博士論文

Foodscapes: A Study on Shop Choice Behaviour and Urban Structure from a Network Perspective

（フードスケープ：ネットワーク論を用いた買い分け行動と都市構造の研究）

バージェス　アンドリュー　イアン

Abstract

Urban food environments have undergone great change since the beginning of the Twentieth Century. Ongoing rationalisation, economic and technological development as well as social change has led to the establishment of a number of specific food shop types ranging from self-service formats such as supermarkets and convenience stores to specialist formats such as bakeries and butcheries. The deregulation of food retail has seen the emergence of non-traditional formats such as drug stores and home centres.

This research investigates how food and the built environment intersect in the form of foodscapes, that is, the spatialisation of food shopping. Network theory provides insight into the underlying structure of food environments.

Food shopping is itself a largely repetitive, routine activity. Due to the central role of food in daily lives food shopping is highly influential in the organisation of daily life. Therefore changes in food environments have a direct affect on everyday life. Further, changes in everyday life have a direct influence on food environments as shops adapt to evolving lifestyles. As Japan undergoes dramatic demographic and population change the pressure on this recursive relationship is heightening awareness of the relationship between food and the city in the form of growing issues such as food deserts and social exclusion.

Japan's commercial environment has evolved over a number of decades. The essentially mixed-use planning system has led to a rich tapestry of integrated urban textures with a variety of levels of commercial activity. Food shopping in Japan is characterised by the high frequency of shopping trips carried out during the week, the generally small purchases as well as the high number of shops used. Japanese shoppers tend to use a number of food shops, even within the same food shop type, to meet their shopping needs.

Existing research into food shops and the built environment can be broadly categorised into two streams; the economic aspects of food retail which manifests in analyses of shop location, competition and distribution, and secondly social aspects of food shopping in the form of access to healthy food and issues such as food deserts. These kinds of research tend to focus on specific food shop types or specific shopping areas. However, the mobility of modern urban inhabitants as well as the dispersion of foods across a various food shop types has limited the usefulness of these approaches. This research investigates how foodscapes are constructed by modern shoppers as they move across urban environments and shop formats in their everyday food shopping activities.

Network theory provides an opportunity to understand the structure of these food environments. While network theory has been used in a wide variety of fields including sociology and ecology, it has rarely been used in architecture and urban planning. Considering that modern shopping practices take place both inside and outside of traditional neighbourhood boundaries, network theory allows these spatial restrictions to be transcended revealing previously unseen underlying urban structures.

This research investigates how foodscapes vary in different urban environments. A survey of shopping behaviour was undertaken in 5 areas of Kashiwa City, a regional city with a population of approximately 400,000 located 30km north-east of Tokyo. Households of five Junior High Schools were asked to record information regarding routinely visited food shops for 10 food types and returned valid responses for 363 households. The respondents exhibited uniform social backgrounds in terms of age, sex and family size. By controlling for these factors the influence of the local food environment can be exposed more clearly.

Shops and households were geolocated and weighted bipartite graphs for each of the areas were constructed from the responses and their structural characteristics analysed. Sub-communities detected within each graph revealed varying clustering patterns of shops that can be categorised as ‘polymodal’, ‘monomodal’ or ‘bimodal’ where polymodal networks suggest a number of defined shopping patterns within a community and monomodal networks suggest undefined patterns.

Analysis of the role of specific nodes (shops) within a network was based on betweenness centrality values to understand the capacity for a shop to 'bridge' between shopping patterns and local clustering coefficient values to understand the embeddedness of a shop within a community. In all of the areas analysed Confectionery & Cake Shops and Bakeries showed significant capacity to bridge across shopping patterns. While shopping patterns for each area was consistent across most food types, how shopping for food is translated on to food shop types varies by area. As a result, where in one urban environment convenience stores showed high scores for embeddedness, discount shops were prominent in another.

This questions traditional assumptions of the role of specific shop formats in food environments as well as the role that local communities play in the production of foodscapes and leads to discussions on the resilience of foodscapes in the face of economic, demographic and lifestyle change.

Acknowledgements

I would like to express my appreciation and gratitude to Hiroshi Ota for his constant encouragement and patience despite times of an unnerving lack of progress. Also, I would like to acknowledge Prof. Hidetoshi Ohno who encouraged me on this path from the beginning of my Masters degree through to where I am today. Without his acceptance and space to move this thesis would not have been possible.

I would also like to acknowledge the Japanese government who supported me financially through the Monbukagakusho Program. Such generosity is truly a credit to relations between two countries. Further, the Centre for Spatial Information Science (CSIS) at the University of Tokyo provided me with incredibly valuable spatial data to support my research.

Finally, and most importantly I would like to express my deepest thanks to my family. To my parents whose belief in me throughout the years of study has often exceeded that which I've had in myself. And to my wife and daughter, without whom this thesis simply would not have been possible. Throughout difficult times they have been a constant reminder of the truly important things in life.

