easily give their opinions about water distribution because PIM staff is now from the same area and understand their local customs and the details of the irrigation situation.

(d) Improvement of farmers' awareness of the importance of conserving water: After establishment of PIM, farmers are directly involved in water distribution and the maintenance of facilities. This improves their awareness of the importance of conserving water via their understanding of the present condition of regional water resources.

The results of interviews on the introduction of PIM could help to rationalize water management in Turpan. However, some problems were revealed from the interviews with PIM staff. For example, they consider it difficult having to work day and night in periods with severe water shortages. They desire an increase in staff because they feel that current staffing levels are inadequate. However, the budget prevents an increase of staff under current conditions.

CONCLUSION

We considered agricultural water use in Turpan from the perspective of change in the management organization. There are wells and karezes in this area and the pumping up of groundwater affected the water resources of the karezes. Preventing karezes was required to maintain the groundwater

level by reducing groundwater pumping via improved irrigation efficiency. PIM was introduced in this area for improving water management. From interview researches it is clear that PIM has a possibility of improving irrigation efficiency, some beneficial effects, such as the improvement of local government finances and the avoidance of water conflict. However, there are some problems that still need to overcome to ensure continuous running of PIM. Specifically, we suggest that the local government should pay a subsidy to PIM and that the automation of water supply facilities should be introduced, among others, for the sustainable management of PIM.

ACKNOWLEDGEMENTS

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Research article

Development of the Saturated Ion-Exchangeable Mordenite for Desalinization Technology in Agricultural Fields

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Abstract Soil salinization has being occurred not only in arid and semiarid region but in humid region under saline and shallow groundwater condition in the world. In Northeast Thailand, approximately 17% of land is salt- affected and it appears even in paddy fields in dry season. It is not easy to develop water resources in the region because of uneven rainfall patterns and geological formation such as unevenness of terrain. Rainfall in monsoon season charges soil water and groundwater, and it could be used as irrigation water resources. However, the water is salinized, and it needs treatment of desalinization process for the use of irrigation. In preliminary study, we developed artificially saturated mordenite with hydrogen ion for the first step of the development of the technology, and we found high rate of ion-exchange of the mordenite, sodium adsorption and hydrogen desorption, in test solution which was formed by one monovalent cation of sodium. However, soil and groundwater in salinized agricultural fields are not formed by one cation, containing various cations and pH is high, so that we need to reveal ion-exchange ability of the mordenite in such a complicate ion mixed conditions. Therefore, the objective of this study is to develop the saturated mordenites as ion-exchangeable materials for desalinization and to reveal ion-exchange ability of it by batch test. Batch test was conducted using the saturated mordenite and groundwater taken from the salt-affected field in Khon Kaen Province, Northeast Thailand. As a result, we found that sodium ion of the groundwater which contains various cations was adsorbed selectively by saturated mordenite. It is also revealed that alkalization is solved since pH decreased by desorption of hydrogen ion from saturated mordenite to groundwater. Hence, we concluded that the saturated mordenite can be utilized as ion-exchangeable material for desalinization of saline soil and groundwater in the experimental field.

Keywords salinization, saturated mordenite, desalinization of groundwater, ion exchange reaction, developing water resources

INTRODUCTION

In Northeast Thailand, approximately 17% of land is salt-affected and high salinity effects on crop growth (Land Development Department, 1991). Northeast Thailand belongs to tropical wet and dry climate and it distinguish clearly between dry season and monsoon season. Origin of the salt is rock salt in a stratum that called Mahasarakham formed during the Tertiary period, and eluted salts to groundwater is carried to soil surface by evapotranspiration in dry season at location because of high groundwater level. Total area of paddy in Northeast Thailand is approximately 6,070,000 ha and it

accounts for 58 % of paddy fields in Thailand. However, productivity of crops is low due to soil degradation and salinization of irrigation water (Kimura et al., 1990). In addition, it is less suitable to construct extensive irrigation facilities in the region because of uneven rainfall patterns and geological formation such as unevenness of terrain (Fuji et al., 2012). Leaching is most popular way to solve salt-affected fields, however, it is not easy to apply it in Northeast Thailand because of less water resources and entailing high costs for development of irrigation and drainage channels.

On the other hand, there are rich amount of shallow groundwater derived from monsoon rainfall in the fields of Khon Kaen, Northeast Thailand. If it can be utilized for irrigation, it may help water resources development for dry season cultivation. Mordenite is a variety of natural zeolite and it has cation adsorb ability and it has been utilized as soil improvement material in various fields (Yoshida et al., 1971). In preliminary study, we have developed three types of saturated mordenite, type-K, type-KH and type-H, these are saturated by potassium ion, potassium ion: hydrogen ion =1:1, and hydrogen ion, respectively. We revealed that three types of saturated mordenite have ability of sodium adsorption, and type-K can supply K^+ to soil, type-H reduce alkalization of soil water and type-KH has both functions. Especially, type-H has high ability to adsorb sodium ion when using test solution of one monovalent sodium cation (Umakoshi, 2016). However, soil water and groundwater in salinized agricultural fields are not formed by one cation, containing various cations and pH is high, so that we need to reveal ion-exchange ability of the mordenite in complicate ion mixed conditions.

OBJECTIVE

The objective of this study is to examine ability of the saturated mordenites as ion-exchangeable materials for desalinization by batch test using saline groundwater in Khon Kaen Province, Northeast Thailand.

MATERIALS AND METHODS

1. Production of Saturated Mordenite Type-H

In this study, we produced saturated mordenite type-H (saturated mordenite) which has highest adsorbed ability of sodium in preceding study (Umakoshi, 2016). Procedure of the production is described below.

Equipment: Following equipments were used in this study: natural mordenite, potassium chloride aqueous solution (1 mol L^{-1}), nitric acid solution (100 mmol L^{-1}), deionized water, ethanol solution, acetone solution, centrifugal tubes (50 mL), weighting machine, shaking machine, centrifugal machine and ventilator.

Test procedure: The test procedures were summarized as follows.

(1) Put 2 g of natural mordenite and 20 mL of potassium chloride aqueous solution (1 mol L^{-1}) in a centrifugal tube then shake it for one hour by shaking machine. Thereafter centrifuge it for ten minutes by centrifugal machine then discard the supernatant liquid.

(2) Put 20 mL of 1 mol L^{-1} potassium chloride aqueous solution in the centrifugal tubes of (1) again then shake it for ten minutes and centrifuge them for 10 minutes and then discard the supernatant liquid. Repeat this process twice.

(3) Change solute in order, 100 mmol L^{-1} Nitric acid solution, Deionized water, Ethanol solution, Acetone solution and then shake them for 10 minutes and centrifuge them for 10 minutes and do same procedure as (2).

(4) Dry mordenite for 24 hours.

2. Groundwater Sampling

We took groundwater from agricultural field in Ban Phai, Khon Kaen Province, Northeast Thailand on 2nd December 2016.

3. Cation Analysis

Cations of the groundwater were analyzed using atomic adsorption spectrophotometer, novAA 350 (Analytik Jena AG) at Khon Kaen University.

4. Batch Test

We conducted batch test to examine quantitative analysis of sodium adsorption by saturated mordenite. Test method and equipment are shown below.
Equipment: The equipments used in this test are as follows: saturated mordenite, pH meter, EC meter, centrifugal tubes (50 mL), shaking machine, centrifugal, machine, atomic adsorption spectrophotometry, deionized water and weighting machine.
Test procedure: The test procedures were indicated as follows.
(1) Analyze cations, Na^+, $Ca2^+$, K^+ and $Mg2^+$, of groundwater and measure EC and pH.
(2) Put 20 mL of groundwater and 1 g of saturated mordenite type-H (M:GW=1:20), 40 mL of groundwater and 1 g of saturated mordenite (M:GW=1:40), 40 mL of groundwater and 0.5 g of saturated mordenite type-H (M:GW=1:80) in tubes respectively and then shaking them for one hour and centrifuge them for ten minutes.
(3) Analyze the cations of the supernatant liquid and measure EC and pH.

RESULTS AND DISCUSSION

1. Result of Groundwater Analysis

Figure 1 shows result of cation analysis of the groundwater, and EC and pH of the groundwater were 2.3 mS cm^{-1} and 8.0, respectively. Concentration of sodium was 274.5 ppm. It shows that sodium was dominant ion of the groundwater and it was 72% of the total of four cations. CEC of natural mordenite is 2 mmol g^{-1}, therefore it could be estimated that 1 g of saturated mordenite can adsorb sodium ion of 0.17 L of the groundwater.

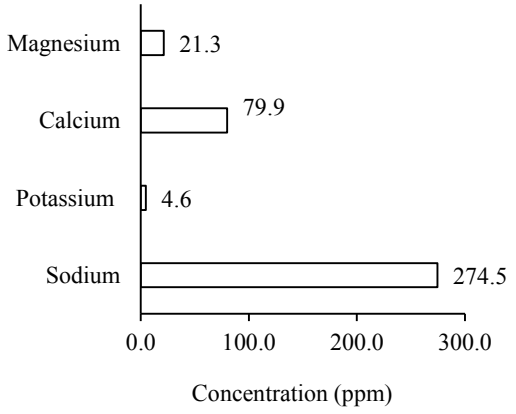

Fig. 1 Cation composition of groundwater

2. Batch Test Using Saturated Mordenite and Groundwater

Table 1 shows changes in concentrations of cations, sodium, potassium, calcium and magnesium, before and after the bath test. Decreasing of the concentrations was due to cations adsorption by saturated mordenite. Sodium concentration after batch test in M:GW=1:80 didn't decrease as much as M:GW=1:20 and M:GW=1:40. It could be due to adsorption of other ions such as ammonium ion which was supplied by fertilizer application in the research field.

Figure 2 shows amounts of adsorbed cations after batch test. Amounts of sodium, calcium and magnesium increased along with increasing the ratios of mordenite to groundwater. It clearly showed that amount of sodium was adsorbed much more than other cations. It means that sodium ion was adsorbed selectively by saturated mordenite. Concentration of potassium after batch test increased. Particle surface of saturated mordenite should be saturated by hydrogen ion and there should be no potassium ion on the surface, so that potassium ion after batch test cannot be increased. So, this should be a measurement error of the equipment.

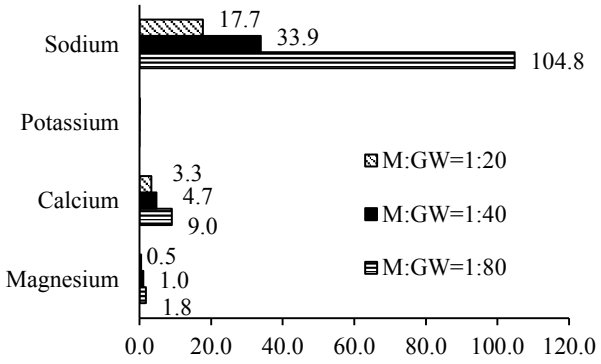

Fig. 2 Amounts of adsorbed or desorbed cations by saturated mordenite

3. Changes in EC and pH before and after Batch Test

EC and pH decreased after batch test as shown in Figs. 3 and 4. EC didn't decrease as expected because of existing of other cations such as ammonium ion applied by fertilizer and anions. Decreasing of pH was due to ion exchange, sodium adsorption and hydrogen desorption, of particle surface of saturated mordenite. It means that alkalization was reduced since pH decreased by desorption of hydrogen ion from saturated mordenite to groundwater.

Table 1 Changes in ion concentration before and after batch test

Cations		M:GW=1:20	M:GW=1:40	M:GW=1:80
Sodium (mmol L^{-1})	Before	11.9	11.9	11.9
	After	3.1	3.5	5.4
Potassium (mmol L^{-1})	Before	0.1	0.1	0.1
	After	0.1	0.1	0.1
Calcium (mmol L^{-1})	Before	2.0	2.0	2.0
	After	0.4	0.8	1.4
Magnesium (mmol L^{-1})	Before	0.9	0.9	0.9
	After	0.7	0.6	0.9

4. Estimation Cost of Implementation of Saturated Mordenite in Actual Saline Field

Mordenite can be purchased about US$2 per kilo in Japan, so that the amount of mordenite are needed 8.4 kg if we could apply saturated mordenite as sheets on agricultural field which has an area of 1a using the data of groundwater as well as this study. Therefore, the costs were estimated about US$170 considering only costs of mordenite (Haruta, 2018).

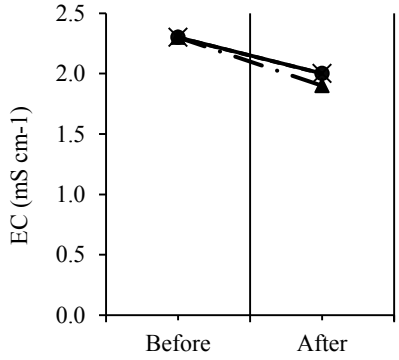

Fig. 3 Changes in EC before and after the batch test

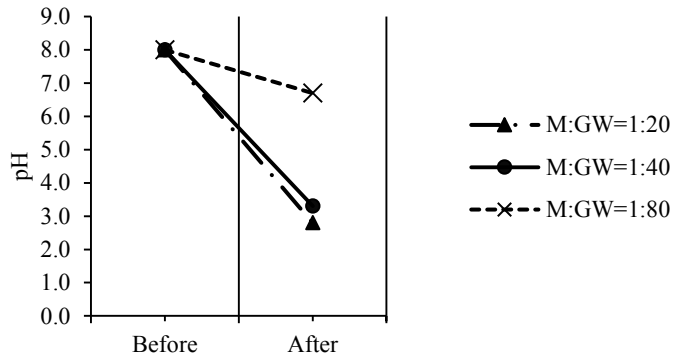

Fig. 4 Changes in pH before and after batch test

CONCLUSION

Sodium ion of the groundwater which contained various cations was adsorbed by saturated mordenite selectively. It is also revealed that alkalization is reduced since pH decreased by desorption of hydrogen ion from saturated mordenite to groundwater. We could reveal ion-exchange ability of saturated mordenite in ion mixed conditions compared to the previous study using test solution (Umakoshi, 2016). Hence, we concluded that the saturated mordenite can be utilized for desalinization of saline soil and groundwater in the experimental field.

Estimated costs for applying saturated mordenite in actual fields were less than US$200 per 1a. There exists shallow groundwater in the field and it goes up to root zone by capillary rise during dry season. Applying saturate mordenite in soil layer in a proper way, it can work as desalinization material and pH adjuster.

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Research article

Spatial Assessment of Cultural Ecosystem Services for Urban Forests based on a Multi-point Field Survey: Case in Nagoya City, Japan

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Abstract Urban forests including urban parks, secondary forests, and natural forests provide many benefits for citizens, such as recreational opportunities, scenic beauty, and cultural heritage value. Each has a different role in the provision of cultural ecosystem services (CESs) in a city. One issue with urban forests in Japan is the decrease of forests with the loss of CESs. The objective of this study was to develop a method to categorize the CESs of urban forests through multi-point field surveys as a case in Nagoya City, Japan. Then the equivalency and/or alternativeness of the forest CESs were examined. In total, 180 forests in the city were surveyed. The percentages of forests featuring aesthetic and daily recreation values were high. Using a hierarchical cluster analysis, the forests in the city were categorized into 9 types. Future issues include the idea that, in addition to CESs, other ESs should be considered as a part of a comprehensive ES assessment.

Keywords GIS, ecosystem service, cultural ecosystem service, forest, Japan

INTRODUCTION

Urban forests have many benefits for citizens, such as recreational opportunities, scenic beauty, and cultural heritage value. There are several types of forest: urban parks, secondary forests, natural forests, and more. Each has a different role in the provision of ecosystem services (ESs) (Millennium Ecosystem Assessment (MA), 2005). One issue with urban forests in Japan is their decrease over the past few decades due to the loss of forests. For example, in Nagoya, which is the third largest urban area in Japan, forest area has been decreasing. According to the Nagoya City government, the green coverage ratio of the city, including forests, grassland, agricultural land, and water bodies, was 22.0% in 2015 which was a decrease from 29.8% in 1990 (Nagoya City, 2015).

