

# **An Understanding of the Food Chain System in Malaysia: A Mini-Review Approach**

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## **Abstract**

The socio-food-flow system focuses on the structure of mental models, which can assist in recognising social systems and human structures as well as determining their knowledge and views about the level of comprehension of the food-chain system. Qualitative methods like face-to-face and online interviews, cognitive mapping, and even image interpretation, are used to create the mental model method. It is also assisted using quantitative approaches for the goal of obtaining more accurate and relevant data, such as questionnaires, so that the results acquired cannot be challenged by any researcher. In addition, the researchers are carrying out a literature review over the next five years abroad, from 2015 to 2021. As a result of the study's findings, most researchers prefer to discuss food-related research in the context of food health and safety, while others prefer to discuss it in the context of food treatment technology. This is supported by the findings of previous studies conducted by researchers, in which 13 journals were reviewed from indexed sources such as ScienceDirect and Scopus from 2015 to 2021. This study could be used to remind the whole community of the food chain system's relevance for improving product quality and reducing the environmental impact of production. The conceptual approach of the model can assist researchers in increasing public awareness of the relevance of the food chain system in the future.

## **Keywords**

Mental Models, Sustainability, Food Chain Systems, Knowledge, Society

## **1. Introduction**

The sustainability of the food chain systems management directly leads to the health of the Earth's systems. Maintaining a stable supply of basic resources is the main concern of territorial sustainability (Wostl, 2019). Simultaneously, agricultural systems are a significant factor affecting the impact of human activities on the Earth's ecosystems, accounting for approximately 60% of global greenhouse gas emissions (Meng Cai, 2021). As a result, food production in developing countries such as Malaysia is incredibly challenging, particularly in terms of resource management efficiency. Furthermore, production and consumption patterns can be identified based on actor roles in the food chain system network. Given the complexity of the food chain system and the interplay of socioeconomic factors, supply and consumer demand, this phenomenon of reduced food reserve loss should be carefully considered, considering that the majority of the world's citizens have a positive spending pattern on imported food products and dietary restrictions (Charlene Li, 2021).

Thus, food chain management has a strong correlation with influencing the factors involved, as well as the role of indirect actors, such as the importance of nutrition, health, economic development of society, stakeholders' involvement, and key sectors in food production and processing. According to Juan D. Suárez-Gómez (2021),

“interaction occurs when the operation of one set of institutional arrangements has an effect on the outcome of another or other sets of institutional arrangements.” Understanding the relationships between actors is critical for enhancing the inclusiveness and efficiency of food system governance, as it enables actors to form strategic alliances with institutions in order to accomplish individual or collective goals (Olivier De Schutter, 2020).

**1. 1 Introduction**

The purpose of this study is to identify selected food chain systems that employ mental model approaches in their research methodologies. Additionally, it will aid in comprehending the scope of food chain systems from a more holistic perspective on the long-term viability of food systems based on previous research. Following the study’s findings, other researchers can utilise the study’s contribution and selection of fundamental concepts related to food chain systems, particularly using mental model approaches.

**2. Materials and Methods**

The study employs a systematic review of the literature. The study’s search for literature solution methods is geared toward mental modelling techniques for comprehending food chain systems. The search engine prioritises keywords associated with mental models, sustainability, food chain systems, knowledge, and society. The work scope focuses on identifying two language-specific search terms, namely Malay and English. The search for previous studies uncovered 13 journals published between 2015 and 2021, all of which were indexed in two databases, ScienceDirect and Scopus. In researching food chain systems, the summary in Table 1 takes mental model approaches into account.

**Table 1.** Journal categories according to the themes and approaches used

No	Research	Journal, Publisher & Year	Objective	Gaps/ Discussion	Methods	Results
1.	Adithya Pradyumna, Florence Egal & Jurg Utzinger  Sustainable food systems, health, and infectious diseases: Concerns and opportunities	Journal of Acta Tropica  (Elsevier) 2018	Drew attention on the infectious diseases research and practice communities for the diverse challenges and opportunities that exist in the area of food systems and health, placing particular emphasis on infectious diseases in low- and middle-income countries (LMICS)	Identified potential pathways of influencing policy to support health protection and promotion, and how these can be jointly addressed with other sectors in context-appropriate projects and programmes	Network Analyses	Current food system practises expose the vulnerability of populations to various health issues. Indeed, several health challenges, such as malnutrition, infectious diseases, antimicrobial resistance, and non-communicable diseases, are caused by existing food system practises. There is growing awareness of the seriousness of the situation across sectors, including the