Table of Contents

List of Figures

List of Tables

1

Introduction

Food infiltrates almost every aspect of our lives. From constructing national identities to security and health, how and where we access food is becoming increasingly important. The study of foodscapes has increased in relevance in recent years in a number of fields ranging from geography to health studies, covering both the built environment and imagined spaces. As disparities from demographic, socioeconomic and technological change increase, how and where we access food is becoming increasingly important.

This research investigates the relationship between food shopping behaviour and food environments. It is particularly concerned with how food environments develop differently across urban environments and the empowerment that this endows food shops. Network analysis methods provide unique insight into these structures.

By understanding the underlying structure of these foodscapes it is possible to understand how changes in foodscapes, either through changes in the lifestyles and shopping behaviours of inhabitants or through changes in the built environment, affect communities.

In more specific terms, increasing rationalisation and economic pressure has led to an environment where food shops are opening, and closing, at increasingly rapid rates. This is especially compounded in Japan where dramatic demographic shift and population decline are

transforming urban environments and cultural norms. The lamenting of the decline of *shotengai* is well documented[1]. Food safety and security is becoming more important, as new types of shopping such as internet shopping and mini-supermarkets are emerging to create new urban patterns of movement and community. By understanding how specific food shops may be sensitive to these changes or how specific food shops play a role in community building, we can better plan for the inevitable reconfiguration of local urban environments.

Foodscapes are generally understood as the spatialisation of food. This research is concerned with how consumers exercise choice and how these choices are at once influenced by local food environments and influence local food environments. Food is an important part of understanding urban environments because food is a central part of daily lives. The purchase of food, it's preparation and consumption crosses all social, economic and cultural boundaries. Food is also directly related to health and in recent years disparaties in access to food has led to not only disproportionate health issues amongst urban inhabitants but also social exclusion[2].

Food also has strong ties to cultural identity. For example, in 2013 *washoku*, traditional Japanese cuisine, was designated as an UNESCO intangible cultural heritage. On the other hand, food shopping is a typically mundane and repetitive activity. However, repeated behaviour, or routines, are an essential component of daily life and everyday practice[3]. They provide safety through the establishment of trust and reduction of risk in daily life. Through their repetition and reinforcement, routines also contribute to the construction of shared practice, a kind of communal knowledge about how things are done in a particular community.

Japan in particular has it's own idiosyncrasies. Japanese households tend to make many food shopping trips during the week and use a number of shops to meet their shopping needs. This contrasts with areas such as the UK where 'one-stop' shopping is more common[4]. This discriminatory, or *kaiwake* as it is known in Japanese, behaviour creates an environment where food shops such as supermarkets are not strictly in competition but also have aspects of symbiosis.

---

1 Arata, M. 商店街はなぜ滅びるのか：社会政治経済史から探る再生の道 *(Shotengai Ha Naze Horobiru No Ka: Shakai Seiji Keizaishi Kara Saguru Saisei No Michi)*

2 Choi, Y. et al. *Food Deserts, Activity Patterns, & Social Exclusion: The Case of Tokyo, Japan*

3 Giddens, A. *The Constitution of Society: Outline of the Theory of Structuration.*

4 Haddock-Fraser, J. et al. *The Failure of Multinational Food Retailers in Japan: A Matter of Convenience?*

While architecture tends to generalise, for example supermarkets, as generic, from the point of view of the shopper significant differences exist.

Furthermore, the planning system in Japan promotes mixed-use environments which has led to extremely varied accumulations of shopping environments. This also has a direct impact on the way that people organise their daily lives. In terms of architecture, specific shop formats have developed in reaction to these routines or shopping behaviours. These food shop types have evolved since the beginning of the Twentieth Century, each with their own form and mode of operation. The rationalisation of food shopping has led to self-service formats such as supermarkets, hypermarkets and convenience stores providing uniform shopping experiences, department stores with high-end personalised service, local grocery stores and shotengai with their friendly attitudes as well as discount shops with low-cost bulk-buying strategies. Japan also has a rich history of consumer co-operatives which are widely used and ingrained in social practice. These shop types are both constructed out of shopping habits and practices as well as influence the construction of these habits and cultural norms.

So there is a direct relationship between food and architecture in that shopping behaviour influences the form that shops take and vice versa. As lifestyles change, or as local food environments change, the structure of inhabitants daily life necessarily changes. Charting these changes is an important way to understand how inhabitants engage with and construct their local environment. It is through shopping choices that inhabitants directly affect their local environment; shops that are used by inhabitants will survive, shops that are not used will simply disappear.

This research is particularly concerned with regional cities in Japan. While Japan is known for it’s dense urban megalopolises, medium sized urban centres make up significant proportion of Japan’s urban environment. In recent years these cities have been particularly exposed to economic and population pressures. To date little consideration has been paid to the relationship between the design of food shops and their location and social relations.

