

ESG in Asia: A Closer Look at Sustainability in the Asian Food System

Ashley Yip

ABSTRACT

Asia contributes to 40% of global emissions from the agriculture industry. Its contribution roots itself in the imperialistic system of global trade, and manifests in severe environmental, social, and economic problems. This study examines the demand-side factors specific to three Asian countries (China, Singapore, and Thailand) influencing the recent developments towards a sustainable food system, as well as assess how industries have responded to governmental regulations, ENGOs, and global industrial standards in accordance to the sustainable food movement. Market valuation data show a strong positive relationship between market signals and consumer purchasing decisions. The data from the qualitative studies show that economic growth and foreign pressure are the most significant driving factors for sustainability policy in the assessed countries. Literature reviews highlight the need to identify unique strategies towards sustainability that are localized and catered to each nation within Asia. Nations like Singapore and China should continue to lead in the region's regulatory landscape, while ensuring inclusivity in multilateral processes. With transparency as a priority to address consumer food safety and health concerns, Asia should encourage the development of the novel foods industry. Financial institutions should strengthen engagement with investors in the industry. International, regional, and national action should be taken to encourage the growth of the industry while spotlighting local stakeholders, such as smallholder farmers and local geography. However, as the scope of this study is limited in data and countries assessed, the author recommends a more robust dataset for extrapolation to the Asian region.

KEYWORDS

Food justice, decolonizing food systems, food politics, sustainability in Asia, green finance

INTRODUCTION

The agricultural industry was responsible for a third of global greenhouse gas emissions in 2019, with Asia accounting for 40% of these emissions (Tiseo 2021). Asia's gargantuan contribution to global greenhouse gas emissions from the agriculture industry roots itself in a complex history of global trade. Asia's participation in the imperialistic system of global trade is often the reason for its inertia in achieving sustainability goals. For purposes of this study, "sustainability" will be assessed under the scope of the Sustainable Development Goals¹ developed by the United Nations. In the context of food systems, these sustainability standards cover reducing emissions, improved food security and sovereignty, increasing access to locally-sourced, and culturally-appropriate foods, and improving accessibility to the economy of the food system.

With the rapid development of agriculture and trade in the 19th century, European travelers explored the world for the most lucrative seed types, crops, and trade routes. This quest for seeds and crop types was critical to cater to a rapidly-increasing demand for food by the growing global population (Friedmann 2009). Asia is home to rich agricultural production key to our thriving global food system -- 90% of global rice production and consumption, for instance, occurs in the region (ADB 2012). Asia is a region rich with natural resources and centuries-old farming methods that have sustainably fed its people forever. However, with the rapid expansion of global agricultural trade and its effects on local politics, culture, and socioeconomic inequality, many regions in Asia find themselves handling improper and unregulated agricultural practices (Qin 2022). Although policies for a greener agriculture sector have been increasing in number over the years, it is critical to engage the very bottom of the global food production chain in order to ensure holistic and bottom-up progress for our global food system.

A Euro-centric focus on global agriculture trade and expansion has led to 1) the imperialization of the global food system, and 2) the unhindered depletion of natural resources

¹ The 17 SDGs are: no poverty; zero hunger; good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry, innovation and infrastructure; reduced inequalities; sustainable cities and communities; responsible consumption and production; climate action; life below water; life on land; peace, justice, and strong institutions; and partnerships for the goals.

and environmental degradation beyond the United States' shores. In *Capital*, Marx claimed that "large scale industry", namely agriculture, "spurs on rapid increases in...the colonization of foreign lands, which are thereby converted into settlements for growing raw material of the mother country". (Marx, 1996) This phenomenon plays out in the globalization of agricultural production and its exploitation of the global South – particularly Asia.

Asia's food system is also largely vulnerable to the vices of the global imperialized governance system, which further complicates the success of its sustainability policy-making in trade, environment, and societal issues. The global imperialized governance system is largely built upon neoliberal bipolarity of power, whereby there are very few countries and regions who hold disproportionate power over global policy - the United States and Europe. Where Asia was once a thriving source of various native foods, Western colonization and the expansion of Western-centric global agricultural trade drastically changed land use to be redirected towards monoculture cash crops (Houghton 1994). Rapid land use change is but one major result of improper agricultural practices – public health, landscape change, accelerated climate change, loss of genetic diversity, socioeconomic impacts on smallholder farmers, and food insecurity are various aspects of Asian societies that have been hit hard by a gargantuan transition in agricultural practices (Benhin 2006) (Brodie 2016). However, the future is unknown for Asia, as it is insufficient to predict its success based on the trajectory of the US and Europe, where the concepts of "food justice" and "food sovereignty" originated from and are Euro-centric in nature (Solomonian and Di Ruggiero 2021).

A combination of governmental and industrial action, as well as nonprofit organizations have pivoted the region towards achieving a more sustainable food system. As Asia continues to achieve its sustainability goals in the food system, it is imperative that the reasons for its success thus far are assessed. Assessing the reasons for its success thus far requires expert understanding of local stakeholder relationships and local culture or politics, rather than assessing the reasons for its success against Euro-centric standards for sustainability.

As a result of the disrupted supply chains during the pandemic (Fan et al. 2021), food insecurity became a major issue in Asia, a region that relies heavily on agricultural imports. Therise in food insecurity spotlighted several food innovations within the region and accelerated research and development towards a more sustainable food system (Valoppi et al. 2021). For example, agriculture-tech (agri-tech) policies increased in number in Singapore, China, and Korea, in order to address local food insecurity (Goh n.d.).

It is critical that the key mechanisms behind a sustainable food system for Asia are identified in alignment with regional politics, culture, and traditions. Fully understanding stakeholder relationships in the food system, and creating policies with this understanding will ensure that the policies will alleviate the negative impacts on society and the environment. This study will examine the demand-side factors specific to Asia influencing the recent developments towards a sustainable food system, as well as assess how industries have responded to governmental regulations, policy, ENGOs, and global industrial standards in accordance to the sustainable food movement.

OBJECTIVES

In this study I ask, “What are the key mechanisms necessary for a sustainable food system for Asia in the future?” To answer this question, I will be assessing the following: how demand-side factors (consumers and supply-demand policy) specific to Asia have influenced the recent developments towards a sustainable food system; how industries have responded to governmental regulations, policy, ENGOs, and global industrial standards in accordance to the sustainable food movement; and how industry stakeholders have influenced the fluctuation in valuation of sustainable foods. This will be assessed through a questionnaire and follow-up interviews with key stakeholders on demand-side driving factors in the food system, market valuation data, and literature reviews on recent developments in innovation, policy, and more towards sustainability in the Asian food system.

My working hypotheses are that demand-side factors have significantly contributed to the recent growth in sustainable initiatives like food innovation and food security policies. I will tackle these working hypotheses using a combination of qualitative research with demand-side stakeholders, and a database of recent developments towards a sustainable food system. I also hypothesize that innovative food companies have responded positively to supportive governmental regulations and industrial standards for sustainability because there is little pushback to the sector, but food conglomerates may be reluctant or defensive to such policies. I will assess this by conducting literature reviews. Lastly, I hypothesize that industry stakeholders have a significant impact on the valuation of sustainable foods with the help of multiple surrounding factors like political climate and consumer perception. I will assess this by conducting simple linear correlation tests between databases of market valuation and industry perception.