						public health community.
2.	<p>Christophe Bene, Peter Oosterveer, Lea Lamotte, Inge D. Brouwer, Stef de Haan, Steve D. Prager, Elise F. Talsma &amp; Colin K. Khoury</p> <p>When food systems meet sustainability – Current narratives and implications for actions</p>	<p>Journal of World Development (Elsevier) 2018</p>	<p>Explored these narratives to shed light on the explicit or implicit epistemological assumptions, mental models, and disciplinary paradigms that underpin them</p>	<p>The analysis revealed that the concept of sustainability, although widely used by all the different communities of practise, remains poorly defined, and applied in different ways, usually based on a relatively narrow interpretation</p>	<p>Analysis Literature</p>	<p>The research agenda on sustainable food systems needs to focus on better understanding the trade-offs of food system sustainability and to help societies navigate these more efficiently and equitably.</p>
3.	<p>Davy Vanham &amp; Adrian Leip</p> <p>Sustainable food system policies need to address environmental pressures and impacts: The example of water use and water stress</p>	<p>Journal of Science of The Total Environment (Elsevier) 2020</p>	<p>Clarified why addressing both pressures and impacts is relevant for policymaking, using the example of the pressure on water use and the impact on water stress</p>	<p>Evaluated the relevance measured by these footprints; they must be related to their respective local and/or planetary boundary</p>	<p>Consumptive Water Footprint (WF)</p>	<p>A water quantity sustainability scheme that addresses both water use and water stress can be used for supporting food system policies, including food package labelling.</p>
4.	<p>Radilaite Cammocka, Daysha Tonumaibe, Cath Conna, Losi Sa'uLilola, El-Shadan Tautoloa &amp; Shoba Nayar</p> <p>From individual behaviour strategies to sustainable food systems: Countering the obesity and</p>	<p>Journal of Health Policy (Elsevier) 2020</p>	<p>Extended solutions which address the increasing rates of obesity and diet related NCDs in New Zealand while considering diet and human health in concurrence with sustainability</p>	<p>Explored policy solutions to increasing rates of obesity and diet related NCDs while considering diet and human health, in-concurrence with environmental sustainability</p>	<p>Behavioural Approaches</p>	<p>The shift in diets and the obesity rates and NCDs in New Zealand can be traced to changes in the food system. Such changes have significantly affected the way people eat, ultimately increasing the consumption of unhealthy foods. Among the challenges</p>

	non-communicable diseases epidemic in New Zealand					faced in the food environment, availability, accessibility, taste, affordability, and convenience have greatly been attributed to the epidemic.
5.	<p>Bruno Notarnicola, Serenella Sala, Assumpcio Anton, Sarah J. McLaren d, Erwan Saouter &amp; Ulf Sonesson</p> <p>The role of life cycle assessment in supporting sustainable agri-food systems: A review of the challenges</p>	<p>Journal of Cleaner Production (Elsevier) 2016</p>	<p>The challenges for life cycle assessment arising from the complexity of food systems, and the recommendation of research priorities for both scientific development and improvements in practical implementation</p>	<p>The main research challenges need to be addressed for life cycle assessment (LCA) to fully support decision-making and the transition towards sustainable food systems</p>	<p>Life Cycle Assessment (LCA)</p>	<p>The intrinsic variability of food production systems requires dedicated modelling approaches, including addressing issues related to: the distinction between technosphere and ecosphere; the most appropriate functional unit; the multi-functionality of biological systems; and the modelling of emissions and how this links with life cycle impact assessment. Also, data availability and interpretation of the results are two issues requiring further attention, including how to account for consumer behaviour.</p>

6.	<p>Claire N. Friedrichsena, Samira H. Daroubb, Martha C. Monroed, John R. Steppc &amp; Stefan Gerber</p> <p>Stakeholders' mental models of soil food value chain in the Everglades</p>	<p>Journal of Geoderma (Elsevier) 2019</p>	<p>Explored mental models of farmers and experts, examining the communication gap concerning soil health and food security</p>	<p>The mental models of farmers suggest that research and extension related to building and maintaining the entire soil food value chain would increase the likelihood that farmers would better care for their soil and be profitable, and examined how different mental models of the SFVC can impact soil related technology development and dissemination</p>	<p>Mental Model Approach</p>	<p>This research contributes to the literature by recognising the importance of examining the barriers to soil communication between stakeholders, and the importance of including soil examination within the larger food system.</p>
7.	<p>Eileen Bogweh Nchanji &amp; Cosmas Kweyu Lutomia</p> <p>COVID-19 challenges to sustainable food production and consumption: Future lessons for food systems in eastern and southern Africa from a gender lens</p>	<p>Journal of Sustainable Production and Consumption (Elsevier) 2021</p>	<p>Explored the implications of Covid-19 on sustainable production and consumption by focusing on common beans, vegetables, fish, and fruits produced and consumed in rural, semi-urban, and urban areas</p>	<p>Short food supply chains can sustain rural and urban livelihoods against the adverse effects of the pandemic and contribute towards sustainable production and consumption.</p>	<p>Descriptive statistics</p>	<p>COVID-19 implications on production may not be uniform across countries and regions, possibly varying depending on pre-COVID-19 underlying challenges and social vulnerabilities. The findings also showed possible gender differences in consumers' resilience to the pandemic's impacts on production and consumption.</p>

