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## Comparative advantage and export potential of Thai vegetable products following the integration into the ASEAN Economic Community

### RESEARCH ARTICLE

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### Abstract

International trade, which is the exchange of capital, goods and services across international borders or territories, has contributed to the rapid global economic growth in recent decades. In Southeast Asia, the establishment of the Association of Southeast Asian (ASEAN) Free Trade Area and the implementation of the ASEAN Economic Community have benefited Thai entrepreneurs and other member countries' as nearly all import restrictions are removed and market entry barriers lowered. The ASEAN is an organization of countries in Southeast Asia set up to promote cultural, economic and political development in the region; and comprises 10 member states: Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. Specifically, this research has explored the possible economic impacts of trade liberalization and improved connectivity on Thailand's exportation of 23 vegetable product groups to the ASEAN member states (AMSs) using the Revealed Comparative Advantage and Revealed Symmetric Comparative Advantage indices based on the 2009-2013 datasets. In the analysis, the indices were applied to the 14 fresh and 9 preserved vegetable product groups from 15 countries (i.e. AMSs, Australia, China, Japan, South Korea, the USA) to determine their comparative advantages. The dendrogram was used to cluster the countries with regard to their ability to export the fresh and preserved vegetable products. In addition, the Boston Consulting Group matrix was utilized to determine the relative market positions of the Thai fresh and preserved vegetables. The analysis results identified four each of the Thai fresh and preserved vegetable product groups with high comparative advantage in the ASEAN market.

**Keywords:** ASEAN, RCA, RSCA, comparative advantage, BCG, exporting, integration

**JEL code:** F13, F19, F49, F69

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## 1. Introduction

The global economy of recent decades has been characterized by rapid growth<sup>1</sup>, driven in part by the exponential increase in international trade. At the same time, the international trade boom has been fueled by advancing technology and the concerted efforts of nations to eliminate trade barriers<sup>2</sup>. Integration into the world economy has proven a powerful means for countries to realize economic growth, development and poverty reduction<sup>3</sup>, in addition to the improved overall standards of living. Thus, some developing countries have opened their own economies while others have deliberately opted to limit the access to their markets (IMF, 2001).

Thai vegetables are of economic significance in the country's international trade of agricultural products. Revenues from vegetable exports contribute enormously to the country's agricultural sector and economic stability.<sup>4</sup> Due to the Kingdom's location in the tropical zone, most Thai vegetables can be grown all year round (Cheyroux, 2003). In addition, the Thai government has embarked on a plan to transform Thailand into 'the kitchen of the world'<sup>5</sup>. Nevertheless, Thai vegetable products are facing various obstacles, including competitive offerings, diverse consumer preferences between regions, and trade and non-trade restrictions (Prachason, 2009).

Between 2011-2013, the Thai export value of vegetables decreased at an annual rate of 1.18% due to the decline in demand from its major importers, such as the EU, Japan, Taiwan and the UK. However, Thailand's vegetable export to certain ASEAN countries, including Malaysia and Singapore, had increased. Thus, the ASEAN countries present an opportunity to expand the trade (Anon, 2014). As a free trade area, the 10-member countries expect the ASEAN Free Trade Area (FTA) to ease the flow of goods and services in the region. Thailand, an ASEAN member, would reap considerable benefits from the freer regional trade as the production costs would be lower.

In essence, the benefits of the ASEAN FTA include the reduction, or even removal, of tariffs between the member states, the reduced product prices due to increased competition, and possible investment opportunities in the market. On the other hand, the major drawbacks of the trade agreement entail the risks of an influx of cheap imports flooding local markets and the poor governance in some member countries. In fact, the reduced tariffs have negatively impacted Thailand's agricultural sector due to a greater number of imported agricultural goods.

With the increase in global and regional FTAs, the Kingdom's 'vegetables industry', which refers to the production, distribution and sale of agricultural and food products, must refine its current strategy to remain relevant and competitive (Urata, 2004). In Southeast Asia, the ASEAN FTA has benefitted Thai businesses with the increase in exports. By the same token, other member countries of the FTA are provided with opportunities to enter the Thai market. Furthermore, several of the FTA partner countries are capable of offering the same products at comparable, or competitive, price and quality. Thai operators are thus required to be prepared for the intensified competition.

It is thus imperative to analyze the competitiveness of Thai vegetables exports and identify the vegetable commodities that can compete in the export market. The results would be of particular use to future free

<sup>1</sup> The world has become a much smaller place over the past two decades. International trade has grown twice as fast as worldwide income during this period. Spurred by advances in information technology, a growing share of this trade is in services rather than merchandise, especially among rich countries (Dollar and Kraay, 2001).

<sup>2</sup> Trade barriers are government-induced restrictions on international trade. Economists generally agree that trade barriers are detrimental and decrease overall economic efficiency, which can be explained by the theory of comparative advantage (Anon, 2011).

<sup>3</sup> Economic integration is the unification of economic policies between different states through the partial or full abolition of tariff and non-tariff restrictions on trade present among them prior to their integration.

<sup>4</sup> An economy with fairly constant output growth and low and stable inflation would be considered economically stable.

<sup>5</sup> The campaign is aimed at promoting Thai food and products.

trade negotiations between Thailand and other ASEAN member countries on vegetable products, as well as to the promotion of vegetable products with export potential.

This research has attempted to assess, based on the 2009-2013 datasets, the economic impacts of trade liberalization and improved connectivity on Thailand's exportation of vegetables to the ASEAN member states (AMSs) using the Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) indices. In the analysis, the indices were applied to the 14 fresh (Harmonized System (HS) codes 0701-0714) and 9 preserved (HS codes 2001-2009) vegetable product groups from 15 countries (i.e. AMSs, Australia, China, Japan, South Korea, the USA) to determine the comparative advantages among the countries under investigation. The Boston Consulting Group (BCG) matrix was also utilized to determine the relative market positions of the Thai fresh and preserved vegetables and to subsequently formulate the corresponding strategic plans and actions. Moreover, the dendrogram was used to cluster the countries with regard to their ability to export the fresh and preserved vegetable products.

The organization of the rest of the paper is as follows: Section 2 chronicles the ASEAN trade liberalization and reviews the global and ASEAN trade of vegetable products. Section 3 details the research data and analytical methods. Section 4 discusses the research findings and the guideline recommendations to raise the competitiveness of Thai vegetable products. The concluding remarks are provided in Section 5.

