



Transformation of Vegetable Industry through Policy Intervention and Technology Transfer

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INTRODUCTION

The vegetable industry is one of the important industries in Malaysia. It provides food for people, creates jobs for rural community and generates revenue for economic development. In general, the vegetable industry in Malaysia is carried out by small-holder farmers. Farmers manage their land or rented land from the government. The average size of farm is between one and 1.5 hectares. The farmer's small size is generally not viable, and income from vegetable cultivation is unable to sustain a better livelihood. As a result, many farmers do other jobs to supplement their income.

The development of the vegetable industry in Malaysia is guided by the National Agriculture Policies (NAPs), Government Transformation Program and the Eleventh Malaysia Plan. The National Agricultural Policy was established to address the issue of rural poverty and imbalance of income between the commercial and traditional farmers. This policy was formulated to eradicate poverty and slow performance of the agriculture sector. The emphasis of this policy was to eradicate poverty among traditional farmers and at the same time to increase the value of the agricultural produce for export markets. The development of the agricultural sector was geared towards a modern industry. Downstream and value added agricultural industries were emphasized and encouraged by the application of innovation and technologies in the value chain of vegetable industry. This paper discusses the issues of the vegetable industry in Malaysia, and how policy intervention and innovation could transform the industry into a profitable one.

Vegetable industry

Generally, growing and marketing vegetables is considered a small industry in Malaysia. Vegetables are cultivated in approximately 38,400 hectares or only 0.58% of the total agricultural land in Malaysia, in 2015. The land area has decreased around 2.3% as compared to 2010, due to competition with other industries such as manufacturing (Table 1). Some of the lands were converted into housing estate, especially within the urban area.

Table 1. Agriculture land use, 2010 – 2020

Commodities	'000 Hectare			Average Annual Growth Rate (%)		
	2010	2015	2020	10 MP		11MP ¹
				Target 1	Achieved	
Industrial Commodities						
Rubber	1,020.4	1,087.6	1,197.6	2.2	1.3	1.9
Oil Palm	4,853.8	5,480.0	5,672.0	1.9	2.5	0.7
Cocoa	20.1	18.2	23.4	8.4	1.4	5.2
Pepper	14.2	16.3	18.3	4.0	2.8	2.3
Subtotal Industrial Commodities	5,908.5	6,602.1	6,911.3	2.0	2.2	0.9
Agrofood						
Paddy	444.3	394.2	368.2	-2.4	-2.4	-1.4
Vegetables	39.3	38.4	45.7	2.4	-0.4	3.5
Fruits	239.4	203.1	206.9	-0.5	-3.2	0.4
Coconut	105.7	85.8	77.6	-3.4	-4.1	-2.0
Fisheries	33.8	46.8	116.6	4.0	6.8	20.0
Others	7.1	9.6	10.2	5.2	6.4	1.1
Subtotal Agro-food	869.6	777.9	825.2	-1.4	-2.2	1.2
Total Land Use	6,778.1	7,380.0	7,736.5	1.4	1.9	0.7

Source: MOA, 2016c

In general, it is estimated that around 46,000 or 8.18% of the total farmers are involved actively in vegetable farming (MOA, 2016b). The vegetable industry is carried out by medium age farmers. The average age of vegetable farmers is 45 years old, and almost all of them received at least secondary level of education. More than 60% of farmers are new to the industry as most of them have less than ten years' experience in cultivating vegetables. The young farmers are receptive to innovation and technologies. Thus, it is easy for them to adapt to technology transfer.

Malaysia produces around 1.03 million tons vegetables in 2015. An increase of around 58% as compared to 2010. Even though the land area has decreased from 39,300 hectares (2010) to 38,400 hectares in 2015, the production increased tremendously, due to the application of technologies. Vegetable production was better through the increase in productivity of the existing and new areas. The production will be increased by intensity of crop rotation from 1.8 in 2010 to 2.5 in 2020. Vegetable production is expected to increase from 0.7 million tons to 2.9 million tons with a growth rate of 9.8% per annum (Fig. 1). Production is projected to increase due to increase in productivity and expansion of new areas for cabbage, mustard, cucumber, spinach, eggplant, beans and okra.

