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Introduction

India's historical footprint in Malaysia dates as far back as two thousand years ago as proven by the discovery of ancient Hindu relics and ruins at Bujang Valley in Kedah, Malaysia. Of course, since then history has taken over with numerous events that shaped Malaysia today. As of 2024, India's footprints are everywhere in the lives of the Malaysians such as food, culture, religion and languages. On the country level, Malaysia and India have maintained close cooperation in defense, politics and economics and are close partners in trade.

As for trade, India's decision to restrict white rice export in July 2023, sent shock to the world rice eating nations including Malaysia as she is net rice importer and India is one of her major sources of supply. Rice production in India has exhibited an impressive development in the last decade. As shown in Figure 1, the paddy production increased by a quarter from 160 mn MT to 201 mn MT between 2012/2013 and 2023/2014. However, after the pandemic, the rice production shrunk from 203 mn MT to 201 mn MT due to El Nino phenomenon. Domestically, due to post-pandemic effect, the inflationary rate in 2023 was relatively high, in that the Consumer Price Index reached 7.44% while the Consumer Food Price Index registered at 11.51% in July 2023 (over July 2022) (Min. of Statistics & Program Implementation, 2023). To check the domestic prices and to ensure domestic food security, the Indian Government has instituted measures to restrict export of rice from India. The Notification No. 20/2023 produced by the Directorate General of Foreign Trade stated that "Export Policy of Non-basmati white rice (Semi-milled rice, wherever or not polished or glazed: Other) under HS Code 1006 3090 is amended from "Free" to "Prohibited" (Min. of Commerce and Industry, 2023). The prohibition of white rice was effective on 20th July 2023. At the same time the government intended to continue providing grains for the 228 million poor farmers and consumers. However, the impact of the export restriction on the world rice market was devastative as the price level has increased by more than 20% compared to ten years ago (IMF, 2024).

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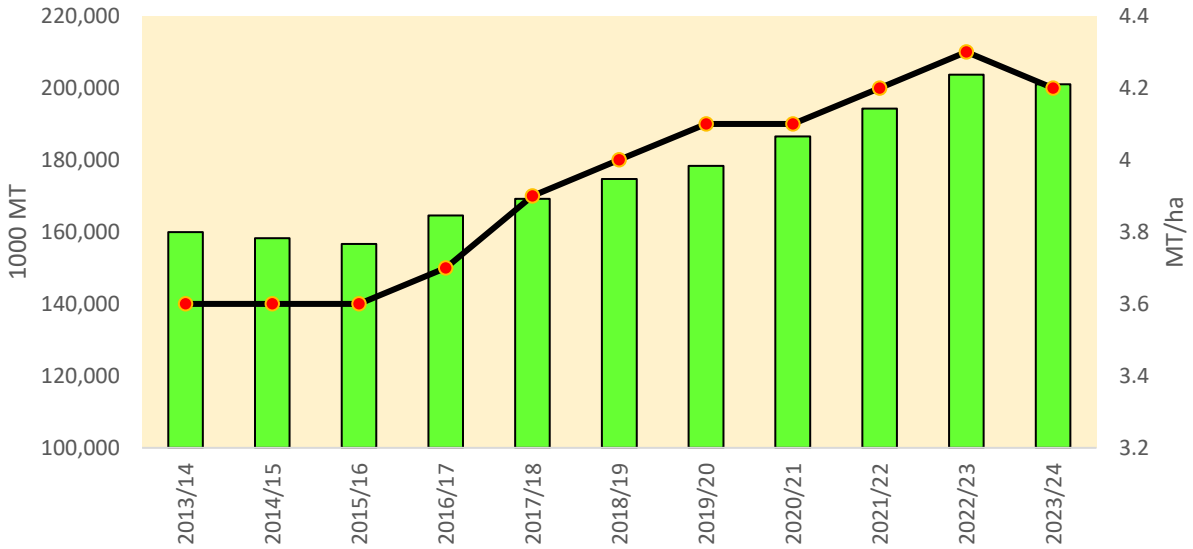
Figure 1: India: Paddy Production (1000MT) and Productivity (MT/ha), 2013/14 - 2023/24



Source: USDA (2024). India: Production of Rice

Most countries are in the midst of recovering from the biggest crisis the world has ever experienced which was driven by triple-challenge: ie. pandemic, Russia-Ukraine conflict and climate change phenomenon. The export ban saw Malaysia grappling with problem of providing adequate rice to her population. She has to rely on high price imports of rice to offset local shortages. The increase in rice price was an additional burden to the poor consumers at large as the country was experiencing post-pandemic inflationary effect. Besides food availability problem, lower income affected the purchasing power of the poor consumers. For instance, UNICEF study (2019) indicated that the quality of the urban dwellers' diet was badly affected as fresh food and protein were unaffordable. Similarly, every time India experiences onion shortages, Malaysia will be affected as onions are one of the ingredients in the country's dishes for all the races (Malay, Chinese and Indians). Hence, disruption in India's food production will affect Malaysia's import but not vice versa. Since India is self-sufficient in food, hence it does not import much food items from Malaysia with the exception of palm oil which is being used to produce local vanaspati ghee. Unlike India, with the exception of poultry and pork, meat and fisheries products, Malaysia is a net importer of other food items.

In the last few decades India has achieved remarkable progress in food production. From a country that was dependent on food imports and donations in 1960s, she has become self-reliant in food and one of the world's largest exporters of major food items. These include, rice, wheat, milk, honey, meat, chickpeas and lentils, and bananas. While Malaysia, the food sector has not grown as fast as it industrial crops particularly palm oil and rubber. In fact, the self-sufficiency levels or

SSLs for most of food products have shown a downward trending and food import bill has significantly increased particularly after pandemic.

