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Conceptualizing Food Bank Distribution Efficiency Via Smart Mobility: A Systematic Literature Review

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Abstract

The scientific debate has been reignited globally, emphasising the importance of food banks. Although there are comprehensive studies on food banks, the effort to conduct a systematic literature review (SLR) on this particular research issue has been challenging since it fails to include the procedures, making it difficult for scholars to replicate or interpret. This research aims to review the existing studies about food bank distribution efficiency via smart mobility. An SLR using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines was conducted. The search strategy includes identification, screening, eligibility and inclusion on established online databases, including Web of Science and Scopus. This paper investigates the efficiency of implementing a smart mobility system as one of the foodbank's distribution channels. This paper examined definitions of the food bank and smart mobility and conceptualised food bank distribution efficiency via smart mobility.

Keywords: Distribution Efficiency, Food Bank, PRISMA, Smart Mobility, Systematic Literature Review

Introduction

Food waste is among the most commonly discussed subjects (Ceballos et al., 2015). Food waste has a long history that is intertwined with globalisation. In 2019, Food and Agriculture Organization reported that more than 900 million tons of food waste were produced (FAO, 2021). The report further explained that 61 percent was the household's food waste, 26 percent from food service and 13 percent from retail. Specifically, Malaysians generate enough food waste daily, accounting for 38,000 tons of domestic waste 45 percent of which is food waste (Zainal, 2021). The author further added that more than 4,000 tons are still edible. Food waste is when edible food goes uneaten due to the inefficiency of supply chains (Cicatiello et al., 2016). Food waste is expected to increase as food production struggles to keep up with the world's rapidly growing population. This shows the importance of planning daily meals. Otherwise, issue of food waste could not be solved. Making a list of groceries,

planning meals appropriately before expiry dates, and practising first-in-first-out (FIFO) at all times can help reduce and control food waste. In addition, Malaysian could also get creative by repurposing leftovers, donating food to the needy, and cooking just the right amount for each meal (Zainal, 2021). Hidden behind this food waste problem are starvation problems that should not occur due to increased food waste dumping.

Quoting David Beasley, the World Food Program executive director, alleged that the world is in the middle of the worst humanitarian crisis since World War Two; at the same time, we were hit by the COVID-19 pandemic and are on the edge of starvation (Hamid, 2020). World Food Program currently provides food assistance to approximately 100 million individuals; however, reaching the population could be challenging due to COVID-19 (Hamid, 2020). The scientific debate has been reignited globally, emphasising the importance of food banks (De los Rios et al., 2015). A food bank is a non-profit organisation that collects and distributes food to charities that help the hungry. There are two types of food banks which are traditional and modern. Traditional food banks have long been used to serve communities, but in recent years, hunger-relief organisations have begun focusing on a more progressive food assistance tool, that is, mobile food banks. However, mobile food banks are still new and vaguely understood. It is popular in the engineering area as the term "smart mobility" refers to the use of technology to solve urban mobility issues and is very much related to the engineering field. Most smart mobility focuses on how smart mobility can be applied and benefit from various angles, especially from an environmental point of view. Smart mobility also has an impact on the economic and social dimensions.

However, smart mobility in food bank distribution is somewhat unfamiliar. This method of distributing food to those in need is gaining popularity and attracting the attention of nonprofit organisations and donors across the country. Smart mobility, on the other hand, is an integrated system of multiple activities aimed at reaching long-term sustainability (Pinna et al., 2017). The most vital feature of smart mobility is connectivity and big data in which users can communicate all information in real-time, and public administrators, at the same time, can conduct systematic management (Pinna et al., 2017). According to the findings of the analysis, smart mobility is well-known not only in engineering but also in environmental science (Chen et al., 2017). Thus, the literature was reviewed accordingly

Methodology

The study utilised secondary data collection using a library desk search for papers published in two database search engines: Scopus and Web of Science (WoS). The papers were processed through several stages using keywords about smart mobility and food distribution. The searched papers were downloaded and reviewed. Studies between 2017 and 2021 were included in the review, corresponding to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021). The researchers screened and reviewed the papers based on inclusion and exclusion criteria, as shown in the following table.