BACKGROUND

Asia holds a key role in the global food system -- agricultural production in the region is scaled to cater to global demand, often leaving the region susceptible to social and environmental risks. In 2020, a ban for palm oil was initiated by the European Parliament, as a means to tackle the negative environmental impacts of palm oil production (Klepper 2020). Smallholder farmers in Indonesia, the world's top producer for palm oil, were deeply affected. Improper agricultural practices, like land clearing without regard for the surrounding ecology, have long been cemented into these smallholder farm's ways of life as a result of decades of playing catch-up with accelerated demand. For these smallholder farmers to successfully integrate sustainable practices, they require localized guidance. However, sustainable mechanisms for change are often neglected or deprioritized in the blind rush toward pushing sustainable agriculture forward on a global scale.

The deprioritization of "externalities" of agricultural production reflect a much larger systemic issue at hand -- the imperialism of our food system. The UNFAO's creation was built around Euro-centric standards for sustainability in an era of liberal internationalism and neoliberalism, leaving it with disproportionate amount of power over determining how "progress" in the food system looks like for the rest of the world, without enough regard for transitions and guidance for the Asian stakeholders (OECD/FAO 2016). It is imperative that we assess how the world's biggest agricultural producers are experiencing the highest rates of malnutrition (FAO 2021).

As a result of systemic imperialism of the global food system, Asia faces a myriad of challenges in its food system -- environmental degradation, depletion of natural resources, poverty, and corruption (OECD/FAO 2016). External, international factors have set up a structure of injustice and unsustainability in the Asian food system, and created a cycle of issues like corruption, climate change, and poverty that many struggle to break out of in the food system (ADB 2012). As the regional population has continued to grow rapidly alongside GDP, undernourishment rates vary across countries in the region, signaling that food security remains a significant issue -- Asia contains about 60 million or 8% of the world's undernourished population (FAO 2017).

The food system in Asia is also vulnerable to and lacks resilience with regards to climate change and natural disasters such as floods and tropical storms. Most recently, Asia's food system was severely impacted by the COVID-19 pandemic's effect on supply chain disruptions and food insecurity (Deuss et al 2022) . Poverty in Asia persists with regards to food insecurity, in that price

impacts on the real incomes of poor households are high, particularly with those who are involved in the food industry such as smallholder farmers and agriculture laborers (ADB 2012). A historical and continuous lack of governmental support for supporting low-income households in regards to food-based safety nets, food relief systems, as well as crop insurance further troubles the region's food system (ADB 2012). Lastly, the volatile political climate also brews weak infrastructure for distribution of resources towards those who need it most (OECD/FAO 2016).

The stakeholders in Asia have different relationships with one another, and driving forces among economic stakeholders, policymakers, and consumers have different weightages that could affect strategies to push for sustainability in the food system. Historically, the policies in assessed nations (China, Singapore, Thailand) are largely influenced by politics, often plagued with tumult and uncertainty (ADB 2012). Additionally, the region's politics are typically influenced by larger diplomatic powers, and/or guided by the post-World War Two bipolar world order (Tellis 2017). Yet, with the global move towards a neoliberal era, countries have adopted closer relationships with investors and consumers in order to gain competitive advantage in economic growth. This thesis aims to evaluate these two opposing factors and the weight of their impact on the Asian food system.

THEORY AND KEY CONCEPTS, RESEARCH FRAMEWORK

A key concept to explore in determining key driving factors for sustainability in the Asian food system are the Porter Hypothesis and the Lead Market Hypothesis. The Lead Market Hypothesis asserts that implementing environmental regulation can enhance a country's international competitiveness, thereby creating competitive incentives for other nations. The Porter Hypothesis asserts that by implementing environmental standards, resource productivity increases, thereby increasing competitiveness for a firm. This hypothesis views pollution as a resource inefficiency. These hypotheses serve as a framework towards understanding key theories that guide different societies towards different sustainability policies depending on the degree to which the culture aligns itself with.

The demand-side factors assessed are consumer behavior, government spending on food-systems-related initiatives, and investment by industry in capital goods. Based on Keynesian economic theory, demand-side factors affect aggregate demand in the market (Heoinsdottir 2012). In response, the change in aggregate demand in the market will have an

impact on sustainability in the food systems, particularly with the number of policies and the change in interest in novel foods (Sands et al. 2014). The relationships between these demand-side factors and their effect on sustainability in the food system ranges across regions (Sands et al. 2014). For example, a region which relies heavily on foreign direct investment may experience a policymaking process that tends to favor FDIs over, perhaps, public political opinion. The three identified demand-side factors above are critical factors whose relationship with one another will be assessed and weighted in importance, in order to evaluate the exact driving forces for sustainability in the Asian food system.

METHODS

Study Site

To evaluate the key mechanisms for a sustainable food system for Asia in the future, I conducted both qualitative and quantitative methods. The data collected was centered in an Asian context, but with particular focus on countries pushing for sustainable food initiatives (China and Singapore), and a country whose food system is vulnerable to external shocks (Thailand). The countries were chosen due to my prior understanding through news articles and current affairs. I confirm this hypothesis through the following study. The studies assessed these four stakeholders: (1) investors in green finance, impact investors, and key finance/market observers, (2) consumers, (3) policymakers, government lobbyists, and influential political powers, (4) non-profit organizations like the UNFAO. In order to assess these key mechanisms, I conducted interview coding, literature reviews, and correlation tests between market valuation data and consumer behavior.

Interviews and questionnaire

To assess how demand-side factors such as consumers and supply-demand policy have influenced recent developments towards a sustainable food system in Asia, I conducted a questionnaire and then held interviews with key stakeholders. I tapped on my existing networks in the University of California, Berkeley, and from previous internships in the policy and food space in Asia. I cold-emailed industry experts on the following topics to speak on their insights -- Asian economic policy, Asian agricultural policy, and consumer behavior of sustainable foods

like alternative meat or agricultural technology.

I drafted a questionnaire of about 10 to 20 questions, split equally among quantitative and qualitative questions. These questions contain a mix of qualitative and quantitative questions that reflect current trends and developments in the food system with regards to number of policies, type of policies, investments in sustainable foods, market valuation, and consumer perception. After an initial collection of responses, a follow-up interview of just 30 minutes was conducted with respondents whose insights inspired further thought or required further clarification with regards to their stance on the topic. All questions can be found in the Appendix.

To code the responses of the interviewees, I grouped the responses into the categories listed below. Correspondingly, I split the questions such that responses to the questions guided my understanding as to which of the following key factors have the largest impact on driving policy in Asia. These key factors were determined based on the literature reviews conducted on Asian and food systems policies. The reviews provided a clear and overarching understanding of the different motivations for policy-making in Asia.