## 2. Trade liberalization and international trade of vegetable products

### 2.1 Thailand and ASEAN trade liberalization

The Association of Southeast Asian Nations (ASEAN)<sup>6</sup> was first established in 1967 in accordance with the Bangkok Declaration, comprising five founding member nations: Indonesia, Malaysia, Philippines, Singapore and Thailand. Brunei, Vietnam, Laos, Myanmar and Cambodia were later admitted into the grouping respectively in 1984, 1995, 1997, 1998 and 1999. In 2007 a formal charter for ASEAN was ratified by the 10 AMSs and came into effect the following year.

ASEAN seeks to promote the socioeconomic progress and regional stability through cooperation in banking, trade, technology, agriculture, industry and tourism. In 1992, the bloc members agreed to create a regional common market, i.e. the ASEAN FTA, which became effective in 1993. With the implementation of the ASEAN FTA, tariffs among the ASEAN nations, particularly among the six oldest ASEAN members, are greatly reduced. According to Ken (2014), three major impacts of an FTA are the reduction of tariffs on goods, the lowering of barriers to trade in services, and a time-cost saving arising from shared logistics. The bloc members have also pledged to collaborate to promote foreign investments in the region. In addition, the grouping has reached free trade agreements with China (2004), South Korea (2006), Japan (2008), Australia, New Zealand and India (2009).

Thailand is Southeast Asia's second largest economy with gross domestic product (GDP) of approximately US\$ 365 billion in 2014<sup>7</sup>. Given the importance of exports to the country's GDP, the Kingdom has been spearheading trade liberalization in the region and facilitation with the rest of the world (Kawai and Wignaraja, 2011). In addition, Thailand has been a strong advocate for ASEAN's regional economic integration, which has taken shape since the inception of ASEAN Free Trade Agreement in 1992. The liberalization process under the ASEAN Economic Community (AEC) is giving Thailand huge opportunities for the expansion of market and production (Nguyen, 2014).

Overall, ASEAN has been on the right track to eliminating all tariffs as it has progressed to a level of 80% with regard to elimination of intra-regional tariffs on goods. Certain items remain on sensitive lists of each

<sup>6</sup> Overview ASEAN. Association of Southeast Asian Nations. Retrieved 15 February 2015.

<sup>7</sup> The populations and GDP of 10 ASEAN member countries available on the IMF's world economic outlook database 2014.

member country, e.g. coffee beans, copra, potatoes and cut flowers in the case of Thailand. Nonetheless, the tariffs on the sensitive-listed items are to be reduced to zero by the end of 2015.

Even with a complete elimination of tariffs, non-tariff barriers (NTBs) to trade, e.g. quotas and licenses, are still widely deployed despite the requirements of the member countries to scale down and totally remove the NTBs under the free trade agreement<sup>8</sup>. One such NTB example is the inconsistent and unreasonable labeling and packaging requirements that impede free trade across ASEAN. NTBs could undermine the economic integration process and the realization of the AEC by 2015. Economic integration will continue but will be 'limited to economies which are able to address the NTBs and the supply-side capacity constraints. It will also be limited to highly integrated production networks.' The private sector should involve in identifying NTBs and subject all non-tariff measures (NTMs) to a 'compliance review' in order to ensure that they are transparent and non-discriminatory and in order to minimize trade restrictiveness (Sanchita *et al.*, 2013).

Due to its geographical location, the region is poised to be the world's supplier of fruits and vegetables, which are a necessary part of human diet and a source of earnings for the region. In addition, countries in the northern hemisphere, e.g. European countries and the US, cannot grow vegetables in the winter and thereby provides ASEAN with an enormous economic opportunity. In fact, Thailand's trade in vegetables within the region, although gradually rising during 2010-2014<sup>9</sup>, was relatively small vis-à-vis with countries outside the region, e.g. Japan, the EU and the USA. It is thus anticipated that the full implementation of the AEC in 2015 would significantly increase the trade and investment activity in agricultural products within the ASEAN region.

The EU, US and Japan are currently the major export markets of Thai vegetables, while ASEAN is an attractive market with good prospects for vegetable products from Thailand (Anon, 2012). The implementation of the ASEAN FTA has gradually reduced import tariffs to 0% for most member countries since January 1 2010, with the ASEAN newcomers (i.e. Cambodia, Laos, Myanmar and Vietnam) also gradually lowering their respective import tariffs. The import tariff reductions in turn lower the costs of exports and thereby contribute to an increase in exports to these countries (Calvo Pardo *et al.*, 2009).

In addition, greater benefits from the ASEAN economic integration could be realized with increased outbound investment by Thai businesses. Currently, a majority of Thai small and medium-sized enterprises (SMEs) have failed to fully explore opportunities in the region. Rather, they need to broaden their perspective and be looking for allies, partners and connections in ASEAN so that they have more of a competitive advantage once the full integration takes place.

Within ASEAN, trade liberalization will stimulate the output of each member country in accordance with their comparative advantage. Nonetheless, since trade liberalization tends to increase the output of capital-intensive goods more than that of labor-intensive goods, the less-developed countries within the region likely reap a smaller share of benefits vis-à-vis their more developed counterparts. In addition, a significantly larger proportion of gains from an FTA would be captured by the physical means of production than by the labor, further exacerbating the wide income gap between high-income and low-income households within ASEAN (Danupon *et al.*, 2009).

## 2.2 The aftermath of Thai-Chinese Bilateral Trade Agreement

Under the global free trade agreement, China and India are two formidable exporting countries of vegetables and fruit, while countries in Southeast Asia and South Asia are the net importers (Tingjun and Thomas, 2006). Notwithstanding, China at the same time needs to import inputs from multiple sources and thus ASEAN,

<sup>8</sup> Given the very slow progress in identifying NTBs from among the NTMs, a critical step is to subject all existing NTMs to a compliance review to ensure that they are transparent, non-discriminatory, and minimizes trade restrictiveness. (Chia, 2013).

<sup>9</sup> The United Nations Commodity Trade Statistics Database (UN COMTRADE).



with its proximity to China, could serve as a strategic source of natural-resource-based and intermediate inputs under the FTA.

According to Sarasin (2011), China was a country with the highest production of vegetables in 2005, accounting for as much as 60% of the world's vegetables production. This was followed by India at 9%, USA 4%, Turkey 3%, and other countries with an aggregate of 24%.

For Thai vegetable products exports, China is the country's principal customer, with the 2013 export value of over 500 million US dollars, contributing to almost half the export value. By comparison, the combined value of Thai vegetables exports to the other nine ASEAN member countries was surprisingly small, accounting for a mere 6.38% of the total vegetables export value of US\$ 700 million annually. However, trade in vegetable products among ASEAN grew by 11.7% per annum (Anon, 2014).

