Factors Affecting the Market Mix of Hydroponics Vegetables, Seaweed, and Mushroom

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Abstract

The study was aimed to determine the factors affecting market mix of vegetables grown by hydroponics, seaweed, and mushroom, which would lead to market development of the processing products under Bangkhla Natural Innovative project of Rajabhat Rajanagarindra University. Two hundred participants were picked from tourists who visited Chachoengsao province and ordinary consumers who lived in Chachoengsao province, Thailand. The participants were selected by using systematic sampling method, and the data was analyzed by the multiple regressions. This study revealed that the size of family and their income were factors that affected market-mix products of hydroponics vegetable, seaweed, and mushroom, which were statistically significant at the level of 0.05. Other factors affecting the market-mix products of those given vegetables were the products, price, place, and the promotion. The sequences of favorite processing products of hydroponic vegetables were in the form of salad, salt preserved products, and dried products, respectively. The favorite processing products for main courses were in the form of fresh seaweed noodle, dry noodle, and seaweed mix chili paste, while the processing products for snack were in the form of seasoning seaweed crispy chip, seaweed sheet, and seaweed mixed bread. The favorite processing products of market-mix of mushroom for the main course were those that prepared in the form of canned mushrooms, mushroom sheet, and mushroom ball, respectively. Moreover, the favorite processing products of mushroom for snacks were mushroom crispy cake, mushroom bread sheets and jelly mushroom, respectively.

Keywords: Hydroponics vegetables, seaweed, and mushroom

1. Introduction

Crops are sources of foods for livestock and mankind that providing necessary nutrition for human body in which other kinds of food could not provide or not enough for livestock and mankind. There are some crops that can be used as sources of protein and fat, where some groups of people having them in substitution for animal meats. The price of crops is also cheaper than meats but the compositions of crops are highly in nutrition. Crops are important sources of energy and nutrition for human body such as fiber, vitamin, carbohydrate and protein. Vegetables help the digestive system to reduce the acidic condition in human body due to the consumption of meats products. The fibers in vegetables help to normalize the excretory system by reducing the intestinal pain and chances of colorectal cancer. It also helps reducing Cholesterol, controlling weight, and preventing the appendicitis. There are several crops, which are quite popular among Thai people, i.e., cabbage, lettuce, morning glory and kale as vegetables. These crops are internationally well known vegetables. Other crops such as weed, mushroom, tomato, all kinds of bean, and melons are also very popular in foreign countries.

Vegetables are necessary for human body in everyday life because of the nutrition that support the health and strengthen the body structures. It enhances an effectiveness of excretory system because of the enrichment in vitamin and minerals. However, the newly processing technology nowadays is used to reduce manpower and processing time, resulting in intensive use of agricultural chemical, while the crops are vulnerable to diseases and insects where the chemical is inevitably being used. Many crop growers are less knowledgeable concern of how to increase the production, processing, and marketing of crops. Some are selling vegetable that used toxic chemical together with safe vegetables resulting in misunderstanding of consumers between bio-based products and chemical-based products.

Food safety issues concern safe vegetable products become the prominent national agenda. To standardize the production and processing of safe foods, and enable consumers of both Thai and foreign countries gain accesses to safe foods, all processing should be done in order to produce foods free of chemical toxic residues or not exceed the standards of the Ministry of Public Health from farms to tables. Thai Fund for Health Promotion has supported food safety issue since 2004 in helping the nation to create awareness among consumers in health conscious regarding the food safety, fresh, and clean vegetable products. Some groups of consumer are interested in safe vegetables products. The safe vegetables mean that the production and processing are fully concerned about safety products free from chemical toxic residues or food safety, and if there are any residues remained, it should not exceed the standard level of CODEX (Codex Alimentarius) defines by FAO (Food Agricultural Organization) and WTO (World Trade Organization). In Thailand, Department of Agricultural Extension under Department of Agriculture and Health Ministry defines the standards.