- Economic growth (increased job opportunities, opportunity for market expansion, etc)
- Diplomatic relations (foreign direct investment, maintaining relations with important diplomatic power, gaining diplomatic power, etc)
- Sustainability (reducing socioeconomic inequality, reducing carbon emissions, etc)
- Local dissent (public
- opinion and pressure, riots, protests, etc)
- Tradition, religion, and culture

The identification method for identifying strings on R Studio will be used, directly corresponding to a list of words that will sort the comments made by interviewees on the aforementioned topics. For the full set of 10 questionnaires and an estimated 3 follow-up interviews, this provided a robust set of data in numbers corresponding to the number of times a specific term appeared, thereby drawing conclusions on the tone of the transcript and directing to a general conclusion on the effect of demand-side factors on sustainability in the Asian food system.

Qualitative: Literature reviews

To assess the tension or lack thereof between stakeholders (innovative food industry and governmental organization), I conducted literature reviews to assess where a select theme or related concepts appeared in the text. I identified 20-30 news articles, peer-reviewed journals, and press releases in the last two decades. These articles and journals commented on, reported on, or analyzed political or lobbying campaigns, and/or tension or lack of between the innovative food industry and governmental organizations, as well as recent trends and potential future changes. For instance, “Group Standard for Plant-Based meat was issued in China” (Qin 2021) informs on the evolving regulatory landscape in China, and its positive impact on Asia’s economic outlook for novel foods, thereby creating positive speculation for potential growth in Asia’s novel foods sector.

I annotated these literature reviews carefully and accordingly, with the aim to provide an overview of the landscape of stakeholder relationships in Asia’s food system. I created annotated bibliographies for each source, then identified the most significant literature that can inform on potential trends for stakeholder relationships in the industry, based on historical events, market trends, and cultural contexts. I recorded quotes, statistics, and narrowed research provided specific evidence with regards to identified countries and their specific local contexts, and used those to conclude on key local drivers towards sustainability. This then directed conclusions on whether the Porter Hypothesis or Lead Market Hypothesis has a stronger significance in the future of the food system policies in the assessed countries.

Quantitative: Strength of relationship between market valuation data and consumer behavior

To evaluate the strength of the relationship between market behavior and purchasing behavior, I conducted correlation tests between market valuation data and consumer behavior, with data only from the past two decades (from 2002). I identified stock valuation databases, including the Straits Times Index and AgFunder, where stock groups and ETFs that group the food industry in Asia are assessed. These included groups such as plant-based protein, alternative protein, cell-cultured foods, hydroponic agriculture, aquaculture, etc. companies. These industries are slated as food-technology, slated to tackle prevalent issues in the global food system such as food insecurity, by increasing accessibility and yield of agricultural production.

While the cell-based and alternative protein industries are only just beginning to enter the Asian market, some significant trends in sales and market data can be obtained from the aforementioned platforms. The list of companies and/or entities are as follows:

1. Alternative Protein
 - a. Singapore: Next Gen Foods
 - b. China: Starfield Food Science and Technology
 - c. Thailand: Krungthai Compass Research Centre
2. Cell-based products
 - a. Singapore: Shiok Meats, Turtle Tree
 - b. China: CellX
 - c. Thailand: N/A
3. Vertical farming (hydroponics and aquaponics)
 - a. Singapore: DataBridge Market Research
 - b. China: DataBridge Market Research
 - c. Thailand: DataBridge Market Research

These companies only reflect the Asian population, and should tap on credible databases from agriculture-tech/food-tech companies. One or two market behavior data companies are then identified to provide quantitative data surrounding reasons for purchase, length of customer loyalty, etc on plant-based foods and alternative proteins, and/or other novel foods.

Using linear graphing, I determined the strength of the relationship between the stock price of the novel food industry and corresponding variables on sales and consumer behavior. The independent variables are the market valuation metrics, and the dependent variables were the customer behavior metrics (i.e customer behavior changes according to market valuation metrics). The types of variables varied by country and by industry, due to the limited availability of public valuation data. This data would directly corroborate an accurate conclusion on the direct relationship between market behavior and purchasing behavior, informing on the strength of the relationship between industry and consumer preferences. For instance, a decreasing stock price may cause perception of sustainable foods to decrease and have a perceived degradation of popularity and/or economic opportunities. The strength of the relationship is estimated by the following formula:

$$\text{correlation} = (y - b)/x$$

where “y” is the value of the independent variable, “x” is the value of the dependent variable, and “b” is the y-intercept of the line produced.

RESULTS

Interview Coding and Questionnaire

Economic growth

10 of 10 respondents of the questionnaire responded that economic growth is a motivating factor for sustainable growth in Asia. The data collected from the interviews also show that all stakeholders agreed that economic growth is one of the most significant considerations in pushing for sustainable development in the Asian food system.

During the interview, an impact investor said, “None of the initiatives we have seen related to food-tech and novel foods would have blossomed...would not have put Asia in the center of the map if there was no projected return on investment.” An ESG specialist highlighted, “The economy drives policy and politics...regional pressure will force Singapore and China to take action in the food system once everyone else sees that not enough is being done.” When prompted as to how this plays out in the policymaking and lobbying process for sustainability in the Asian food system, the ESG specialist said, “I get calls everyday, four times a day, asking “What is ESG? My client is asking us to handle this, and you seem to know.” This is so different from just a few years ago. People are getting more involved now in the finance sector, it is a force to be reckoned with. And there is no shortage of bankers and finance ministers at multinational conferences talking about ESG now. They know it is important.”

Diplomatic relations

9 of 10 respondents of the questionnaire responded that diplomatic relations is a motivating factor for sustainable growth in Asia. The data collected from the interviews also show that all stakeholders agreed that diplomatic relations is one of the most significant considerations in pushing for sustainable development in the Asian food system.

An impact investor said, “The international community is increasingly calling for more action on sustainability, and Asian countries are under pressure to meet these expectations.” Several significant events related to the Asian food system saw global scrutiny in the past two decades, leading to new policies aimed at sustainable development. A professor in ESG brought up examples of such events: the 2008 Chinese melamine or milk scare, the 2019 COVID-19 pandemic’s effect on food security in Thailand and Singapore, and its roots in China. Following the 2008 Chinese melamine milk scare, the Chinese government released its most strict draft amendment to its Food Safety Law shortly after facing international pressure. For instance, the European Union announced a ban on imports of baby food containing milk from China. The COVID-19 pandemic was traced to the mishandling of meat products in a wet market in China as part of a lack of oversight on the food system. The pandemic halted food supply chains, affecting import-reliant countries like Singapore and export-reliant economies like Thailand. International policymakers called for urgent and stringent measures to the food system in China in response to the widespread impact of the pandemic, applying pressure to the country’s food system policymaking.

Sustainability

4 of 10 respondents of the questionnaire responded that sustainability is a motivating factor for sustainable growth in Asia. The data collected from the interviews showed that just 1 of 3 interviewees agreed that sustainability is one of the most significant considerations in pushing for sustainable development in the Asian food system.