Table 1
Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Timeline	2017 - 2021	2016 and earlier
Document type	Journal articles and conference papers	Book chapter, review, etc.
Language	English	Non-English
Subject area	Social science and	

A search for "food bank" or "smart mobility" found 1964 papers in Scopus, while 1630 papers were identified in Web of Science. The search was between the years 2017 and 2021. To optimise the systematic review, the search strategy was divided into search 1 and search 2, respectively, as suggested by Vargas, de Moura, Deliza and Cunha (2021). The search strategy is presented in Table 2.

Table 2
The strategy of searching using keywords

Search	Keyword
Search 1	"Food Bank"
	"Food Bank" AND Distribution
	"Food Bank" AND "Supply Chain"
	"Food Bank" AND Efficiency
	"Food Bank" AND "Food Waste"
Search 2	"Smart Mobility"
	"Smart Mobility" AND Distribution
	"Smart Mobility" AND Efficiency
	"Smart Mobility" AND "Food Delivery"
	"Smart Mobility" AND Food

Peer-reviewed papers were included, considering the aspect of food bank distribution efficiency and smart mobility: definitions, correspondence between a distribution and smart mobility, the correlation between the food bank and smart mobility, the interaction between smart mobility and efficiency, and factors affecting sustainable development dimensions. The dimensions of sustainable development identified in relation to our topic are the social, economic, and environmental dimensions.

Findings

A. Background of the Selected Papers

A total of 3,594 papers were identified from an online database. 1,964 papers are from the Scopus search engine, and 1,630 papers are from the Web of Science search engine. The search scope was then limited to journal papers in English and excluded conference papers, conference rreviews book chapters, review, book, editorial, short survey, note, erratum, letter, and data paper. Narrowing the papers between 2017 and 2021 and selected papers in social science and environmental science, the list was reduced to 386.

Then, 26 duplicate papers were eliminated. Researchers screened the journals' titles, keywords and abstracts using the inclusion and exclusion criteria mentioned in Table 1. It was reduced to 87 papers. The papers were selected for full-text reading, and 49 were excluded using the exclusion criteria of full-text reading. The researchers manually screened to ensure the papers matched the inclusion criteria, as shown in Table 1. Based on the process, the researchers agreed that 38 papers fulfilled all inclusion criteria and were included in this study.

Figure 2 shows that there was a significant increase in manuscripts published from 2017 to 2021. This demonstrates a growing trend of studies on the food bank and smart mobility studies among researchers.