Despite the Thai-Chinese free trade agreement, a number of Chinese local administrative governments have however imposed NTBs in the form of, e.g. local taxes, quality inspection, hygiene standards, plant diseases and insects. In addition, the conditions and terms of trade are specified by Chinese entrepreneurs (Sandee, 2013). On the contrary, no import restrictions exist for vegetables and fruits from China to Thailand under the Thai-Chinese FTA, placing Thailand in a disadvantageous position (Sally, 2007).

The situation is exacerbated if the vegetables and fruits produced by Thai and Chinese agriculturists are similar, e.g. onions and garlic, and destined for the same buyer countries. When faced with this situation, most Thai farmers switch to other non-competitive crops (Benja and Kingkorn, 2004). In addition, many Chinese vegetables can be grown all year round and are much lower in production costs. Thus, the entry of Chinese vegetables into the Thai market has driven down the price of locally produced vegetables. It is believed that more Thai fruits and vegetables with Chinese substitutes would inevitably suffer from the adverse impact of a future price slump.

### *2.3 World trade for fresh and chilled vegetables and processed vegetables*

As illustrated in Supplementary Figure S1, the EU and APEC countries collectively commanded the global vegetables exports in 2011, with their respective export of fresh vegetables of 35 and 36%; and the processed vegetables exports of 41 and 28% of the global total vegetables exports. On the other hand, the shipments of vegetable products from ASEAN of the same period were 4 and 5% of the global total vegetables exports for fresh and processed vegetables, respectively. In Supplementary Figure S2, the principal importers of vegetables products in 2011 were the EU and G7 countries. In addition to being an important exporter of vegetables products, the EU was a major consumer of fresh and processed vegetables with the import values of 36 and 37% of the global total vegetables exports. Although the main export markets of vegetables products are in the EU and the USA, ASEAN is still a lucrative market with good prospects for Thai vegetables products due to their geographical proximity and similarity in diets.

### *2.4 ASEAN trade for fresh and chilled vegetables and processed vegetables*

As shown in Supplementary Tables S2 and S3, trade in vegetable products among ASEAN member countries has been on an upward trend. Upon closer inspection, the fresh vegetables exports from Cambodia and Laos increased significantly in value by positioning their offerings as organically produced vegetables, while most Thai vegetables exports are preserved vegetables due to the availability of processing technology and added value. On the other hand, Brunei and Indonesia are two principal importers of vegetables products in the ASEAN grouping with little exports because of less favorable geographical location and high domestic demand.

### 3. Research methodology

This research has employed the RCA index developed by Béla Balassa (1965)<sup>10</sup>. The RCA index is defined as a ratio of certain export products of a country's overall exports to the world in relation to a country's total exports to total world exports (Vollrath and Thomas, 1991). In other words, it measures a country's export of a particular commodity in relation to its total exports and to the corresponding export performance of a set of countries. In addition, the RCA index is applicable to certain sectors or commodities. In this research, the RCA index is concerned with the regional ASEAN bloc. The RCA index can be expressed as:

$$RCA_{ij} = \frac{(X_{ij} / X_{it})}{(X_{nj} / X_{nt})} \quad (1)$$

where  $RCA_{ij}$  is the comparative advantage index of export product  $j$  of country  $i$ ,  $X_{ij}$  is the export value of product  $j$  of country  $i$ ,  $X_{it}$  is the total export value of country  $i$ ,  $X_{nj}$  is the export value of product  $j$  of  $n$  countries (or ASEAN), and  $X_{nt}$  is the total export of  $n$  countries (or ASEAN).

The RCA index values in this research are interpreted in accordance with the classifications of RCA index values in Hinloopen and Marrewijk (2008), where

$RCA > 1$  means that the proportion of a country's (country  $i$ ) export of product  $j$  to the total export of country  $i$  is greater than the proportion of exports of that product (product  $j$ ) in the ASEAN market to the total export of the ASEAN countries (i.e. country  $i$  has a comparative advantage in exporting product  $j$  in the ASEAN market). In other words, when the RCA is greater than 1, the country under consideration has a revealed comparative advantage in the sector.

$RCA < 1$  means that the proportion of country  $i$ 's export of product  $j$  to the total export of country  $i$  is less than the proportion of exports of that product (product  $j$ ) in the ASEAN market to the total export of the ASEAN countries (i.e. country  $i$  has a comparative disadvantage in exporting product  $j$  in the ASEAN market). In other words, when the RCA is less than 1, the country has a revealed comparative disadvantage in the sector.

$RCA = 1$  means that the proportion of country  $i$ 's export of product  $j$  to the total export of country  $i$  is equal to the proportion of exports of that product (product  $j$ ) in the ASEAN market to the total export of the ASEAN countries. In other words, country  $i$  has neither comparative advantage nor disadvantage in exporting product  $j$  in the ASEAN market.

To address the issue of asymmetry, the RSCA, which has a measurement range of -1 to 1, was applied to the RCA index values in the second stage of the analysis.

$$RSCA_{ij} = \frac{(RCA_{ij} - 1)}{(RCA_{ij} + 1)} \quad (2)$$

The  $RSCA_{ij}$  index magnitude is  $-1 \leq RCA_{ij} \leq 1$ . Specifically, an  $RSCA_{ij}$  index beyond zero or close to  $\{+1\}$  indicates that product  $j$  of country  $i$  possesses a comparative advantage over its competitors. Conversely, an  $RSCA_{ij}$  index below zero or approaching  $\{-1\}$  shows that product  $j$  of country  $i$  is comparatively disadvantageous. In Tables 3 and 4, a plus sign (+) indicates a revealed symmetric comparative advantage and a minus sign (−) indicates a revealed symmetric comparative disadvantage.

In addition to the analysis of comparative advantages, this research has determined the strategic market positions of the Thai fresh and processed vegetable products using the BCG matrix. The BCG matrix is a

<sup>10</sup> The RCA is an index used in international economics for calculating the relative advantage or disadvantage of a certain country in a certain class of goods or services as evidenced by trade flows (Widodo, 2009).

framework to evaluate the strategic position of a business/brand portfolio and its potential.<sup>11</sup> The matrix classifies a business portfolio into four categories based on industry attractiveness (growth rate of that industry) and competitive position (relative market share), i.e. star, question mark, cash cow and dog. The general idea is to classify positions of products along the two dimensions (Wind and Mahajan, 1981). These two dimensions reveal the likely profitability of the business portfolio in terms of cash needed to support that unit and cash generated by it. The aim of the BCG analysis is to provide an insight into which products/brands to make further investment and which to pursue divestment.