Cultural ESs (CESs) bring aesthetic value, recreation, education value, spiritual and religious values, inspiration, social relations, and cultural heritage value (MA, 2005). CESs are different from other ESs because they are assessed subjectively by individuals (Burkhard et al., 2012). Nahuelhual et al. (2013) summarized the approaches to the spatial mapping of CESs, such as recreation and ecotourism, into four types: visitors' expenditure; recreation areas; monetary benefits; and valuing by stakeholder assessment (Sieber, 2006; Sherrouse et al., 2011; van Riper et al., 2012; Hayashi et al., 2015). Nahuelhual et al. (2013) also developed a method to evaluate CESs using maps. Then, plenty of scholars have conducted economic evaluations of CESs (Costanza et al., 1997). By providing a city-scale assessment, several papers explored ES spatial assessments, including the CESs provided by urban forests (Dobbs et al., 2014; McPhearson et al., 2013). However, the scope of the CES items was limited. So, comprehensive and detailed assessments of CESs are needed to understand their provision and usage on a city scale.

Then it will be possible to discuss the equivalency and alternativeness of the CESs provided by urban forests. This is the focus of this study.

OBJECTIVES

The objective of this study is to develop a method to categorize forest CESs from the perspective of their provision and usage using multi-point field surveys. Then the equivalency and/or alternativeness of the CESs will be examined. The case study focused on urban forests in Nagoya City, Japan.

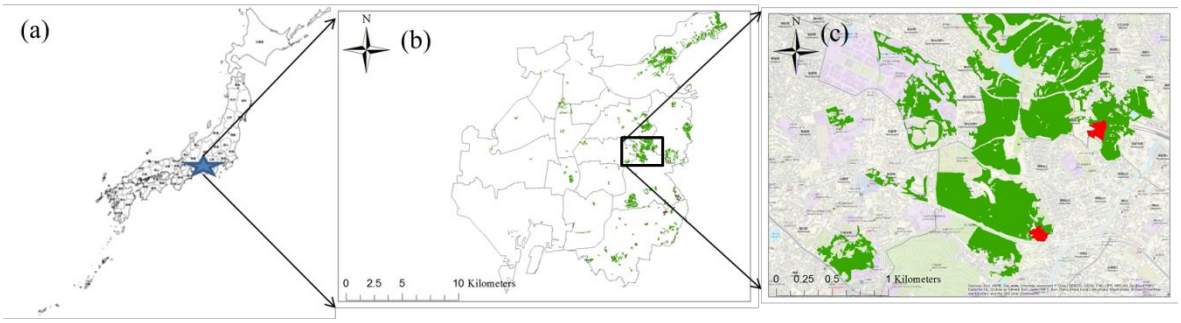

Fig. 1 Maps of the study area: (a) Japan with Nagoya City as a star symbol, (b) Nagoya City outlined in black with forests (≥1 ha) in green, (c) east-part of Nagoya City (as an example) with forests and bamboo forests in green and red, respectively

Source: Hayashi and Ooba (2015) and Hayashi (2017), forest and bamboo from Nagoya green coverage GIS provided by Nagoya City

METHODOLOGY

Nagoya City (city hall location: 35.181°N, 136.906°E) is the third largest city population-wise in Japan, with over 2 million residents. It is located in the geographical center of Japan (Fig. 1 (a)). The average annual temperature in 2015 was 16.6°C, and the average precipitation was 1803 mm (Japan Meteorological Agency, 2016). The city has an area of about 326 km^2 (Nagoya City, 2016b).

In this study, multi-point field surveys were employed to understand the provision and citizen usage of forest CESs. In the study, forests were defined as continuous tree crown areas with one ha or more of forest area. Based on the Nagoya green coverage geographic information system (GIS) data (provided by Nagoya City via personal communication), 180 forests (among around 240 total) with one ha or more of forest area were studied.

The field surveys were conducted in a similar style to Hayashi and Ooba (2015), which was as follows. First, one of the authors surveyed the entire forest area by foot. Then the forest usage of each CES was judged subjectively on the following five-point scale, tentatively: 1. "very frequently," 2. "frequently," 3. "sometimes," 4. "not so much," and 5. "rarely used," as well as "not enough information to make a decision," for both inside of the forest and the surrounding area. After conducting several visits to each forest site in various seasons from 2013 to 2016, the final scores were determined by the author subjectively with the opinions of field survey collaborators. The values were then put in the opposite order (e.g., 5. "very frequently" to 1. "rarely used") and then converting to 0 to 1 value. The CESs, which followed the categories of MA (2005) with some modifications, included in this study are listed in Table 1. However, based on several visits to each forest, "education value: school-related event," "inspiration," and "social relations: working or schooling in the forest" were slightly difficult to evaluate, so these items were excluded from the analysis. In total, 14 CES items (CES14) were used. Then seven new CES items were developed from the CES14 (Table 1). The maximum score of each CES14 value was selected for each CES7 value. Then, the following four data sets were used for the analysis: CES14 inside forest (CES14 in forest), CES14 inside forest with the surrounding area (CES14 in area), CES7 in forest, and CES7 in area. For example, let us imagine that there were children's play facilities in a park. If these were located inside a park forest, they would be classified as CES14 in forest and CES14 in area. However, if they were not inside a park forest but rather around the forest inside the park, they would be classified as only CES14 in area.

Table 1 CES14 and CES7 categories

CES14	Contents	CES7
subCES1	Aesthetic value	Aesthetic value (AE)
subCES2	Daily recreation: walking, etc.	Daily recreation (DRE)
subCES3	Daily recreation: play with children by play facilities	
subCES4	Daily recreation: play in forest (e.g. insect collecting)	
subCES5	Holiday recreation: holiday leisure, picnics, hiking, etc.	Holiday recreation (HRE)
subCES6	Holiday recreation: sports, etc.	
subCES7	Attraction facilities	Education value (ED)
*1	Education value: school-related event	-
subCES8	Education value: nature observation meetings/classes	Education value (ED)
subCES9	Spiritual value	Spiritual and religious values (SR)
*2	Inspiration	-
subCES10	Traditional festival	Spiritual and religious values (SR)
subCES11	Normal festival	Social relations (SO)
subCES12	Religious value	Spiritual and religious values (SR)
subCES13	Cultural heritage value	Cultural heritage value (CH)
*3	Social relations: working or schooling in the forest	-
subCES14	Social relations: volunteers	Social relations (SO)

*Note: *1, *2 and *3 were excluded.*

In addition, the basic parameters of the CESs were listed for each forest: "forest area," "in scenic districts designated by the city (S_D)" (Nagoya City, 2016a), "in shrine or temple (S_T)," and "in major attraction facilities listed by the city (A_F)" (Nagoya City, 2014).

Utilizing the CES14, statistical analyses including the Kolmogorov-Smirnov normality test and Spearman's Rank Correlation Coefficient among the CES14 items were conducted. Also, to investigate what percentage of Nagoya forest provided each CES, the total number of forests provided by each CES was summed up and divided by the total number of forests studied (N=180).

For the CES7 data sets, similar basic statistical analysis was conducted. Then, the differences among the CES7 in area items were tested with Friedman's test with pairwise comparisons. Also, a hierarchical cluster analysis (using Ward linkage) was conducted to categorize Nagoya City's forests into several types based on the CES7 in area with basic parameters: namely, forest area, S_D, S_T, and A_F after converting to the 0 to 1 scale.

Statistical analyses were conducted using SPSS ver. 22 (IBM). ArcGIS10.2.2 (ESRI) was used for GIS analyses.

RESULTS AND DISCUSSION

In total, 180 forests were studied. The total area of accumulated forest area studied was over 1,000 ha, which was around 30% of the total tree area in the city in 2015 (Nagoya City, 2015).

Table 2 Basic statistics for each subCES on a five-point scale

		subCES													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
CES14 in Forest	Mean	2.3	2.2	1.4	1.7	1.9	1.0	1.3	1.7	2.0	1.4	1.4	1.4	1.4	2.1
	Median	3	2	1	1	1	1	1	1	1	1	1	1	1	1
CES14 in Area	Mean	2.8	2.7	2.1	2.0	2.3	1.9	1.7	2.0	2.2	1.5	1.7	1.7	1.5	2.3
	Median	3	3	1	1	3	1	1	1	3	1	1	1	1	3

Table 2 shows the mean and median of each CES14 on a five-point scale for both the CES14 in forest and in area. SubCES1 (aesthetic value), subCES2 (daily recreation: walking, etc.), and

subCES5 (holiday recreation: holiday leisure, picnics, hiking, etc.) under CES14 in area showed relatively higher values than the other CESs.

Regarding the correlation coefficient among the CES14in area categories, subCES2-subCES3, subCES2-subCES9, subCES3-subCES4, and subCES7-subCES11 were relatively highly correlated, with coefficients over 0.7 (see Table 3).

Table 3 Correlation coefficients among CES14 in area

	subCES												
	2	3	4	5	6	7	8	9	10	11	12	13	14
subCES1	.623**	.514**	.454**	.685**	.252**	.491**	.616**	.625**	.185*	.532**	.076	.212**	.429**
subCES2		.737**	.667**	.540**	.428**	.171*	.575**	.741**	-.111	.261**	.093	-.060	.588**
subCES3			.888**	.466**	.572**	.077	.398**	.678**	-.104	.252**	.032	-.080	.416**
subCES4				.449**	.549**	.092	.429**	.616**	-.105	.272**	.009	-.066	.359**
subCES5					.265**	.478**	.550**	.596**	.016	.585**	-.094	.056	.554**
subCES6						.169*	.256**	.395**	-.254**	.253**	-.177*	-.161*	.127
subCES7							.386**	.315**	.152*	.720**	-.157*	.290**	.179*
subCES8								.660**	-.106	.454**	.002	.000	.549**
subCES9									-.115	.348**	.036	.057	.593**
subCES10										.129	.502**	.624**	-.096
subCES11											-.238**	.202**	.225**
subCES12												.376**	.033
subCES13													.029

*Note: statistical significance: **, <0.01; *, <0.05, N=180*

The results on the percentage of forest provided by each CES in area against the total number of forests are presented in Fig. 2. SubCES1 and subCES2 showed high percentages of nearly 80%. This means that nearly the 80% of the forests in Nagoya were used for subCES1 and subCES2 purposes. SubCES5, subCES9 and subCES14 were more than half. Conversely, the percentages of subCES7 (attraction facilities) and subCES10 (traditional festival) were relatively small, at around 20%. These kinds of CESs were found in a limited number of forests.

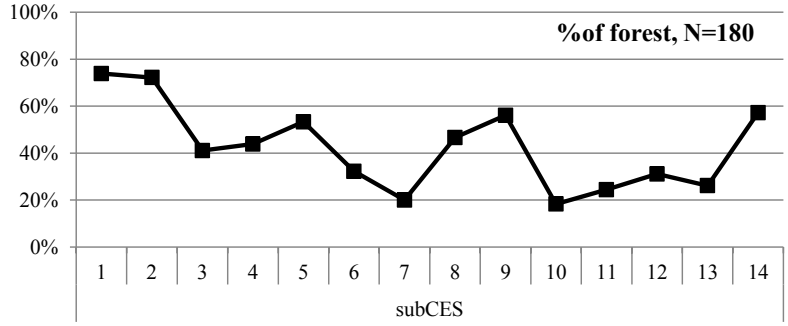

Fig. 2 Percentage of forests provided by each subCES in Nagoya

Regarding the analysis of the CES7 in area, the mean and median of each CES7 item are presented in Table 4. Here, the AE and DRE were high, but the CH was low. The results of Friedman's test showed that the differences among the several CES7 items were statistically significant, such as CH-ED and ED-HRE.

Table 4 Basic statistics for each CES7 on a five-point scale

		AE	DRE	HRE	ED	SR	CH	SO
CES7 in	Mean	2.8	2.8	2.6	2.3	2.7	1.5	2.6
Area	Median	3	3	3	2	3	1	3

*Note: Friedman's test with selected pairwise comparison; CH-ED:**, ED-SO: NS , ED-HRE:*, SO-SR: NS, HRE-SR: NS; SR-AE: NS, **, <0.01; *, <0.05, NS: not significant; N=180*

Table 5 Cluster analysis results for 9 forest categories (Using Ward linkage, total N=180)

	Category No and contents	N	Area(ha)
CES medium to high in S_D	1: in A_F	13	93
	2: in S_T	10	44
	3: other	43	529
CES low to medium	4: in S_T in S_D	15	44
	5: in S_T out side of S_D	12	24
	6: in S_D with low CESs	35	198
	7: outside of S_D, S_T and A_F with medium CESs	16	37
	8: outside of S_D, S_T and A_F with low to medium CESs	12	26
	9: outside of S_D, S_T and A_F with low CESs	24	41
Total		180	1,036

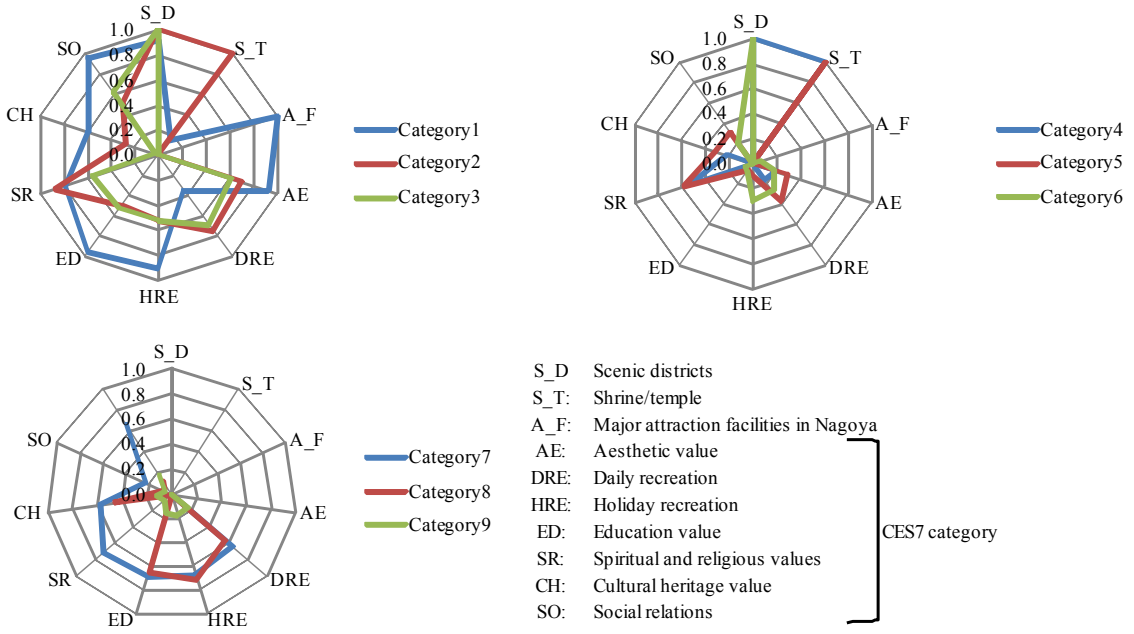

Fig. 3 Radar charts for each forest category after averaging values in each category

Using a hierarchical cluster analysis, we divided Nagoya's forests into 9 categories using the data sets of the CES7 in area with basic parameters. A basic description of the 9 categories can be found in Table 5, and the results of the radar charts for the categories are presented in Fig. 3. According to the results, the forests in category 1, including Atsuta Jingu shrine and Nagoya Castle, have relatively high values for most of the CES7 items within major attraction facilities (A_F), because these are major historical and cultural spots in Nagoya featuring nature areas. The forests, namely, Higashiyama Park, were also high in most of the CES7 items except for the CH, because a zoo and a botanical garden with nature areas can be found in these areas. Categories 2 showed relatively high values for most of the CES7 items in shrines or temples (S_T) including cemetery. The total number and area of forests in category 3 were 43 and 529 ha, respectively—higher than the other categories. On the other hand, categories 4 and 5 were located in shrines or temples (S_T) with low to medium CESs in which a lot of the natural forests were designated as conservation areas by the city or prefecture. The forests in category 9 were located outside of S_D, S_T, and A_F, with low CES7 items because they are located in a remote or low intervention area. So these are relatively low provisions for CES assessments.

Regarding the equivalency and/or alternativeness of the forest CESs, forests within the same category had similar roles in CES provision and usage by citizens, so their equivalency and/or alternativeness were relatively high. The number of forests in categories 1 and 2 with high CESs was small, so their alternativeness was relatively low.

An important point is that the forest category only included the CES contents and should be elaborated on; for example, the spatial distribution of the forest CESs and their future demands could be included. Also, the results were obtained by focusing on CES assessment without considering other ESs and habitats/species, except for basic parameters considered. Some forests were located in somewhat remote areas, even in a big city, so that there still remained natural forest with little human intervention. In this case, the use of cultural aspects of ESs were limited. These issues should be considered appropriately as part of a comprehensive ES assessment in the future.