A CEO of an agribusiness startup accelerator said, “The majority of Asian Consumers care more about food safety and traceability (low use of pesticides, saving water, fresh produce, locally sourced, what protein was fed, how it was raised cage free, no antibiotics) security (being able to afford, and have access to, the food they want, when they want it, if CEA was more accessible and affordable all would want locally sourced), much more than reducing carbon emissions or future cell based Meats. It is policy makers that care more about carbon emissions and future foods than demand side consumers. Mostly due to not understanding the connection between carbon emissions (look at the high use of Amazon, if the consumer cared about carbon emissions they would not buy 6 things knowing they are going to return 4. One pair of pants going to 6 destinations before it is purchased. Convenience is still King with the consumer. And for the low income consumer, safe, affordable and nutritious [food] is paramount.”

Local dissent (public opinion and pressure, riots, protests, etc)

2 of 10 respondents of the questionnaire responded that local dissent is a motivating factor for sustainable growth in Asia. The data collected from the interviews showed that just 1 of 3 interviewees agreed that local dissent is one of the most significant considerations in pushing for sustainable development in the Asian food system.

Tradition, religion, and culture

None of the respondents of the questionnaire responded that tradition, religion, and culture as a collective is a motivating factor for sustainable growth in Asia. The data collected from the interviews showed that just 1 of 3 interviewees agreed that tradition, religion and culture are one of the most significant considerations in pushing for sustainable development in the Asian food system.

Qualitative: Literature reviews

In the Asia-Pacific region, governments have been increasingly-focused on the food system in recent years (Kodama 2021). By 2030, Asia's population is projected to be 250 million people larger and 65% of the world's middle-class population will reside in Asia-Pacific. Increased consumer demand is posing a challenge for the agri-food system. Asia-Pacific is a major component in the current global food chain, accounting for 19% of total global food and agriculture exports, and 31% of total food and agriculture imports. According to a report published by Allied Market Research, the global food traceability market is expected to grow to \$22.27 billion by 2025, from \$10.96 billion in 2017, registering a CAGR of 9.3% from 2018 to 2025 (Wojcicka-Swidarska 2021). Between 2012 and 2016, new vegetarian and vegan product launches increased by 140% and 440% respectively in Southeast Asia alone. Plant-based meats are increasingly popular -- consumers are looking to cut down meat consumption by seeking tastier, healthier, well-priced alternatives.

Some of the largest challenges posed for the region are a rapidly-growing population, integrating technology into supply chains, high levels of waste, an inferior quality of end products due to inefficient supply chains, climate change, and environmental degradation.

Nonetheless, Asia-Pacific is estimated to have one of the largest CAGR rates of 14.9% from 2018 to 2025, owing to growth in industries such as fresh produce & seeds, fisheries, and meat & livestock along with expansion of leading players in China, India, and other emerging economies (Wojcicka-Swidarska 2021). Between 2012 and 2016, new vegetarian and vegan product launches increased by 140% and 440% respectively in Southeast Asia alone (Wojcicka-Swidarska 2021). However, the region faces tight regulatory control surrounding approval of innovative food ingredients and novel foods.

China

In China, several policies surrounding the food system have been implemented in the past two decades. Literature shows that China's food security has been closely tied with its national security. There is also an increased focus on the food system from a policy lens. As a result of heightening global tensions, such as the China-U.S. trade war, Chinese President Xi Jinping claimed that "food security is an important foundation for national security" in April 2021. The Chinese minister of agriculture and rural affairs also called seeds and grains as the "computer chips of agriculture".

Regarding the novel foods industry, the country has developed numerous policies to align with the growth of the sustainable foods sector. On Dec 25 2021, the Chinese government released "basic requirements" for plant-based meat production within the country (Qin 2021). The new standards are focused on improving the nutritional quality of these foods and ensuring food safety for consumers. Specifically, it states that "improving nutritional quality of plant-based foods is encouraged", "improving protein quality and content", "reduce total fat, added sugar, sodium" are all significant focuses. It also emphasizes that "a note that relevant materials are of plant-based origin should be communicated to consumers". As an added note, "plant-based meat" was encouraged to be labeled as "imitated", "artificial", or "Su" (vegetarian). In 2022, China's Ministry of Agriculture and Rural Affairs (MARA) released a Plan for Emissions Reduction and Carbon Sequestration in Agriculture and Rural Areas. This plan created an opportunity for green transformation in the agricultural sector and its supply chain. It consists of an improved set of laws and regulations, generating a more "relaxed" and

encouraging environment for capital investment into the food system's new innovations. By 2025, the plan aims to systematically integrate the following goals: agriculture and rural carbon emission reduction, food security, and rural revitalization. The plan intends to build a low-carbon development model for the food system, particularly targeting carbon emissions in crop and livestock farming and intensifying the carbon sequestration capacity of crop farming. This plan is in line with China's goals for carbon peaking in 2030 and carbon neutrality by 2060 (Yan 2022). This indicates governmental support for publicity and promoting awareness and acceptance of low-carbon foods among the public. However, there lies many infrastructural challenges for the Chinese government. Incorporating sustainability and technology for growth in new and unfamiliar territory that is the novel foods industry requires strong coordination across stakeholders that the government needs to guide and coordinate, with the goal of carbon reduction in mind. A concurrent focus on green finance is also recommended, and standards across all provinces must be standardized, normalized, and localized.

China currently implements the "catalog policy" towards foreign investment. Essentially, foreign investments are selectively encouraged in some industries, while others are not. If the investments are encouraged, investors will receive preferential taxation and land lease. Any other investments are either prohibited or heavily regulated. A patent cannot be granted to an organism. However, it does not mean IPR (intellectual property rights) on such fields are deprived of protection in China. Microorganisms could be protected similarly to the protection of plants under the Plant Variety Protection. This creates an environment that may prove challenging for foreign companies to branch out within the country. There is also currently no standardized classification for novel foods, and pre-market approval is required to enter the market. There is also no clear-cut standard to determine what novel food includes. This trend was repeated with the introduction of genetically-modified products in the past, where alternative meat (plant-based meat) faced a debate on whether it should be categorized as meat or not.

Singapore

In 2019, the Singapore government implemented an initiative to have 30% of all food in the country be produced locally, by 2030. At the time, 93% of the food in Singapore was

imported. Singapore's food policies have been catered towards this new initiative, prioritizing food security and resilience of resources, as well as nutritional leadership (Wong 2021). It is centered around making urbanization and food systems more sustainable and resilient. Its priorities do not lie in increasing the quantity of production, but rather to improve nutritional benefit and quality of the foods produced. This is in line with the 2030 Green Plan, launched in 2021, which outlines a five-pronged approach to achieving sustainable development goals in the island nation.

This ties in with the country's rapidly-growing novel foods sector. The government recognizes the importance of investing in sustainable food production in order to achieve this 30 by 30 goal. As a result, its 30 by 30 policies prioritize scalability of these companies, their export market potential, and consumer demand for sustainable food products. An interview with an industry expert revealed that "what the consumers out there really want in terms of delivering the kind of nutrients, the safety quality, as well as the tastes and texture that everybody's looking for." In 2023, the Singaporean government also finally approved Eat Just, a renowned alternative protein multinational company, to commercialize chicken bites in the nation.