8.	<p>Baqir Lalani, Payam Aminpour, Steven Gray, Meredith Williams, Lucie Buchi, Jeremy Haggar, Philip Grabowski &amp; Jose Dambiro</p> <p>Mapping farmer perceptions, Conservation Agriculture practises and on-farm measurements: The role of systems thinking in the process of adoption</p>	<p>Journal of Agricultural Systems (Elsevier) 2021</p>	<p>Explored the association between farmers' mental models of CA/conventional practises and on-farm measurements; and evaluated cowpea aboveground biomass, yield, weed cover, and soil quality parameters from the farmers' main plot</p>	<p>Higher forms of experiential learning practise can be related to higher degrees of systems thinking and stronger positive perceptions of CA, even among the CA 'disadopters.'</p>	<p>Fuzzy Cognitive Mapping (FCM)</p>	<p>The importance of systems thinking abilities and the inclusion of biophysical, socio-economic, and mental modelling variables rather than simple binary measurements may have led to erroneous conclusions on CA and thus has implications for how CA is understood and promoted in the future.</p>
9.	<p>Robert Murphy Jr, Austin Estabrooks, John Gauvin, Steven Gray, Anita C. Kroska, Nathan Wolf &amp; Bradley P. Harris</p> <p>Using mental models to quantify linear and non-linear relationships in complex fishery systems</p>	<p>Journal of Marine Policy (Elsevier) 2021</p>	<p>Integrated the local expertise of commercial fishers and seafood processors into management planning to predict how regulatory changes could impact social-ecological systems. Participatory modelling among managers, scientists, and industry can be useful in integrating different perspectives and gaining a more comprehensive understanding of how different scenarios can cause direct and</p>	<p>The new survey techniques based on principles from FCM were refined and developed to offer new ways for researchers and managers to predict the outcomes of various levels of change on fishers.</p>	<p>Fuzzy Cognitive Mapping (FCM)</p>	<p>Results show both linear and non-linear relationships between bycatch regulations and fishing operations; thus, providing evidence counter to the traditional assumption that the relationships between policy and fishing operations are always linear and constant across variable levels of change. It is important to explore a broad suite of regulatory consequences using human</p>