The current trend of market for fresh vegetables products has changed dramatically. The increase in variety of products can be observed such as local cash crops both from tropical and temperate zones, which include the imported ones. A wide variety of cash crops are available all year round for consumers to select it. Apart from varieties, the productions of these cash crops are performed in many ways, i.e., soil-based growing with natural fertilizer, chemical-fertilizer, and growing plants in sand, gravel, or liquid, with added nutrients but without soil or hydroponics. There are several changes in quality control of production and distribution, too.

These efforts are bring up concerns of the “Safety” for both producers and consumers, and also creating the differentiation of products and value added, creating the competitiveness in local and abroad markets. In terms of healthcare for the consumers, they have more choices to select for their own safety. This reflect the care that the government provides for local consumers and also prepare for exploring international markets by strengthening the standard of agricultural products and foods to meet the international standards for the fairness in international trade.

The target population of consumers for safe foods in Thailand is around 8-10 million people, which is quite a large number who interested in consuming safe foods. There are many foreign tourists occasionally traveling in Thailand who are preferred to consume safe foods. The industry of safe agricultural foods in Thailand is expanding. The price is higher than ordinary foods for 20-30 percent. Due to the awareness of food safety and health consciousness in the foreign markets, it leads consumers paying attention to safe foods and non-chemical agricultural products. The world market value is approximately 14,000 million dollars or approximately 560,000 baht, the growth rate is approximately at 25% annually.

The developmental approach of Rajanagarindra Rajabhat University at Bangkhla campus, which approved by the University Council, has focused on sustainable development of Rajanagarindra Rajabhat University by improving process and procedures in proactive ways in accordance with its missions that emphasize on providing services, organizing activity by community empowering to develop Bangkhla communities. The working committee of Rajanagarindra Rajabhat University at Bangkhla campus has created a project of Natural Innovative with the plan to produce three kinds of crops, i.e., hydroponics vegetables, edible seaweed, and mushroom.

To follow the aforementioned policy, the researcher carried out this research. The Approach was emphasized on market development of safe vegetables products, i.e., hydroponics vegetables, edible seaweed, and mushroom. The study was aimed to search for appropriate approach for the product development of three crops as mentioned, to satisfy the consumers and tourist in order to establish the Service Link Center leading to the commercial development of products. In addition, the knowledge from the research would be beneficial for the growers and general public, too.

2. Literature Review

Wier et al. (2003) showed that the behavior and attitudes of the organic-fertilizer fruits consumers had concluded that health hazards were the main motivation for purchasing of organic-fertilizer fruits and pesticide free fruits. Consumers that are confidence in vegetable consumption are dwindling as many consumers become aware of the unhealthy practices employed for the production of conventional growing of vegetables and the health risks associated with the consumption of their products. Studies conducted in Ghana (Oboubi et al., 2006) found that vegetables produced in and around suburban centers had residues such as chemical deposits and fecal coliform bacteria. This study was conducted as part of a collaborative initiative among four West African countries, i.e., Ghana, Benin, Burkina Faso, and Senegal. It was aimed at ascertaining farmers' and consumers' awareness and perceptions on production andconsumption of organic vegetables. It was also aimed at coaching them on how to produce or obtain and consume safe vegetables. Much attention was paid to the use of chemical pesticides in vegetable production and the presence of chemical residues on vegetables and vegetable products. It also set up to provide data for the production of safe

vegetables in West Africa. In doing this, the study assessed the general knowledge and perceptions of consumers about safe vegetables and determined the market potential for their production in Ghana. This paper provides information on consumers' perceptions, purchasing behavior and willingness to pay for safe vegetables in the cities of Kumasi and Cape Coast in Ghana (Aceampong P. P. et al, 2012)

There are many advantages of hydropotonic vegetables. They can be grown throughout the year. They can grow rapidly both in a limited area and the poor soil. Moreover, the quality of the product is also high (Carson W. H., 2013).