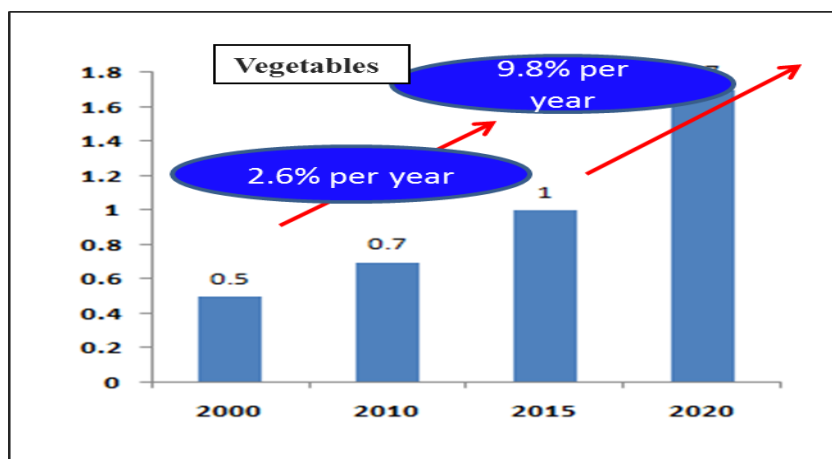


Fig. 1. Vegetable production in Malaysia

However, the production is still insufficient to meet the demand of local consumers. The demand has increased from 1.58 million tons in 2010 to more than 1.91 million tons in 2015. The wider gap of supply is contributed by higher demand for temperate vegetables. Malaysia imports around 880,000 tons of vegetables from China, Holland, USA and Thailand, mostly the temperate types of produce such as cabbage, carrot and cauliflower.

The demand for vegetables is projected to increase from 1.91 million tons in 2015 to 2.4 million tons in 2020, with growth of 4.5% per annum. Consumers are concerned about their health and eat more vegetables. The consumption of vegetables grows by 2.6% per annum from 55 kilograms to 70 kilograms per annum in the same period (Table 2).

Table 2. Demand and Supply of vegetable in Malaysia (2011-2020)

	2010	2015	2020	AGR (%)		
				2011-2015	2016-2020	2011-2020
Demand	1,580	1,907	2,454	3.8	5.2	4.5
Supply	651	1,029	2,956	9.6	10.0	9.8
Supply gap	41.2%	53.9%	120%			

Source: DOA, and DOSM, 2016

Consumers are aware of the importance of health care, and the changes of lifestyle which created opportunities for farmers to increase vegetable production. At the same time, entrepreneurs have the chance to develop new vegetable-based products such as minimally processed vegetables, vegetable juices, functional foods, frozen vegetables, and high-fiber vegetables. Thus, the Malaysian government sets a new direction to transform the vegetable towards a competitive industry. The development of this industry will focus on increasing the productivity, the expansion of commercial cultivation, the reduction of post-harvest losses and strengthen market intelligence.

Impact of policies and program intervention

There are several policies, and initiatives that have been implemented by the Government to promote the vegetable industry. The government introduced the National Agrofood Policy 2011-2020, followed by the Economic Transformation Program (ETP) and Government Transformation Program (GTP) and the 11th Malaysian Development Plan (2016-2020).

The National Agro-Food Policy (2011 – 2020) was established to address the issue of rural poverty and imbalance of income between the commercial and traditional farmers. This policy was formulated to eradicate poverty and slow performance of the agriculture sector as the country's engine of economic growth. This policy emphasizes strategies to eradicate poverty among traditional small holder farmers and at the same time, increase the value of the agricultural produce for the export markets. The development of the agricultural sector was geared towards modernization and commercialization of the sector (MOA, 2016c).