Other initiatives have been incorporated as well, such as a community-agriculture initiative and action to decentralize food production to the general public. For instance, the Foodscape Collective was launched to create a fair and circular food system. The government and community support aims to turn underutilized space into edible gardens in communities, creating ecosystems of food, biodiversity, and people. Another organization called Edible Garden City has transformed over 260 empty spaces into food hubs, such as schools and hospitals. Most recently, a 60-million SGD fund was announced to support local farmers expanding production capability, boost yield, raise productivity, and sustainability (Wijkvliet 2022).

A key development in Asia's sustainable foods journey is the launch of the Asia Sustainable Foods Platform, an organization which aims to provide support for food-tech companies in all stages of company growth. The Platform is launched by Temasek, Singapore's sovereign wealth fund, and is working in partnership with A*STAR's Singapore Institute of Food & Biotechnology Innovation (SIFBI) to invest over S\$30 million in the Food Tech Innovation Centre (FTIC) (Temasek 2021). This signifies a leap forward for both the region and the country, thereby also spotlighting Singapore as a leader in the push for development in the sustainable foods sector.

Thailand

In Thailand, the government is also focused on developing its agriculture sector alongside bigger plans to improve national security, digitalisation, and overall infrastructure. In 2020, the country developed a national traceability system for its agrifood supply chain, called TraceThai. This was imperative for its local workforce, of which 30% work in the agriculture sector. The country has since then taken on an intersectional approach to policy, incorporating Big Data, Smart Agriculture, E-commerce and other progressive technologies to improve the agrifood sector whilst ensuring traceability in the food system. The country's Agricultural Technology 4.0 strategy focuses on a "3S" strategy of Safety, Security, and Sustainability to build resilience in its food system (Neo 2022). These initiatives are also supported by the growth of sustainable food production in the country, seeing alternative protein companies grow in number as well as multinational sustainable food firms seeking headquarters in the Southeast Asian country.

During the 2022 7th APEC Food Security Ministerial Meeting hosted by Thailand, Thailand introduced a roadmap towards achieving food safety and trade facilitation, life quality improvement, and natural resource sustainability. The meeting was centered around the Food Security Roadmap Towards 2030, and Thailand introduced its five policies intended to promote food security covering the following categories: food safety and trade facilitation, life quality, improvement, natural resource sustainability, promotion of innovation and technology, and the creation of balance in the economy, society and environment. In addition, Thailand is also advancing the Bio-Circular-Green Economy Model or BCG Model to pursue sustainable, balanced, and inclusive economic and social growth. All of these efforts are based on the 20-Year National Strategy guided by the Sufficiency Economy Philosophy and the Sustainable Development Goals, as declared by General Prayut Chan-o-Cha (WWF 2021).

However, Thailand has been facing a slew of challenges in recent years. Thailand ranks 13 in the world's largest food exporters, yet it sees over 260,000 of its population being undernourished -- many of them are farmers (WWF 2021). The country's agricultural production has seen a major transition from traditional farming methods to monopolized, industrial agriculture practices. As a result, food safety, ecosystem resilience, and social welfare are compromised in the nation's rural population. Furthermore, the nation's ongoing political conflict casts a shadow on progressive policy-making. Following a decades-long conflict between political parties, the military, and the monarchy, the nation's policy-making centers its

efforts onto strengthening fundamental infrastructure rather than engaging in progressive food-system policies at the same levels of its neighbors.

Quantitative: Strength of relationship between market valuation data and customer behavior

There is a positive relationship between the value of investments in alternative protein and consumer behavior (China's Starfield Food Science & Technology, Singapore's Next Gen Foods, and Krungthai Compass Research Centre). The correlation between the two variables vary. For China, investments at the final stage of funding were recorded, alongside consumer retention. China's Starfield has a correlation of 263 with its rise in consumer retention. For Singapore, investments at the final stage of funding were recorded, alongside consumer interest in buying alternative protein based on market research. Singapore's Next Gen Foods has a correlation of 33 with its rise in consumer interest. For Thailand, investments in the general market were recorded from 2019 to 2021, alongside consumer interest in buying alternative protein based on market research. Thailand's alternative protein market has a correlation of 251 with its rise in consumer interest. Overall, an increase in investments are directly correlated with an increase in perceived benefit or consumer interest in alternative protein in both countries. The relationship between investments and consumer behavior for all three countries is positive for the alternative protein sector.

There is a positive relationship between the value of investments in cell-based food products and consumer behavior (Singapore's Shiok Meats and China's CellX). The correlation between the two variables vary. For China, investments at the final stage of funding were recorded, alongside consumer willingness to try, based on market research data. China's CellX has a correlation of 5.71 with its rise in consumer retention. For Singapore, investments at the final stage of funding were recorded, alongside consumer interest in buying cell-based foods based on market research. Singapore's Shiok Meats has a correlation of 240 with its rise in consumer interest. The relationship between investments and consumer behavior for the two countries is positive for the cell-based products sector.

There is a positive relationship between the value of investments in vertical farming products and consumer behavior. The correlation between the two variables vary. With data recorded from Data Bridge Market Research, an increase in investments are directly correlated

with an increase in perceived benefit or consumer interest in vertical farming products in both countries. The relationship between investments and consumer behavior for all three countries is positive for the sector.

DISCUSSION

The data reveal key trends unique to Asia's ecosystem of stakeholders in the food system, and have significant implications for sustainability in Asia's food system. The market valuation data show that there is a generally positive relationship between market valuation and consumer behavior, and correlation calculations reveal a strong relationship between signals from the market and consumer purchasing decisions. The questionnaire responses and follow-up interviews show that economic growth and foreign pressure are the most significant motivating factors for sustainability policy in the assessed countries. The literature reviews revealed that the food industries in the assessed countries have responded with either new or ramped-up sustainability policies in the food system following tightening global regulations over recent decades. However, these range in time-scale, flexibility of regulations, and sequence of roll-out.

The data reveal a need to weigh these stakeholder relationships against the unique contexts of Singapore, China, and Thailand, in order to provide recommendations on key mechanisms for a sustainable food system in these regions. The three assessed countries span a range of priorities and motivations when it comes to policy-making. As introduced at the beginning of this study, policy-making with regards to sustainability tends towards either a Porter hypothesis or Lead Market hypothesis. The data reveal that Singapore's political-economic stance would tend toward Lead Market, China's would tend toward neither, and Thailand's would tend toward Porter. Knowing this, this study aims to discuss the best ways forward for the assessed nations towards sustainable food systems. Going forward, this study also aims to extrapolate the insights derived to provide recommendations for all countries in Asia.

Interview coding and questionnaire

SRQ 1: How have demand-side factors (consumers and supply-demand policy) specific to Asia influenced the recent developments towards a sustainable food system?