CONCLUSION

In this study, based on multi-point field surveys, a method to categorize CESs was considered, taking into account their provision and usage as a case study in Nagoya City. Also, the equivalency and/or alternativeness of forests from the perspective of CESs were examined. The correlations among CESs were not very high, except among recreation values. The percentages of forests equipped with aesthetic and daily recreational values were high in the city. Via cluster analysis, the forests were categorized into 9 types by CES7 in area with forest area, S_D, S_T, and A_F. Then the equivalency and/or alternativeness of the forest CESs were discussed. This forest categorization could be used for a CES management planning and environmental assessment for development activities. Future issues include the fact that, in addition to CES assessment, other ESs and habitat/species assessment should be considered as part of a comprehensive ES assessment.

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Research article

Brigada Eskwela and Disaster Preparedness as an Approach to Pupils' Academic Achievement

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Abstract Brigada Eskwela is a volunteerism program which is annually launched to prepare the public schools for the opening of classes enlivening the spirit of solidarity among the school personnel, pupils, parents, and rural residents. Classroom repair, furniture repainting, and school ground cleaning are some of the Brigada Eskwela activities that are geared towards making schools disaster-prepared, ecologically-conscious, and conducive to learning. Having these annual activities along with the schools' Disaster Preparedness program assures smooth opening of classes because teachers and pupils will no longer clean and set up their classrooms during the first day of school. This study aimed to determine the schools' implementation of Brigada Eskwela and Disaster Preparedness Program in relation to the academic achievement of pupils in Ubay 1, Ubay 2, and Ubay 3 Districts of Bohol. This employed descriptive-normative survey. A total of 45 elementary schools were surveyed including 45 school heads, 422 teachers, and 180 rural residents. The findings showed that the Brigada Eskwela implementation was evaluated "excellent" so with the disaster preparedness as "very high capacity". In turn, these programs had significantly improved the pupils' academic achievement and had raised awareness among the rural residents the importance of culture of safety. School heads played an important role in the implementation of these programs. Their managerial skills potentially affected Brigada Eskwela implementation and disaster preparedness of the schools. It was then recommended that the rural residents may strengthen its disaster preparedness through establishing a Family Disaster Plan to avoid casualties from any hazard and calamity that may occur. Moreover, Brigada Eskwela should also be implemented in the private schools to intensify partnership towards their stakeholders.

Keywords BrigadaEskwela, disaster preparedness, rural residents, volunteerism

INTRODUCTION

Angela (2013) stressed that positive learning environment, either in school or home setting, is important for a child. Healthy and safe learning environment denotes a child-friendly and hazard-free classroom where children feel safe and valued at all times.

Through the spirit of volunteerism and public-private collaboration for Philippine education, the Republic Act 8525, also known as the "Adopt-A-School Act", was crafted in 1998. With the Adopt-A-School Program (ASP), the Department of Education launched the National Schools Maintenance Week in May 2003 and was institutionalized on May 2008 by Department of Education Order No. 24, s. 2008. Dubbed, "Brigada Eskwela", the program enlivened the spirit of volunteerism through bringing together teachers, parents and community members every third week of May to work together in repairing and preparing public schools for the class opening. It is also participated by individual, private organizations, business sectors, local and national government agencies which together share their efforts, time and resources (Vargas, 2016).

On the other hand, Department of Education Order No. 83 or the Disaster Preparedness Measures for Schools mandated public schools to be disaster-resilient by implementing measures for the protection against rains or floods of all school paraphernalia like textbooks, teaching manuals, school records and equipment; designing orientation to all pupils and students on disaster preparedness; conducting of regular disaster drills; properly informing pupils and students on early signs of weather disturbances and their effects; and, observing policies in coordination with the local government units on decisions regarding the suspension of classes during disasters or calamities.

In addition, UNESCO (2013) elaborated three pillars of comprehensive school safety, namely, the Safe Learning Facilities; the school Disaster Management; and the Risk Reduction and Resilience Education. These pillars were adopted by the Department of Education in accord to their Disaster Risk Reduction and Management (DRRM).

Ayeni, et al (2011) concluded that the collaborative effort between the school personnel and other stakeholders is greatly important in the success towards the development of learning infrastructure and environment and to any projects a certain school may implement. After all, the most benefited individuals of such are the children themselves. Hence, it is of great importance to establish a close monitoring and evaluation of all the programs of the Department of Education like the Brigada Eskwela and Disaster Preparedness to make sure that these programs continuously respond to the ultimate goal of the department – the welfare and total development of the children.

OBJECTIVE

The researchers would like to investigate the status of implementation of Brigada Eskwela and Disaster Preparedness programs in public elementary schools. This further evaluated the influence of the school heads' managerial skills towards the implementation of these programs and their impact towards pupils' academic achievement.

METHODOLOGY

This study utilized descriptive-normative survey with documentary analysis. School heads' managerial skills were measured using adopted questionnaires from the study of Timbal (2012). Meanwhile, the Brigada Eskwela and Disaster Preparedness were assessed using the standard checklist issued by the Department of Education. The respondents of the study were all the teachers and school heads of subject elementary schools and selected rural residents of Ubay I, Ubay II, and Ubay III Districts in Bohol. There were a total of 647 respondents, comprising 422 teachers, 45 school heads, and 180 rural residents. The National Achievement Test mean score of the pupils for the school year 2014-2015 was used as basis for their academic achievement.

RESULTS AND DISCUSSION

The Brigada Eskwela program of the Department of Education of the Philippines demands school heads' managerial skills. It became one of the Department's initiatives of enjoining the rural residents and local communities to respond to the needs of public schools in the Philippines. This referred to the advocacy known as National Schools Maintenance Week.

As reflected in Table 1, school heads generally performed 'very often' the managerial skills they possessed in the school operation. In particular, they excelled equally both in conceptual and technical skills. Basically, conceptual skill includes the ability of the school heads in updating and coaching his teachers on recent trends in education; applying logic in effectively solving problems; allocating responsibility for continuous improvement; and flexibly modifying course to suit changing circumstances. Technical skill, on the other hand, is about being computer-literate; regular monitoring and evaluation of school projects; managing people and resources; maintaining order and discipline in school; and identifying smarter ways to do things.

Table 1 School heads' managerial skills as perceived by the respondents

Parameters	School Heads N=45		Teachers N=422		Rural Residents N=180		Overall		
	WM	DV	WM	DV	WM	DV	WM	DV	Rank
Conceptual Skill	3.40	Always	3.22	Very Often	3.19	Very Often	3.27	Always	1.5
Communication Skill	3.23	Very Often	3.13	Very Often	3.11	Very Often	3.16	Very Often	4
Human Relation Skill	3.28	Always	3.18	Very Often	3.15	Very Often	3.20	Very Often	3
Technical Skill	3.34	Always	3.28	Always	3.19	Very Often	3.27	Always	1.5

Although perceived as 'very often' done, it didn't imply that the school heads' communication and human relation skills were alarming. Communication skill requires a two-way process, the concept of listening and speaking. Further, it refers to ones' ability to understand and to be understood by others in the most possible way. Meanwhile, school heads' human relation skills involve establishing good relationship towards others; understanding the social fabric of the organization; being sensitive to others' feelings; keeping promises and commitments; and handling difficult people with diplomacy and tact. All these skills are of importance for school leaders to effectively do the tasks expected from them. According to the study of Uko (2015), effective management is a precursor to facilities sustainability, utilization and maintenance as it enhances effective productivity. Hence, it can be said that a school head with good managerial skills could effectively facilitate the schools' Brigada Eskwela and Disaster Preparedness programs.

Table 2 Respondents' perception towards schools' Brigada Eskwela implementation

Parameters	School Heads N=45		Teachers N=422		Rural Residents N=180		Overall		
	WM	DV	WM	DV	WM	DV	WM	DV	Rank
Enrolment Preparation	2.13	VG	2.10	VG	2.06	VG	2.10	VG	**5**
School Leadership	2.48	E	2.51	E	2.51	E	2.50	E	**3**
Teachers' Preparation	2.74	E	2.63	E	2.58	E	2.65	E	**1**
Learners' Status	2.48	E	2.65	E	2.61	E	2.58	E	**2**
Physical Plant/Facilities	2.27	E	2.24	VG	2.20	VG	2.24	VG	**4**
COMPOSITE MEAN	2.42	E	2.43	E	2.39	E	2.41	E	

As shown in Table 2, the parameters included in the Brigada Eskwela were enrolment preparation, school leadership, teachers' preparation, learner's status and physical plant/ facilities. It shows that as far as Brigada Eskwela was concerned, respondents perceived that teachers were more than prepared. This simply unveiled the idea that prior to the opening of classes, all the teaching paraphernalia like lesson plans, teaching manuals, curriculum guides, instructional materials, school register, class records, and even the classroom structuring were ready for use. Furthermore, this implied that teachers were efficient enough to prepare for their assigned tasks as curriculum implementers.

The learners' status which included the actual attendance of the students per class or the teacher-pupil ratio was excellently facilitated by the schools and their staffs to make sure that quality education in every classroom was maintained. Moreover, the aspect on school leadership was also carried out by the school heads, teachers and stakeholders well. This covered the School Improvement Plan (SIP), Annual Implementation Plan (AIP), Annual Procurement Plan (APP), supervisory plan, calendar of school programs for the entire school year, distribution of teaching loads for teachers, project work and financial plan, advocacy plan, monitoring and evaluation plan, and transparency measures of expenditures.

In consonance, Brigada Eskwela program was also perceived to be of potential help in preparing the school facilities before the classes started. This included the repair of classroom and its furniture, water drainage system and sanitation maintenance, rehabilitation of the school garden, and the like which made the school child-friendly and a zone of peace. Lastly, the program has also showed significant contribution to the schools' enrolment preparation. This finding suggested that the information dissemination pertaining to enrolment including the hanging of streamers, establishing of information action centre and help desks, education caravan, and community immersion; rigid and strict adherence to No-Collection-Policy; family mapping; networking with stakeholders; and soliciting school supplies and uniforms for the less privileged pupils were a contributory factor to increased enrolment.

In the overall, the Brigada Eskwela implementation was rated "excellent". With this, it can be implied that there was a strong partnership between the school and the rural residents. Furthermore, this proved that the objectives of the said program have been achieved through the spirit of volunteerism. This result agreed to the study conducted by Celestial (2015) which stated that Brigada Eskwela was highly implemented by public elementary schools from its pre-implementation to the post-implementation stage.

On the other hand, one of the targets of Brigada Eskwela is to ease the public schools' vulnerability to both natural and human-made disasters. Hence, the Department of Education issued the *Comprehensive Disaster Risk Reduction and Management (DRRM) in Basic Education Framework* under Department Order No. 37, s. 2015 to guide DRRM efforts in the basic education sector towards resilience-building in offices and schools, and to ensure that quality education was continuously provided and prioritized even during disasters and/or emergencies. This framework served as basis towards the attainment of Department's three education outcomes, namely: *Access, Quality, and Governance (AQG),* and maintained a learner-centered, rights-based implementation at all levels. It set the direction and priority areas for DRRM in the Department of Education while maintaining the prerogative of field offices to decide on what specific activities to undertake depending on their exposure to hazards, available resources and existing partnerships and linkages.

In order to achieve the education outcome as to *Access*, DRRM interventions, policies and mechanisms should be in place to ensure the immediate resumption of classes after the occurrence of any hazard or calamity so that school children will not be hindered from the access of learning services. Meanwhile, even if the concepts on Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) have been integrated in the K to 12 Curriculum, the constraints to access, along with the psychosocial condition of school children and teachers, affect the quality of education. Thus, in order to reinforce the education outcome as to *Quality,* there is a need to identify strategies including support materials attuned to the learning needs of children and teaching strategies that could adapt to emergency situations. On the other hand, with the acknowledgement that DRRM is a complementation of infrastructural and non-infrastructural interventions, *Governance* comes crucial in the implementation. This will determine the institutionalization and implementation of systems and protocols that will be issued. In this study, these three education outcomes served as the parameters to evaluate the implementation of the disaster preparedness of the subject schools.

Table 3 Respondents' perception towards schools' disaster preparedness

PARAMETERS	School Heads N=45		Teachers N=422		Rural Residents N=180		Overall		Rank
	WM	DV	WM	DV	WM	DV	WM	DV	
Access	0.90	VH	0.85	VH	0.86	VH	0.87	VH	3
Quality	0.97	VH	0.89	VH	0.88	VH	0.91	VH	1.5
Governance	0.94	VH	0.88	VH	0.92	VH	0.91	VH	1.5
COMPOSITE MEAN	0.94	VH	0.87	VH	0.89	VH	0.90	VH	

Table 3 showcases the status of implementation of Disaster Preparedness wherein both the Quality and Governance got the highest rating. This finding suggested that the teachers, pupils, parents, stakeholders, and the community had the knowledge about disaster management through

regular conduct of evacuation drills like earthquake, fire, tsunami, flooding, and locks down drill. DRR and CCA were also evidently integrated in actual classroom instruction whereby disaster prevention measures were also taught. In addition, as to governance, the schools had strong partnerships with external stakeholders in order to address the DRR and CCA related needs of the school; and a well-organized and capacitated DRRM Committee including the rural residents was created and made functional. Lastly, an existing emergency incident control system that included accessible student emergency contact numbers and school records back-up system was well-established. To sum up, the overall implementation of schools' disaster preparedness was with very high capacity.

Another target of Brigada Eskwela is to achieve higher learning outcomes of pupils through establishing an environment that supports learning. Herein, the study utilized the results of National Achievement Test, a standardized test annually administered by the Department of Education in partnership with National Educational Testing Resource Center (NETRC).

Table 4 National Achievement Test (NAT) mean percentage scores

n=45

Level	Range	Frequency	Percentage (%)
Superior	90-100	4	8.89
Meeting Standard	75-89	33	73.33
Below Standard	35-74	8	17.78
Poor	0-34	0	0.00
Total		45	100%

Table 4 exhibits the mean percentage scores in National Achievement Test. Clearly, majority of the elementary schools had mean percentage scores categorized as "meeting standard". The NAT results indicated commendable academic performance of the same schools with excellent Brigada Eskwela and very highly capacitated Disaster Preparedness. This implied that Brigada Eskwela and Disaster Preparedness were potential factors that affected the performance of the pupils.

CONCLUSION

In the light of the findings of the study, it can be concluded that the school heads' managerial skills played a vital role in the successful implementation of the different programs and projects of the school such as Brigada Eskwela and Disaster Preparedness, leading to its ultimate goal – the quality and relevant education for the pupils. Brigada Eskwela and Disaster Preparedness did not only make the public schools accessible to all, conducive to learning, ecologically-conscious, and disaster-resilient but also promoted awareness among the rural residents the importance of culture of safety. The rural residents have also shown positive response to the said programs through actively engaging in the planning and implementation. Moreover, these programs, with the help of a committed and skilled school heads as the mediator, have been found out to be potential factors affecting the National Achievement Test (NAT) mean percentage scores of the pupils.

RECOMMENDATION

It is highly recommended that Brigada Eskwela and Disaster Preparedness Programs be implemented in all private schools not only to become disaster-prepared or to increase their pupils' academic achievement but also to intensify the good rapport between the schools and their stakeholders. Also, the rural residents may strengthen their disaster preparedness through crafting a Family Disaster Plan to prevent casualties from any hazard and calamity that may occur.

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Research article

Using Vermitechnology in Soil Rehabilitation for Rice Production in Salt-affected Area of Northeast Thailand

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Abstract Soil degradation resulting from salinity is a major obstacle to the optimal utilization of land resources. In Northeast Thailand, approximately 17% of the land is salt-affected due to salt bearing rocks, predominantly in Nakhon Ratchasima, Khon Kaen, Roi-Et and Mahasarakham provinces. The present extent of salt-affected soils in the Northeast already substantially restricts crop production in many areas especially rice production. This study aims to study using vermitechnology to rehabilitate saline paddy soil for rice production. The experiments were conducted to study the influence of earthworm and their activity on soil properties, production and growth of rice variety (Pathumthani 1) under the influence of salt. The results found that Activities of earthworms encourage the release of available plant nutrient, especially when associated with the utilization of organic matters. Applying 1% of biochar per 1 kg of dry soil, 650 kg of rice straw per Rai, and 1,000 kg of vermicompost per Rai can significantly increase organic carbon in soil in deteriorated paddy soil (EC= 0.08 – 0.13dS/m), slightly saline paddy soil level 1 (EC= 1.56 – 1.71 dS/m), and moderately saline paddy soil level 2 (EC= 2.90 – 3.47 dS/m). Moreover, the amount of total nitrogen, exchangeable sodium, exchangeable calcium, and exchangeable magnesium in soil also increased under all soil salinity level. The experiment under control condition indicated that activities of earthworms associated with the utilization of biochar, rice straw, and compost produced by earthworm enhanced the availability of plant nutrients. Furthermore, earthworms are soil organisms that benefit to soil property rehabilitation such as improving physical properties of soil by assisting on soil inversion. The burrowing by earthworm loosens the soil causing well drainage and aeration and improving water holding capacity. Activities of earthworms associated with the utilization of biochar, rice straw, and vermicompost in different soil salinity level under control condition enhanced growth rate of rice that increases rice productivity.