National Agro-Food Policy (NAP) 2011-2020

The NAP 2011-2020 is succeeded by the National Agriculture Policy 1, 2 and 3 which was introduced since 1980. *The National Agrofood Policy is the guiding principle for Malaysia to stay competitive in the agriculture and agri-based industry while providing food security at affordable price for the populace, despite their burgeoning socio-economic status.* The NAP was formulated with the objectives of (i) providing food security and safety (ii) making agri-food a competitive and sustainable industry, and (iii) increasing level of income of agri-based entrepreneurs. In order to achieve those objectives, seven development strategies were outlined, (i) Ensure national food security by increasing food production and food access, as well as stabilizing food prices, and ensuring food safety and nutrition; (ii) Increase contribution of agri-food industry by increasing productivity through the use of intensification of agriculture factors, and expansion of agri-based industry; (iii) Complete value chain by strengthening of local and global markets web, and integrating sustainability practices and traceability system as part of the value chain (iv) Empower human capital by providing knowledge and skills to extension workers; (v) Strengthen R & D activities, innovation and use of technologies (vi) Create good ecosystem for private sector-led business by providing adequate integrative infrastructure and agriculture-related business activities, competitive investment incentives to attract local and foreign investors, enhance financing and risk sharing access, strengthening the roles of agricultural SMEs, and rationalizing subsidies and minimize market distortions; and (vii) Strengthen the delivery system by involving relevant stakeholders, and most importantly, the need to develop a Strategic Industry Development Council (SIDC). This policy targeted to increase the capacity, improve competitiveness through quality products, products certified with international standard and offering the niche products. Under the NAP, several strategies were introduced to promote the vegetable industry by the following initiatives:

- Open new land area and increase productivity;
 - Enhance post-harvest facilities and marketing logistics; and
 - Strengthening market organic vegetables.
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- Open new land area and increase productivity
Land for vegetable cultivation will be expanded to 45,700 hectares in 2020, an increase of around 3.5% as compared to 2015. Under the NAP, government identified ten commodities to be cultivated in a bigger scale for domestic as well as export markets. The commodities include cabbage, tomato, long bean, lady finger and chili. Vegetable production will be enhanced through application of new technologies such as fertigation and factory farming. Good agricultural practices and modern cultivation methods such as fertigation, precision farming and the use of rain shelter are expected to increase productivity from 12.9 tons to 16.8 tons per hectare. The expansion of land area and increase in productivity is expected to contribute around 84% and 16% of the total production of 2.4 million tons in 2020. Strategies to increase the opening of the new area of 8,000 hectares will be implemented as follows:

- Develop new areas through Permanent Park for Food Production, cultivation of vegetables in idle land, and commercial-scale private farms;
 - Promote the integration of vegetable crops with rubber and oil palm plantation; and
 - Transform the non-granary area into vegetable cultivation.
- **Improve post-harvest handling and marketing facilities**
Farmers and entrepreneurs are encouraged to give emphasis on post-harvest handling that includes packaging and storage of vegetables to sustain quality and prolong their shelf life. Entrepreneurs are also advised to comply with 3P Regulation (Pembungkusan, Pelabelan and Pengredan or literally translated as Packaging, Labeling and Grading) under the Regulations of the Federal Agricultural Marketing Authority. The 3P regulation aims to enhance the efficiency and effectiveness of the marketing of local produce in order to retain their competitiveness. It also aims to maintain current market share and to expand both domestic and overseas market access in line with the changes in global trade. Facilities at the collection centers, grading and distribution will be fully and widely used to strengthen the marketing of fresh vegetables. Marketing of vegetables which is aimed toward contract farming will be intensified by identifying the leading companies in order to ensure that farmers get a premium price and guaranteed market.
 - **Strengthening the market of organic vegetables**
Awareness on vegetables that are free of chemicals and are considered safe are expected to increase the demand for organic vegetables among consumers. Efforts will be intensified to promote the production of organic vegetables because they can be sold at premium price. Farmers are encouraged to change their farming practices and move to organic farming. More land will be cultivated with organic farming and certified with the Malaysian Organic Scheme (SOM).

Economic Transformation Program on Agriculture

The Economic Transformation Program (ETP) is a comprehensive program that aims to transform Malaysia into a developed nation by 2020. It also aims to enhance the gross national income per capita from US\$6,700 in 2009 to US\$15,000 in 2020. Under the ETP, the government focuses on 12 national key areas (NKEA) that includes agriculture. The Agriculture NKEA focuses on transforming a traditionally small-scale, production-based sector into a large-scale agribusiness industry that contributes to economic growth and sustainability.

This transformation is based on an integrated and market-centric model that comprises four key themes that include capitalizing on competitive advantages, tapping premium markets, aligning food security objectives with increasing GNI, and participating in the regional agricultural value chain.