Spirulina (Dillon et al, 1995) is a microscopic and filamentous Cyanobacterium that derives its name from the spiral or helical nature of its filaments. It has a long history of use as food and it has been used during the Aztec civilization. *Spirulina* refers to the dried biomass of *Arthrospira platensis*, which is an oxygenic photosynthetic bacterium found worldwide both in fresh and marine waters. This alga represents an important staple diet in man and has been used as a source of protein and vitamin supplement in man without any side effects. Apart from the high content of protein (up to 70%), it also contains vitamins, especially B_{12} and provitamin A (β-carotenes), and minerals, especially iron. It is also rich in phenolic acids, tocopherols and γ-linolenic acid. *Spirulina* lacks cellulose cell walls and therefore it can be easily digested

An international detective hunt has been underway for 40 years. Researchers in Japan, China, India, Europe, USA and other countries are discovering how and why this alga is effective for human and animal health. Hundreds of published and reviewed scientific studies have focused on how *Spirulina* become to be a source of food, its phyto-nutrients and extracts boost the immune system and improve health. A more complete scientific bibliography and reference guide is available in the book "*Spirulina*, whole Food" and at the website "Spirulina Source.com". The following summary briefly touches on some important areas of research and findings that *Spirulina* stimulates the immune system, increases anti-viral activity, offers anti-aging and neuro-protective benefits, reduces risk of cancer, reduces kidney toxicity, builds health lactobacillus, overcomes mal-absorption and malnutrition, improves wound healing, and reduces radiation sickness (Henrikson, 2011).

Once the mushrooms are taken into consideration, there are too small proteins in mushroom. The proteins are used in the body of humans and animals, while the dried mushrooms still conserve the proteins. In order to get full proteins, we must eat two kinds of mushrooms for a day in order to have the essential amino acids, vitamin E, vitamin C, B complex and Riboflavin (Christopher H,1995).

One aspect of interest is the consumer behavior, which is concern with the individual, group or organization. It is about the process for selecting, having more confidence, using and eliminating the products, serving the experience or ideas in order to meet the needs and preferences, and the effect of those processes on the consumer and society. The most prevalent model from this perspective is 'Utility Theory', which proposes that consumers make choices based on the expected outcomes of their decisions. Consumers are viewed as rational decision makers who are only concerned with self-interest (Kotler, 2000, Schiffman and Kanuk, 2009).

The results of the two surveys, both in China and in America, were quite similar about awareness of green products, which were better for the environment. Furthermore, the North

America has slightly higher scores, where about 80% of US consumers will buy green products if the product is available to them and at a similar cost. In China, that figure is 75% of consumers (Cross et al, 2013).

Terms in used

Hydroponics vegetables are vegetables that grow up not on soil but using liquid compound that full of nutrition. The compound flows through the roots of the vegetable constantly enable the vegetable to obtain oxygen enough to stimulate the growth.

Edible seaweed means algae *Spirulina* and its related products.

Mushrooms are fresh mushrooms and its related products, which manufactured under the BangKhla Natural Innovation project.

The demand is defined as objects that consumer requires in order to response to their consumption need. In this research, the focus is the demand regarding products, price, distributed channels and market promotion.

Consumers' behavior defined as the process of decision to buy and consume the products. The study will determine who are the target market, type of product purchased, why, where, and how.

3. Research Method

3.1Research Methodology

In this study, the researcher was focused on the study of the consumer's behavior of hydroponics vegetables, edible seaweed and mushroom among the tourists and general consumers in Chachoengsao province, and to recommend the approach for market development of hydroponics vegetables, edible seaweed and mushroom in response to the demand and to satisfy the tourists and general consumers by using market mix in Chachoengsao province.

The population and sample: The populations were consisted of 200 tourists and 200 consumers in Chachoengsao province. The systematic sampling method was used to select the samples. The research instrument was the questionnaire, which developed by the researcher. It consisted of three sections. Part one was the enquiry regarding the social environment such as size of the family and personal variables, such as gender, age, income, education and occupation. Part two was the enquiry regarding the market mix of the demand for hydroponics vegetables, edible seaweed and mushroom as type required products. Part three was the enquiry regarding the behaviors of hydroponics vegetables, edible seaweed and mushroom using five levels of rating scale, which the data were analyzed by the ANOVA and multiple regression.