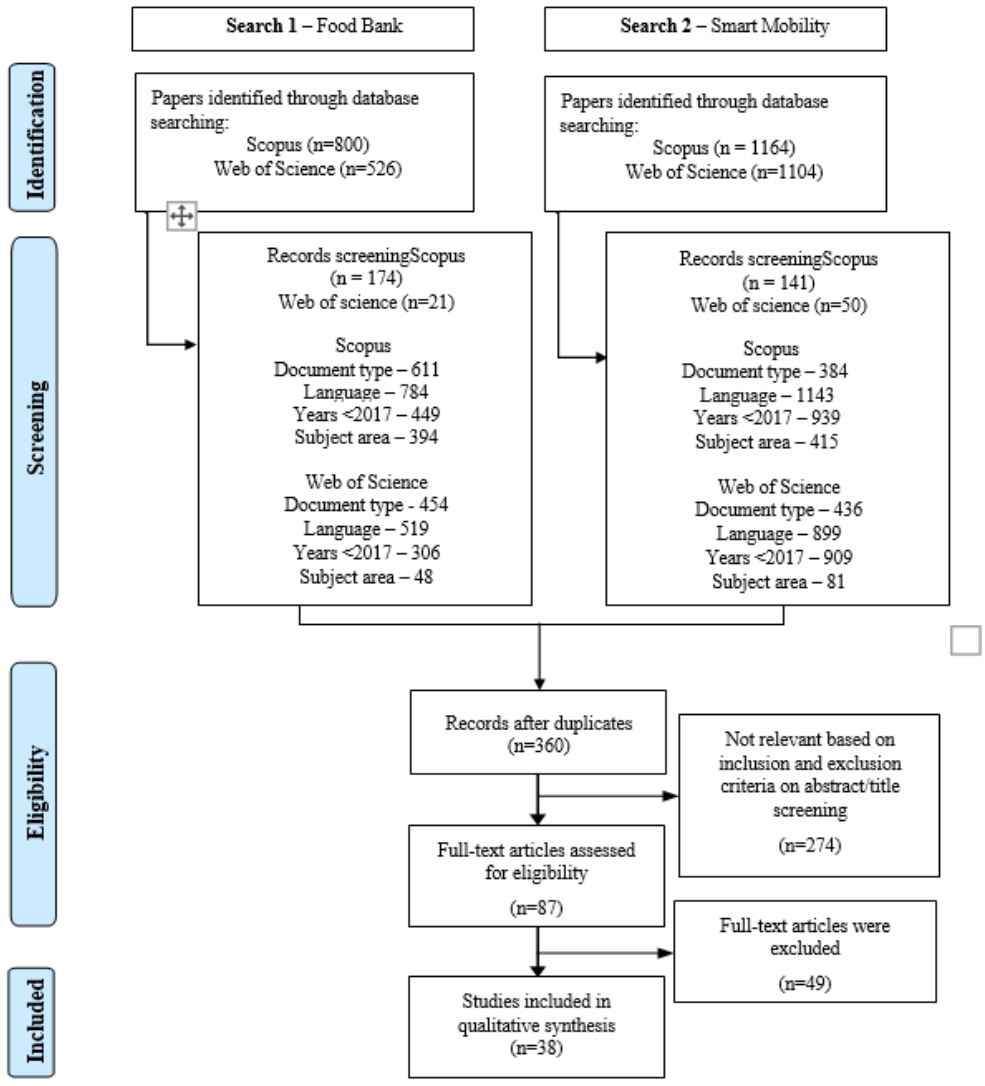

Figure 1. PRISMA flow diagram of the study selection. Adapted from Page et al. (2021)

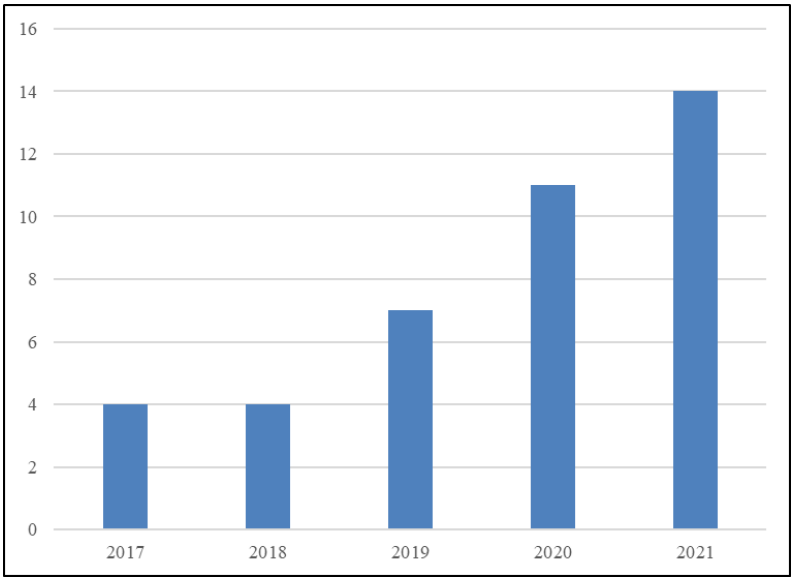

Figure 2. Distribution by the publication year of the 38 publications included in the analysis

Concerning the development dimensions, nine journals (23.7%) focused on the environmental dimensions, where most of them investigating several dimensions linked to distribution efficiency, including gas emission, food miles, and modes of mobility. Six papers (15.8%) concentrate on the social dimension, considering dimensions associated with social responsibility, human welfare, and preserving social stability. Meanwhile, one paper (2.6%) was on the economic dimension, considering the impact of the implemented smart mobility concept in the country. Additionally, one manuscript (2.6%) addressed social and economic dimensions, while seven papers (18.4%) addressed social and environmental dimensions. Nonetheless, economic and environmental dimensions contributed to seven manuscripts (18.4%). Finally, seven out of 38 papers considered social, economic and environmental dimensions of sustainable development.