Economic growth and foreign pressure are the most significant motivating factors for

sustainability policy in all three countries. With novel food developments emerging both globally and regionally, competition among the countries will rise rapidly as each nation races to be the first to optimize any and all novel food business opportunities. As developments on the innovative end pick up steam, the regulatory landscape will also evolve to support the food industry. According to the Lead Market Hypothesis, Singapore and China's large decision-making power in the region will ramp up competitiveness in Asia. Singapore and China have historically made strides in the regulatory landscape, and have a disproportionate amount of influence on other countries in Asia (Niquet 2006). According to the Porter Hypothesis, Thailand will take upon more measures that significantly maximize resource efficiency in the food system and reduce pollution. Thailand is a significant contributor to global agricultural production, particularly in key products like sugar, rice, and cassava. Its large rural farming population -- 7.4 million households in 2021 -- suffers as a result from improper agricultural practices, alongside environmental damage and a lack of governmental supervision (Statista 2022). Hence, Thailand will likely benefit from regional policy-making led by the aforementioned countries.

Literature reviews

SRQ 2: How have industries responded to governmental regulations, policy, ENGOs, and global industrial standards in accordance to the sustainable food movement?

Following tightening global regulations, literature revealed that assessed nations responded with ramped-up or new sustainability policies in the food system. However, these ranged in time-scale, flexibility of regulations, and the sequence of roll-out.

With China, policies were rolled out with two key goals in mind: maintaining its diplomatic image and the strength of its economy. China prioritizes maintaining its strong position as a leader in the global balance of political power. It is a P5 nation² that allies with global political power Russia, which thereby reinforces the global bipolar world order. Foreign pressure has a large impact on its policy-making as a result. China's priorities also lie in strengthening and diversifying economic growth, and fortifying its place as Asia's center of trade and innovation. Hence, the timeline of Chinese food policies is hastened in the light of significant events in the food system, because it is constantly under close scrutiny by other world leaders, like the European Union. Regulations surrounding food are also much less flexible and unlikely to make revolutionary moves unlike European counterparts who have trailblazed much

² The United Nations Security Council maintains a permanent list of five countries that have privilege in vetoing any resolution as a result of the post-World War 2 political order.

of sustainable food policy. China understands that their Asian neighbors take cues from its policy-making to design their own standards, which thereby feeds into its economic success in the future, hence it takes extremely cautionary measures to ensure that its policies are the right move. “Revolutionary” policies in the food system, like legalizing the sales of certain novel foods, are therefore painfully slow and inflexible in their roll-out.

With Singapore, policies were rolled out with two key goals in mind: food security and strengthening its position as the hub for food innovation within Asia and the entire world. With food security being a prime concern for the nation, they prioritize internal food safety and security, while trying to lead an example for the rest of the region. Its regulations surrounding food have been supportive of rapidly-developing innovation in the area, and it is commonly hailed as a role model for the novel foods industry and for food system policy-making, whilst being an economic superpower and Asia’s trade hub. In its policy-making procedures, Singapore is keen to involve key stakeholders to launch itself as a novel food superpower.

With Thailand, the nation’s economy and policy-making is playing catch-up with its more powerful counterparts, while addressing deep-rooted conflict and political issues. Foreign pressure to excel in food security is not as high of a priority as the other two countries, but keeping its economy and social welfare afloat is paramount. Its policymaking regarding food systems will unlikely change in mindset towards sustainability, unless faced with strong political cues from countries like China and Singapore.

The spectrum of responses highlight the need to identify unique strategies towards sustainability that are localized and catered to each nation within Asia. In other words, these three countries cannot be treated as a collective in this study. Notably, research and development and innovative developments rose in numbers in all three countries following the increase in regulations (global, regional, and national). This cements the need for a strong regulatory landscape in the food system going forward to ensure sustainability.

Market valuation

SRQ 3: How have industry stakeholders influenced the fluctuation in valuation of sustainable foods?

When there are negative signals in the novel foods market, consumers respond

negatively. When there is news on the market of an ESG violation in a product, consumers are less likely to buy that product. In the countries assessed, buy-side stakeholders were responsive to the recent growth in the innovative food market in Asia. While the linear correlation between market signals and buy-side response varied in strength among the three countries, the relationship between the two is evident. Therefore, it is crucial that mechanisms for sustainability are catered specifically for the different levels of interaction between the two variables, within the three different countries' contexts.

Synthesis

CRQ: What are the key mechanisms behind a sustainable food system for Asia in the future?

Asia is a deeply diverse region. However, it unites under the collective vice of exploitation in the global food system, creating a prevalence of ongoing issues like malnourishment and poverty. Having understood the key mechanisms behind the Asian food system in this study, it is imperative that these key stakeholders, relationships, and policies are tapped to create an effective mix of strategies for a sustainable food system in the region. The countries assessed are meant to be representative of other nations in Asia, and therefore the recommendations are applicable to the region as a whole.

On Consumers

Knowing that sales of novel foods are reactive to market valuation and ESG news, it is important to ensure that consumers are especially paid attention to in this strategy.

Because misinformation on novel foods and a lack of awareness on the food system (such as issues like food insecurity, environmental damage, and inhumane labor practices) is rampant in the region, region-wide or nation-wide educational programs should be implemented to raise awareness. These programs should target two key priority worries among consumers as revealed in the data: food safety and health. These programs can take on different forms from different stakeholders in the food system.

For novel food products, companies should ensure that there is transparency on ingredients, supply chain, and product development processes. This could entail product labels, sustainability certifications, and other forms of information on the sold products. Organizations should also consider partnerships with governmental agencies to increase credibility of their

products whilst raising awareness for the larger purpose in the development of their product, such as global food insecurity, diabetes, and malnourishment. Partnering with credible organizations under food safety and health care will help consumers better understand food safety in the novel foods industry as well. Targeting advertisements towards the youth, through social media channels, is also key to ensuring the youth are engaged in sustainable mechanisms for the future food system.

Ensuring consumers are engaged and well-informed is key to creating a sustainable future for the Asian food system.

On Investors

Misinformation is also rampant on the investor end, thereby also affecting sales of novel foods. A general awareness program must also be crafted for the financial sector of the food system. Notably, key financial players like large banks have begun incorporating ESG into their practice as ESG becomes increasingly in the spotlight. However, there is still much to be done in the region to ensure that investors are well-informed of the benefits of the novel food industry, as well as the importance of divesting from Big Agriculture³ practitioners that perpetuate the existing unsustainable global food system.

The finance industry should review industrial standards for novel foods to ensure that the barriers to entry in investments in that area are lowered. This could involve a relaxation of requirements to be registered as a novel food product, or an enforcement for transparency in the supply chain. This requires regular review of market regulation with governmental bodies, both national and regional, even international. Furthermore, countries like China and Singapore, where many large banks are headquartered, must lead the way in implementing the aforementioned regulations. More efforts should be made to engage investors in sustainability talk in the food system. It is evident that their involvement significantly affects market value and the development of key initiatives (such as novel foods) that are paramount to a sustainable food system for Asia.