In view of a challenging future where the landscape for food security is characterized by complexity, uncertainty and shock, Malaysia has to relook at her food security strategy and learn from India. Complexity refers to the interaction of multi-dimensional factors in a feedback loop manner as manifested during the pandemic crisis. The combination of pandemic, Russia-Ukraine conflict and climatic hazards proved to be disruptive to the world economy during 2020-21. Uncertainty and shocks could come from numerous sources such as climate change, price variability and other technical factors such as new technologies, herd behaviour of market participants and so on. Under such a condition, the conventional method of addressing food security using "silo" or "vertical" approach is no longer applicable. For instance, the Green Revolution which focused on the usage of chemical fertilizer to improve yield has been shown to be unsustainable, particularly the damaging impact of the chemical fertiliser on water and soil in India and Malaysia. Besides, fertilizer is costly as it is determined by the fossil-fuel price which is subject to its own supply and demand dynamics. Damages to the farm's eco-systems will erode the sector's resilience in the long term. To that end, the paddy sector demands a greener Green Revolution for sustainability and efficiency. In fact, United Nations in their Food Systems Summit in September 2021 proposed the use of systems approach in analysing and managing food security. This shift implies a change in the paradigm and mindset of the stakeholders involved in the food security; ie policy makers, industry participants and researchers. They must have appropriate mental models in understanding and addressing food security issues.

In view of the shift in approach towards food security, this paper briefly examines the application of systems thinking to food security for both countries. Based on this approach, proposals are made on the possible collaborations for both countries in developing a sustainable food security ecosystems. The following paragraphs sketch the development path of agriculture in India and Malaysia. This is followed by a description of systems thinking and its application to the food security and proposals for collaborations of the two countries.

Food Sector Development Path: India and Malaysia

As for food security pursuit, both started on the same footing but differ in outcomes. They differ widely on geo-physical and socio-economic mix. But the starting base was almost similar. That is, both countries were the victims of the same colonial master, savaged by WWII; majority of the population was poor, dependent on imports for basic food and had a big food trade deficit. The scale of problems may be bigger in India due to its size, diversity in geophysical characteristics and socio-cultural complexities. Despite the adversities and diversities, India has solved its food deficit problem. The paths taken by both countries were about similar, but India began to excel in the early 21st century.

Both countries launched Green Revolution to increase production and reduce poverty. In India, under the leadership of a well-known scientist Dr Swaminathan, he has transformed India's agricultural landscape from famine and hunger to surpluses in production through science and R&D. He started with genetic manipulation in paddy and wheat, developed fertilizer - responsive, high-yielding and short-stature varieties. By end of 1970s, the country became self-sufficient in grain production.

India has revolutionised agricultural production equation by going beyond relying on the four conventional variables: land, water, labour and energy resources. The productivity of these four factors is remarkably enhanced by advanced technology. These include: (i) high yielding varieties that were engineered to be more responsive to fertiliser and resistant to lodging. (ii) Improved crop nutrition through chemical fertilisers. (iii) Crop protection through pesticides and herbicides. (iv) Mechanisation and precision farming. (v) Innovations like drip irrigation and intercropping which optimised water usage and land productivity (The Economist, 22 June 2023).

Other major innovative strategy is deepening agricultural credits and insurance through private banks. HDFC Bank, which is a subsidiary of the Housing Development Finance Corporation, led the pack by charging about of a third to half the rates that are typically found in the informal market. This has expanded their agricultural lending from USD1.2 bn to USD7.5 bn 2022 (The Economist, 22 June 2023). Their success caused more banks to follow suit hence increasing choices to farmers and competition in this sector. This lending boom sharply reduces costs for farmers, better access to credits and minimises their risk of otherwise being victimised by vicious loan sharks.

The other revolution that boosted the food sector is the "ag-techs" disruption at all levels of the supply chain of food, leading to substantial jumps. India implemented digital-friendly policy ie supporting start-ups in agriculture and providing extensive provision of internet penetration in rural India. Between 2013-2020, the ag-tech starts up or companies grew from 50 to more than 1000 which have raised some $1.6bn (Amith Agarwal, 2023). The digital start-ups facilitated farmers' production and marketing activities. Numerous digital applications were developed to facilitate farm processes such as These include: provision of farming supplies, input and equipments, expert services, finances, farm records, distribution and marketing (McKinsey & Company, 2023).

Unlike other technologies such as robotics, big machines or mills which require large scale operations, digital apps are size neutral. The apps can be used both by small and big farmers alike. This digital trait explains for the success of ag-techs in Indian food sector growth.

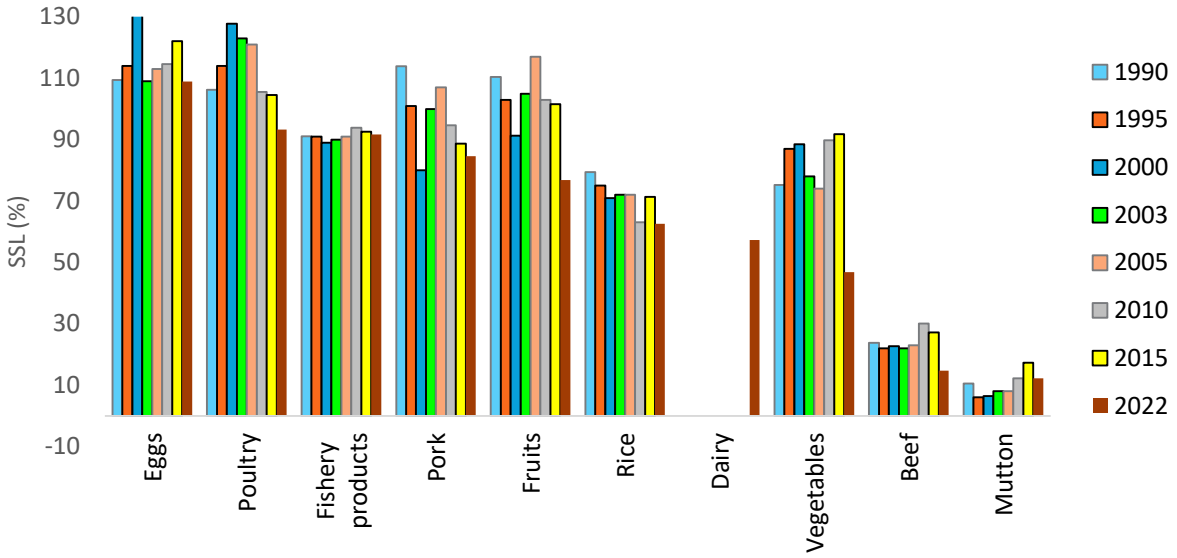
It is not all rosy picture of the Indian food sector. The sector is plugged with numerous resource issues such as land degradation and soil health, water scarcity and irrigation woes, fragmented holdings and subsistence farming, price fluctuations, climate change among others. Nevertheless, in a nutshell, India has proven that despite all the odds, it has risen to be one of the world largest food exporters by fully utilising its local resources and talents.