B. Food Bank

In the systematic review, nine out of 38 papers (23.7%) addressed food banks with a broader area, and only four (10.5%) directly focused on food banks. Some papers do not provide a clear explanation of food bank concepts. As a result, the terms of food banks are not generally recognised. One clarification of food bank identified in several studies was related to a charitable association, and prior studies supported this notion (Wool et al., 2021; Mandal et al., 2021; Dubey & Tanksale, 2021; Simmet et al., 2018; Michelini et al., 2018; Hesse et al., 2019; Rombach et al., 2018; Narayanan & Altay, 2021; Diabat & Gao, 2021; Hermsdorf et al., 2017).

Michelini et al (2018) defined a food bank as a body that collects donated food from farms, manufacturers, distributors, retail stores, customers, and other sources, much of which would otherwise be wasted, and distribute it to those in need through a network of community works. Similarly, the food bank's core activity is collecting food waste and distributing it to charitable food programs (Narayanan & Altay, 2021). Food banks are operated on a limited budget and depend on contributions and volunteer labour from the community.

Resource allocation is an important aspect of dealing with food banks. It refers to the delivery of resources to meet the request (Hermsdorf et al., 2017). The knowledge aspect is especially

imperative because food bank employees deal with food as a limited supply and engage with food bank clients who are regularly homeless and eventually reliant on food banks (Alkaabneh et al., 2021). Hence, it is important to consider the immediacy of food stores, method of logistics, and cost in considering where to buy food, as well as the role of the local food bank in facilitating food access during the time (Wool et al., 2021).

For volunteers, a food bank is a method to put abandoned products and leftover food to good use for persons who receive donations. A food bank is sometimes needed to reduce hunger and, at other times, a source of nutrition and comfort (Dubey & Tanksale, 2021). Wool et al. (2021) highlighted that due to the high cost of healthy food, the needy were grateful for the fresh fruits and vegetables provided by the local food bank. Although they were satisfied with the food bank, several pointed out that the quality and amount of fresh food were inconsistent (Wool et al., 2021).

Food banks gained popularity, claiming to provide food to thousands of families experiencing food insecurity (Mandal et al., 2021). A study by Armour and Barton (2019) found that volunteering's meaning and purpose are beyond the instant needs of the families. Some store owners have established specific procedures to reduce waste and donate products to the food bank (Horoś & Ruppenthal, 2021). Attentive collaborations of charitable food association and professionals in social, nutritional, and health sciences should accompany the food banks' growth and assistance to support person in need and helps to control and reduce food waste.

C. Smart Mobility

Out of 38 papers, eight papers (21.1%) addressed smart mobility with broader area, and 15 (39.5%) were closely linked to smart mobility. The meaning of smart mobility is recognisable according to the increasing of papers published between 2017 and 2021. One explanation of smart mobility used in numerous studies is directly associated with supports in levitation, the quality of the logistics in the sense that it is environmentally friendly. Several studies have replicated these results (Bıyık et al., 2021; Mladenovic & Haavisto, 2021; Castellanos et al., 2021; Kramar et al., 2020; Loos et al., 2020; Moscholidou & Pangbourne, 2020; Sjoman et al., 2020; Manders & Klaassen, 2019; Pinna et al., 2017; Tran & Brand, 2021; Battisti et al., 2021; Groth, 2019).

Smart mobility is the new buzzword in this advanced and sophisticated world. Congestion, mishaps, and a shortage of parking space are all putting pressure on present transportation systems. The smart transportation concept has sparked a lot of interest and changes. It mobilises actors and resources; however, according to Manders and Klaassen (2019), given the ambiguities, these advancements should be closely reviewed before being promoted as answers to transportation concerns and sustainability challenges. Smart mobility solutions could meet many transportation demands by cutting prices and enhancing public transit, ridesharing, and active transportation service. The concept placed a heavy emphasis on developing transportation solutions for populations that have traditionally been underserved (Golub et al., 2019). Traditional mobility has been turned into smart mobility as the smart city movement has evolved. A series of transportation programs related to broader municipal activities supported by technology to increase liability, competitiveness, and sustainability are underway (Chen et al., 2017).