3.2 Conceptual approach of the research

This research was aimed to study the approach for the market development of safe vegetables products, i.e., hydroponics vegetables, edible seaweed and mushroom. The conceptual approach is summarized in Figure 1

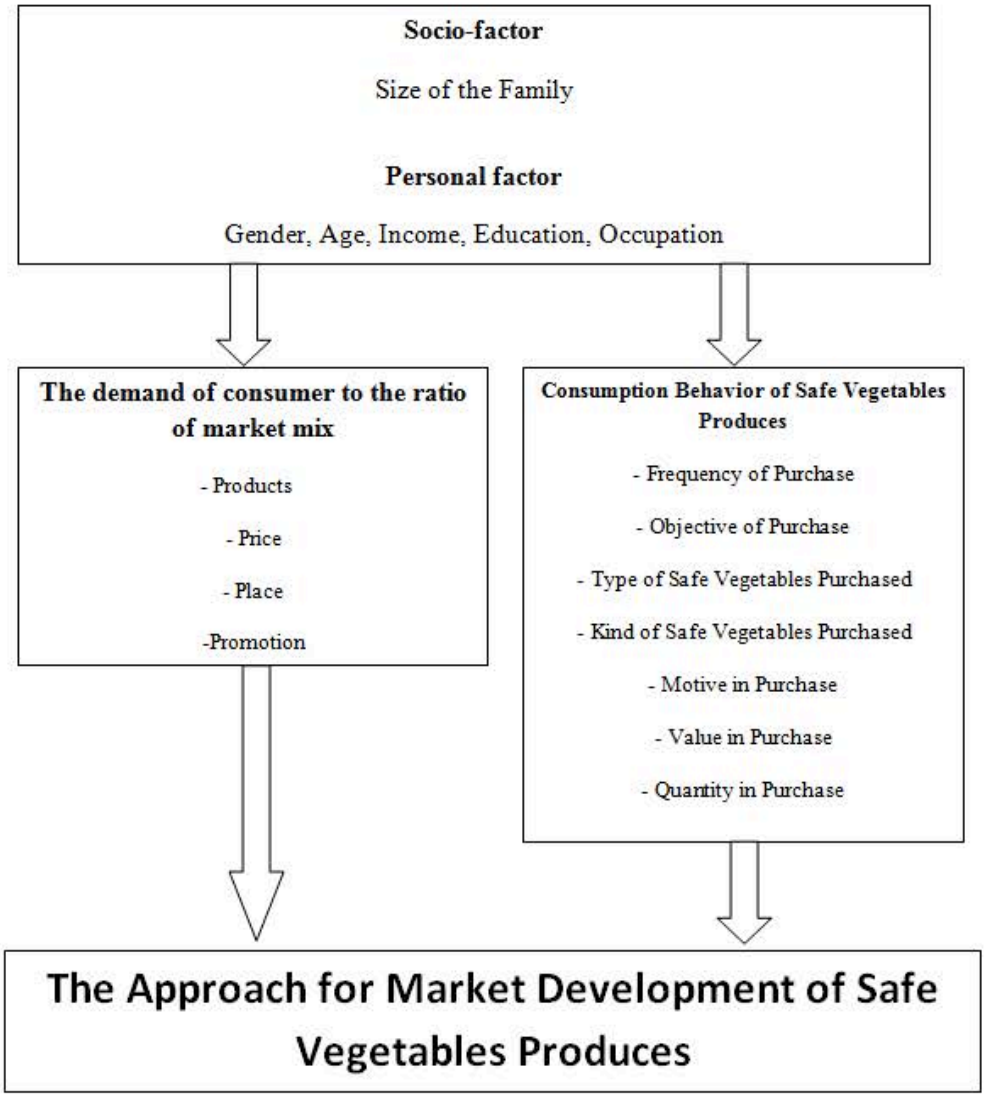

Figure 1: Conceptual Approach

4. RESULTS AND DISCUSSION

Results of an analysis of the factor affects the market mix of safe vegetables products found that all independent variables could be used to predict ratio of attitude toward market mix at 13 percent with an error of 0.391. The most effective variables to predict the attitude were the business owners, occupation, students, size of family and income, respectively.