Sixteen entry projects have been identified to spur growth of this sector and a special project is for the development of the fruits and vegetables industries. This project aims to produce premium fruits and vegetables to the Middle East and Europe, which import more than 50% of the global production of higher quality of local fruits and vegetables that comply with food safety standards. Around 3000 farmers are placed under the anchor companies that manage the integrated supply chain model, gain market access and export the produce. Three high-value highland vegetables such as lettuce, tomato and capsicum have been identified as target produce for this project.

Under this project, the Ministry of Agriculture and Agrobased Industry has targeted to increase the total export value of Malaysian fruits and vegetables to RM400 million (US\$90 million) in 2020. This is will be achieved by strengthening ties with Malaysia's existing trading partners to create more markets for the country's fruits and vegetables.

Eleventh Malaysia Plan (11MP)

In 2016, the government launched the Eleventh Malaysian Plan that covers the period of 2016-2020. Under the 11MP, the government aims to modernize the agriculture sector through the application of science and technology. The agriculture sector is expected to grow at 3.5% yearly and accounted for 7.8% of GDP in 2020. Efforts will focus on strengthening food security, increasing productivity, improving the skills of farmers, fishermen and small farmers, improving delivery services and support, strengthening the supply chain, and ensuring the compliance of requirements of the international market (PEMANDU, 2016b). The 11MP sets new approaches and strategies to enhance the agriculture industry such as:

- Use of ICT and agricultural technology that can improve production efficiency and increase productivity, and also reduction of production costs. Use of application can help disseminate information on market demand and prices as well as an interactive platform for advice;
- Preservation and optimally use of agricultural land through the "Taman Kekal Pengeluaran Makanan (TKPM) or literally translated as the Permanent Park for Food Production. During the 10th Malaysia Plan, TKPM was able to provide benefits to as many as 453 farmers, of which 171 farmers earned more than US\$750 per month. This initiative will be strengthened and benefit more farmers and entrepreneurs;
- R&D and commercialization particularly focused in the development of new varieties and to improve integrated management of diseases and pests, and also product development;
- Training that could improve farmers' skills, and the Agropreneur program was introduced by government to encourage youths to participate and become entrepreneurs. The government also provides grants or soft loans to promote more entrepreneurs to become involved in fruit and vegetable-based product business;
- Strengthening of cooperatives and agricultural organizations throughout the supply chain could ensure that farmers get higher income on an ongoing basis through cluster-based approach by production, quality control, processing and marketing; and
- Improve market access through online marketing, promotion and branding that can help increase sales.

Agricultural technology transfer

Downstream and value-added agricultural industries were emphasized and encouraged through the application of innovation and technologies in the value chain of vegetable industry. Many innovations and new technologies were introduced in the supply chain, from production until marketing of vegetables. The technologies include the development of new varieties, the formulation of synthetic and organic fertilizers, the introduction of production system, integrated pest and disease management, post-harvest handling, quality standards, labeling and branding, and marketing. These innovations and technologies were developed by government research institutions, including MARDI, and transferred to farmers and

entrepreneurs. These technologies were transferred freely as public goods and benefited the farmers and entrepreneurs (Rozhan, 2015).

Technology transfer by MARDI has evolved from a simple dissemination of technologies through technical papers to a combination of hands-on training, consultancy and a complete package of technology transfer that includes the physical technology such as machines, new variety of crops, and new agricultural or processed products. Appropriate technologies used in the project activities refer to technologies that are cheap, easy to learn, suitable for target groups, suitable for small-scale operations, environmentally friendly and easy to handle and maintain.

The example of technologies developed by MARDI are as follows:

- Urban farming production system;
- Edible landscape;
- Vertical farming for high value vegetable;
- Organic farming: Production system and fertilizer for high value vegetables;
- Organic production system and sustainable ecosystem for vegetables, fruits and herbs;
- Post-harvest and minimally processed vegetables for institutional consumers; and
- Cultivation of round cabbage at lowlands.

CONCLUSION

Vegetable is still a relevant industry in Malaysia. This industry has a great future as the demand of locals as well as global consumers is increasing every year. The concern toward health and changes in lifestyle has led to higher demand for vegetables, especially the less chemical or organic produce. The future direction of the vegetable industry in Malaysia will be guided by more dynamic policies that support the welfare of the farmers. This industry will also develop through the application of innovation and technology in the value chain, from production until the produce reach the consumers.

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