Cities are responding to the implementation of smart mobility policies; thus, many enterprises are starting to adopt this new way of thinking in mobilisation (Pinna et al., 2017). The smart mobility paradigm concentrates on more efficient road networks and driving behaviour facilitated by rapid ICT deployment (Tran & Brand, 2021). This will inevitably keep pace with the unlimited internet as technology advances. Additionally, smart mobility strives to increase passenger and commercial vehicle mobility while also reducing environmental consequences and improving social well-being (Melo et al., 2017). On the other hand, by incorporating blockchain into the smart mobility space, fewer automobiles could be on the road and traffic will be more efficiently handled (Wong et al., 2020).

Therefore, smart mobility is a critical component of a smart city and has the potential to reduce traffic congestion, commute times, and road crashes while also allowing passengers to tailor their travels (Bıyık et al., 2021; Kramar et al., 2020). Adding to the facts above, smart mobility will develop more public transportation and help many communities that do not have a vehicle or cannot drive. It is a business proposal aimed at the millions of senior citizens who do not have driver's licenses and are underserved by public transportation (Sourbati & Behrendt, 2021). The move to smart cities and their accompanying smart mobility solutions, such as ride-hailing services, has revealed new transportation and mobility safety and security problems and challenges beyond traditional traffic safety considerations (Acheampong, 2021). Within the transportation literature, shared mobility can be categorised as part of the smart mobility concepts (Castellanos et al., 2021).

Smart mobility refers to the potentially disruptive changes in the transportation sector brought on by automation, digitalisation, and the platform economy (Mukhtar-Landgren & Haavisto, 2021). Mobility as a service is frequently mentioned as a key component of future smart mobility (Sjoman et al., 2020). Smart mobility is based on a country or city's aims and environments, such as traffic concerns and accessible sources of logistics (So et al., 2020). The advent of smart mobility alternatives impacts not just mode selection but also departure time, route, destination, and activity patterns (Choudhury et al., 2018).
Smart mobility systems are designed to aid in the efficient use of local transportation networks as well as long-term mobility in metropolitan areas (Bucchiarone et al., 2021). The emergence of the notion of smart mobility, which anticipates multimodal behaviours, plays a significant role. This notion reflects a major shift in transportation systems, in which vehicle ownership is increasingly being replaced by vehicle usage (Groth, 2019). Smart mobility is a new concept of everyday mobility that conceptually incorporates multimodal. On the other hand, is a complex socio-technical model whose contours are only beginning to emerge (Groth, 2019).

Discussion

Smart mobility is a wise form of transportation. This is because the implementation of the use of smart mobility can contribute to the sustainability in terms of development. Smart mobility is inaugurated to hasten the transition to zero-emission vehicles while maximising environmental and air quality benefits (Bucchiarone et al., 2021). With the growth of smart cities globally, there is an urgent requirement to embrace the concept of smart mobility, but presently, the phrase is rarely heard or used. The interdependence of economic, social, and environmental development is a fundamental concept of sustainability.

The resource allocation operation is at the heart of food bank operations. The distribution of resources to meet demand is referred to as resource allocation (Hermsdorf et al., 2017). The growing global importance of waste management and poverty issues has resulted in the development of alternative distribution formats to reduce food waste (Michelini et al., 2018). As Trząskowska et al (2020) mentioned, safety is the most important aspect of food quality. Hence, additional resources are required to transport food for human consumption in a safe manner (Prescott et al., 2020). With the advancement of technology, existing food banks now have new opportunities to integrate online and traditional channels by developing web platforms and/or mobile apps to support food distribution, information management, and logistics processes (Michelini et al., 2018).
Smart mobility is also a commercial proposition aimed at the millions of older people who will surrender their driver's licenses and are not served by public transportation (Sourbati & Behrendt, 2021). Drones and robots are considered emerging transportation technologies challenging the conventional delivery systems currently in use (Samouh et al., 2020). The deployment of various technologies, such as smart mobility, is expected to boost the transportation sector in the upcoming years due to increased awareness of using hygiene and innovative routines. Based on our research, an extensive body of research has recently addressed improving food bank procedures or enhancing the effectiveness of a food bank supply system. However, research focusing on distributing donated relief supplies via smart mobility is lacking (Hermsdorf et al., 2017).