Table 1: **One-Way ANOVA**

Source of Variance	SS	df	MS	F	p
Regression	4.634	9	.515	3.352	.001
Residue	31.794	207	.154		
Total	36.427	216			

** p< .01

From table 1, it indicated that several independent variables were related to dependent variables. It implied that at least one variable was able to predict the attitude toward the market mix of safe vegetables produces with statistical significant at .01.

Table 2: Statistical score to predict the attitude toward market mix of safe vegetables products.

Variables	*b*	*S.E.b*	β	*t*	*p*
GENDER	-0.84	.056	-.102	-1.499	.135
SIZE	-0.63	.025	-.169	-2.483*	.014
AGE	.005	.003	.149	1.892	.060
OCCU1	.374	.139	.292	2.702**	.007
OCCU2	.055	.127	.040	.430	.668
OCCU3	.131	.107	.151	1.223	.223
OCCU4	.285	.104	.334	2.742**	.007
EDU	-.041	-.041	-.118	-1.648	.101
INCOME	.001	.001	.146	1.998*	.047
A	3.836	.188		20.429**	<.000
	R^2 = .127	Adjusted R^2 = .089		*S.E.est*=0.391	

*p> .05, ** p < .01

From Table 2, all variables could be used to predict the attitude toward market mix of safe vegetables products at 13 percent with the error in predicting was 0.391. This was the additional work of researcher to find the personal factor that affects the market mix.

The most effective variable to predict the attitude toward market mix of safe vegetables products were the business owner (OCCU4) ($\beta = 0.334$) with significantat the level .01, next was a private employee and student (OCCU1) ($\beta = 0.292$) with significant at the level .01, size of family (SIZE) ($\beta = 0.-.169$) with significant at the level .05, INCOME ($\beta = 0.146$) with significant at the level .05, respectively. For other variables, the prediction power was not very significant.

The data could be derived from a formula as follow,

ATTITUDE = 3.836-0.84(GENDER)-0.63(SIZE)+.005(AGE)+.374(OCCU1) +.055(OCCU2)+.131(OCCU3)+.285(OCCU4)-.041(EDU)+.001(INCOME)

And could be derived from standard prediction score as,

ATTITUDE = -.102(GENDER)-.169(SIZE) +.149(AGE)+.292(OCCU1)+.040(OCCU2)

+.151(OCCU3)+.334(OCCU4)-.118(EDU)+.146(INCOME)

Most of the respondents were female (55.80 percent), whereas 44.20 % were male. It was found that 52.00 percent were single regarding to their marital status, while 40.70 % were married and 3.80 percent were divorced, respectively. The family size of 4 persons was 33.50 percent, more than 5 persons in family was 28.20 %, and 1-2 member was 19.80 percent, respectively. The average age was 33 years, the age range between 20-29 years was the highest percentage (32.90%), the age range between 30-39 years was 26.40 percent, and the age range between 40-49 years was 21.70 percent, respectively. Most of the participants were business owners (36.20 percent), private company employees (28.10percent), and students (18.00 percent), respectively. It was found that the educational level of the participants with bachelor degree, while those who finished high school was the highest group (47.30), 20.70 percent were graduated from vocational schools, and 14.10 percent were obtained diploma.

An average income per month was 12,000 THB, while32.40 percent of the participants' incomes were ranged between 10,000-19,000 THB, 32.00 percent of the participants' incomes were below 10,000 THB, whereas 17.30 percent of the participants' incomes were ranged between 20,000-29,999THB, respectively.