The implementation of the BCG matrix requires undertaking the following five steps: first, select a products (i.e. fresh and preserved vegetables), and, second, define the market (i.e. the ASEAN market). Next, calculate the relative market share by dividing the market share of the product by the market share of biggest competitor. Then, determine the relevant market growth rate by referring to the average revenue growth of market leaders in the vegetable industry. Finally, identify the strategic position of the product or business unit in the BCG matrix with a circle, taking into account the relative market share and growth. Furthermore, there are four strategic courses of action that could be pursued by a company after classification: harvest (for a business/product that falls in the cash cow category), divest (for dogs and some question marks), maintain and invest (for cash cows and stars) (Kotler, 2003).

Furthermore, to reduce the data complexity and provide conceptual simplifications, this research has utilized the dendrogram to cluster the 15 countries under study by their respective ability to export the fresh (HS 0701-0714) and processed (HS 2001-2009) vegetable products. Generally, clustering lumps together objects that share some observed qualities, or divides a set of objects into separate classes whose boundaries reflect differences in the members' observed qualities. Specifically, the dendrogram is a tree-like structure whose branches terminate at the objects being clustered, and the lengths of its branches indicate differences within clusters being merged or partitioned (Krippendorff, 1980).

### 3.1 Data

The current bilateral or multilateral (e.g. World Trade Organization) trade negotiations require the use of the HS codes. Thus, this research has grouped and categorized the products to be analyzed into 23 standard items as suggested in the Harmonized System: HS code of the Global Trade Atlas<sup>12</sup>. Specifically, the vegetables under study are divided into two groupings by HS codes: the fresh or chilled vegetables grouping, consisting of 14 product groups (HS 0701-0714) and the preserved or processed vegetables grouping, consisting of nine product groups (HS 2001-2009) (Supplementary Table S1). In addition, the import and export datasets of interest belong to the 2009-2013 period of 15 countries (i.e. the AMSs, Australia, China, Japan, South Korea and the USA).

### 3.2 Analysis

In the RCA analysis, the RCA indices were calculated on a yearly basis (2009-2013) for each country under study (15 countries). A positive RCA value reveals a comparative advantage while a negative outcome indicates a comparative disadvantage with regard to a particular commodity of a country. To mitigate the issue of asymmetry associated with RCA, the RSCA was applied to the RCA index values for further analysis, where a positive RSCA result reveals a comparative advantage while a negative outcome indicates a comparative disadvantage. The countries were then clustered by their respective ability to export the fresh and processed vegetable products using the dendrogram. In addition, the BCG matrix was utilized to determine the strategic market positions.

<sup>11</sup> The BCG model is based on the product life cycle theory that can be used to determine the level of priority to be given in the product portfolio of a business unit (Fleisher and Bensoussan, 2003).

<sup>12</sup> The Harmonized System is a multipurpose international product nomenclature developed by the World Customs Organization, which classifies items into 21 categories, 97 groups and over 5,000 commodities. The classification system has been adopted by all member countries of the World Trade Organization for international trade.



## 4. Results and discussion

### 4.1 The Revealed Comparative Advantage and Revealed Symmetric Comparative Advantage results

The RCA is measured by comparing the ratio of total exports of goods in a country with a proportion of such products in the market. However, the RCA can only reveal whether the country has a comparative advantage in the export of goods. In other words, the RCA results of different countries are not for comparison purposes and thus it is difficult to infer from the results with respect to the competitive advantages between countries.

#### ■ Revealed Comparative Advantage of fresh or chilled vegetables (HS 0701-0714)

In Table 1, the overall average RCA of fresh or chilled vegetables of Thailand between 2009-2013 was 0.61, which is less than 1, with an average annual growth rate of -1.41%. The result showed that Thailand has a competitive disadvantage in the fresh or chilled vegetables in the ASEAN market and relies little on the income from the export of fresh or chilled vegetables in this market. By comparison, several other countries exhibit a competitive advantage in exporting fresh or chilled vegetables in the ASEAN market, including Cambodia (RCA=1.38), Laos (RCA=8.25), Malaysia (RCA=1.56), Myanmar (RCA=21.72), Vietnam (RCA=2.18), Australia (RCA=2.69) and China (RCA=8.04).

Even though the overall RCA indicates Thailand's comparative disadvantage in the export of fresh or chilled vegetables to the ASEAN market, the individual RCA results reveal the comparative advantage for Thailand (RCA>1) in four groups: 0703, 0710, 0711, 0714. These four groups are tomatoes, frozen vegetables, vegetables provisionally preserved, and manioc, arrowroot salem. Interestingly, Malaysia has a comparative advantage in almost all fresh or chilled vegetables listed, while some countries are in an unfavorable position of no comparative advantage in any fresh or chilled vegetables groups, such as Singapore.

**Table 1.** The average Revealed Comparative Advantage indexes of vegetable products belonging to Harmonized System codes 0701-0714 based on the 2009-2013 data of the 15 countries (adapted from The United Nations Commodity Trade Statistics Database (UN COMTRADE: <https://comtrade.un.org>)).

Country	Code															Average year 2009-2013	Growth rate (% p.a.)
		0701	0702	0703	0704	0705	0706	0707	0708	0709	0710	0711	0712	0713	0714		
Brunei		1.01	0.00	0.29	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.03	0.00	0.00	0.01	0.07	0.00
Cambodia		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.07	0.01	11.85	0.04	0.03	21.76	1.38	12.09
Indonesia		2.58	0.19	0.53	2.29	0.44	1.05	0.08	1.46	0.33	1.91	0.06	1.20	0.50	0.88	0.67	-4.74
Laos		0.00	0.00	0.01	72.07	0.01	26.16	0.01	0.69	0.04	0.00	0.99	0.05	0.31	51.83	8.25	40.30
Malaysia		1.16	4.86	1.76	1.52	4.36	2.67	5.05	3.75	2.73	1.99	0.96	1.80	0.10	0.27	1.56	1.25
Myanmar		0.11	0.00	4.50	0.00	0.00	0.06	0.00	0.53	0.02	0.22	0.01	0.41	60.30	0.04	21.72	-4.31
Philippines		0.00	0.00	1.42	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.23	2.63	0.01	0.00	0.32	8.28
Singapore		0.95	0.01	0.13	0.16	0.20	0.34	0.00	0.09	0.29	0.32	0.14	0.46	0.03	0.11	0.14	3.47
Thailand		0.21	0.10	1.13	0.08	0.16	0.03	0.13	0.25	0.68	1.24	2.54	0.39	0.48	1.09	0.61	-1.41
Vietnam		0.48	0.49	5.17	0.38	0.06	1.90	0.03	0.09	4.11	0.55	6.09	3.72	0.05	6.52	2.18	12.19
Australia		26.19	0.49	0.42	2.50	4.20	29.45	0.08	0.09	0.97	1.05	0.12	0.38	3.81	0.08	2.69	5.01
China		22.00	0.25	21.00	13.04	1.83	22.62	0.00	5.22	1.52	3.19	4.68	128.05	0.92	2.00	8.04	-5.17
Japan		0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.04	0.03	0.00	0.19	0.00	0.16	0.02	5.94
South Korea		0.08	0.00	0.00	0.03	0.00	0.04	0.00	0.00	0.33	0.01	0.00	0.18	0.00	0.01	0.07	8.92
USA		9.22	0.01	0.03	0.02	1.04	0.15	0.00	0.00	0.31	0.69	1.10	8.02	0.48	0.00	0.57	7.16