In the existing literature, there appears to be increasing attention on the relations between transportation and technology; however, the understanding of shared mobility as a component of this interaction remains ambiguous (Castellanos et al., 2021). Smart mobility is emerging, intending to decrease the efficiency of last-mile mobility. Such a mode of transportation allows for cost and convenience savings (Bucchiarone et al., 2021). Based on the literature review, various types of smart mobility are used to facilitate daily movement in Malaysian cities with a high population density, such as Selangor, for example, users of electric scooters and electric cars. In a delivery mode, one smart mobility trip means replacing a normal delivery truck with a better energy-efficient vehicle, thus, more cost-effective when it is used for multiple items delivery, given the same route. However, less total energy use and vehicle miles travelled (VMT) (Spurlock et al., 2020).

A. Economic and Social Dimensions

The reviewed papers informed that smart mobility and food bank leads to economic growth. Several studies have discussed these ideas (Rombach et al., 2018; Martins et al., 2019; Bergstrom et al., 2020; Bıyık et al., 2021; Mladenovic & Haavisto, 2021; Mukhtar-Landgren & Paulsson, 2021; Sjoman et al., 2020; Loos et al., 2020; Manders & Klaassen, 2019; Pinna et al., 2017; Melo et al., 2017). Typically, these organisations of food banks accept edible food from corporations and individuals, process it at storage facilities, and then distribute it to end users, either directly or indirectly, through non-profit community and governmental agencies. Return on investment and other economic parameters are not of primary concern for social economy actors such as food banks. Instead, most of their activities revolve around social and environmental performance (Rombach et al., 2018). As the goal of development supports the economic and social development of a country or region, it can happen without the requirement for a disaster in the context of improving people's lives (Martins et al., 2019). For instance, allocating efficient cooktops, providing bicycles as inexpensive transport, or

microfinancing entrepreneurial schemes in a poor regions. Additionally, food banks rely on volunteers and donated food. They are rarely a dependable food source for the population who are helpless to food insecurity owing to socioeconomic disadvantage (Simmet et al., 2018).

The need to design more sustainable cities is becoming more pressing, and mobility behaviour significantly impacts how many cities are socially, economically, and environmentally sustainable (Bucchiarone et al., 2021). Groth (2019) stated that the potential use of mobility services remains economically and cognitively presupposed. It will be useful to compare excess food redistribution solutions where an excess of food still accommodates people's consumption and to evaluate the social, economic and environmental effects of these results over the whole life rotation (Bergstrom et al., 2020). New technologies and innovation policies are frequently propelled by a competitiveness and economic growth rationale (Mukhtar-Landgren & Paulsson, 2021). The authors further explained that, in terms of the economic aspect, an intellectual transit system has more benefits than a human-monitored transit system involving social skills and competence. Similarly, as an alternative integrating several rules, inspiring vehicle owners to maintain specific agreements with the necessary authority controlling autonomous driving should be stimulated, which decreases the disturbance that comes with intense policy regulations in the logistic sector (Bıyık et al., 2021). In traffic congestion, smart mobility is employed, which causes economic expenses and necessitates using smart mobility solutions (Manders & Klaassen, 2019). Although implementing Mobility as a Service (MaaS) was deemed difficult, MaaS is thought to generate business opportunities and expand the local industry (Mladenović & Haavisto, 2021). Proponents of smart mobility claim that it has the potential to generate significant economic advantages and reduce the pollution and congestion issues linked with private vehicles (Sjoman et al., 2020).

B. Environment Dimension

Food banks served an important role in ensuring food security by recovering surplus food and redistributing it to the poor community. Food banks can be considered a new phenomenon in many countries. Though it is not a new concept worldwide, food banks redistribute extra food obtained from vendors and manufacturers to the needy; thus, it is a connection to food waste prevention (Dubey & Tanksale, 2021). Food waste is a major issue affecting the environment and the worldwide population (Michelini et al., 2018; Prescott et al., 2020). Effective food waste prevention strategies are those established by store proprietors based on their experience and management style, optimising sales and management approaches, careful planning, accurate procurement, and prompt price discounts on soon-to-expired dates (Horos & & & Ruppenthal, 2021). Perishable food waste is a serious challenge for society and must be addressed to ensure everyone's food security. Furthermore, when food waste is disposed of in landfills, it decomposes, emitting greenhouse gases such as methane and carbon dioxide (Mandal et al., 2021). Reducing food waste by sending donated food products from stores to food banks can increase the aggregator's profitability and reduce the environmental effect.