Keywords earthworm, rice production, salt-affected area, amelioration

INTRODUCTION

Soil degradation resulting from salinity is a major obstacle to the optimal utilization of land resources. Salt-affected soils are widely distributed throughout the world, with around 20% of the world's cultivated land affected (Sumner, 2000). In Northeast Thailand, approximately 17% of the land is salt-affected due to salt bearing rocks (Land Development Department, 1991), predominantly in Nakhon Ratchasima, Khon Kaen, Roi-Et and Mahasarakham provinces (Department of Mineral Resources, 1982). The salinization of soils in Northeast Thailand has several unique characteristics, and has been accelerated by human activities such as improper land management practices, deforestation, irrigation, salt-making, and construction of roads and reservoirs (Mitsuchi et al., 1986). All of these human activities except salt-making are believed to promote salinization by causing the level of saline groundwater to rise towards the surface. Eventually, low-lying paddy fields become subject to rapid salinization. The present extent of salt-affected soils in the Northeast already substantially restricts crop production in many areas. Concerns regarding the potential future

expansion of areas of salt-affected soils and their effects on land and water resources have been reported to be one of the most important issues for farmers who live in affected areas (Kohyama and Subhasaram, 1993; Topark-Ngarm, 2010).

Soil salinity has become a serious threat to crop productivity. Many previous studies (Keren, 2000; Levy, 2000; Liang et al., 2003; Sardinha et al., 2003) have reported on the adverse effects of excessive amounts of salts on the physical and chemical properties of soils and on plant growth and yield. Salt-affected soils exhibit unique structural problems resulting from soil physical processes such as slaking, swelling, and dispersion of clay, which in turn cause degradation of soil structure (Boivin et al., 2004; Tejada and Gonzalez, 2005). These structural changes can affect water and air movement, plant available water holding capacity, root penetration, seedling emergence, and runoff and erosion, as well as tillage and sowing operations (Oster and Jayawardane, 1998). Salinity also affects soil chemical properties through the presence of high soluble salt concentrations (Sumner, 2000). This alters the osmotic and matric potential of the soil solution, thereby adversely affecting soil microbial communities and their activity (Zahran, 1997; Sardinha et al., 2003; Rietz and Haynes, 2003). This in turn can have a negative influence on plant growth and yield (Marschner, 1995). In addition, changes in the proportions of exchangeable ions in the soil solution have osmotic and ion-specific effects that can produce imbalances in plant nutrients, including deficiencies of several nutrients, or conversely high levels of Na+ (Grattan and Grieve, 1999; Mengel and Kirkby, 2001). In order to solve such problems, expansion of amelioration actions and improved management practices are needed to reclaim salt-affected soils (Qadir et al., 2001; Suarez, 2001; Barrett-Lennard, 2002).

The amelioration of salt-affected soils can be accomplished through many effective methods, such as water leaching, chemical remediation, and phytoremediation (Sharma and Minhas, 2005; Qadir et al., 2007). The amelioration of salt-affected soils using chemical agents, including gypsum, calcite, calcium chloride and organic matter (farmyard manure, green manure, organic amendments, and municipal solid waste), is a successful approach that has been implemented worldwide (Mitchell et al., 2000; Hanay et al., 2004; Sharma and Minhas, 2005; Tejada et al., 2006). According to Melero et al. (2007), the application of organic matter conditioners has become a common practice in salt-affected areas in the last several decades and constitutes an important method of soil regeneration and fertility enhancement. The application of organic matter for soil remediation is considered essential for sustainable land use and crop productivity.

Vermitechnology has been developed as a means of using earthworm converting wastes into value-added products which can be utilized for improving soil structure and fertility. Agro wastes could effectively be tapped for resource recovery through vermicomposting technology to produce a product for use in land rehabilitation. Adding compost or vermicompost to soils can help to replenish soil organic carbon which can help to improve soil health and promote further primary productivity (Iwai et al., 2010; 2011; Lal, 2004;).

Earthworms are known to have beneficial effects on the physical, chemical and biological properties of soils, and thereby contribute to increased plant growth and crop yields in both natural and managed ecosystems (Edwards and Bohlen, 1996; Edwards, 1998). Their beneficial effects have been attributed to improvements in soil properties and structure, greater availability of mineral nutrients to plants (Gilot, 1997), and enhanced microbial populations and activity, thereby producing biologically active metabolites such as plant growth regulators (Doube et al., 1997).

OBJECTIVE

The objective of this study was to investigate the effectiveness of vermitechnology for alleviating salt-affected soils, and to determine the effect of these amendments on the rice production in Northeast of Thailand.

METHODOLOGY

Preparation of Soil and Vermicompost

An experiment was carried out to investigate the effects of vermicompost produced on soil properties of different level of saline soils on the growth of rice under greenhouse conditions at Khon Kaen University, Thailand, during the rainy season of 2015. The soil was air-dried and passed through a 2 mm mesh to remove stones and other debris. The initial physical and chemical properties of the soils before the start of the experiment are shown in Table 1. Vermicompost were prepared in a laboratory of the Land Resources and Environment Department, Faculty of Agriculture, Khon Kaen University. They were produced from cassava waste materials incubated for two months in black plastic pots. The earthworm species used to produce the vermicompost was Eudrilus eugeniae. The chemical properties of the vermicompost used are shown in Table 1.

Table 1 Chemical characteristic of soil, biochar and vermicompost used for experiments

Parameter	Soil	Biochar	Vermicompost
Soil texture	loam	-	-
Sand (%)	49.9	-	-
Silt (%)	38.1	-	-
Clay (%)	12.0	-	-
OM (%)	0.63	16.40	8.37
EC (dS/m)	0.09	2.85	2.20
pH (1:5)	6.32	6.34	6.84
Total N (%)	0.059	0.16	0.77
Extractable P (ppm)	2.94	2,543.53	2,309.52
Exchangeable K^+ (ppm)	56.14	5,886.65	7,683.94
Exchangeable Na^+ (ppm)	48.89	113.45	142.34
Exchangeable Ca^{2+} (ppm)	930.90	3,084.95	13,675.76
Exchangeable Mg^{2+} (ppm)	81.38	669.86	1,992.63

Experimental Design

The experiments were conducted to study the influence of earthworm and their activity on soil properties, production and growth of rice variety (Pathumthani 1) under the influence of salt. The experiment was laid out in a completely randomized design (CRD) with three replications. Three level of saline soils were used, in deteriorated paddy soil (EC= 0.08 – 0.13dS/m), slightly saline paddy soil level 1 (EC= 1.56 – 1.71 dS/m), and moderately saline paddy soil level 2 (EC= 2.90 – 3.47 dS/m). Seven treatments were compared: T1 = control; T2 = biochar (BC1%); T3 = biochar (BC1%)+earthworms (20 individuals pot-1); T4 = rice straw 650 kg/rai; T5 = rice straw 650 kg/rai)+earthworms (20 individuals pot-1); T6 = vermicompost (VMC) 1,000 kg/rai; T6 = earthworms (20 individuals pot-1). Seven kilograms of 2 mm sieved air-dried soil were placed in each black plastic pot of 30 cm height and 25 cm diameter for each treatment.

Table 2 The results of vermitechnology with different amendments on Rice production in deteriorated paddy soil (EC= 0.08 – 0.13 dS/m)

Treatments	Spikelet number	Yield)kg./Rai(	1000 grain weight)g)
Soil	12.33	816.00 ab	25.40 ab
soil add earthworm (EW)	13.67	849.20 ab	26.87 a
soil add biochar (BC)	11.33	705.10 bc	25.90 a
soil add BC and EW	14.33	1,000.51 a	26.77 a
soil add rice straw	12.00	512.09 c	23.33 b
soil add rice straw and EW	13.33	599.47 bc	26.23 a
soil add vermicompost (VMC)	14.67	817.12 ab	26.37 a
soil add VMC and EW	16.00	1,024.38 a	27.17 a
f-test	ns	**	**
CV %	20.18	14.27	4.04

Note: Values are mean ± standard deviation. Means with the same letter in the same column are not significantly different (P>0.05)

Table 3 Results of vermitechnology with different amendments on Rice production in slightly saline paddy soil level 1 (EC= 1.56 – 1.71 dS/m)

Treatments	Spikelet number	Yield)kg./Rai(	1000 grain weight)g)
Soil	7.33	496.00 bc	24.60
soil add earthworm (EW)	8.67	593.90 abc	26.30
soil add biochar (BC)	6.33	482.85 bc	25.30
soil add BC and EW	9.33	751.44 ab	26.43
soil add rice straw	7.00	385.21 c	23.80
soil add rice straw and EW	8.33	635.48 abc	26.53
soil add vermicompost (VMC)	9.67	763.06 ab	26.67
soil add VMC and EW	11.00	878.00 a	27.07
f-test	ns	**	ns
CV %	32.11	21.06	5.02

Note: Values are mean ± standard deviation. Means with the same letter in the same column are not significantly different (P>0.05)

Plant Data Collection

The growth and rice production were measured.

Soil Analyses

Triplicate soil samples were collected at a depth of 0–10 cm by taking a soil core from each pot at the end of the experiment. The soil samples were analyzed for soil physical and chemical properties at the laboratory of the Land Resources and Environment section, Faculty of Agriculture, Khon Kaen University. Soil texture was determined by a hydrometer (Bouyoucos, 1951). Soil pH was determined in a 1:2.5 soil to water solution by a pH meter. Electrical conductivity (ECe) in saturated paste extracts was measured following the method described by the United States Department of Agriculture (USDA, 1954). Cation exchange capacity (CEC) was determined by the 1 N ammonium acetate method (Black, 1965), and total soil organic carbon (SOC) was determined by the method of Walkley and Black (1934). Total nitrogen (TN) was measured by the Kjeldahl method (Bremner, 1960). Extractable phosphorus (Extr. P) was determined by the Bray II method (Bray and Kurtz, 1945). Exchangeable potassium (Exch. K+), sodium (Exch. Na+), calcium (Exch. Ca2+) and magnesium (Exch. Mg2+) were extracted with 1 N ammonium acetate (pH 7.0) (Schollerger and Simmon, 1945). The concentrations of K+ and Na+ from these extracts were analyzed by flame photometry, while those of Ca2+ and Mg2+ were analyzed by atomic absorption spectrometry following a standard procedure.

Statistical Analysis

The data collected were analyzed statistically using analysis of variance (ANOVA) techniques. Treatment means were compared by the Least Significant Difference (LSD) method at the 5% level. All data analysis was done using Statistix 8.0 (Analytical Software, 2003).

RESULTS AND DISCUSSION

The results found that Activities of earthworms encourage the release of available plant nutrient, especially when associated with the utilization of organic matters. Applying 1% of biochar per 1 kg of dry soil, 650 kg of rice straw per Rai, and 1,000 kg of vermicompost per Rai can significantly increase organic carbon in soil in deteriorated paddy soil (EC= 0.08 – 0.13dS/m), slightly saline paddy soil level 1 (EC= 1.56 – 1.71 dS/m), and moderately saline paddy soil level 2 (EC= 2.90 – 3.47 dS/m). Moreover, the amount of total nitrogen, exchangeable sodium, exchangeable calcium, and exchangeable magnesium in soil also increased under all soil salinity level. The experiment under

control condition indicated that activities of earthworms associated with the utilization of biochar, rice straw, and compost produced by earthworm enhanced the availability of plant nutrients.

Table 4 The results of vermitechnology with different amendments on Rice production in moderately saline paddy soil level 2 (EC= 2.90 – 3.47 dS/m)

Treatments	Spikelet number	Yield)kg./Rai(	1000 grain weight)g)
Soil	5.33	314.56	22.50
soil add earthworm (EW)	6.67	460.41	23.90
soil add biochar (BC)	4.33	457.14	23.37
soil add BC and EW	6.67	480.00	23.57
soil add rice straw	5.00	400.54	23.07
soil add rice straw and EW	5.00	459.32	23.43
soil add vermicompost (VMC)	6.33	521.36	23.20
soil add VMC and EW	8.00	535.51	24.53
f-test	ns	ns	ns
CV %	37.63	18.41	3.44

Note: Values are mean ± standard deviation. Means with the same letter in the same column are not significantly different (P>0.05)

CONCLUSION

The above results showed the beneficial effects of earthworm and vermicompost application in increasing the rice growth and production. The results of soil analysis showed that application of vermicompost significantly increased soil organic carbon, CEC and soil N, P and K contents. Organic amendments can thus serve as a source of essential nutrients for plants as well as contributing to improved soil properties. In addition, these amendments increased exchangeable K+, Ca2+ and Mg2+ while decreasing exchangeable Na+ in the saline soil, thereby reducing soil salinity. These results suggest that the use of earthworm and vermicompost is likely to be helpful for both alleviating salinity and improving crop productivity in salt-affected areas. The addition of earthworms as soil conditioners can also contribute to improved physical, chemical and biological properties of the soil and thereby increase its nutritive value for plants.

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Research article

Dried Porang Industry in Lakewood, Zamboanga Del Sur, Philippines

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Abstract Porang is a kind of small scaly fish, as small as anchovies which thrive in brackish water. In a lake in Lake Wood, Zamboanga del Sur, a group of fishermen survived for many years because of Porang fishing and dried Porang industry. This study was conducted to determine the current status of the dried Porang industry in Lake Wood, Zamboanga del Sur, Philippines. This is a normative-descriptive study employing observation, interview, and questionnaire techniques. The 120 fisherfolks who were directly involved in the dried Porang industry were the respondents of the study. It was found out that there were problems and challenges which the respondents and the industry were facing at present. One of the problems met was the slowly decreased of Porang in the lake. The result also showed that their practices especially the hygienic practices were not in conformity with the code of practice for processing and handling of dried fish as reflected in the Philippine National Standards. It is recommended that a seminar about proper handling of dried fish be conducted so that the fisherfolks will be aware of it, thus leading to sustainable dried Porang industry. It is recommended further that these fisherfolks would also be educated on the proper way of catching this kind of fish to avoid their possible extinction in the lake.

Keywords dried, Porang fish, practices, conformity, Philippine standard

INTRODUCTION

Porang fish (*Rasbora* sp.) is one among the abundant fish species and the only endemic specie found in Lake Wood Zamboanga del Sur (Superales, Zaparalla, Zacala, & Narbasca, 2013). Just like any other fish species, Porang is high in protein and rich in omega-3 fatty acids which are also essential nutrients in the human body system.

For some reasons, the *Subanens* (the major ethnic group living in the suburban areas) in particular, have been using their own initiatives in preserving the Porang following no standard procedure in drying it. Besides, the *Subanens* do not care the aftertaste of their dried Porang nor even consider its packaging, resulting at a very low price when selling the dried Porang in the market.

Although, despite the Subanens have been preserving the Porang by drying, still there could be many methods of preserving fish in order to withstand longer such as, by salting, freezing, smoking, cooking, pickling, and drying. Noticeably, there has been no established standard procedure has been followed by the Subanens in drying the Porang, to the extent of its production practices and marketability. Hence, this investigation sought to shed light by employing descriptive survey design using interview and questionnaires in assessing the current status of the Dried Porang Industry in Lake Wood, Zamboanga del Sur and further finding out the production process is in conformity with the Philippine National Standard (PNS) Bureau of Food and Drugs (BFAD).

OBJECTIVES

This study was conducted to determine the current status of the dried Porang industry in Lake Wood, Zamboanga del Sur in terms of source of fresh Porang, volume of catch per season, Porang catching method used, number of years in Porang fishing, strengths and drawbacks of Porang fishing, common problems and challenges of Porang, fishing industry, marketability and shelf life.

METHODOLOGY

This is a normative-descriptive study employing observation, interview, and questionnaire techniques. The 120 fisherfolks who were directly involved in the dried Porang industry were the respondents of the study.