On Government

The study revealed that foreign pressure is a significant motivating factor for sustainable

³ “Big Agriculture” is an all-encompassing term for the oppressive and monopolistic system characterized by industrial agriculture

food initiatives in Asia. Recent developments in the novel food industry, backed with strong support from governmental funding, show Asia's reckoning as a key potential launchpad for sustainable foods globally, if not already. Governmental or policy-making action therefore must be implemented in three facets: international, regional, and national.

On an international scale, food and agriculture-related multinational organizations should uplift and center Asian countries in regular reviews of international standards on sustainability in the global food system, especially in a historically Euro-centric system. More multilateral platforms should be created to empower Asian nations and encourage active involvement in global policymaking. Foreign pressure is a key motivating factor for the region, hence making attendance mandatory and high-stakes will ensure their involvement in the future of the global food system. A combination of regulatory, voluntary, and market-based measures on an international level also need to be implemented to ensure consistency in the strength of stakeholder relationships all through Asia.

On a regional level, mandating a high level of engagement of all stakeholders in the food system in the process of policymaking for the Asian food system is recommended. This is a key first step to take in order to establish a coordinating mechanism for the region. This process will involve: a) definition and recognition of a broad range of relevant stakeholders, including, in particular, representatives of government agencies, academia/civil society, NGOs, business and community-based organizations (especially those uplifting the underprivileged in food system), b) improvement of communication among those groups, and c) establishment of a national forum or council for multistakeholder consultation.

Trickling down to national-level control, a core group, such as an inter-ministry task force, should be designated with appropriate authority and responsibility. An important mandate of the core group will be 1) capacity-building for government officials (in all sectors), and 2) reviewing/reorienting existing policy instruments across all ministries concerned, including stocktaking from other international initiatives addressing issues (such as the UNFAO.). Particular attention should be paid to government functions in terms of channeling national/local undertaking with international initiatives, such as regional networking, and with external financial resources.

Limitations and Future Directions

The three countries I've chosen have very unique histories in their politics, economics,

and food systems. The complexities behind their mechanisms for sustainable policy will not be fully captured in this limited dataset. Additionally, the accessibility and availability of market valuation data was limited by public datasets. The success of a singular, but top-ranked, novel foods firm was used to be representative of the success of the small innovative foods industry. I also experienced a shortage in interviewees due to the non-response and clash of schedules. Nonetheless, the interviews provided key contextual evidence that complemented this study's secondary research. The scope of this study aims to gain a deeper understanding of food systems policy in Asia, as well as predict the region's policy-making style based on previous responses to general environmental policy and general politics. However, food systems could be approached from a myriad of perspectives aside from an environmental one, such as food safety and national security.

Moving forward, I recommend creating a more robust dataset on more countries in the Asian region to create a more accurate and extrapolatable model for key mechanisms towards a sustainable food system. Additionally, I recommend conducting more interviews with more experts on stakeholder mindsets on the topic of food systems in Asia.

Global policy on the environment and food systems is often Euro-centric, as indicated at the beginning of this paper. Industrial and governmental standards on food systems often take off from Euro-centric standpoints, and other regions often take the cue of their Western counterparts to make moves on food systems themselves. Asia, as a result, is exploited under the current global food system. By decentralizing the food system, uplifting its most vulnerable rural communities contributing to the food system, and supporting local innovations that can improve national food security, Asia can create a sustainable food system. Fully understanding what makes policy-making in the food system more effective, efficient, and sustainable requires deep insight into the strength of stakeholder relationships in the region. Decolonizing the Asian food system will reap enduring and unparalleled benefits for the region's climate-sensitive geography and poverty-ridden population, by tapping onto its leadership potential in novel foods and its unique stakeholder relationships in the homes of the world's best foods.

ACKNOWLEDGEMENTS

I would like to thank the instructors of ESPM 100ES and ESPM 175 who have guided me through this thesis, namely Tina, Danielle and Robin. I would also like to extend my gratitude to my mentor Moon for her expert guidance. I am also incredibly grateful for the experts who set aside time in their busy schedules to participate in the questionnaire and interviews. I would also like to thank the amazing faculty at the College of Natural Resources, who continue to inspire me every day since my first day at UC Berkeley. I could not have finished this thesis without my amazing housemates and friends who have cheered me on since day one from across the country and the world. Thank you! Last but not least, I want to thank my family, who has been my number one fan throughout it all.

REFERENCES

- Asian Development Bank. 2012, May 9. Asian Agriculture: 12 Things to Know.
- Brodie, J. F. (2016). Synergistic effects of climate change and agricultural land use on mammals. *Frontiers in Ecology and the Environment*, 14(1), 20–26. JSTOR.
- Goh, L. (n.d.). How AgriTech Is Transforming Traditional Agriculture in Emerging Markets.
- Friedmann, H. (2009). Feeding the Empire: The Pathologies of Globalized Agriculture Vol.41: Socialist Register 2005: The Empire Reloaded <https://socialistregister.com/index.php/srv/article/view/5828>
- Ingram, J., & Maye, D. (2020). What Are the Implications of Digitalisation for Agricultural Knowledge? *Frontiers in Sustainable Food Systems*, 4, 66. <https://doi.org/10.3389/fsufs.2020.00066>
- James K. A. Benhin. (2006). Agriculture and Deforestation in the Tropics: A Critical Theoretical and Empirical Review. *Ambio*, 35(1), 9–16. JSTOR.
- Marx, K. (1996). *Das Kapital*. Regnery Publishing. Friedmann, H. (2009). Feeding the Empire: The Pathologies of Globalized Agriculture Vol.41: Socialist Register 2005: The Empire Reloaded <https://socialistregister.com/index.php/srv/article/view/5828>
- Tiseo, I. (2021). Emissions from agriculture worldwide 1990-2019, by region. Statista. <https://www.statista.com/statistics/1254146/agriculture-emissions-worldwide-by-region>
- Qin, Y., He, J., Wei, M., and Du X. 2022. Challenges Threatening Agricultural Sustainability in Central Asia: Status and Prospect. *Int J Environ Res Public Health*.

Fan, S., P. Teng, P. Chew, G. Smith, and L. Copeland. 2021. Food system resilience and COVID-19 – Lessons from the Asian experience. *Global Food Security* 28:100501.

Valoppi, F., M. Agustin, F. Abik, D. Morais de Carvalho, J. Sithole, M. Bhattarai, J. J. Advances in Food Science and Technology for Feeding the World Population. *Frontiers in Sustainable Food Systems* 5:626227.

Solomonian, L., and E. Di Ruggiero. 2021. The critical intersection of environmental and social justice: a commentary. *Globalization and Health* 17:30.

Gernot K. (2020). Winners and losers from the proposed ban on palm oil. *International Sustainability & Carbon Certification*.

OECD/FAO. (2016). *International Regulatory Co-operation and International Organisations: The Case of the Food and Agriculture Organization of the United Nations (FAO)*. OECD and FAO.

FAO. 2021. *Transforming food systems for food security, improved nutrition and affordable healthy diets for all*. FAO, Rome.