Hence, regarding environmental sustainability, several forms of joint mobility, including bike-sharing or car-sharing, can decrease carbon dioxide emissions by causing users to reduce car usage or delay purchasing a private car. For example, ride-hailing may have an adverse

environmental effect by causing people to take more trips or reduce their share of trips taken by more sustainable modes such as public transportation (Castellanos et al., 2021). Besides, smart mobility strives to increase passenger and commercial vehicle mobility and improve social well-being (Melo et al., 2017). Transporting huge quantities of near-expired food from shops to food banks presents logistical issues in terms of getting the food to the food banks on time so that it may be consumed (Mandal et al., 2021). According to Moscholidou and Pangbourne (2020), smart mobility should help create safer, quieter, and more enjoyable streets, minimise clutter, and allow for future space reallocation to public transportation or active modes. Solutions from smart mobility may manage traffic congestion as well as limit the usage of private vehicles, which can pollute the air and harm the environment. Sjöman et al (2020) contented that smart mobility encompasses not just high-tech vehicles, carsharing, public transportation, and other modes of transportation, but it may also revitalise a country's cycling culture. Bicycles require less space as compared to cars, reducing traffic congestion on highways and can reduce air pollution. Smart mobility programs are aimed at people who use public transportation in various ways. The automobile and communication technology inventions offer various services for vehicle drivers, including parking, navigation, tolling, entertainment, and autonomous driving (Chen et al., 2021).

C. Conceptualizing Food Bank Distribution Efficiency via Smart Mobility

After further deliberation on the attributes of food banks and smart mobility through a review of the 38 selected research. It was found that three attributes are most discussed in the smart mobility and food banks study, i.e., environmental, social, and economic factors, as depicted in Figure 4. According to previous research, the environment consists of two dimensions: logistic network and waste disposal (Mandal et al., 2021). While social include household income, age and language dimensions (Golub et al., 2019). The economic variable consists of three dimensions: cost saving, operational performance, and long-term investment (Martins et al., 2019).

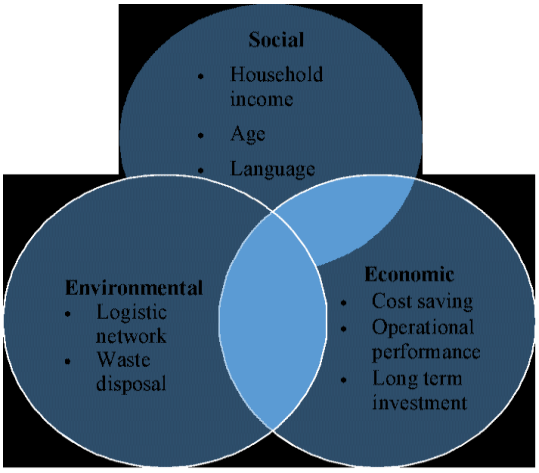

Figure 4. Conceptualizing food bank distribution efficiency via smart mobility

Conclusions

In conclusion, 38 papers on the food bank and smart mobility were systematically reviewed using PRISMA flow diagram. Furthermore, it highlighted the identification, screening, eligibility, and inclusion criteria. According to the selected studies, smart mobility is an

effective distribution mode. There are three dimensions of the food bank, and smart mobility discovered that is societal, economic, and environmental dimensions. Despite these dimensions, there have not been many previous studies that connect smart mobility as a distribution mode. Compared to papers focusing specifically on smart mobility, much of the prior research was conducted by researchers. Researchers can conclude that smart mobility gains less attention among researchers. This is because, based on the year the papers were published, "smart mobility" term is popularised in recent years compared to the food bank. The latter term has gained much attention among prior researchers. The ever-increasing population of urban cities has placed a significant strain on existing infrastructure and resources. Digital transformation is a feasible way to ensure that cities' infrastructure meets the increasing needs of residents. Combining smart mobility with emerging technologies raises the standard of living. Nonetheless, future studies should give more attention to this topic, as the actual quantities and types of waste could offer significant evidence and provide recommendations on preventing food waste and distribution using smart mobility.

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