RESULTS AND DISCUSSION

Table 1 manifested the source of fresh Porang, volume of catch per season, Porang catching method, and number of years in Porang fishing. It shows that 46 or 40 percent of the fisherfolks got more fish in the creek while about 11 or 9.57 percent revealed that they got fish from the central section of the lake.

This implies that the fishermen in Lake Wood got Porang fish often in the creek (sapa). This is the area where most of the Porang thrive. However, some of the fisherman can also caught more in the lakeshore especially those fishermen who did not own a bukana which serves as an entrance of Porang to the creek. The creek serves as the breeding place of Porang. According to Simons (2017), a creek often shallows and flows into larger bodies of water such that of the lake that will provide habitat to non-living and living things.

Also shown in Table 1, is the volume of catch of Porang by the fishermen per season. It discloses that during rainy season 108 or 93.91 percent of fishermen caught 0-6 kilos, 4 or 3.48 percent caught 7-15 kilos and 1 or 87 percent each had 16-21 kilos and 22 kilos and above. Meanwhile, during dry season, 113 or 98.26% had 0-6 kilos catch and 3 or 1.74 percent had 7-15 kilos. The results implied that during dry season the fishermen of Lakewood got only a few catch of porang. According to the fishermen they can have 2 kilos or below or even nothing during dry season. Only few of Porang reached the creek or bukana in this period. Most of the fishermen made other alternative to support their families. Other find jobs out of town and others went on farming to provide their family's daily needs. For the fisherfolks, the family experienced crisis during this season.

The results implied that fisherfolks have greater catch of Porang in rainy season than in dry season. It has been observed by them that Porang were abundant because of the increased water flow on the creeks and water inlets. During this time, the water temperature declines and the Porang move to higher areas to spawn and breed. As cited in the study of Alkins-Koo (2000) and Ballesteros (2009), in the tropical water system, most fishes breed during the rainy season; however, a few breed during the dry season, (Pusey, 2002) (Torres-Mejia &Ramírez-Pinilla, 2008) or throughout the year (Alkins-Koo, 2000). Variation in reproductive seasonality has been associated with several factors, such as availability of nursery areas, availability of food for adults or juveniles and competition for breeding sites in the river system. The highest feeding activities of tropical fishes usually occur during the rainy seasons when the availability of prey is relatively higher (Ballesteros, 2009).

In the same table it is shown that the catching method used. Fish net (Pukot) got the highest as admitted "by 75 respondents (61.22%)". Net with bamboo on both ends got the lowest response as claimed "by 28 respondents (24.35%)". The results connote that the fishermen in Lake Wood used fish nets in catching the Porang. According to the fisher folks there were regulations made by the Local Government Unit (LGU) on the size of the hole of the net to be used in catching Porang. Because there is no strict implementation on the said policies, some of the fisherfolks used net with small holes than the prescribed net in catching the Porang which led to the capture of small specie. This is one of the reasons why the Porang is diminishing in the lake. There was depletion of catch per day. Net with bamboo of both ends were the usual fishing gear used by some fishermen especially those who were catching Porang on the lakeshore or in the creek.

Furthermore, Table 1 showed the number of years the Porang dryer-sellers go on fishing. 0-3 years posted the highest percentage as replied "by 46 respondents (40%)" while "by 12 (10.43%)" had been in Porang fishing from 7 to 9 years. The results indicated that most of the Porang fishermen have experienced on Porang fishing on a short period of time but it was also noted by the researcher that "by 38 respondents (33.04%)" had 10 years and above experience in Porang fishing which means that Porang fishing was already their source of livelihood since they started this job.

Table 1 Source, volume of catch, catching method and number of years in Porang fishing

Source of fresh Porang	Total		Percentage (%)		Rank
Entry point of the Lake	30		26.09		2
Creek	46		40.00		1
Central Section	11		9.57		4
Other Part of the Lake	28		24.35		3
Volume of catch per season	Rainy Season			Dry Season	
	F	%`	Rank	F	%`	Rank
0-6 kilos	108	93.91	1	113	98.26	1
7-15 kilos	4	3.48	2	3	1.74	2
16-21 kilos	1	.87	3.5	0		
22 kilos and above	1	.87	3.5	0		
Catching method	Frequency		Percentage		Rank	
Bamboo Trap	12		10.43		2	
Fish Net	75		61.22		1	
Net with bamboo on both ends	28		24.35		3	
Number of years in Porang fishing	Frequency		Percentage		Rank	
0-3	46		40.00		1	
4-6	19		16.52		3	
7-9	12		10.43		4	
10 and above	38		33.04		2	

Table 2 discloses the strengths and drawbacks of Porang Fishing. Among the identified strengths "help augment family income" was identified as the top strength "by 44 respondents (38.26%)". And "by 34 respondents (29.57%)" claimed it "sustained family's food consumption while "by 17 (14.78%)" said it "help promote the One Product One Municipality". The results implied that the Porang industry was of great helped to the Porang fishermen for this generate additional income at the same time it could also be used as a staple food for their consumption.

Porang fishing had also drawbacks as reflected in Table 2. More than half " by 71 respondents (61.74%)" testified that this is seasonal, " by 30 respondents (26.09%) said that the industry is depleting and slowly becoming extinct while 8 or 6.96 percent of the respondents claimed that younger generation slowly lost their interest in Porang fishing and 6 or 5.22 percent said this industry is a slow merchandising commodity.

Table 2 Strengths and drawbacks of Porang fishing

Strengths	Total	Percentage (%)	Rank
Help augment family income	44	38.26	1
Sustain family's food consumption	34	29.57	2
Help in the economic development of the community	20	17.39	3
Help promote One Product One Municipality	17	14.78	4
Drawbacks			
This industry is a slow merchandising commodity	6	5.22	4
This is a seasonal industry	71	61.74	1
Depleting and slowly becoming extinct	30	26.09	2
Younger generation is slowly losing interest	8	6.96	3

The findings connoted that the Porang in Lake Wood is sporadic, meaning that the abundancy of the species is not constant. To the fishermen their cached is not anymore as plentiful as before, nowadays only few Porang will be caught that sometimes they can experience "no catch" at all for three hours or more staying in the lake water watching for their fish net.

On the other hand, Table 3 reflected the problems and challenges of Porang industry. As shown, "by 87 respondents (75.65%)" claimed that diminishing Porang was the number one problem. It is followed by no control on the size of Porang catch as identified "by 11 respondents (9.57)". Meanwhile, no law or ordinances got the lowest rank as answered 7 or 6.09 percent of the respondents.

Table 3 Problems and challenges of Porang industry

Problems	Frequency	Percentage (%)	Rank
No control on the size of porang catch	11	9.57	2
Diminishing porang	87	75.65	1
No law/ordinance controlling the catch of porang	7	6.09	4
Teenagers no longer challenge on porang fishing	10	8.70	3
Challenges			
Look for another possible ways to catch porang	8	6.96	2.5
Organize fisherfolks and make common policies on porang fishing	92	80.00	1
Give more concern on the environment, the lake or fisherfolks	8	6.96	2.5
Better ways for porang fishing, drying and selling	7	6.09	4

The results indicated that the Porang in the lake of Lake Wood deteriorated. This is the common problem encountered by the fisher folks. According to the fishermen if only the local government of Lake Wood implemented fully the regulations in catching the Porang there is no reason the Porang, will not multiply and increased its number.

Table 3 also revealed the common challenges of Porang, as shown "to organize the fisher folks in Lake Wood to make a common policies on Porang fishing" was the highest challenges as identified "by 92 respondents (80%)". "Look for another possible ways to catch Porang" and "Give more concern on the environment" got a tie occupying the second challenges as claimed "by 8 respondents (6.96)". "Teenagers are not anymore challenged on Porang fishing instead they are much interested on the job offered outside the community or in Lakeview resort" ranked as the lowest challenges as identified "by 7 respondents (6-09%)".

The results revealed that the fisher folks wanted to be organized to come up with only one policy to be followed by the organization. An organization can be a social unit that is designed to accomplish the need of its members and have a common purpose. Just like the fisherfolks they wanted to be organized because according to them the Porang industry will not prosper if they are not structured as one organization.

Table 4 Marketability and shelf life of dried Porang

Marketability	Days					
	1	2	3	4	5	6
115 kilos produced	50	25	30	10		
50 kilos produced	25	20	28	10	10	7
50 kilos produced	10	8	7	7	5	3
Shelf life	Month					
Dried Porang	1		2	3	4	
1:1/2	√		√	√	√	
1:1/4	√		√	√		
1:1/8	√		√			

Table 4 reflected the marketability and shelf life of dried Porang. The researcher observed three groups of Porang dyers and sellers for one week to find out the marketability of their products. The

first group produced 115 kilos which were all sold out on the fourth day. The second group produced 100 kilos of dried Porang and were sold out on the sixth day. This is the same with the third group which produced 50 kilos, the products were all sold out on the sixth day also. This only indicated that the dried Porang is marketable.

According to the fishermen, they were not anymore consuming their dried Porang products most of the time because of its less supply that the price becomes higher. They sold it to the buyers or "barter" it in exchanged of other commodities.

For shelf life, the researcher bought 3 packs of dried Porang with different ratio of fish and salt. First pack is Porang with a ratio of 1 kilo of fish salted with ½ kilo of salt. The second pack 1 is to ¼ kilo of salt and the third has the ratio is 1 is to 1/8 kilo of salt. The researcher placed the product at room temperature packed in plastic. She made observations for four months. It was noticed that the 1:1/2 lasted for four months while the packed with lesser salt 1:1/8 lasted for only 2 months.

The results showed that the higher the amount of salt the more longer in its shelf life but it degraded its quality because it became very salty. Packaging materials could also help in prolonging the shelf life of dried Porang. With these observations, Porang can sustain its life longer only if preserved well with a good grade of salt and packaging materials.

Fig. 1 (Left) Dried Porang, (Right) Bukana or water inlet connecting the lake, where the Porang is usually catch

CONCLUSION

Based on the findings presented, the following conclusions were established by the researcher.The current status of Porang industry in Lake Wood, Zamboanga del Sur is depleting due to the destructive fishing gears used by some fisherfolks in catching Porang. Furthermore, the preservation and production practices of the fisherfolks did not met the standard process set by the Philippine National Standards (PNS) Bureau of Food and Drugs (BFAD).

RECOMMENDATIONS

Based on the findings, it is imperative that the LGU shall take part on the full and strict implementation of the ordinances made by the local executives of Lake Wood, Zamboanga del Sur. Furthermore, the Academe, particularly the JHCSC- Lake Wood campus, among its other functions, may coordinate with the LGU, BFAD, DA on monitoring and evaluating the status of the Porang industry. The fisher folks should organize a cooperative to handle the buying of Porang fish, processing, drying, packaging, and marketing. The Porang cooperative should engage into a fish cage culture.

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Research article

Application of Integrated Modeling System to Ecosystem Services Evaluation

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Abstract In recent years, many case studies have been conducted on ecosystem service (ES) evaluation in both developed and developing regions. A method to integrate the ES evaluation has hitherto been undeveloped and a few systems been proposed for the same. Based on our previous studies on estimations of the potential supply of ES in both rural and urban areas, a modeling system capable of performing an integrated evaluation of ES is automatically applied into our study. A geographical and ecological information database of the ecosystem in Japan was connected, and an interface of an estimation model of the ecosystem services was connected to an integrated system. A system with a visible interface and clearly defined concepts and concept relationships, is helpful not only to researchers who are unfamiliar with GIS and modeling, but also to stakeholders and decision makers.

Keywords environmental planning, ecosystem services (ES), Geographical Information System (GIS), meta-modeling, semantic modeling

INTRODUCTION

The concept of ecosystem services (ES) refers to a variety of services ranging from highly related ecological functions (supporting and regulating services, e.g., material cycles inside ecosystems) to highly related human society functions (provisioning and cultural services, e.g. food production, logging, and recreation space provision).

Recently, many quantitative and spatial case studies on ES have been conducted using the geographical information system (GIS, e.g., Verhagen et al., 2015). Large projects on the assessment framework of ES, such as InVEST (Jackson et al., 2016), Oppla (Verweij et al., 2015), TESSA (Peh et al., 2013), and the Artificial Intelligence for Ecosystem Services (ARIES project, 2016), are also being conducted.

Rapid emergence of overwhelming volumes of data in recent years, for example the increasing number of elevation, landuse, and species occurrence databases, make choosing a suitable dataset for our study difficult. Many portal sites and meta-database projects for efficient database location are now being developed, e.g., KNB (The Knowledge Network for Biocomplexity), and OBIS (Ocean Biogeographic Information System). Despite great efforts to digitize data location, many researchers still search for files using browsers and download them individually, unzip, and convert them to a suitable format (file type, encodings, geographical projection, etc.), manually.

The existence of diverse methods of ES assessment in terms of aims and scopes presents a serious barrier to the sharing of ES studies, especially to the integration of various ES evaluations. For example, various methods of quantifying ES have been proposed: lookup table, statistical models explained by environmental variables, and mechanistic models based on ecology and earth sciences (Verhagen et al., 2015). The lookup table is fairly straightforward and transparent. However, its accuracy and its application are limited by its high dependency on location and disregard for the temporal and spatial continuity of ecosystems. Mechanistic models can perform highly accurate and

detailed simulations; however, models developed by researchers or projects cannot be exchanged because highly specific ecosystem and ES concept terminologies are assigned.

Semantic modeling and semantic meta-modeling (Villa et al., 2014) are attractive methods in the big-data and divergence-model era. Based on machine-readable knowledge bases, such as unit systems, physical constants, formulae, and relationships between ES and landuse, a distributed database and model are automatically assembled to the requirements of a user.

OBJECTIVES

In this paper, the authors applied semantic modeling to our previous estimation method of urban ES (Ooba et al., 2015). A detailed description of the current situation of data-model rich ecology is given in the former section, where the needs of semantic modeling are discussed. In the next section, details of a trial application of the semantic modeling on urban ES assessment are given.

BACKGROUND OF SEMANTIC METHODOLOGY

Before the downsizing of digital electronic devices, measuring and observing field data such as geographical and ecological data was rather difficult in terms of accessing study areas, recording outside, and security. However, acquiring field data from various electric sensors, data loggers, wireless internet, remote sensing, global positioning system, etc. is much easier. Growing memory and bands of the networks governed by Moore's law results in relatively low-cost storage and transport of geographical and ecological data. Although the explosive availability of the data provides equal accessibility, new problems that have already been pointed out in the introduction section, still occur.

One of the solutions to this problem is the development of meta-databases. These systems need data annotations such as author names, data type, location and time of observation, and so on. For description method for the annotation, Dublin Core is commonly used and a related search engine for ecology has been developed, e.g., Morpho by the KNB project.

Statistical methods of computer modeling, including spatial analysis, have made marked progress with the growth of data availability. Free and commercial software for statistical modeling are well developed as they are not required to list software names. In addition, distributed data analysis frameworks are also available (e.g., Spark). It also mentions that the advancement of machine learning in this decade must be focused on.

It seems that the abundant data and models are not enough to address the concerns of policy makers and stakeholders regarding biodiversity, ecosystem, and ES. In addition to the diverse models of ES that are difficult to integrate, these models that assess and interpret ES do not meet the more practical needs of policy makers, stakeholders, and governmental and private planners (Urban and rural design, environmental planning, and ecosystem conservation).

Machine readable knowledge can solve this problem through machine reasoning (Villa, 2009; Villa et al., 2009, 2014). Ontology in computer science suggests an inference system based on sets of concepts and relationships among the concepts in a domain (e.g. disciplines of science or industrial sectors). For example, if a system holds an ontological engine and can access a knowledge base of the unit system, it appropriately converts from a unit (e.g., area, m2) to another unit (e.g., ha).

A system that operates databases and models using such ontological inference provides an integrated platform for the assessment of ES for specialists, as well as non-specialists, e.g., for aid in decision making regarding ecosystem conservation to keep ES from development. Non-specialists may not always understand the significance of the contribution of data and models to the success of a project, such as an environmental problem, in terms of accuracy and effectiveness as well as a specialist. However, the understanding of some concepts related to the environmental problem is simple enough that they can be shared by both non-specialists and specialists. Once an agreement on the ontology and the semantic modeling system to be used is established, discussions on the problem may benefit the data and models based on the system.

k.LAB software provides an integrated environment for the development of knowledge bases and data-model complexes, including automatic model selection (meta-modeling). This technology has been developed in conjunction with the ARIES project. Many studies have been conducted in the San Pedro River Basin, USA (Bagstad et al., 2016a), Puget Sound, Washington (Zank et al., 2016), the Southern Rocky Mountains (Bagstad et al., 2016b), and so on.