Malaysia treaded a different path for her agriculture and food. The colonial master had exploited the country's natural resources towards the production of industrial commodity – rubber to support their automobile industry in the nineteenth century. By 1970 about 2 mn ha of rubber was planted (Depart of Statistics, Malaysia or DOSM). Due to competition from the non-agricultural sectors, area under rubber began to decline and this was followed by the plantation of a new crop, oil palm which is more lucrative at the expense of food (Fatimah et al., 2019). By 2023, the oil palm the area under which reached 5.6 mn ha or 75% of Malaysia's agriculture area. Oil palm contributed 44.2% to the agricultural valued added in 2022, rubber (7.4%) (DOSM). Malaysia is ranked second as the world largest oil palm producer and exporter in the world in 2022 (www.statistica.com).

These lop-sided development towards industrial commodities has somewhat marginalized food sector development which left a lasting legacy to the country with which it is struggling till today. Basically, the SSL reflects the ratio of domestic production to apparent consumption in terms of quantity where the latter is calculated as production plus import and net stock and minus export. The higher the SLL level, the higher the ratio of production over apparent consumption indicating that there is high level of local production to fulfil consumption and hence low import dependence and vice versa. The determinants of consumption are population growth, increase in income and changing lifestyle. As of 2022, with the exception of poultry and pork meat, the self-sufficiency levels or SSLs[1] of food items were below 100% and downward trending (Figure 2). These data suggest that the consumption is growing faster than local production. The deficit of local food is met through import.

[1] SSL is defined as the ratio of Production over Production + Import +/- Stock – Exports (Ministry of Agriculture and Food Industries, 2021)

Figure 2 Self-sufficiency levels of selected food commodities (%) selected years



Source: Department of Statistics, Malaysia (various years)

Malaysia implemented Green Revolution in the 1970s with big success where SSL for rice (the country's staple food) increased from 40% in the 1950s to 85% in the late 1970s. However, despite subsidies and full control of the market by the public sector since 1971, the progress has slowed down due little improvement in yield and market innovations (Fatimah et al. 2019a). By 2020, the SSL for rice has reduced to 63.9% (DOSM).

Import filled the food production–consumption gap. As of 2010, the food deficit stood at RM12.1 bn compared to RM31.2 bn in 2022 (Economic Planning Unit, 2022). During pandemic, food availability was limited to the poor sections of the community due to restrictions and limited supply. However, as the pandemic subsided, the problem minimised.

Malaysia has been in deficit in food trade (since 1950s) due to higher import growth relative to exports. Besides imported labour, Malaysia also imported most input items such as seeds, breeds, feeds for livestock (including soya beans), fertiliser, pesticides, agricultural machineries and parts. The import value of fertiliser was RM3.2 bn in 2022 (DOSM). The highest import value was cereals valued at RM13.7 bn (soya bean and rice) with a deficit of RM8.9 bn. Low productivity of food commodities at large and high input cost were responsible for the slow growth and lack of competitiveness of this sector.

There is no one single factor to explain the lacklustre performance of Malaysian food sector. Besides the heavy biased policy emphasis on the industrial crops, other setbacks include limited R&D and innovations, extensions, structural and institutional limitations. Institutional problems

include weaknesses in collective effort among farmers, ineffective micro credit system and limited infrastructures in the hinterland areas. Structural issues include lack of competition in the market especially in the paddy and rice market and some of the food commodity markets. The convergence and interconnectedness of all the factors explain for the sub-optimal performance of the sector. For instance, limited R&D innovations caused lower value addition in the food sector and hence disincentivized new entrants into the sector and so on. Despite her natural comparative advantages, such as richness in biodiversity, plentiful of sunshine and water resources, the inability of the policy makers to capitalize on them led to the slow growth of this sector. On the contrary, India capitalizes on her young talents to drive extensive digitization to expedite efficiency in food production and marketing in India. This is further supported by numerous infrastructural programmes and minimum support price policy. In short, India provides an effective food security policy strategy that propel her food industry into a greater height.

However, both countries have not steered their food sector along the systems principles which resulted in the serious repercussions on the environment due to unsustainable practices. Under systems' view, all important sub-systems such factors of production and environmental factors are embedded in the policy framework. Failing to do this, resulted in serious resource degradation which may cause food insecurity and poverty which may further aggravated in a vicious circle if unaddressed. The following paragraphs provide a systems framework that is useful as a guide for a sustainable future for the food sector in both countries.