Results of the analysis for the consumption behavior of safe vegetables found that 48.70 percentof the respondents purchased products mostly 1-2 days per week, where 26.80 percent purchased in the rangeof 3-4 days a week, and 14.20 percent purchased everyday, respectively. Once the purpose of buying for household consumption was analyzed, it was found that the highest category was 61.10 percent, 33.30 % was for personal consumption, and 3.89 % was for giving to others. The hydroponics vegetables were the highest demand (57.10 percent), while mushrooms were accounted for 29.20 percent, and the consumable weed was 13.70 percent. In terms of related products, the hydroponics vegetables salads were the highest items (65.50 %), where the preservative items were 7.50 percent and dried items were 6.30 percent shared among the products. The demand for edible seaweed as normal meal as noodle was 14.00 percent, where 13.30 % were dry and crispy seaweed, 8.30 percent were chili paste mixed seaweed. The demand for edible seaweed as snack such

as seasoning crispy cake was 20.00 percent, while 9.80 % were dry seaweed, and 8.80 % were bread mixed weed. The demand for mushroom as normal meals ofseaweed-ball was 11.80 percent, while 10.80 percent were chili paste mushroom TA-DAENG, and9.00 percent were chili paste mushroom NUM-PIC-NOOM 9.00. The demand for mushroom as snacks such ascrispy chip mushrooms was 15.30 percent, while 14.30 percent were baked bread mushroom, and 6.00 percent were jelly mushroom. The motive to eat safe vegetables was come to consideration, it was found that 78.20 percent were concerned with personal and family health, while 9.10 percent were related to support growers and for safety of human and environment, and 7.00 percent were related to a variety of choices. The expenses for safe vegetables products, which were accounted for the range of 51-100 THB weekly were 32.30 percent, while 23.10 percent were spent between 101- 150 THB, and 22.60 percent were spent more than 200 THB per week, respectively. The compositions of safe vegetable in cooking, which used two items were 31.80 percent, while 28.40 percent was used three items for cooking, and 28.20 percent were fully used of safe vegetables products.

Results of the analysis of the attitude toward market mix showed that the products and place were the highest concern factor with price was the second factor, while the promotion factor was also high. Once all factors were considered in total, the average attitude toward market mix was high. When an analysis was done in details, it was found that the packaging of safe vegetables products should be related to growing process and the nutrition was the highest. The next attitude factor was the decoration of stores, the cleanliness, and the displays were the decision making of the purchases. In addition, the changes in price also affected the buying decision. Although the price of safe vegetables products seemed to be higher than normal but it reflected the quality of products, which showed the least average scores.

Once the products were considered, the average score related to the given information of growing process and nutrition for vegetable was the highest one. The products should differentiate its packaging and should be available throughout the market for consumers. It should have more variety of products. The vegetables that had signs of insect bite, which used to convince the consumer that it was safe products, had the lowest score.

In terms of price, the average score of changing the price of products affected the decision of consumers to buy safe vegetableproducts was the highest one; where the pricing of products was based on cost of production. The price of the products was the fundamental factor in decision making to buy of the consumers. The pricing of safe vegetable products to a certain position as a high-end product earned the lowest score.

In terms of distribution channel, the highest score was related to the decoration, tidiness, and displays, while the integrity of the store was a reason for decision making to the purchase. The proximity of the store was also one of the reasons that affected the purchase, whereas the convenience for consumers to buy safe vegetables earned the lowest average score.

In terms of the promotion, the most effective way was an advertisement through newspaper, radio, and television to help consumers to make a decision. It was shown that the campaign ran by government also increased the consumption. The price reduction was also induced the consumption of safe vegetables. The logos or brand of the products had the lowest average score.

5. Summary and conclusions

This study showed that hydroponics vegetables received the highest score from consumer needs, while the market mix of hydroponics vegetables was quite popular because of consumer's behavior, which selected at least two kinds of hydroponics vegetable from many kinds of vegetables to cook food. Furthermore, mushroom and seaweed received the second and third average score, which could support the processing product more than hydroponics vegetables. Therefore, it should encourage and promote the production of mushroom and seaweed to be available in the market of vegetables. Moreover, it was shown that consumers were motivated by the save vegetables becausethe health of consumers and member of family appeared to be healthy, resulting in the continuous growing of the market for save vegetables.

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