CASE STYDY

A fairly simple and transparent method was proposed for the spatial assessment of ES supply potential for a rapidly growing city in a developing country (Ooba et al., 2015, 2016; Kay et al., 2015). Integrated potential supply of ES can be estimated from a limited dataset (e.g. digital elevation map, DEM, and remote sensing image) and it can suggest the relative importance of green space inside a study area for the purpose of conserving ES supply. First, elevation and land cover map are obtained from remote sensing images or geographical maps. Indices related to each type of ES (supporting, regulating, provisioning, cultural, and habitat) are calculated using primary units or simple models related to a target type of land cover on a km-level grid. In the previous study (Ooba et al., 2014), these indices were collinear due to limited data-sources; one index that was not correlated to other indices was assigned to one type of ES category (Table 1). Finally, the ES indices are aggregated to an integrated index by ES weights estimated from results of internet surveys (Ooba et al., 2016).

Table 1 Methods used to estimate ecosystem services (see also Ooba et al., 2015)

Service category	Proxy variable	Basic units, method details*	Unit
Supporting	Carbon sequestration	3.09(W)	t/y ha
Provisioning	Food supply	2.98(A)	t/y ha
Regulating	Inverse of soil erosion coefficient	$S = 65.41\sin^2\theta + 4.56\sin\theta + 0.065$ C = 1 (R), 0.33(A), 0.0085(W)	-
Culture	Economic value of green space	Value per unit area as green belt area A(ha) $V = 3.0184A^{-0.437}$	10^6 JPY/y
Habitat	Continuity of green space	ArgGIS tool (Focal statistics) proximity as 2 km radius	-

** Land-use codes—R: Residential Area, A: Agricultural field, W: Vegetation mainly covered by wood plant*

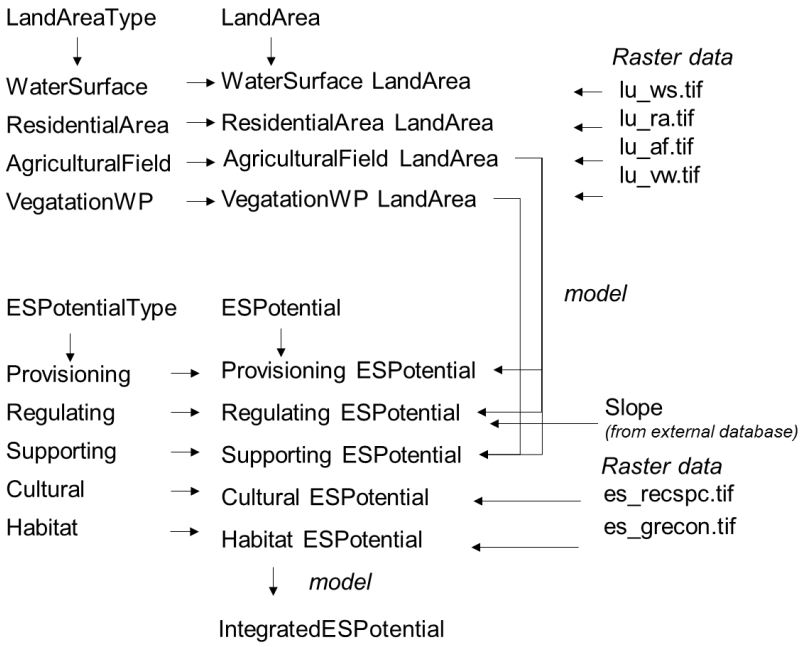

Fig. 1 Concepts and related attributes for the simple evaluation of ES supply potential

These manual operations by GIS were transplanted into a semantic modeling environment (k.LAB, ver. 0.9.8) based on ontology. Because there was no common knowledge base (ontology) that suited our purpose, we created a small, toy-level, ontology based on our method, for a trial assessment (Fig. 1). Two main concepts of land area and potential ES supply were asserted on a project in the system as "LandArea" and "ESPotential", and these concepts had their types described by the following attributes. "LandAreaType": WaterSurface, ResidentialArea, AgriculturalField, VegatationWP (Wood Plant); "ESPotentialType": Provisioning, Regulating, Supporting, Cultural, Habitat. In the next step, models that mention a multiple line statement are defined for file loading and calculating on the project. A study area is Nagoya City, Japan as the same as in the previous study, and then spatial context must be defined on the integrated system before model running.

In this study, due to somewhat complex spatial assessment calculation for Cultural and Habitat ESPotential, these raster files that had been prepared by GIS were loaded into the projects. DEM that an index of regulating services needs is obtained automatically from the standard knowledge base of k.LAB accessed to the default repository.

Results that is the same as the results of previous studies (Ooba el al., 2015). Relatively high potential supplies were exhibited in the area surrounding the city (agricultural fields and secondary forests).

The source code and data in this study will be open, and the k.LAB software can be used freely after a simple application in the integrated modeling project site (ARIES project, 2016).

CONCLUSION

Solving environmental problems requires collaborations between, not only biologists and ecologists, but also other scientists, engineers, environmental planners, and individuals from many other sectors. Vihervaara (2013) stressed the role of international and ecological monitoring networks, such as ILTER, for the assessment of biodiversity and ES, and the usefulness of the acquired data in the mitigation and adaptation of climate change. Integrated platforms for semantic modeling may enhance the potential of the data. Moreover, ES tools suitable for non-specialists under consensus on ecological concepts may provide new insight into regional planning from the perspectives of biodiversity and ES. Bagstad et al. (2014) mentioned that the semantic framework using hypothesis driven approaches or trusted process-based models is more confidential than statistical modeling from a reason of being able to validate of reasoning.

We have reported on the results of our toy program for the popups of popularization of semantic modeling in the Asia region; however, we can elaborated on more complex functions of the well-established k.LAB system. Many researchers have indicated more complicated usage of the system such as baysian model, watershed model, mechanistic model of ecosystem and so on, which have been researched in the ARIES project.

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Research article

Model of Chachoengsao Province Network of Growers of Quality Mangoes for Export

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Abstract The study on a successful farmer network is a mixed-method research that focuses on mango farmers in Chachoengsao province under a protocol of multistage sampling. Several factors influencing farmers to set up their own network are common interests, problems and needs that led them to establish a new production system based on Good Agricultural Practice (GAP) in order to fulfill their customer needs in terms of quantity and quality. The results of hypothesis testing regarding the farmers' opinions on GAP in the aspect of understanding, positive thinking and positive behavior before and after network setup revealed statistically significant difference. Farmers who owned different farm sizes had different opinions on GAP in terms of understanding and positive thinking before network setup, but not different after setup. Meanwhile, the positive behavior had no statistically significant difference before and after network setup. The network model should have an operating protocol to link inputs and outputs. Operation under suitable strategies can organize the farming system to fulfill customer needs by transferring appropriate changes directly to customers or target groups. The strategic map should start from giving knowledge, changing internal process management, fulfilling stakeholder expectation and end with fulfilling customer satisfactions under the support of government and private sectors.

Keywords network, model, mango, Chachoengsao province

INTRODUCTION

Solving agricultural problems in the form of integrated development for farmers to become sustainably self-reliant is a challenging and crucial task that requires time, serious contribution and continuity. Since the past, many governments have consistently implemented this kind of development. Recently, all sectors have been more involved in participating in the integration. The concepts and approaches for dealing with these problems have been developed in various ways. The concept of integrating farmer networks is yet another approach that has been used and considered to help strengthen the farmers as well as offer synergy. However, in integrating farmer networks, there is still the problem of absence of model and potential strategies for possible application of such prototype.

As for the nature of operation as a network, it requires coordination and connection between members in the groups and between small groups that are interlinked in the network. Moreover, it's very crucial to have relationship and correlation among groups as well as the connection of information and knowledge which contributes to learning process, exchange of knowledge , ideas, experiences and working process, in the form of integrations among groups, networks that will eventually result not only in increasing success of implementation but also more chances in eliminating weaknesses, and developing strengths and competency to effectively deal with external situations. In addition, constant participation in the collaboration will also help strengthen and ensure members and groups of the network and raise awareness in the management of lifestyles, environment and local resources which contribute to the empowerment and encouragement for the government to participate in the operation e.g., encouraging the establishment of community forums as well as group operation for self-reliant development (Thana, 2544).

Considering the agricultural sector, fruit is a significant product. As for the years 2013-2015, fruit is ranked the fifth out of ten agricultural plant commodities for export. The export of fruit is in the form of chilled, frozen and dried fruit products. (Office of Permanent Secretary Ministry of Commerce, 2015). Furthermore, the development of fruit products is recognized and prioritized by the government for agricultural development, and there are strategies formulated for the development of Thai fruit products. In Thailand's fruit development strategy for the years 2010-2014, mango is defined as one of the six major economic fruits that the Ministry of Agriculture and Cooperatives provides the policy for, focusing on the promotion of production, and marketing in the form of mango planting network with systematic, unified management to provide sustainable solutions, so as to stabilize the price, increase value for export and to gain sales revenue for farmers (Office of Agricultural Economics, 2010).

Thailand is regarded as a source of tasty mangoes with most desirable quality that meets the standard, for either domestic or foreign consumers, particularly, in Chachoengsao province where there are approximately 86,000 Rai of mango plantations, the country's largest mangoes plantation area. Mango fruit is, therefore, regarded as a major economic fruit of the province. Every district is capable of producing mangoes. Districts capable of mango planting for exports include Bang Khla, Ratchasan, Phanom Sarakham, Plaeng Yao, Sanam Chai Khet, Tha Takiap and Klong Khuean. Apart from domestic markets, these mangoes have also been distributed to international markets, which tend to keep increasing. Since the province is capable of producing mangoes of good tastes and good quality, there have been signed contracts for exporting mangoes between farmers and export companies made every year from 2001 until present. More importantly, the mangoes produced in this province are safe for consumers as they are certified garden products based on Good Agricultural Practice (GAP) by the Department of Agriculture. Mango varieties grown in the province include Barracuda (Nam Dok Mai), Nam Dok Mai Si Thong, Nang Klang Wan, Raed, and Khiaw Sawoei. Major varieties of mangoes for export of the province are Nam Dok Mai #4 and Nam Dok Mai Si Thong. The largest markets for A-grade mangoes are Japan, Europe and the United States, respectively. For the inferior quality mangoes, the markets for export are Malaysia, Indonesia and Singapore (Kenan Institute Asia et al, 2006).

In addition, growers of quality mangoes for export have integrated in the form of network, which, at present, consists of two main groups with 230 members in total, including Chachoengsao Mango Exporter Community Enterprises, and Chachoengsao Mango Cooperative. The integration of farmers in the form of network represents an approach that will help strengthen farmer's capacity. Thus, the studies about the prototype of mango growers networking in such areas will be a significant part in effectively solving the problems of integrated development for farmers to become sustainably self-reliant.

OBJECTIVE

The objectives of this research were 1) to understand farmer's network. 2) to study farmers' opinions on Good Agricultural Practice (GAP) in three aspects, namely understanding of GAPs content, positive thinking and positive behavior and 3) to propose the network model in the form of prototype model called Model of Chachoengsao Province Network of Growers of Quality Mangoes for Export.

MATERIALS AND METHODS

This study was an applied research that focused on Chachoengsao province network of growers of quality mangoes for export as a form of mixed-method research with both qualitative and quantitative research. Multistage sampling was used including 1) Purposive Sampling 2) Quota Sampling, with the criteria as follows: a) must be member of Chachoengsao Mango Exporter Community Enterprises or Chachoengsao Mango Cooperative b) only active operators were selected. In addition, accidental sampling technique was used for data collection and the criteria include willingness to participate and focus group interview with a sample of 36 members, accounting for 15% of the total members of 230.

The tools for data collection consisted of interviews, questionnaires, in-depth interviews and focus groups interview. Qualitative data was analyzed by descriptive and content analysis, while quantitative data employed statistical analysis software for social science research, including descriptive statistics, t-test and one-way anova (F-test).

RESULTS AND DISCUSSION

General Characteristics of Mango Growers

It was found that their average age was 56.83 years, and the mango plantation area was divided into 3 groups, including not exceeding 15 Rai (30.56%), 16-30 Rai (44.44%), and more than 30 Rai (25.00%). The average farm size was 22.89 Rai. Most of the farmers were members of Chachoengsao Mango Cooperative, which accounted for 61.11%, and the remaining farmers were members of Chachoengsao Mango Exporter Community Enterprises.

Mango Growers Network

It was found there were two main groups of growers of quality mangoes for export, including Chachoengsao Mango ExporterCommunity Enterprises, and Chachoengsao Mango Cooperative. Each group had their own operation and divided the works according to their skills. Several factors influencing the farmers to set up their own network were common interests, problems and needs that led them to establish a new production system based on Good Agricultural Practice (GAP). In addition, there were also links to other mango grower groups which were important groups of mango growers from around the country under the Thai Mango Growers Association whose goals are to jointly plan production and marketing, as well as perform quality control to meet the same standard for domestic sale and export throughout the year, and to establish reliability for consumers. The main exported markets were Japan and South Korea, etc.

Farmers' Opinions on Good Agricultural Practice (GAP)

The results of farmers' opinions on Good Agricultural Practice (GAP) in three aspects, namely understanding of GAPs content, positive thinking and positive behavior are as follows: (The items consisted 8 element: water resource, cultivation site, use of agricultural substance, product storage and on-site transportation, disease and pest-free production, management of quality production, harvesting and post-harvesting handing, data recording. The meaning of mean scores were: 1.00-1.49 = lowest level, 1.50-2.49 = low level, 2.50-3.49 = medium level, 3.50-4.49 = high level, 4.50-5.00 = highest level).

1. It was found that the farmers had the overall opinion on mango production according to Good Agricultural Practice (GAP) in three aspects, including; a) understanding, b) positive thinking and c) positive behavior at a low level before network setup, with average scores of 2.16, 2.20 and 2.02, respectively. After network setup, the opinion was at a high level with average scores of 3.90, 4.12 and 4.22, respectively.
2. The results of the study of farmers' opinions on mango production according to Good Agricultural Practice (GAP) in three aspects, including ; a) understanding, b) positive thinking, and c) positive behavior found that there was a difference before and after network setup at a statistical significance level of 0.01, where t = -32.46, -42.83 and -31.94, respectively, and df = 35
3. The results of the study involving the relationship of size of plantation area (farm area) farmer's opinions associated with Good Agricultural Practice (GAP), in 3 aspects: a) understanding, b)positive thinking and c) positive behavior before and after network setup (integration of working as network) revealed that;

1) Farmers with different plantation sizes had different opinions on compliance with Good Agricultural Practice (GAP) in terms of understanding and positive thinking before network setup at

a statistical significance level of 0.01. However, after network setup, their opinions were not different at a statistical significance level of 0.01 (Table 1).
2) The opinions of farmers with different plantation sizes on compliance with Good Agricultural Practice (GAP) in terms of positive behavior before and after network setup were not different at a statistical significance level of 0.01 (Table 1).

Table 1 Results of farmers' opinion on Good Agricultural Practice (GAP)

Subject	Source of variance	SS	df	MS	F	Sig.
Understanding before network setup	Between Group	1.34	2	0.67	9.10	0.001
	Within Group	2.44	33	0.07		
	Total	3.78	35			
Understanding after network setup	Between Group	0.06	2	0.03	1.48	0.242
	Within Group	0.61	33	0.02		
	Total	0.67	35			
positive thinking before network setup	Between Group	1.09	2	0.55	12.03	0.000
	Within Group	1.50	33	0.05		
	Total	2.59	35			
positive thinking after network setup	Between Group	0.10	2	0.05	1.63	0.211
	Within Group	1.05	33	0.03		
	Total	1.15	35			
positive behavior before network setup	Between Group	0.40	2	0.20	5.08	0.012
	Within Group	1.32	33	0.04		
	Total	1.72	35			
positive behavior after network setup	Between Group	0.02	2	0.01	0.08	0.922
	Within Group	3.14	33	0.10		
	Total	3.16	35			

These results suggest that the integration of working as a network results in the increased efficacy of operation among farmers which is consistent with the opinion of Attha Intaralak (Director- General of Department of Agriculture Extension at that time) saying that "The integration and networking of manufacturers provide farmers with rough knowledge about appropriate manufacturing technology in order to develop and enhance the production efficiency, particularly promoting farming group GAP certification standards, as well as the exchange of knowledge and technology among them, and the centralization of production and packaging. In addition, networking will also provide cooperation and cooperative solution"(BioThai Foundation, 2554).