Systems Thinking

A system is a set of related components that work together in a particular environment to perform whatever functions are required to achieve the system's objective (Meadows, 2008). It is a discipline for seeing wholes and a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots (Senge, 2006). Unlike other approaches, systems thinking allow one to represent and assess dynamic complexity. Note that the UN and FAO recognised the presence of "complexity" in the food systems. Complexity encompasses traits like multi-dimensionality of factors, interactions of agents, feedback relationships, non-linearities and delays among others (Sterman, 2010).

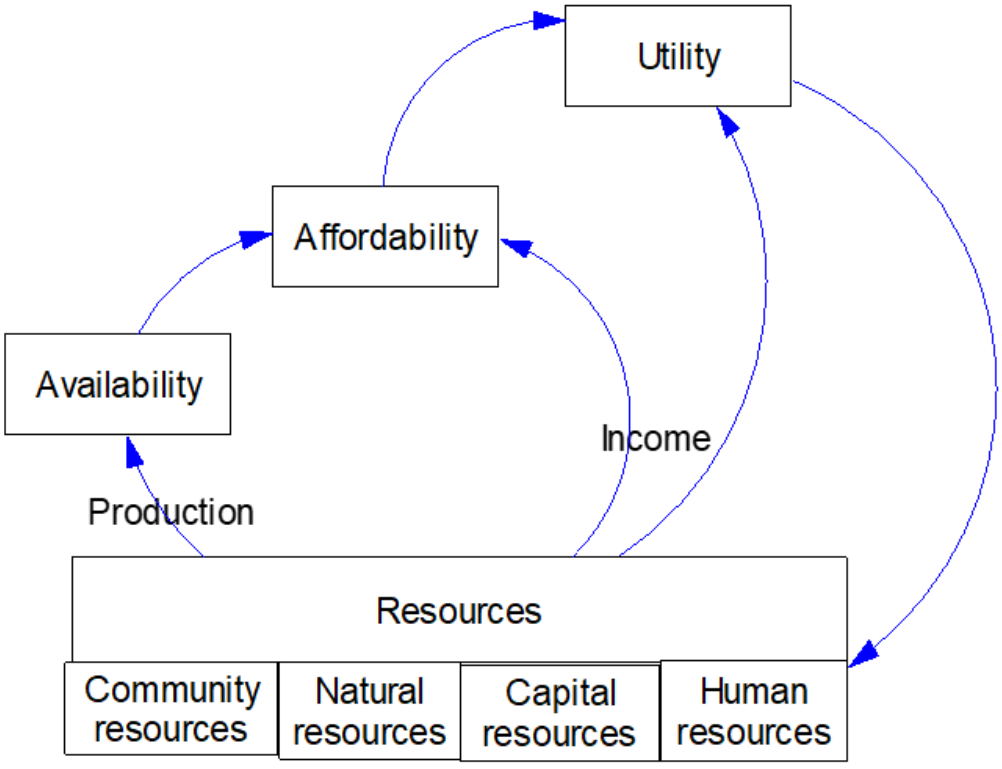
According to the World Food Summit in 1996 (FAO,1996), "food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". This definition has been the framework of reference on food security policy worldwide. The stated framework defines four main dimensions of food security namely; food availability, accessibility and utilisation and stability of the three dimensions (FAO, 2008).

Food availability refers to the 'supply side' of food security. The determinants of food supply are: food production and stock levels and trade of food. Food accessibility refers to access by

individuals to adequate resources or entitlements for acquiring appropriate foods for a nutritious diet. Food utilisation refers to adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. The determinants of food utilisation include non-food inputs in food production (fertiliser and chemicals), dietary behaviour and availability and access to food. The stability of the three pillars is a function of economic and social stability of a country.

As shown in Figure 3, the three pillars do not exist independently but are related to each other. For instance, the availability of food is determined by production which is a function of resources such as community, natural, capital and human resources. Once availability and affordability are functioning, nutritious food can be made available for the population which helps improve health and quality of human resources. Better human resources improve productivity and income which are corollary to higher availability and affordability of food. The loop is closed when the population achieves better nutrition and hence better human capital to mobilise their resources for food production. Stability refers to a harmonious co-existence of the three dimensions to ensure a sustainable food security over time and space. In other words, the three dimensions must be fulfilled simultaneously as one cannot function without the other.

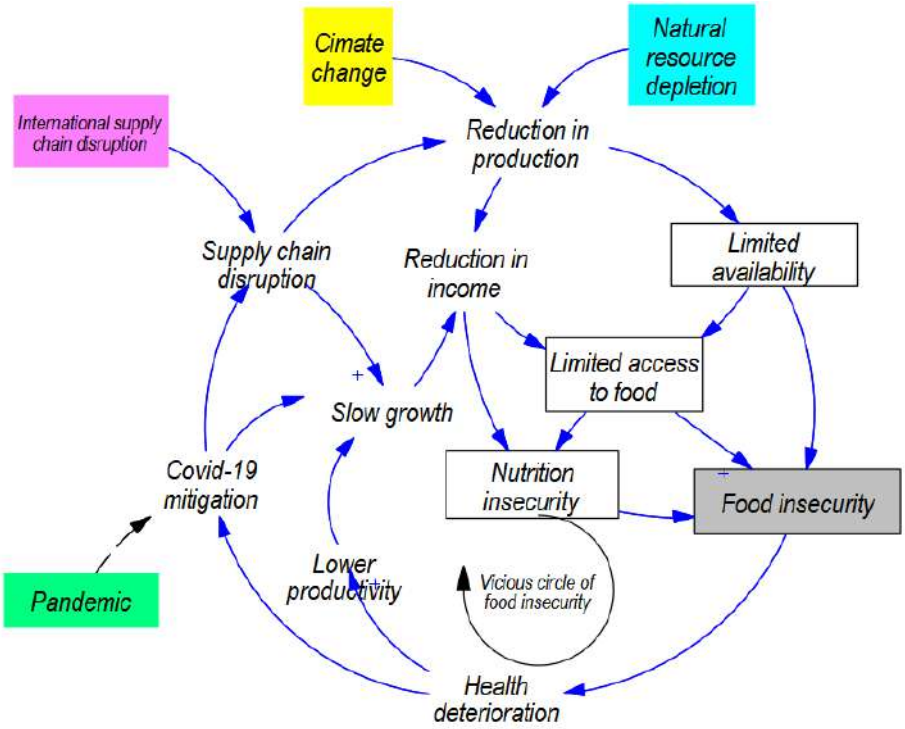
Figure 3 Interconnectedness of food security pillars