### ■ Revealed Comparative Advantage of preserved or processed vegetables (HS 2001-2009)

In Table 2, the overall average RCA of preserved or processed vegetables of Thailand between 2009-2013 was 2.23, with an average annual growth rate of 0.22%. The result showed that Thailand has a competitive advantage in the preserved or processed vegetables in the ASEAN market and relies considerably on the income from the export of preserved or processed vegetables in this market. Other countries with a competitive advantage in exporting preserved or processed vegetables in the ASEAN market include Malaysia (RCA=1.17), the Philippines (RCA=4.79), China (RCA=2.53) and the USA (RCA=2.88).

Further analysis indicates that Thailand, in fact, has a comparative advantage ( $RCA > 1$ ) in only four preserved or processed vegetables groups: 2005, 2007, 2008 and 2009. It is also shown that some other countries have an advantage in the export of other preserved or processed vegetable groups. In particular, the US has a comparative advantage in almost all preserved or processed vegetables. On the contrary, other countries are in a position with no comparative advantage in any preserved or processed vegetables, including Brunei, Cambodia, Myanmar, Vietnam, Japan and South Korea.

To mitigate the issue of asymmetry associated with the RCA, the RSCA was utilized in the subsequent stage of the analysis and the results presented in Tables 3 and 4, where a positive sign denotes an  $RSCA > 0$ , indicating a comparative advantage and a negative sign for otherwise. The RSCA results revealed eight vegetable products (identical to the RCA analysis) with comparative advantage (four each for the fresh and preserved vegetable groups under study): onion, garlic and leeks (HS 0703,  $RSCA = 0.06$ ); frozen vegetables (HS 0710,  $RSCA = 0.11$ ); provisionally preserved vegetables (HS0711,  $RSCA = 0.44$ ); manioc, arrowroot salem (yams), etc. (HS 0714,  $RSCA = 0.04$ ); preserved vegetable (excluding frozen) (HS 2005,  $RSCA = 0.42$ ); jam, fruit jellies and marmalades (HS 2007,  $RSCA = 0.37$ ); preserved fruits (HS 2008,  $RSCA = 0.29$ ); and unfermented fruit and vegetable juices (HS 2009,  $RSCA = 0.52$ ).

**Table 2.** The average Revealed Comparative Advantage indexes of vegetable products belonging to Harmonized System codes 2001-2009 based on the 2009-2013 data of the 15 countries (adapted from The United Nations Commodity Trade Statistics Database (UN COMTRADE: <https://comtrade.un.org>)).

Country	Code									Average year 2009-2013	Growth rate (% p.a.)
	2001	2002	2003	2004	2005	2006	2007	2008	2009		
Brunei Darussalam	0.00	0.03	0.00	0.00	0.17	0.00	0.08	0.23	0.52	0.28	0.00
Cambodia	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.00
Indonesia	1.05	0.03	0.44	0.21	0.01	0.11	0.13	0.40	0.25	0.27	-0.55
Laos	0.00	0.00	0.00	0.08	0.00	1.14	0.00	2.23	0.00	0.99	-11.87
Malaysia	1.13	1.06	0.63	4.16	1.78	1.83	1.12	0.79	1.27	1.17	-1.16
Myanmar	0.97	0.15	0.17	0.01	0.16	0.04	0.08	0.14	0.00	0.10	0.00
Philippines	0.09	0.00	0.27	0.02	0.14	0.42	5.77	8.56	1.40	4.79	6.29
Singapore	1.12	1.63	1.74	0.29	0.53	1.10	0.28	0.50	0.27	0.45	-0.71
Thailand	0.85	0.63	0.40	0.26	2.45	0.95	2.16	1.82	3.14	2.23	0.22
Vietnam	0.71	0.57	0.98	0.35	0.31	0.14	2.33	0.39	0.59	0.57	-24.08
Australia	1.99	1.42	0.06	2.27	0.30	0.18	2.25	0.38	1.32	0.79	-3.79
China	1.63	43.86	60.92	1.31	2.66	6.84	0.32	2.80	0.08	2.53	1.91
Japan	0.23	0.00	0.05	0.15	0.08	0.01	0.01	0.03	0.03	0.04	2.02
South Korea	0.42	0.00	0.06	0.03	0.27	0.02	0.01	0.08	0.04	0.09	-1.01
USA	1.03	16.11	1.31	82.84	2.67	0.88	0.97	1.05	1.70	2.88	5.68

**Table 3.** The Revealed Symmetric Comparative Advantage (RSCA) results for vegetable products belonging to Harmonized System codes 0701-0714.<sup>1</sup>

Country	Code														
	07	0701	0702	0703	0704	0705	0706	0707	0708	0709	0710	0711	0712	0713	0714
Brunei Darussalam	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Cambodia	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+
Indonesia	-	+	-	-	+	-	+	-	+	-	+	-	-	-	-
Laos	+	-	-	-	+	-	+	-	-	-	-	-	-	-	+
Malaysia	+	+	+	+	+	+	+	+	+	+	+	-	+	-	-
Myanmar	+	-	-	+	-	-	-	-	-	-	-	-	-	+	-
Philippines	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-
Singapore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thailand	-	-	-	+	-	-	-	-	-	-	+	+	-	-	+
Vietnam	+	-	-	+	-	-	+	-	-	+	-	+	+	-	+
Australia	+	+	-	-	+	+	+	-	-	-	+	-	-	+	-
China	+	+	-	+	+	+	+	-	+	+	+	+	+	-	+
Japan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Korea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
USA	-	+	-	-	-	+	-	-	-	-	-	+	+	-	-

<sup>1</sup> A positive sign denotes an RSCA>0 and a negative sign otherwise.