The Propose Integrated Network Model in the Form of Prototype Model -Model of Chachoengsao Province Network of Growers of Quality Mangoes for Export

The results in this study revealed that possible practical model for the integration of fruit farmer networks must contain a structure consisting of subsystems in providing interaction between inputs and outputs of the agricultural systems management. Such model requires appropriate strategies to suit changes and development and it needs to be capable of transferring, distributing, making benefits and responding to the stakeholders and consumers or prospect clients. Such potential model must provide a strategic map initiated from learning / growth and it will eventually result in changing in the management of internal processes to meet the expectations of stakeholders. Finally, the model will lead to added value and provide satisfaction to consumers or target clients with the support of government and private sectors.

When applied, this model focuses on marketing and innovation (innovative marketing), in which development strategies are required based on the collaboration of such network as follows:
1. Synergies resulting from common problems and common needs.
2. Self-reliant development which includes relevant criteria in addition to what is stated in the first clause above, namely,
a) task allocation based on individual skills,

b) equal or fair sharing of mutual benefits.
3. The development of self-management organization focusing on
a) exchange and transfer of appropriate technology,
b) availability of public funds of the network.

Thus, this model is a strategic model which has passed the test of the experimental network group.

All components of this model focus on two main issues:
a) marketing that meets the expectations of customers in terms of satisfaction and enrichment (values adding),
b) innovation that focuses on appropriate innovation and technology.

This model contains IPO relevant systems which are inputs, process and results (output, outcomes and impacts). As for the outcome, it will be associated with the overall future scenario from the vision of network leader which will result in public funding of the network for buying production inputs at high prices.

The implementation in accordance with the strategic map will include:
1) giving knowledge and developing
2) changing of internal processes
3) increasing revenue for stakeholders,
4) responding to desirable requirements of target consumers.

CONCLUSION

Coordination among various groups of farmers in the form of network include holding seminars to exchange academic knowledge and experience in the production of mangoes so as to offer members a method of producing mangoes with the same standard across the country, and to build credibility and confidence among consumers in general. The network started from two main groups, namely Chachoengsao Mango Exporter Community Enterprises and Chachoengsao Mango Cooperative in order to connect and coordinate the operation among farmer groups. Currently, there are mango grower cooperatives and clubs from nine provinces joining as the core group, including those from Kanchanaburi, Nakhon Pathom, Nakhon Ratchasima, Suphan Buri, Chiang Mai, Chon Buri, Udon Thani, Khon Kaen, and Chachoengsao and many other groups from other provinces and from many communities that are interested in joining.

The results of this study indicated that the integration of operation as a network results in the increased efficacy of operation among farmers, allowing members to share agricultural knowledge and technology. In addition, a potential prototype or model of the integration as a network of fruit farmers to be implemented for practice must contain a structure consisting of subsystems that provide interaction between inputs and outputs of the management of agricultural systems. This prototype/model needs to have an appropriate strategy of management with a strategic map for the operation, and support from government and private sectors.

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Research article

Characteristics of Participants of Non-Formal Education Contributing to Learning Achievement: A Case Study of Snuol Commune, Kratie Province, Cambodia

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Abstract In this study, the main objective was to evaluate the number of days attended at Farmers' school and their academic ability. The research site was Snuol Commune, Kratié Province. First, the relationship between the characteristics of local farmers and the results of the achievement test was clarified. In addition, the educational effect of the Farmers' school was evaluated by multiple regression analysis. The results of the analysis are summarized as follows. 1) According to the results of the Multiple Correspondence Analysis, it was clear that the result of the achievement test was connected with characteristics of local farmers by educational background, gender, and whether or they attended Farmers' school. 2) According to the results from the Multiple Regression Analysis, after being confirmed statistically, Farmers' school attendance and educational background gave positive effects as a result of the achievement test. In addition, the results of the categorical regression analysis suggested the characteristic of the participant of the Farmers' school statistically. The participants of the Farmers' school already have the ability for reading and understanding basic Khmer. As for the educational content that the participant of the Farmers' school expected at the same time, it was suggested that it was knowledge, except the Khmers word acquisition, such as arithmetic or the environmental problem. In conclusion, creating an opportunity for the non-formal education is a necessary condition for knowledge acquisition concerning the appropriate usage and environmental problem of chemical fertilizers and pesticides in the local Cambodia area.

Keywords non-formal education, Farmers' school, Cambodia

INTRODUCTION

In Cambodia, a large amount of pesticides and chemical fertilizers have been used in order to increase the agricultural productivity. This situation has caused the destruction of the environment, such as a long-term deterioration of soil and water quality, and a decline of land productivity. The main cause of the excessive use of pesticides and chemical fertilizers this is because local farmers cannot understand appropriate use (Kazama and Honma, 2015). For this reason, learning their own language, Khmer, is necessary and important. Based on the above-mentioned backgrounds, the main objective of this study was to evaluate the number of days attended at Farmers' school and their academic ability. First, the relationship between the characteristics of local farmers and the results of the achievement test was clarified. In addition, the educational effect of the Farmers' school was evaluated by multiple regression analysis.

The research site was at the Snuol Commune in the Kratié Province. The Kratié Province is located in the northeastern part of Cambodia, where development is the slowest, and the comparable difference with other areas is large. In the Snuol Commune, the applications of agricultural chemicals, such as chemical fertilizers and pesticides, have rapidly been increasing in recent years. Although it contributed to increasing agricultural productivity, the amounts of applying agricultural chemicals caused environmental disruptions, such as soil and water quality degradation, and decreased land productivity in the long term. Until now, a local NGO distributed a document that disseminated correct information regarding chemical fertilizers and pesticides. However, one in about three people of the inhabitants of the Snuol Commune aged 25 to 60 cannot read and write, so the correct information has not been delivered. In addition, at this site, the Institute of Environmental Rehabilitation and Conservation (ERECON) carried out the project "study on sustained utilization of the natural resource" (3/2015-4/2016). In this project, the Khmer language, arithmetic, and an environmental class were conducted with support of ERECON once a week in each village for two hours.

The Kratié Province is located in the northeastern part of Cambodia, where development is the slowest and the comparable difference with other areas is large. In Snuol village, Snuol district, Kratié Province, 170,000 ha, equal to 65%, is used in the total area, 260,000 ha is forest, and 14,000 ha, equal to 5%, is used as agricultural land.

OBJECTIVES

In this study, the main objective was to evaluate the number of days attended at Farmers' school and their academic ability. First, the relationship between the characteristics of local farmers and the results of the achievement test was clarified. In addition, the educational effect of the Farmers' school was evaluated by multiple regression analysis.

METHODOLOGY

The index of a questionnaire carried out included gender and age of the respondent, educational background, and having participated in Farmers' school or not. In addition, for respondents who participated in Farmers school, attendance level, comprehension of the Khmer reading comprehension and writing ability was investigated.

The target area of the questionnaire survey consisted of the following seven villages: Kathdai, Krang, Kbal Snuol, Snuol Kert, Snuol Lech, Prek Kdey and Thpong. The survey period lasted from July to August 2015. The number of useful responses we received per area are as follows: Kathdai: 32 respondents (20.5% of the total respondents); Krang: 4 respondents (2.6%); Kbal Snuol: 18 respondents (11.5%); Snuol Kert: 41 respondents (26.3%); Snuol Lech: 20 respondents (12.8%); Prek Kdey: 26 respondents (16.7%); and Thpong: 15 respondents (9.6%). There were 156 respondents in total.

Based on survey data, Multiple Regression Analysis is applied, and the results of achievement test and the characteristics of the respondent are elucidated. Furthermore, Categorical Regression Analysis is referenced, and the attendance level in Farmers' school, and the characteristics of the respondent are clarified.

RESULTS AND DISCUSSION

Table 1 shows the differences in the means of achievement test scores for respondents. The contents of the achievement test are on a scale of one to fifteen by the Khmer language. The attributes of the respondents and the relations of the achievement test are as follows. Concerning the "Gender" of the respondents, 50% were "male" and 50% were "female." The average score of the actual test by the difference of "Gender" is as follows, "male": 11.86 (maximum of 15) and "female.": 10.41. Concerning the "Age" of the respondents, the majority of respondents were between the ages of "50-

59” years (25.0%), followed by “40-49” years (19.23%) and “More than 70” years (17.95%). The lowest percentage was aged “Less than 20 years” old. The average score of the actual test by the difference of “Age” is as follows: the ages of “50-59” years: 11.28; “40-49” years: 11.48; “More than 70” years: 10.55; and “Less than 20 years” old: 11.0. Concerning the “Educational background”, the majority of respondents had “Primary” (60.26%), followed by “Secondary” (18.59%) and “Never had been to school” (16.03%). The average score of the actual test by the difference of “Educational background” is as follows: “Primary”: 11.13; “Secondary”: 12.90; and “Never had been to school”: 8.52. The respondents of "Never had been to school" obviously had a low average on the achievement test.

Table 1 Demographic information of respondents

Index		Number of response (n)	(%)	Achievement test scoring average
Gender	1. Male	78	50.0	11.86
	2. Female	78	50.0	10.41
Age	1.Less than 20 years old	19	12.18	11.00
	2.20-29years	20	12.82	11.40
	3.30-39years	0	0.00	0.00
	4.40-49years	30	19.23	11.40
	5.50-59years	39	25.00	11.28
	6.60-69years	20	12.82	10.96
	7.More than 70 years old	28	17.95	10.55
Educational background	1. Never had been to school	25	16.03	8.52
	2. Primary	94	60.26	11.13
	3. Secondary	29	18.59	12.90
	4. High school	5	3.21	13.00
	5.College/University	2	1.28	15.00
	Total	156		
	Total average mark			11.13

source : Survey Date
Fs : Farmers School

Table 2 A question index and achievement test scoring average

Index		Number of response (n)	(%)	Achievement test scoring average
The presence or absence of attend in Fs	1. Yes	93	59.62	11.95
	2. No	63	40.38	9.94
Number of times of attend in Fs	1. 1-3 times	17	10.90	12.29
	2. 4-6 times	12	7.69	11.92
	3. 7-10 times	17	10.90	10.29
	4. Over 14 times	50	32.05	11.98
Reading comprehension	1. No	28	17.95	8.11
	2. Yes, little	82	52.56	11.32
	3. Yes, well	45	28.85	11.33
	non-response	1	0.64	13.00
Writing ability	1. No	30	19.23	8.10
	2. Yes, little	78	50.00	11.13
	3. Yes, well	48	30.77	13.00
	Total	156	100.00	
	Total average mark			11.13

source : Survey Date
Fs : Farmers School

Table 2 shows differences in the achievement test scores concerning the attendance of Farmers' school. Concerning attendance in Farmers' school, almost 60% were "Yes" and about 40% were "No". The average score of the achievement test by the difference of "attendance in Farmers' school" is as follows, "Yes": 11.95 and "No": 9.94.Concerning the number of times of attendance in the Farmers' school, "1-3 times" (10.90%),"4-6 times" (7.69%), "7-10 times" (10.90%) and "Over 14 times" (32.05%). The average score of the achievement test by the difference of the "Number of times of attendance in Farmers' school" is as follows: "1-3 times": 10.90; "4-6 times":7.69; "7-10 times": 10.29; and "Over 14 times": 11.98. Concerning "Reading comprehension", almost 20% were "No" , about 53% were "Somewhat" and about 40% were "Yes, well". The average score of the achievement test by the difference of "Reading comprehension" is as follows, "No": 8.11, "Yes, a little": 11.32 and "Yes, well": 11.33. Concerning "Writing ability", almost 20% were "No", about 50% were "Yes, a little" and about 30% were "Yes, well". The average score of the achievement test by the difference of "Writing ability" is as follows, "No": 8.10, "Yes, a little": 11.13 and "Yes, well": 13.00.

Characteristic of Respondents and the Results of the Achievement Test by Multiple Correspondence Analysis

Using attributes from Tables 1 and 2, this part clarifies the characteristics of respondents and the results of achievement test. In this analysis, Multiple Correspondence Analysis was employed.

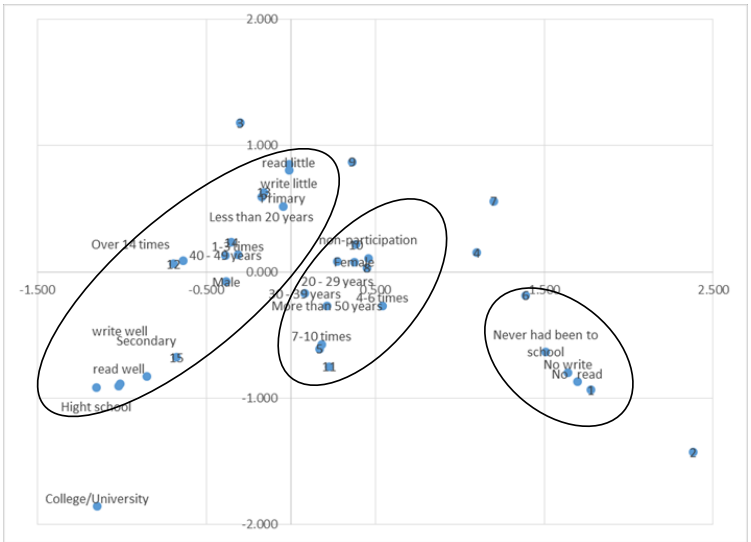

Fig.1 The result of Answer Pattern for using of the characteristics on participants and the achievement test score －Correspondence Analysis －

Figure 1 shows the results of the answer pattern for "participants of non-formal education", "non-participants of non-formal education" and "Never had been to school". In this analysis, Multiple Correspondence Analysis was employed. According to the results of the Multiple Correspondence Analysis, it was clear that the results of the achievement test were connected with characteristics of local farmers by "educational background", "gender", and "whether or not to attend Farmers' school".

Characteristic of Respondents and the Result of Achievement Test by Multiple Regression Analysis

The Multiple Regression Model is shown by Eq. (1), where Y is the achievement test score, X2 is the attendance in Farmers' school (dummy), X3 is the number of times of attendance in the Farmers'

school (1-3 times: 1; 4-6 times: 2; 7-10 times: 3; Over 14 times: 4), X4 is the educational background (Never had been to school: 1, primary: 2, secondary: 3, high school: 4, college/university: 5), X5 is the reading comprehension in Khmer (dummy), and X6 is the writing ability in Khmer (dummy). At the same time, β is the estimation parameter. The ordinary least squares (OLS) method was employed in the estimation of the regression model.

$$Y=\alpha+\beta x2+\beta x3+\cdots\cdots+\beta x6 \quad (1)$$

The estimation results of the multiple regression analysis are shown in Table 3. The statistically meaningful independent variables are as follows: X2 is the attendance in Farmers' school: 2.763 (3.083); X3 is the number of times of attendance in Farmers' school: -0.469 (-1.833); X4 is the highest achieved educational background: 1.211 (3.113); X5 is the reading comprehension in Khmer: 1.042 (0.745); X6 is the writing ability in Khmer: 1.773 (1.315), which shows a t value. From an estimated result, it was confirmed statistically that attendance of the Farmers' and the last educational background gave a positive effect to (Y) as a result of the achievement test.

Table 3 Estimation results of Multiple Regression Analysis

Dependent variable: Achievement test score	Y :				
			Estimated parameter B		
				t-value	p-value
Independent variable					
Constant			5.705	6.909	0.000 ***
The presence or absence of attend in Fs	x2	: Dummy	2.763	3.083	0.002 ***
Number of times of attend in Fs	x3	: 4	−0.469	−1.8336	0.069
Educational background	x4	: 5	1.121	3.113	0.002 ***
Reading comprehension	x5	: Dummy	1.042	0.745	0.458
Writing ability	x6	: Dummy	1.773	1.315	0.191
R Square				0.269	
Adjusted R Square				0.245	

*Note:***1% level of significance,**5% level of significance,*10% level of significance*
Source:Survey Data
Fs : Farmers' school

Characteristic of Respondents and the Number of Times of Attend in Farmers' School by Categorical Regression Analysis

The Categorical Regression Model is shown by Eq. (2), Where Y is the number of times of attendance in Farmers' school; X2 is the achievement test score (1-3 points: 1; 4-6 points: 2; 7-9 points: 3; 10-12 points: 4; 13-15 points: 5); X3 is the educational background (Never had been to school: 1; primary: 2; secondary: 3; high school: 4; college/university: 5); X4 is the reading comprehension in Khmer (dummy); and X5 is the writing ability in Khmer (dummy). At the same time, β is the estimation parameter.

$$Y=\beta x2+\beta x3+\cdots\cdots+\beta x5 \quad (2)$$

In Table 4, the estimation results of the Categorical regression analysis are shown. The statistically meaningful independent variables are as follows: X2 is the achievement test score: -0.070 (-0.707); X3 is the highest achieved educational background: 0.203 (1.829); X4 is the reading comprehension in Khmer: 0.692 (3.888); and X5 is the writing ability in Khmer: -0.518 (-2.960), which shows a t value. From estimated results, it was confirmed statistically after the reading comprehension in Khmer and the educational background gave a positive effect to (Y) as did the number of times of attendance in Farmers' school.