Source: Adapted from FAO (2008)

A shock into the food systems may cause food insecurity and poverty which may reinforce each other into a vicious circle loop (Figure 4). A pandemic shock into the food systems which is shown in the diagram as "Shocks for eg. pandemic", caused an increase in "Covid-19 mitigation measures" such as restrictive movement of inputs such as labour and fertiliser, hence positive causal relationship (in the same direction) between the two. However, these two measures resulted in "Restrictive input flow" hence the inverse causal link between the two led to limited movement of input in the system. An inverse relationship implies that an increase in mitigation measures caused slower movement of input.

Figure 4 Reinforcing loop of food insecurity



Source: Author

"Restrictive input flow" affected food production, reflected in the "Lower food production" variable. The latter caused "Lower food availability" and "Reduced income and livelihood" (note all three variables decreased together as in the earlier cases).

In a similar manner, "Reduced income and livelihood" resulted in both "Lower food accessibility" and "Lower nutrition security". The combination of the two latter variables and "Lower nutrition security" created a "Food insecurity" situation. With time, food insecurity produced "Health deterioration" which "Slower economic growth" and "Reduced income and livelihood". All these variables moved in the same direction hence indicating a reinforcing situation or loop

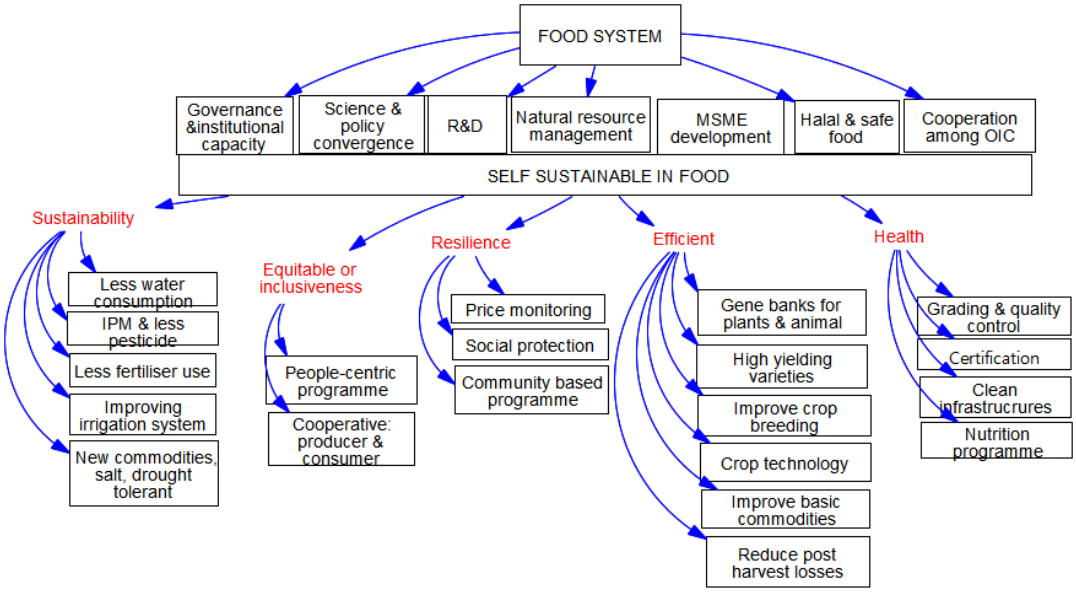
Other shocks that affected the system were “Climate Change” and “Natural resources depletion”. Note that all the links were positive creating a positive reinforcing loop (with the exception between “Covid-19 mitigation measures” and “Restrictive input flows” and “Slower economic growth”). In this case, the reinforcing loop produced decay in the system. It compounded change in one direction with even more change. The reinforcing food insecurity loop would continue orbiting, mimicking the case of the vicious circle of poverty.

In other words, despite the increasing trend of world food production, a country may suffer from food insecurity due to its poor resiliency in managing external challenges such as pandemic shock, climate change and geo-political instability. As proven in Malaysia, inability to ensure adequate level of domestic food production has caused the country to suffer food supply disruption in certain segments of her population during the pandemic crisis (Fatimah, 2023b).

Sustainable and Resilient Food Systems

The conventional linear approach of a resilient food systems depicted in Figure 5. The strategic approaches and their programmes are well listed and comprehensive. However, at times policies often implemented vertically. For instance, over emphasis on production expansion may overlook on the need to oversee its impact on natural resources and environment. Overuse of these resources may backfire production in the long term. That is there is a clear feedback relationship between production and natural resource use which is not captured in the diagram. Similarly, the impact of population growth, consumption sector and income per capita is not in the picture while these are important drivers of the food systems.