**Table 4.** The Revealed Symmetric Comparative Advantage (RSCA) results for vegetable products belonging to Harmonized System codes 2001-2009.<sup>1</sup>

Country	Code									
	20	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brunei Darussalam	-	-	-	-	-	-	-	-	-	-
Cambodia	-	-	-	-	-	-	-	-	-	-
Indonesia	-	+	-	-	-	-	-	-	-	-
Laos	-	-	-	-	-	-	+	-	+	-
Malaysia	+	+	+	-	+	+	+	+	-	+
Myanmar	-	-	-	-	-	-	-	-	-	-
Philippines	+	-	-	-	-	-	-	+	+	+
Singapore	-	+	+	+	-	-	+	-	-	-
Thailand	+	-	-	-	-	+	-	+	+	+
Vietnam	-	-	-	-	-	-	-	+	-	-
Australia	-	+	+	-	+	-	-	+	-	+
China	+	+	+	+	+	+	+	-	+	-
Japan	-	-	-	-	-	-	-	-	-	-
South Korea	-	-	-	-	-	-	-	-	-	-
USA	+	+	+	+	+	+	-	-	+	+

<sup>1</sup> A positive sign denotes an RSCA>0 and a negative sign otherwise.

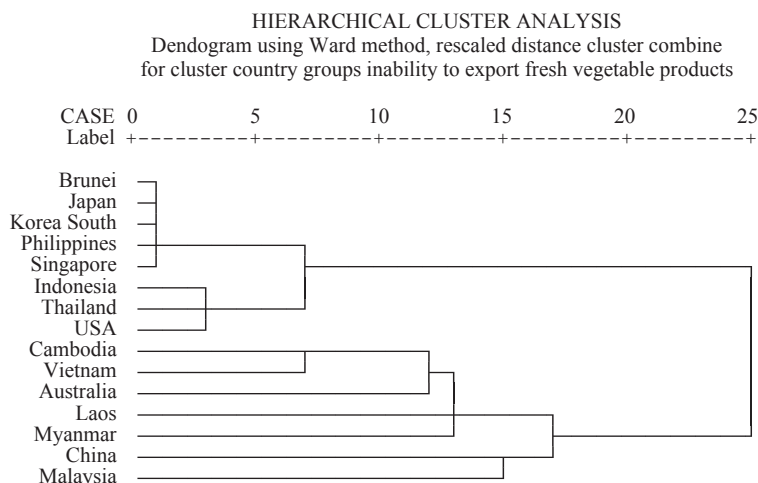
Out of the 23 vegetable product groups under study, the eight aforementioned Thai vegetable product groups are poised to compete for a larger share of the ASEAN market. Nonetheless, to fulfill that ambition, a comprehensive long term strategic plan must be formulated. In addition, the competitiveness of Thai vegetable products should be further enhanced through the adoption of the guideline recommendations proposed in this research.

## 4.2 The clustering results

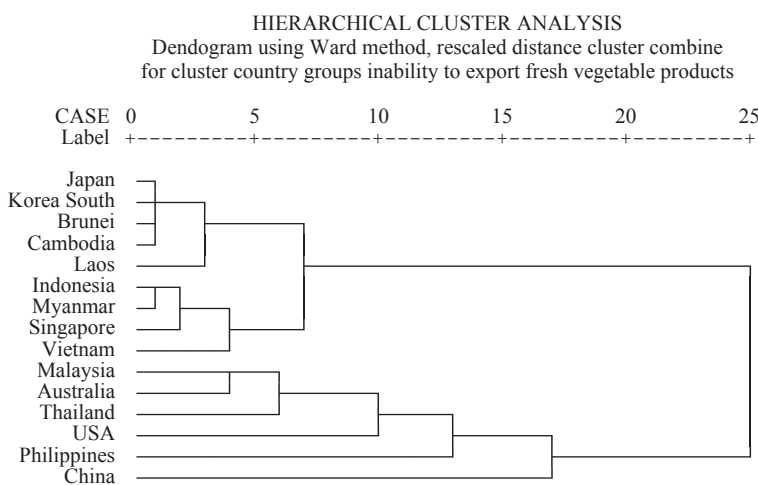
The SPSS (IBM, Armonk, NY, USA) dendrograms using the Ward Method<sup>13</sup> of the fresh (HS 0701-0714) and preserved (HS 2001-2009) vegetable product groupings are presented in Figures 1 and 2, respectively, in which every case (i.e. country) has been brought into one single cluster.

The results identify two clusters (i.e. the clusters without and with comparative advantage) each under the two vegetable product groupings. Under the fresh vegetable product grouping, the cluster with comparative disadvantage consists of Brunei, Japan, South Korea, the Philippines, Singapore, Indonesia, Thailand and the USA, whereas the cluster with comparative advantage consists of Cambodia, Vietnam, Australia, Laos, Myanmar, China, Malaysia (Figure 1). Meanwhile, under the preserved vegetable grouping, the cluster with

<sup>13</sup> SPSS Dendrogram and Ward's Hierarchical Clustering Method: in this method all possible pairs of clusters are combined and the sum of the squared distances within each cluster is calculated, and 0-25 is the standard scale of the dendrogram. This is then summed over all clusters and the combination that gives the lowest sum of squares is chosen. This method tends to produce clusters of approximately equal size, which is not always desirable because of the sensitivity to outliers. Despite this, it is one of the most popular methods, along with the average linkage method (Rosie, 2007).



**Figure 1.** Clustering of country-groups by the ability to export fresh vegetable products (Harmonized System 0701-0714).



**Figure 2.** Clustering of country-groups by the ability to export processed vegetable products (Harmonized System 2001-2009).

the comparative disadvantage comprises Japan, South Korea, Brunei, Cambodia, Laos, Indonesia, Myanmar, Singapore, Vietnam, while that with the comparative advantage consists of Malaysia, Australia, Thailand, USA, the Philippines and China (Figure 2).