OECD/FAO. (2017). *International Regulatory Co-operation and International Organisations: The Case of the Food and Agriculture Organization of the United Nations (FAO)*. OECD and FAO.

ADB. (2012). *Food Security in Asia: No Time for Complacency*. ADB.

Deuss, A., Gaspar, C., Bruins M. (2021) *Environmental impacts along food supply chains: Methods, findings, and evidence Gaps*. 2022. *OECD Food, Agriculture and Fisheries Papers*.

Ashley T. (2017) *New Bipolarity Between the United States and China Poses Challenges for India*. London School of Economics and Political Science Carnegie Endowment for International Peace.

Heoinsdottir, A. (2012) *The Rising Threat of Food Security; A Keynesian Solution to a Global Problem* The Rising Threat of Food Security; A Keynesian Solution to a Global Problem. CUNY City College.

Sands, R.D., Jones, C.A., Marshall, E. (2014) *Global Drivers of Agricultural Demand and Supply*. United States Department of Agriculture. USDA Economic Research Report 174.

Qin, T. 2021. *Group Standard for Plant-Based meat was issued in China*. FoodTechNews.Asia.

Wojcicka-Swidarska, K. 2021. *Understanding novel foods regulations in Southeast Asia*. Fi Global Insights.

Wojcicka-Swidarska, K. 2021. *Tapping into food innovation opportunities in SE Asia*. Fi

Global Insights.

Kodama, K. 2021. Asia-Pacific's Increasing Demand for Food Traceability. Chamber of Digital Commerce.

Andaya, L. Y., and B. W. Andaya. 1995. Southeast Asia in the Early Modern Period; Twenty-Five Years On. *Journal of Southeast Asian Studies* 26:92–98.

Institute for Global Environmental Strategies. 2023. Redirecting education, public awareness and training for sustainable development. *Sustainable Asia 2005 and Beyond*

Pimbert, M. 2015. Food Sovereignty and Autonomous Local Systems. *RCC Perspectives*, No. 1, Think Global, Eat Local: Exploring Foodways.

Shindelar, R. 2015. The Ecological Sustainability of Local Food Systems. *RCC Perspectives*, No. 1, Think Global, Eat Local: Exploring Foodways.

Cho, I. H., and S.-H. Park. 2013. The Rise of China and Varying Sentiments in Southeast Asia toward Great Powers. *Strategic Studies Quarterly* 7:69–92.

Davila, F. Human Ecology and Food Systems: Insights from the Philippines. *Human Ecology Review* 24:23–50.

Yan, Song. 2022. 农业农村部、国家发展改革委联合印发《农业农村减排固碳实施方案》

Yan, Song. 2022. 农业农村部,《农业农村减排固碳实施方案》

Wong, Y. 2021 Food innovation and high-tech farming. Tech For Impact with Asian Development Bank. <https://techforimpact.asia/food-innovation-and-high-tech-farming/>

Ang, H., Mohan, M. 2021 Singapore unveils Green Plan 2030, outlines green targets for next 10 years. Channel News Asia. <https://www.channelnewsasia.com/singapore/singapore-green-plan-2030-targets-10-years-1883021>

van Wijkvliet, N. 2022. No space, no problem. How Singapore is turning into an edible paradise. Sustainable Urban Delt. <https://sustainableurbandelta.com/singapore-30-by-30-food-system/>

Temasek. 2021. PR Newswire. Sustainable Foods Platform to accelerate the commercialisation of sustainable foods in Asia. <https://www.prnewswire.com/news-releases/temasek-establishes-the-asia-sustainable-foods-platform-to-accelerate-the-commercialisation-of-sustainable-foods-in-asia-301423876.html>

Neo, P. 2022. Thailand's hi-tech food future: Government pledges to step up transformation of food and agri sector. Food Navigator Asia. <https://www.foodnavigator-asia.com/Article/2022/04/18/thailand-pledges-to-step-up-transformation-of-food-and-agri-sector>

World Wildlife Fund. 2021. The time for action is now: Thailand's commitments to the UN Food Systems Summit. Our News. <https://www.wwf.or.th/en/?370317/The-time-for-action-is-now-Thailands-commitments-to-the-U-N-Food-Systems-Summit>

Statista Research Department. 2022. Number of farm households Thailand 2014-2021. <https://www.statista.com/statistics/1121699/thailand-number-of-farm-households/#:~:text=In%202021%2C%20there%20were%20approximately,for%20around%20324%20thousand%20households>

Niquet, V. 2006. The Balance of Power in Asia: A Challenge for Europe? China Perspectives 2006.

APPENDIX

Questions

1. To what extent do you agree with these statements? (Rank: Strongly Disagree (1) to Strong Agree (5))
 - a. The food system in Asia has been increasingly in the spotlight over the years, due to food security issues, the rise of novel foods, and food safety concerns
 - b. Demand for innovative foods like hydroponic produce, alternative protein, and aquaculture produce is increasing
 - c. Asian agricultural and food policy is motivated by demand-side stakeholders like consumers and investors
 - d. Asian agricultural and food policy is motivated by foreign policy standards
 - e. Asian agricultural and food policy is motivated by environmentalism - to reduce carbon emissions, sequester carbon, etc.
 - f. Policymakers and lobbyists in Asia are acting on sustainability issues related to the food system, such as food safety, food insecurity, and legalizing novel foods
 - g. Consumer behaviour surrounding certain foods (e.g. rising demand for a certain food group, or a change in diet) has contributed to the recent growth in sustainable initiatives for the Asian food system
 - h. Increasing investor interest in innovation in the food and agriculture sector has contributed to the recent growth in government-based sustainable initiatives for the Asian food system
2. In your opinion, what are some key factors that drive policy in Asia?
 - a. Economic growth (increased job opportunities, opportunity for market expansion, etc)
 - b. Diplomatic relations (foreign direct investment, maintaining relations with important diplomatic power, gaining diplomatic power, etc)
 - c. Sustainability (reducing socioeconomic inequality, reducing carbon emissions, etc)

- d. Local dissent (public opinion and pressure, riots, protests, etc)
 - e. Tradition, religion, and culture
 - f. Others: please specify
3. What are some key factors that drive food and agricultural policy in Asia? Please rank them from 1 (highest rank) to the highest number representing the lowest rank.
- a. Economic growth (increased job opportunities, opportunity for market expansion, etc)
 - b. Diplomatic relations (foreign direct investment, maintaining relations with important diplomatic power, gaining diplomatic power, etc)
 - c. Sustainability (reducing socioeconomic inequality, reducing carbon emissions, etc)
 - d. Local dissent (public opinion and pressure, riots, protests, etc)
 - e. Tradition, religion, and culture
 - f. Others: please specify
4. If there is anything you would like to add, on top of your answers above, please write below. As a brief recap, my thesis hopes to identify key mechanisms for sustainability in the food system in Asia, through evaluating the effect of local demand-side and supply-side factors. I am hoping to assess how demand-side factors have significantly contributed to the recent growth in sustainable initiatives like food innovation and food security policies in Asia.