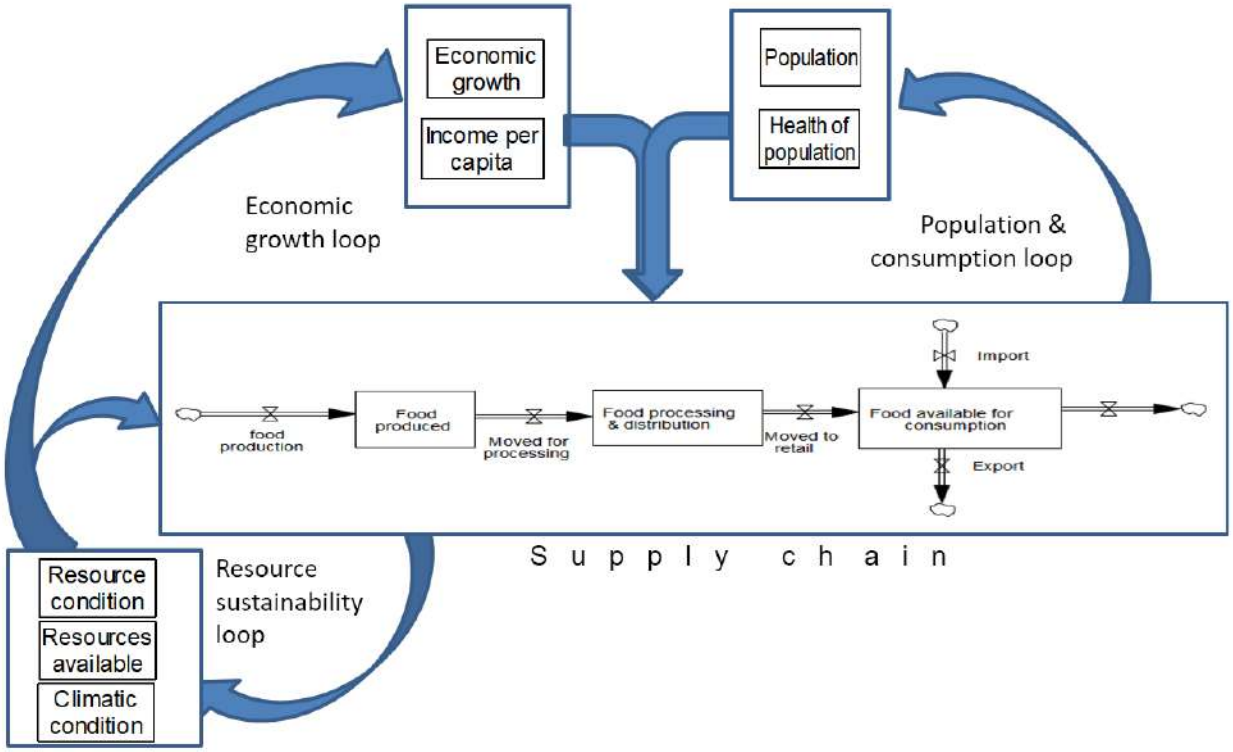
Figure 5: Linear Food Systems



Source: Fatimah (2021)

In the real world, the food systems are a function of interrelationships of a number of important systems that produce direct and indirect impact. A simplified view the new sustainable and resilient food system is sketched in Figure 6. It shows that there is a feedback relationship between the four sub-systems that are: "Resource and sustainability", "Population and consumption and Economic growth" and "Supply chain". "Supply chain" represents the distribution activities of food such as production, processing, wholesaling and retailing. The social behaviour dimension is embedded under consumption as unlike other systems, they lack empirical data unless specific surveys are carried out to source them.

Figure 6: Sustainable and Resilient Food Systems



Source: Adapted from Fatimah (2023)

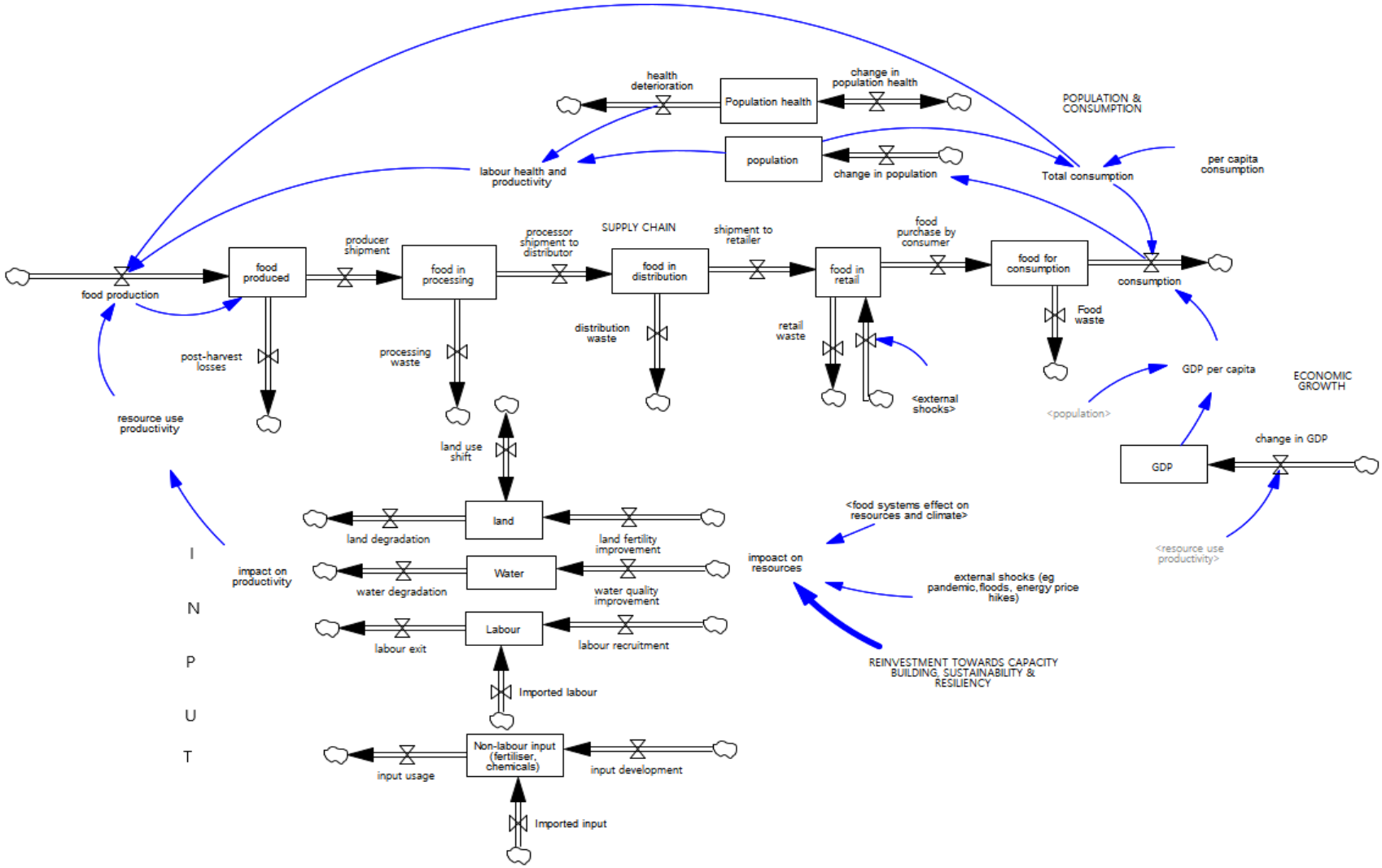
Figure 6 figure shows a close network and feedback relationship of the four sub-systems. The demand for food is determined by two major sub-systems namely "Population & consumption" and "Economic growth" which operate in loops. The former is a function of size of population as well as their health status. The latter is determined by "Income per capita" and "Economic growth". The two sub-systems function as the demand driver for the food systems which is then transmitted through the supply chain which activates the functions of various industry players such as producers, middlemen (buyers, processors, wholesalers, retailers and consumers). Activities in supply chain such as production and marketing affect resource use which include land, water, input as well as climatic situation (categorised as "Resource sustainability loop"). Farming and