#### ■ *Fresh and chilled vegetables*

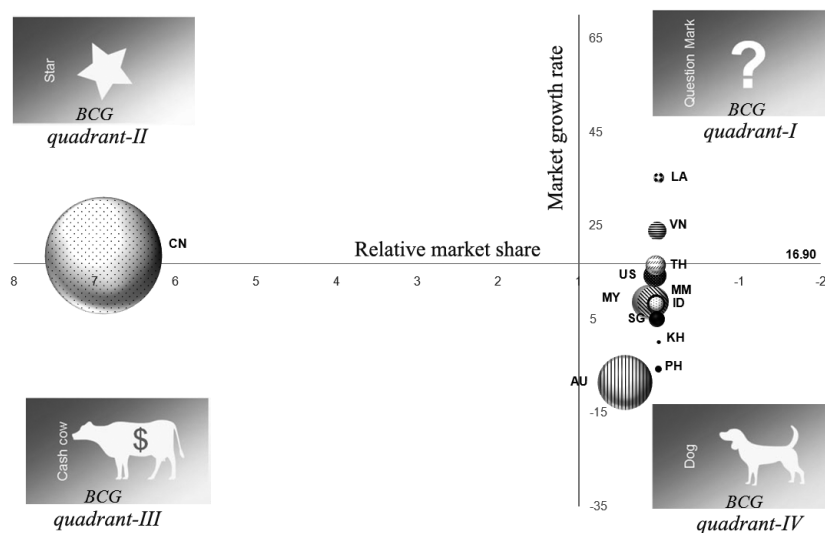
For the fresh vegetable product grouping, the analysis outcomes indicate that the countries with the comparative disadvantage with regard to the export of fresh vegetables to the ASEAN market are Brunei, Japan, South Korea, the Philippines, Singapore, Indonesia, Thailand and the USA. The finding could be attributed to the high domestic demand of these countries and to the inadequate government support on export. Meanwhile, the countries with the comparative advantage include Cambodia, Vietnam, Australia, Laos, Myanmar, China and Malaysia. In fact, several ASEAN countries, including Laos and Vietnam, have instituted the policy to promote the production and exportation of quality fresh vegetables.

#### ■ *Preserved and processed vegetables*

For the preserved vegetables, Malaysia, Australia, Thailand, USA, the Philippines and China possess the considerable potential to supply to the ASEAN market. This is attributable to the deployment of modern technology and scientific methods in the production.

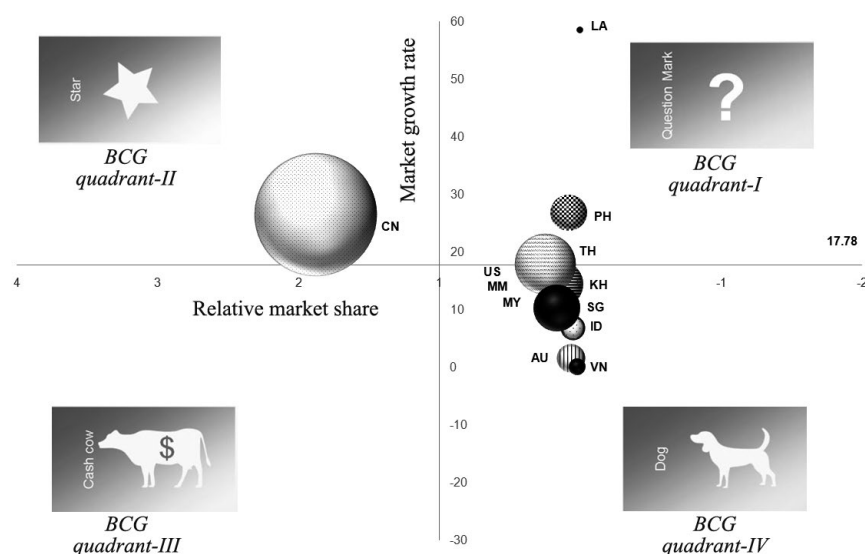
#### 4.3 Boston Consulting Group market position

The BCG matrices relevant to the fresh (HS 0701-0714) and preserved (HS 2001-2009) vegetable products of the 15 countries under study are respectively illustrated in Figures 3 and 4. It could be observed that most ASEAN countries are in either the 'dog' or 'question mark' quadrant of the matrix, suggesting that their exports of vegetables experience a dual-low dilemma in which both the market share and market growth are low. This phenomenon gives rise to the subsequent poor profitability and unfavorable export prospects. To counter, these less competitive countries are must explore new markets for their vegetable products and at the same time increase the degree of penetration of the current markets. Operational streamlining is also imperative so as to lower the costs.



**Figure 3.** The Boston Consulting Group (BCG) matrix for fresh vegetable products (Harmonized System 0701-0714) of the 15 countries for years 2004-2013. AU = Australia; CN = China; ID = Indonesia; KH = Cambodia; LA = Laos; MY = Malaysia; MM = Myanmar; PH = Philippines; SG = Singapore; TH = Thailand; US = United States; VN = Vietnam.





**Figure 4.** The Boston Consulting Group (BCG) matrix for preserved vegetable products (Harmonized System 2001-2009) of the 15 countries for years 2004-2013. AU = Australia; CN = China; ID = Indonesia; KH = Cambodia; LA = Laos; MY = Malaysia; MM = Myanmar; PH = Philippines; SG = Singapore; TH = Thailand; US = United States; VN = Vietnam.

In Figure 3, the Thai fresh and chilled vegetables from the years 2004-2013 were in the dog quadrant of the matrix, with a market share of 0.04 and market growth of 16.41. With its market share of 6.88 and market growth of 18.48, China is in an enviable position with both high relative market share and a high market growth rate. While China has to adopt a strategy to maintain and protect the market share, other players could implement the segmentation, targeting and positioning to expand their shares of the market (Supplementary Table S4). Meanwhile, faced with a slow market growth rate and a small market share, Thailand could increase the export volume through the exploration of new untapped markets and the increased penetration of the current markets.

Figure 4 illustrates the BCG matrix for the preserved vegetable products (HS 2001-2009) of the same 15 countries. The Thai preserved vegetables during the years 2004-2013 were in the question mark quadrant of the matrix, with a market share of 0.25 and market growth of 17.83. This is considerably lower when compared with China whose market share and market growth were 1.88 and 26.40 (Supplementary Table S4). Interestingly, the relative market share and market growth of Thailand and the US are in the same range.

To increase the export of preserved vegetables, Thailand must be innovative in the development of products and might consider forging an alliance with overseas entrepreneurs as a way to explore new markets. Borrowing certain initiatives from other countries' trade policies could be useful for Thailand. For example, China has a policy to support the domestic consumption while Thailand relies heavily on export to drive its economy. In addition, China's agricultural development plan emphasizes the reform of the agricultural sector using innovative and modern technologies. At the same time, the Chinese government is implementing policies to maintain the quality of agricultural land and increase crop yields to achieve food security. Thailand could thus incorporate certain effective practices in the formulation of the country's 5-year agricultural development plan.