Table 4 Estimation results of Categorical Regression Analysis

Dependent variable: Number of times of attend in Farmers'school	Y :		Estimated parameter B	t-value	p-value
Independent variable					
Achievement test score	x2 :	5	-0.070	-0.707	0.481
Educational background	x3 :	4	0.203	1.829	0.040
Reading comprehension	x4 :	Dummy	0.692	3.888	0.000 ***
Writing ability	x5 :	Dummy	-0.518	-2.960	0.000 *
R Square				0.232	
Adjusted R Square				0.151	

*Note:***1% level of significance,**5% level of significance,*10% level of significance*
Source:Survey Data

According to the results of the Multiple Correspondence Analysis, it was clear that the result of the achievement test was connected with characteristics of local farmers by educational background, gender, and whether or they attended Farmers' school.

According to the results from the Multiple Regression Analysis, after being confirmed statistically, Farmers' school attendance and educational background gave positive effects as a result of the achievement test.

In addition, from the results of the categorical regression analysis, the characteristics of the participants in the Farmers' school were confirmed statistically, as follows. The participants of the Farmers' school already have the ability for reading and understanding basic Khmer. As for the educational content that the participant of the Farmers' school expected at the same time, it was suggested that it was knowledge, except the Khmers word acquisition, such as arithmetic or the environmental problem.

CONCLUSION

In this study, the main objective was to evaluate the number of days attended at Farmers' school and their academic ability. The research site was Snuol Commune, Kratié Province. First, the relationship between the characteristics of local farmers and the results of the achievement test was clarified. In addition, the educational effect of the Farmers' school was evaluated by multiple regression analysis. In conclusion, creating an opportunity for the non-formal education is a necessary condition for knowledge acquisition concerning the appropriate usage and environmental problem of chemical fertilizers and pesticides in the local Cambodia areas.

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Research article

Ready to Drink Milk as a Nutritional Tool for Human Capital Development of Thailand

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Abstract Ready to drink milk is one of the nutrient food for Thais as a way for human development in the long run. The research objectives were to 1) study the generality of ready to drink milk as a nutritional tool for human capital development of Thailand, 2) forecast the quantity of ready to drink milk for Thai consumers, and 3) find out the factors affected on consumers' demand quantity for Thais. The secondary data were collected as time series data gathering from Food Intelligence Center of Thailand from the year of 1987 to 2014, the Office of Agricultural Economics Office, Ministry of Agriculture and Co-operatives, Department of Internal Commerce, Ministry of Commerce, Bank of Thailand. Data analysis was applied descriptive statistics which comprised of arithmetic mean, standard deviation, linear forecasting, and growth rate while inferential statistics composed of multiple linear regression analysis in the form of double natural logarithm, T-test, F-test, the Coefficient of Determination (R2) and Durbin-Watson (DW). The research results revealed that 1) ready to drink milk as a nutritional tool as human capital development of all Thai. There obviously trended to get the high potential nutritional consume for Thai as a nutrient food for people of Thailand with the increasingly demand. 2) For ready to drink milk forecasting, quantity demand for ready to drink milk of Thai consumers has been significantly increased as a high nutrient quality drink of essential protein and calcium for Thais. 3) factors affected on ready to drink milk were comprised of its retail prices, quantity of consumer, income per capita as well as the advertising expenditure of ready to drink milk venders. Due to the research results, Thai government should strongly promote ready to drink milk as a tool for human capital to develop both physical and dietary for Thai as a tool for human capital sustainable development.

Keywords ready to drink milk, nutritional tool, human capital development

INTRODUCTION

ASIA is no doubt flexing its muscles as a global milk producer. Recent statistics from the United Nation's Food and Agricultural Organization of the United Nations (FAO) show that the region currently supplies 37 percent of milk worldwide. Thailand is well positioned in all this as its dairy market is valued at $850 million, with UHT milk and culture yoghurt as main drivers. Although there is a growing demand for cheese mostly from urban dwellers, cheese products continue to take a small bite into Thailand's dairy market. Working against it is the local consumers' lack of familiarity of cheese variety and benefits. In fact, most Thais tend to associate the product as a source of fat and a cause of obesity (www.industrysourcing.com).

In Thailand, the long-running School Milk Programme subsidised by the Royal Thai Government is also fueling milk consumption amongst the young. The project daily provides 200-ml milk carton to more than eight million students below the age of 12 years. Estimated cost to finance the project this year stands at $432.6 million, with some 80 dairy companies and cooperatives being roped in to process 1,252 tonnes of raw milk daily. FAO estimates the project to account for more than 30 percent of the total liquid food market (www.industrysourcing.com).

According to FAO data, a precursor to the national School Milk programme was introduced in the mid-1980s to provide an outlet for locally produced milk. By doing so, it hoped to introduce milk nutrition into the diets of young people especially those outside of the urban and semi-urban region. A more long-term goal was for the programme to develop in students a lifelong taste for milk. And acquiring the taste for milk they did. Statistic show that from a low 2-litre milk per capita milk consumption in 1984, the rate has risen to as high of 23 litres by 2002. The dairy market has likewise increased from a 290-million-litres-a-year business in the early 1990s to a 1,146-million litres market by 2003. The ascent continues. Whilst milk production within Thailand has grown 30-fold in close to three decades and average dairy consumption in the Thai diet has more than quadrupled for the same period, experts say demand still exceeds local production (www.industrysourcing.com).

Almost 30 years, the Royal Thai Government launched the national school milk programme as a nutritional tool for human capital development of Thailand. More than 90 percent of consumers in this programme consume ready to drink milk as a nutritional food for diet in order to develop both physical and healthy human capital. Ready to drink milk in Thailand comprised of 3 main different types which are pasteurized milk, sterilized milk, and ultra-high temperature milk or ultra-heat treated milk (UHT) (www.ku.ac.th).

In this research paper, the researcher tried to study and examine the situation of ready to drink milk consumption through the national school milk programme as the Royal Thai government provides students as a nutritional tool for human capital development. Also, the research tried to forecast the quantity of ready to drink milk for Thai consumers as well as find out the factors affected on consumers' demand quantity for Thais.

OBJECTIVE

The research objectives are to:
1) study the generality of ready to drink milk as a nutritional tool for human capital development of Thailand,
2) forecast the quantity of ready to drink milk for Thai consumers, and
3) find out the factors affected on consumers' demand quantity for Thais.

METHODOLOGY

Data collection: The secondary data were collected from Food Intelligence Center of Thailand from the year of 1987 to 2014, the Office of Agricultural Economics Office (AEO), Ministry of Agriculture and Co-operatives, Department of Internal Commerce, Ministry of Commerce, Bank of Thailand.

Data analysis: Data analysis was applied descriptive statistics which comprised of arithmetic mean, standard deviation, linear forecasting, and growth rate while inferential statistics composed of multiple linear regression analysis in the form of double natural logarithm, T-test, F-test, the Coefficient of Determination (R2) and Durbin-Watson (DW).

RESULTS AND DIACUSSION

The research results are expressed corresponding to the 3-research objectives as below.

1) The Generality of Ready to Drink Milk as a Nutritional Tool for Human Capital Development of Thailand

The Royal Thai Government implemented the national school milk as a nutritional tool for human capital development of Thailand especially for children. The establishment of the National Milk Drinking Campaign Board (NMDCB) by the Cabinet decision in 1985 stems from the farmers protests of 1984 on unsold milk. A pilot programme was implemented in selected areas of Bangkok and Chiang Mai for parents to purchase milk at 25 percent less the normal priced milk through monthly coupons for their children in Primary and Kindergarten schools. This programme was the origin of the national School Milk Programme of Thailand. Over the years, the programme was later expanded and today all school children in public schools are provided with 200 ml of free milk.

Today, the operation of the Thai school milk is carried out by the Ministry of Agriculture, Livestock Bureau. As per the cabinet consensus in 2003, ready to drink milk, only plain milk in both UHT and pasteurised format are provided. The success of school milk in Thailand stems is not just measured in terms of nutritional benefits, in previous International FAO sponsored school milk conferences. (School milk conferences, www.fao.org/economic/est/est-commodities/dairy/school-milk/school-milk-conferences.) The economic benefits and the support in national development is less known. Without school milk to provide a stable platform by which to support the growth of the Thai dairy industry, the Thai dairy will definitely not have experience such growth.

2) Forecast the Quantity of Ready to Drink Milk for Thai Consumers

The quantity forecasting of ready to drink milk consumption of Thailand is expressed in Fig. 1 and Table 1 as follows.

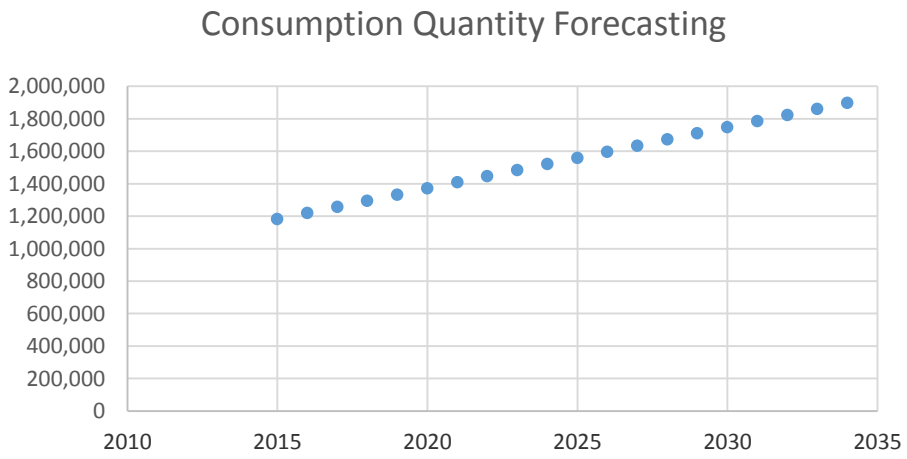

Fig. 1 The quantity forecasting of ready to drink milk consumption of Thailand

Source: Calculated from the data base of the Office of Agricultural Economics, Ministry of Agriculture and Co-operatives, The Royal Thai Government

According to the research results, from the year of 2015 to 2034, the Quantity Forecasting of Ready to Drink Milk Consumption of Thailand would be increased over time with the average 1,540,402 tons a year, standard deviation of 223,007 tons a year, and growth rate of 2.46 percent a year.

Table 1 The quantity forecasting of ready to drink milk consumption of Thailand

Year	The quantity forecasting of ready to drink milk consumption of Thailand)Unit : Tons(	Growth rate (%)
2015	1,182,299	
2016	1,219,994	3.09
2017	1,257,689	3.00
2018	1,295,384	2.91
2019	1,333,079	2.83
2020	1,370,774	2.75
2021	1,408,469	2.68
2022	1,446,165	2.61
2023	1,483,860	2.54
2024	1,521,555	2.48
2025	1,559,250	2.42
2026	1,596,640	2.36
2027	1,634,640	2.31
2028	1,672,335	2.25
2029	1,710,725	2.20
2030	1,747,725	2.16
2031	1,785,421	2.11
2032	1,823,116	2.07
2033	1,860,811	2.03
2034	1,898,506	1.99
Average	1,540,402	2.46
Standard Deviation	223,007	

Source: Calculation from the Data Base of the Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, the Royal Thai Government, 2016.

3) Factors Affected on Consumers' Demand Quantity for Thais

According to the research results, the factors affected on ready to drink consumption in Thailand were expressed as follows.

$$LnQt = -7.88 - 0.084 \ln (Price)\, t + 1.015 \ln (GDPH)\, t + 0.207 \ln (Pop)\, t + 0.486 \ln (Advt)\, t + e$$

(-2.406)** (-14.42)** (35.71)** (42.14)** (36.62)**

$R^2 = 0.97$, $F = 328.91$***, D.W = 1.86

Where (Price) t: Ready to drink milk retail price, (GDPH) t: Income per capita, (Pop) t: Number of population, (Advt) t: Advertising expenditure, e: error term, **: Statistical significance at 99 percent.

Factors affected on ready to drink milk were its retail price, income per capita, number of population and advertising expenditure. The increasing in retail price by 1 percent led to the decreasing in ready to drink milk by 0.084 percent while the increasing in income per capita, number of population and advertising expenditure by 1 percent led to the increasing in ready to drink milk by 1.015, 0.207 and 0.486 percent respectively.

CONCLUSION

Ready to drink milk as a nutritional tool for human capital development of Thailand through the national school milk programme launched by The Royal Thai government to develop human capital by promotion the ready to drink milk consumption for Thai young students in schools throughout Thailand. The successfulness of this programe brought to Thai young students develop both physical and healthy human capital.(www.fao.org/school milk programme in Thailand) From 2015 to 2034, the quantity forecasting of ready to drink milk in Thailand has been increased significantly. Due to the research results, factor that has biggest influenced on quantity demand of ready to drink milk in Thailand was advertising expenditure because Thai ready to drink milk market structure has been

and still be the oligopoly. The national school milk of the Royal Thai government applied ready to drink milk as a nutritional tool for human capital development of Thailand especially Thai young students all over Thailand. In terms of nutrition, ready to drink milk is one of the diets which rich of protein, calcium, and other necessary nutrients for young students as a tool for human capital development.

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International Society of Environmental and Rural Development

Philosophy of ISERD:

Recently, in developing countries, subsistence agriculture is being converted to export-oriented mono-culture, and the amounts of agricultural chemicals applied to the farmland are increasing every year. The applied chemicals in farmland cause serious environmental problems downstream such as eutrophication, unusual growth of aquatic plants, decrease in dissolved oxygen and accumulation of bottom mud in water resources. Also, there seem to be many cases in which people apply agricultural chemicals without understanding its impact to health and food safety. Therefore, it is necessary to promote and enhance understanding of sustainable rural development among local stakeholders including farmers.

Sustainable rural development aims to meet human needs while preserving the natural environment. As it should cover not only social and economic development but also natural environment conservation, no single organization can achieve sufficiently the aspirations of sustainable rural development. Collaboration among international, governmental and non-governmental organizations, together with the academe and scientific sector, is indispensable.

The knowledge and intelligence accumulated in universities and research institutions are also expected to make the programs facilitated by the international, governmental and non-governmental organizations more adequately implemented and meaningful to societal development. However, these cases especially those implemented locally have been scattered without having been summarized well or recorded in annals academic or scientific societies.

So, the International Society of Environmental and Rural Development founded in 2010, aims to discuss and develop suitable and effective processes or strategies on sustainable rural development focusing on agricultural and environmental aspects in developing countries. The ultimate goals of the society are to contribute to sustainable rural development through social and economic development in harmony with the natural environment, and to support the potential or capacity building of local institutions and stakeholders in the rural area with academic background.

Purposes of ISERD:

The primary purposes of ISERD are to contribute to sustainable rural development through social and economic development in harmony with the natural environment and to support the potential or capacity building of local institutions and stakeholders in the rural area with academic background.

In order to enhance the realization of the primary purposes of ISERD, the secondary purposes are;

- to facilitate interaction among international, governmental, non-governmental organizations and local communities,
- to hold conferences or symposia on environmental and rural development,
- to publish the International Journal of Environmental and Rural Development, and
- to encourage and develop local awareness concerning sustainable rural development.

Membership:

There shall be two categories of membership.

(a) Individual

(b) Organizational

An application for membership of ISERD shall be submitted to the secretariat of ISERD, where is located in the Research Center at Institute of Environmental Rehabilitation and Conservation (Japan) by writing or by other appropriate means.

Also every presenter who attends the International Conference on Environmental and Rural Development (ICERD) is registered as an Individual Member of ISERD.

Council of ISERD:

The affairs of ISERD shall be governed and managed by the ISERD Council. The councilors are as follows.

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