marketing practices affect the sustainability of these resources. For instance, excessive chemical and poor water management results in high water foot-print are some examples of unsustainable practices which reduce resource productivity and hence food production. Note that the reverse occurs when an efficient use of resources will result in sustainability and stable economic growth and consumption. The resultant food production will affect the supply chain system as well as consumption in the "Population & consumption" sub-system. This feedback relationship creates the "Population & consumption loop". Similarly, resource productivity influences income per capita (which creates the "Economic growth loop") and hence demand for food. Food demand is then transmitted into the supply chain and resource requirement which affects income and consumption and back to the supply chain which completes the loop for the overall food systems.

The conceptual model of Figure 6 is further expanded by specifying the stocks and flows by focusing on the production, consumption, supply chain and natural resources systems (Figure 7). A stock is something that accumulates overtime. Flows are the input to and outflows from the stock over time.

The stock in the production system is called "food produced" and the inflow into this stock is "food production". "Food production" is determined by input (natural resources, labour and non-labour input) as well as consumption. As shown in the diagram "food production" is a function of natural resources such as "land", "water" and input comprise "labour" and non-labour input (fertiliser, chemicals). Each of these variables is determined by their inflow and outflow which has direct implications on their long-term sustainability. For instance, the sustainability of land is challenged when "land degradation" is severe compared to "land fertility improvement". Note that the amount of land available for food also depends on how much land is being converted to other uses such as oil palm and urbanisation. In other words, to ensure the sustainability of land for food, these are the major inflows and outflows that need to be monitored. Similar arguments apply in the case of water. Its sustainability depends on "water quality improvement" as against water degradation. Lowering water foot-print through advanced water management is one of the possible solutions. The natural resources are susceptible to unsustainable practices of the food systems indicated as "food systems effect on resources and climate" (such as pollution and GHG emissions) as well as other external shocks (eg pandemic, floods, energy price hikes).

Figure 7: Stock and flow diagram of food systems in Malaysia



Source: Stave and Kopainsky (2015) and Fatimah (2023)

As for “Labour”, there are two inflows which are “labour recruitment” from local and “imported labour” from foreign countries. Labour stock depletes by “labour exit”. The major issue in this system is the heavy dependence on “imported labour” which is not sustainable in the long term as it results in foreign exchange outflows, lower wage rate and discourage mechanisation and automation. Hence, an intervention is needed to improve productivity through advanced technology application for sustainability. A similar argument is applicable in the case of “Non-labour inputs (fertiliser, chemicals) stock. Malaysia depends on imports for almost 100% inputs such as fertiliser, seeds, breeds, feed for livestock, corn, soybean, machines and labour. This heavy dependence causes low margins to producers which explains the slow growth of the industry and lack of competitive advantage compared to neighbouring countries. As shown in the diagram the inflow of “input development” is crucial for the sustainability of the input sector in the long term. The darkened arrow indicates the policy supports required to ensure capacity building as well as sustainability and resiliency to improve labour and input efficiency and resource use respectively.

All the above input determines the “resource use productivity” which in turn affects “food production” as well as the country’s “GDP”. “Food production” is an inflow to “food produced” stock which is the first stock of the food supply chain. Besides low productivity, local food produced incur high “post-harvest losses” to the tune of between 25-50% (Tengku, 2017; New Straits Times, 2016). Continuous high post-harvest losses reduce producer’s income and value added of the produce.

The food product continues to enter into the supply chain system through “food in processing”, “food in distribution”, “food in retail” and lastly “food for consumption” stocks. Food waste occurs at every stage of the supply chain. For instance, at the consumer level, it is estimated that Malaysian consumers wasted about 8,000 tonnes/day (Lim et al., 2016). Besides consumer education to institute behavioural change, appropriate technology is needed to convert those losses for value addition. Major issue regarding the supply chain is the inequitable distribution of profit among the participants. More than 90% of producers are small farmers with farms less than two hectares. With small marketable surplus, their countervailing power is weaker compared to their buyers who are highly capital oriented. To achieve equity, the farmers need to be empowered with skills on advanced technology application and organised on a cooperative platform.