#### 4.4 Non-tariff barriers between ASEAN countries

Even with a complete removal of the trade tariffs, exporting countries are nevertheless faced with the imposition of NTBs by other countries, especially those for agricultural products. The current NTBs can be classified into eight main groups: (1) anti-dumping; (2) counter-vailing duty; (3) safeguard; (4) sanitary and phytosanitary; (5) technical barrier to trade; (6) environment; (7) labor; and (8) others, e.g. purchasing

by state, import monopolies, rule of origin. Within the ASEAN grouping, Thailand needs to deal with the following NTBs from other member nations:

**Indonesia:** the main NTB to doing business in the archipelago country of Indonesia is an over-abundance of Chinese intermediaries, through whom business negotiations and transactions are undertaken. In addition, the country has recently closed down half of the ports from originally eight to four ports, resulting in an overcrowded traffic and long queues at the remaining ports, causing damage to the perishables imports. The situation is anticipated to exacerbate with the full integration of the AEC. With regard to food products imports, the country requires that the production and distribution of foods strictly adhere to the Halal regulations.

**Malaysia and Singapore:** Thailand must enter talks with neighboring Malaysia on the logistics issue that would allow freight trucks and trains from Thailand to access and pass through its borders with minimal friction. In addition, Thai exporters are facing discriminatory treatments by many Malaysian intermediaries/importers, making it challenging for Thai products to reach Malaysian consumers. On the other hand, the access to Singapore's market is open but the competition is fierce. The Singaporeans have high purchasing power and demand good quality products; thus, the export of Thai vegetables to the city-state must be of superior quality.

**Cambodia and Vietnam:** a majority of Cambodians perceive that Thai vegetable products are replete with insecticides and hazardous chemicals. To address the issue and establish a strong foothold in Cambodia, Thai entrepreneurs could either export organic produce to or invest in organic farming using modern technologies in neighboring Cambodia. Meanwhile, in the case of Vietnam, the government sector has established a clear policy on the future directions of agricultural development and encouraged the adoption of the Good Agricultural Practice system. Furthermore, in contrast to Thailand, the Vietnamese government has in place procedures and measures to assist agriculturists to improve their production yields, to support local import and export operators with trade information and advice, and to set up a central market system for vegetable products.

**Myanmar and Laos:** numerous entry barriers to the Myanmar and Lao markets await Thai exporters of vegetable products, including poor logistics, inefficient domestic distribution systems, government interventions, as well as cultural differences. In the case of Myanmar, the country has a policy that promotes the development of the local agricultural sector by foreign investments through the adoption and deployment of modern production and processing technologies to meet the domestic demand. Despite Myanmar's joint-venture requirement for a foreign investment, the opportunities are plentiful for Thailand to invest in the agribusiness and expand the market in Myanmar. For Laos, its government encourages investment in agribusiness that deploys modern, environmentally-friendly production and processing technologies, thereby representing an opportunity for Thai organic vegetable products. Lao laborers are nonetheless limited in both quantity and quality.

**The Philippines:** despite positive attitudes among Filipinos toward vegetable products from Thailand, the distribution of goods to more than 7,000 islands and the decrepit infrastructure pose an enormous challenge to Thai exports.

In general, the full integration of the AEC is beneficial to Thailand with regard to a market expansion opportunity in which the consumer base increases from currently 67 million to over 600 million. Besides, the elimination of trade tariffs and NTBs would positively contribute to a larger export market. Nevertheless, the AEC brings with it the fiercer intra-regional competition, in particular, which is relevant to this research, the vegetable products with either comparable or inferior comparative advantage relative to those of other AMSs.

To reap the benefits of the full integration of the AEC, this research has thus put forward the following recommendations to systematically improve Thai vegetable products' competitiveness among the ASEAN member countries.

1. Export entrepreneurs must fully understand the terms and conditions of the trade agreements and duly comply with the terms and conditions.
2. The government agencies must gain a thorough understanding of the NTBs and NTMs of all trading partners and formulate the action plans in response to these non-tariff trade strategies.
3. Informal collaboration and alliance with importers (i.e. buyers) of Thai vegetable products should be promoted to mitigate the impacts of NTB and NTM.

## 5. Conclusions

This research has evaluated the competitiveness in 14 fresh and 9 preserved vegetable products exports of Thailand in relation to Australia, China, Japan, South Korea, the USA and nine ASEAN member countries using the RCA and RSCA indices. The study found eight vegetable product groups (four each for fresh and preserved vegetable product groups) with a comparative advantage vis-à-vis those of the other countries in the study. In addition, Thailand seems to be enjoying more benefit from the preserved or processed vegetable products since these products require certain levels of technology, which some rival ASEAN countries lack. Thus, the country should focus more on the preserved or processed vegetable products for export to the AEC. To enhance the competitiveness of the fresh vegetable products, Thailand should attach greater importance to the quality since Thai products are known more for quality than quantity (low prices). Furthermore, the issues of overreliance on the chemical insect repellants and chemical residues on the products should be tackled.

The research findings also show that most ASEAN countries are in either the dog or question mark quadrant of the BCG matrix, suggesting that their exports of vegetables experience a dual-low dilemma in which both the market share and the market growth are low. Moreover, the findings reveal that Cambodia, Vietnam, Australia, Laos, Myanmar, China and Malaysia possess the comparative advantage with regard to the fresh and chilled vegetables export in the ASEAN market. For the preserved and processed vegetables, Malaysia, Australia, Thailand, US, the Philippines and China possess the considerable potential to supply to the ASEAN market with such agriculture products.

Essentially, the full integration of the AEC would benefit the Thai fruits and vegetables sector due to a larger market with a combined population over 600 million, the enhanced regional cooperation, the improved economies of scale, and dynamism of the bloc members. Moreover, the integration would bring about the improved or innovative forms of supply-chain coordination, thereby further facilitating the bilateral and multilateral trade activities between the member states.

## Supplementary material

Supplementary material can be found online at <https://doi.org/10.22434/IFAMR2016.0029>.

**Table S1.** Harmonized System nomenclature.

**Table S2.** The intra-ASEAN exports of fresh and chilled vegetables (HS code 07) from 2007-2014.

**Table S3.** The intra-ASEAN exports of preserved and processed vegetables (HS code 20) from 2007-2014.

**Table S4.** The Boston Consulting Group matrix (BCG) analysis of the fresh (HS 0701-0714, BCG07) and preserved (HS 2001-2009, BCG20) of the 15 countries for the years 2004-2013.

**Figure S1.** Proportions of global exports of fresh and processed vegetables in 2011 (by economic bloc).

**Figure S2.** Proportions of global imports of fresh and processed vegetables in 2011 (by economic bloc).

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