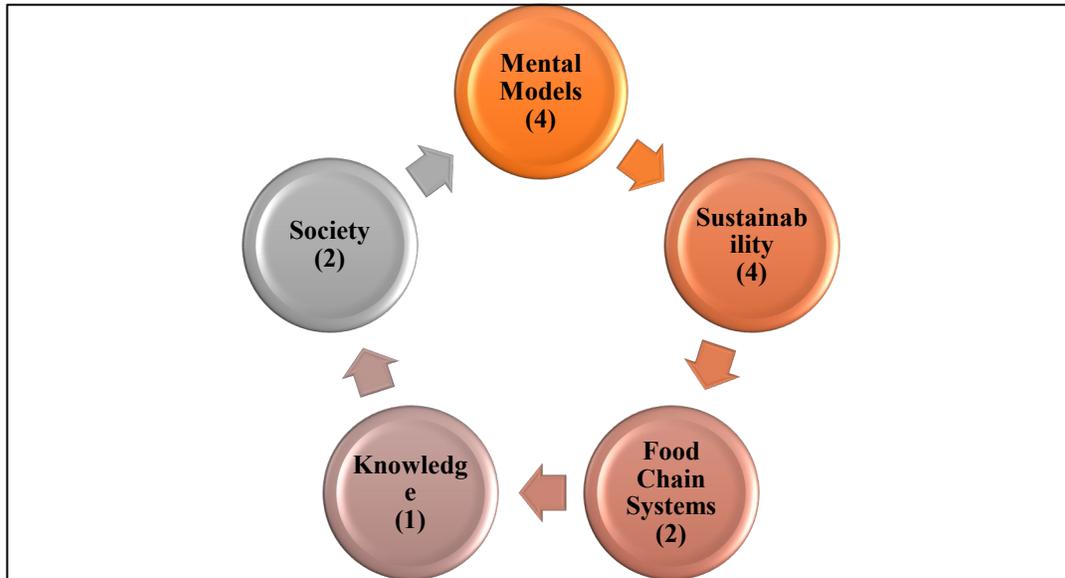
			indirect impacts throughout fishery systems.			dimensions research methods, such as using FCMs, as part of the regulatory decision-making process.
10.	<p>Piergiuseppe Morone, Pasquale Marcello Falcone &amp; Antonio Lopolito</p> <p>How to promote a new and sustainable food consumption model: A fuzzy cognitive map study</p>	<p>Journal of Cleaner Production</p> <p>(Elsevier) 2018</p>	<p>Identified and recommended the most effective policy actions and private initiatives that might modify the current unsustainable food consumption model, by characterising high income countries, in order to achieve a significant reduction in the amount of food wastage.</p>	<p>The researcher had to deal with the reasoning process, expressed in verbal non-technical terms of experts and stakeholders.</p>	Fuzzy Cognitive Mapping (FCM)	<p>Emphasising the complexity of the food waste systems, clearly showed that policy drivers and private initiatives have potential side-effects and negative impacts that should be considered when trying to design a well-suited and balanced policy intervention for the food waste systems.</p>
11.	<p>Glory I. Edwards &amp; Kasper Kok</p> <p>Building a Fuzzy Cognitive Map from stakeholder knowledge: An Episodic, asynchronous approach</p>	<p>Journal of Current Research in Environmental Sustainability</p> <p>(ScienceDirect) 2021</p>	<p>Supported the participatory component of modelling processes without the need for face-to-face interactions</p>	<p>To bridge the gap between a qualitative phase of the PM process and a quantitative phase of mathematical modelling</p>	Fuzzy Cognitive Mapping (FCM)	<p>The results demonstrated that the easy approach is an effective way for co-production to be achieved. The easy approach can thus be considered valid for constructing a representation of a complex social-ecological system.</p>
12.	<p>Tolera Senbeto Jiren,</p>		<p>The governance network</p>	<p>Governance networks that</p>	Social Network	<p>Only a minority of the</p>

	Arvid Bergsten, Ine Dorresteijn, Neil French Collier, Julia Leventon & Joern Fischer  Integrating food security and biodiversity governance: A multi-level social network analysis in Ethiopia	Journal of Land Use Policy  (Elsevier) 2018	influenced food security and biodiversity conservation, that is, on the interactions between agencies and other stakeholders from various districts and governance levels through which decisions are made and actions are taken that affect food security, biodiversity, or both	foster stakeholders' multi-level ties across jurisdictions, and enhance multi-sector interaction would likely improve integration outcomes and social learning, to provide opportunities to identify integration problems for improving institutional fit	Analysis (SNA)	collaborations among stakeholders took both food security and biodiversity into account, despite most actors being individually involved in both sectors. Stakeholders with positional power, sociological power (popularity), and formal authority played a liaison role in the governance network.
13.	Zahir Irani, Amir M. Sharif, Habin Lee, Emel Aktas & Zeynep Topaloglu, Tamara van't Wout & Samsul Huda  Managing food security through food waste and loss: small data to big data	Journal of Computers and Operations Research  (Elsevier) 2017	Explored a set of organisational factors that contribute to food security management through waste reduction, and identified causal relationships among organisational factors using the FCM technique	A new approach to exploring those organisational factors that contribute to managing food security through waste reduction is needed.	Fuzzy Cognitive Mapping (FCM)	This research therefore seeks to provide policymakers with a means of evaluating new and existing policies, whilst also offering a practical basis through which food chains can be made more resilient through the consideration of management practises and policy decisions.

### 3. Results and Discussion

The food chain system is comprised of multiple stakeholders who have the ability to influence outcomes and are inextricably linked, including farmers, producers, processors, distributors, and retailers. Stakeholders in the food chain system typically have a variety of roles and functions, such as consumers and customers, who can represent food safety and quality concerns. On the other hand, food manufacturers place an emphasis on food production controls that can affect the quality of food being traded in the market (Roberto Castro-Muñoz, 2022). Figure 1 summarises

previous research conducted by researchers, categorising them by year of publication, type of publication, nationwide research, and studies focusing on mental model methods as well as those following established themes. Through this study, the researchers identified 13 articles from indexed sources in the ScienceDirect and Scopus databases that were published between 2015 and 2021 as presented in Figure 2. Additionally, the researchers reviewed the articles that were selected based on the discussed theme. The five developed themes are mental models, sustainability, food chain systems, knowledge, and society. The study methods employed are more qualitative in nature, involving journal analysis, book reviews, and discussions in focus groups about freelance studies conducted throughout the country. Upon completion of the classification process, the study's findings have been summarised in the concluding section.