“Resource use productivity” has a direct relationship with GDP as well as “GDP per capita” and “consumption”. “Consumption” affects “population” and thus “labour health and productivity”. The latter is also dependent on the “Population health”. “Labour health and productivity” and “total consumption” will affect “food production” which is an inflow to “food produced” in the supply chain loop.

The above deliberations provide a simplified view of food systems through the lens of stock and flow diagram of system dynamics methodology. It provides the structure of the major systems

which are natural resources, farming, economic systems (represented by supply chain, economic growth and consumption). It indicates the interconnectedness between the said systems in a feedback loop manner. This approach is a departure from the traditional approach which tends to be sectoral, technical and short-term orientation in addressing food security issues. The food systems approach is a holistic view of the system. The food systems do not necessarily equate to food security but they do affect the food security performance. That is, well-functioning food systems may result in a better food security achievement and vice versa.

India-Malaysia Collaborations

Systems thinking has been in existence since 1960s but its application to food security world-wide was only introduced in 2021. It is a way of thinking that allows a country analyses and manages its food sector in a holistic manner. Since the application is still new, for a start both countries may focus on a comprehensive understanding of how the food systems in each country (FAO, 2023). This would involve the following activities: (data preparation to support the transition to sustainable food system. (ii) Evidence-based policy making and policy alignment. (iii) Bolstering public-private collaboration in sustainable food systems development. (iv) Facilitating local knowledge-building and knowledge-sharing. (v) preventing and mitigating risks. The deliberations are described in Table 1.

Table 1: Possible Areas of India-Malaysia Collaborations

Activity	Purposes
Data preparation to support the transition to sustainable food system	Systematic collection and analysis of data that covers various areas of the entire food systems. Purpose: to assess the performance of the food systems, and to inform decision-making.
Promotion of evidence-based policy making	To provide input to policy analyses in examining structural causes of food systems underperformance and carry out policy scenario simulations to generate behavioural change through technical, organizational, and economic supports. To support policy coordination across multiple sectors and stakeholders comprises farmers, industry players, consumers and policy makers. To strengthen the capacity of government bodies to work with businesses and non-public organizations
Enhance public-private collaboration in sustainable food systems development	To facilitating an adaptive process of system changes driven by market- led approaches, aligned with national strategies and combined with policy innovations. Stakeholders include: farmers, firms, traders, consumers, governments, and civil society organizations, and marginalized groups. To build an understanding of and collaboration on governance issues in the food system. To learn, adapt, and synergize different approaches to work towards common food system objectives

Facilitating local knowledge-building and knowledge-sharing	To develop a system of knowledge on food systems based on local and global knowledge. To develop local systems for knowledge generation and dissemination from the knowledge providers to the users through extension services, research institutions, laboratories and knowledge networks. A similar network is needed for knowledge sharing across national boundaries.
Preventing and mitigating risks	Food systems monitoring entail an understanding of the long terms factors that affect the systems such as macro-economic trends, climatic change, technological advancement, natural resources status and socio-political development. The focusses should be on the nature of the interrelationships of these variables and how they affect the food systems. Based on the structural and behavioural nature of the systems, integrated solutions can be developed for risk prevention and mitigation.

Based on the above deliberations, the opportunities for Malaysia - India collaborations are in the following scopes; (i) Cross-national exchanges and knowledge sharing on the food systems issues particularly those that work and the roles of policy strategies in affecting the behaviour and performance of the systems. (ii) Capacity building in data and knowledge management and policy analyses using systems approach such as system dynamics and other systems methodologies. (iii) Since India has proven successful in their food production, it would be useful for Malaysia to learn the Indian policy experiences particularly the Ag-Techs development which was crucial in productivity improvement. India may benefit from Malaysia's experiences in oil palm and rubber downstream development.

Conclusions

The pandemic crisis reveals that the world food ecosystem is a mosaic of an interaction of numerous factors unprecedented before. The factors that affect the fundamentals - supply and demand – saw the emergence of new variables such as pandemic, geo-political shift of world economic power and frequent climatic shocks globally. However, the crisis provided the digital technologies the platform for further expansion in e-businesses as well "working from home" alternative during the lockdown environment as well as under the normal situation. The market analyses can no longer be done on a segmented or vertical approach. As proven under pandemic, all the factors that are affecting the fundamentals are interconnected in a feedback loop manner. The pandemic not only caused millions of deaths in the world but also economic slowdown and hence poverty to population in some weak economies and the resultant food insecurity. Fast forward, as concluded by United Nations in 2021, food security has to be understood and steered through the lenses of food systems encompassing all that matter in delivering the essentials of availability, accessibility and nutrition security. Toward this end, both Malaysia and India may benefit by working together in laying the necessary infostructures and analytical tools to utilize systems perspectives in improving the performance of the food production and security. This collaboration is embedded under the Prime Minister Narendra Modi's 12-Point Proposal on "Food Security" particularly on "National policy framework exchange", "Cooperation in food security and nutrition,""Agrifood system resilience" and "Utilising digital technologies." (ASEAN, 2023).

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Considering the work of the ASEAN-India Eminent Persons Group (AIEPG), and its Report with recommendations for forging a closer partnership for peace, progress and shared prosperity, the Heads of the State/Government of ASEAN and India at the ASEAN-India Commemorative Summit 2012, held at New Delhi on 19-20 December 2012, recommended the establishment of ASEAN-India Centre (AIC), which was formally inaugurated by the External Affairs Minister of India on 21 June 2013 at RIS. AIC serves as a resource centre for ASEAN Member States and India to fill the knowledge gaps that currently limit the opportunities for cooperation. AIC is working with the Ministry of External Affairs (MEA), Government of India to undertake and disseminate evidence-based policy research and provide policy recommendations.

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