**Figure 1.** Distribution of journals obtained according to themes

Mental models are frequently attributed to cognitive representations created by individuals and groups for the purpose of comprehending social and ecological interactions (Baqir Lalani, 2021). To comprehend food chain systems, consumer health, food safety, and food treatment technology are all analysed, as they are critical for stabilising environmental sustainability. Additionally, rural relations and the management of agro-agricultural systems from domestic to global markets via food supply chains and networks have received significant attention. (Humphrey and Memedovic, 2016). All these specifications would be impossible to achieve if stakeholders lacked efficient and systematic governance. This is because efficiency in the food system requires the stakeholders' capacity to determine a product's marketability throughout the food supply chain, from agriculture to sustainable marketing.

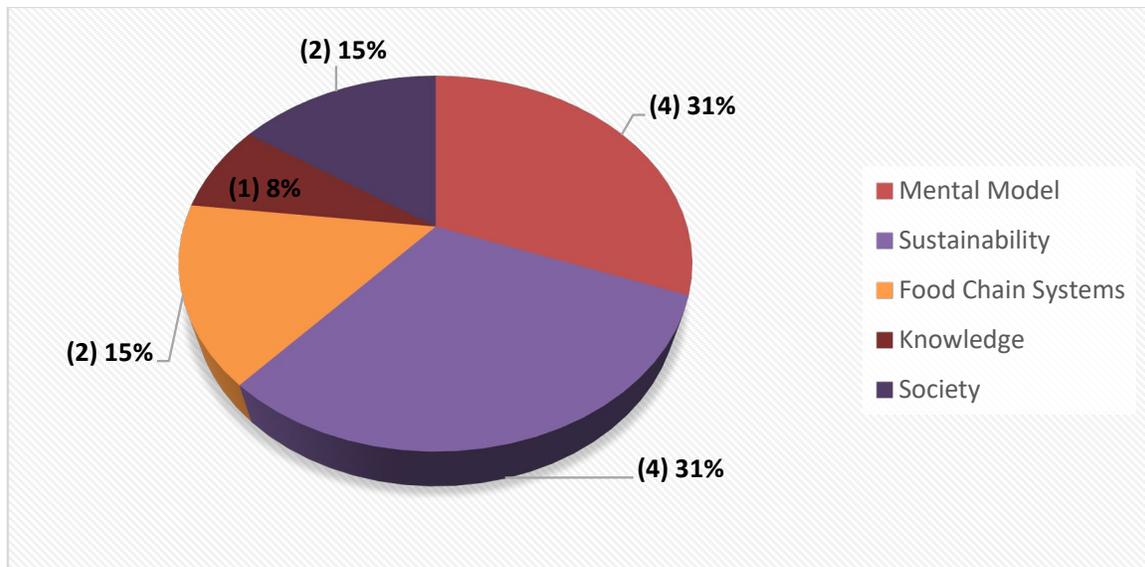


Figure 2. The number of journals obtained by the researchers according to the specified themes

#### 4. Conclusion

The Food Chain System is a distribution network that is inextricably linked to logistics and comes in a variety of sociocultural, economic, and environmental configurations. The food chain system's conservation is critical for preventing the degradation of soil, water, air, and human health resources. The food chain system serves as a benchmark for evaluating a country's food supply network's performance in light of factors such as perishable food sources, seasonal food production, and the availability of high-quality and sufficient food sources, as well as transportation and processing facilities for food products, to meet consumer needs. Understanding the behaviour and the comprehension of human agents is critical in the food chain system due to their relevance to changing consumption patterns of current food sources. Consequently, authorities place a high priority on efficient governance of food chain systems in order to address the issue of excess or reduced food supply and ensure future sustainability. Previous research has demonstrated the inability of concerned parties to focus on simultaneous cognitive thinking across the overall food chain system. Thus, bridging the gap through the consolidation of multiple objectives and cross-disciplinary food systems through the use of mental models is a more pertinent and ideal solution that adheres to the Sustainable Development Agenda

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