1.1 State of the Field

Research into the relationship between food and the city manifests in a number ways across a number of academic disciplines but can generally be categorised into research relating to economics and research relating to social issues.

Research relating to economics takes the form of investigations into the location of food shops relative to competitors or commercial accumulation. Study of the location and organisation of economic activities is not new. William Applebaum's work in the 1960's is often considered the starting point of retail location science. Berry's research, also in the 1960's, categorises urban spaces by retail activity. This hierarchical model included categories, such as 'Traditional Shopping Street', 'Urban Arterial', 'Highway Oriented' and 'New Suburban Ribbon', and formed the basis for understanding urban retail patterns in western cities[5]. Despite assumptions made about the behaviour of both consumers and retailers, for example, single-purpose trips made from home and decision-making based on price and product only, this kind of thinking was still influential in planning policy-making even 30 years later[6].

Research such as Sengoku et al. focus exclusively on dense accumulations of shops negating isolated shops as noise[7]. Research into social issues is typically concerned with access to food, that is food deserts and trip behaviour. Research into access to food tends to focus on minimum requirements, that is the shortest distance to food. Concentrating on deprived areas the focus is on catchment areas and the distance to the nearest shop. However, as noted above, in non-stressed areas, such as the subject of this research, shoppers utilise a number of shops and therefore assuming that shoppers prioritise travel times over all other considerations is problematic. Yakushiji is a good example of this approach[8].

---

5 Berry, B. *Commercial Structure and Commericial Blight : Retail Patterns and Processes in the City of Chicago*

6 Glenn, P. *Consumption, Consumerism and Urban Form: Historical Perspectives*

7 Sengoku, H. et al. *Determining Spatial Extent of Shopping Areas Using Store Density: An Approach with Kernel Density Estimation*

8 Yakushiji, T. et al. *Accessibility to Grocery Stores in Japan: A Comparison Between Urban and Rural Areas By Measuring Distance to Stores*

1.2 Research Significance

Increased mobility in the Twentieth Century has transformed the idea of local. People travel to various parts of a city and even between cities in their daily life forming connections that cannot simply be described by traditional notions of place. While architecture and urban design is strongly connected with the idea of place, this research aims to re-establish what place may mean in the Twenty-First Century, and with it ideas of community.

> *Traditional units such as neighbourhoods or even cities are of little value as work and social movement totally transcend these boundaries. The unit of analysis should be networks rather than place*[9].

This is not to say that place does not play a role in the construction of daily life. This research integrates spatial data with network analysis methods to construct foodscapes.

By understanding food shops as a network of resources for the spreading of information, ideas and social norms, rather than as entities in varying forms of competition, it is hoped that a new level of understanding of everyday consumption can be made.

9 Clammer, J. *Contemporary Urban Japan: A Sociology of Consumption.*

1.3 Significance to the Field

Understanding the relationship of food shopping and urban structure can give insight into the way that shop types evolve and lifestyles evolve.

A case study analysis of Junior High School households' shopping behaviour in five distinct areas found that foodscapes develop differently across urban environments. While shopping behaviour for some food such as rice and bread is similar across urban environments how it is mapped onto shop types varies.

Furthermore, by mapping food environments onto physical space the level of spatial embeddedness can be revealed. The Nearest Neighbour Ratio, developed in this research, allows the spatial correlation of shopping activity to be revealed. It was found that areas without a defined local shopping area but within ready driving distance of food shops form that highest correlated shopping patterns. By showing that these highly spatially embedded places are not necessarily local, a revaluation of the relationship between community and place is sought.

While economic research tends to deals with vertical relationships such as these and horizontal relationships in the form of competition, and architecture deals with spatially co-present phenomena, this research is focussed on how relationships that transcend space. By understanding food shops as networks rather than places a new understanding of urban structure can be unveiled.

1.4 Scope and Limitations

The study of food and foodways is broad and regularly crosses fields ranging from sociology to health studies, urban planning and economics encompassing issues related to the production, consumption and disposal of food.

This research is focussed on understanding food as it manifests in food shopping behaviour. Food production, especially in terms of urban food production and household gardens, is a significant part of the role of food in urban environments but clearly falls outside of this research.

Eating out is also a significant part of the Japanese cultural landscape that has developed specific architectural forms distinct from restaurants such as *izakaya*, family restaurants and food courts, and deserves separate study.

This research is concerned specifically with the role that households play in influencing urban environments through repeated daily activities and movement. Shopping behaviour by definition relates to repeated, routinised actions. While 'on-the-fly' food shopping, that is, unplanned food shopping in unfamiliar areas, is also a significant part of daily life, this aspect of food shopping has been put aside in order to reveal the deeper, culturally ingrained practices that structure urban environments.

From an urban planning and architectural point of view, this research deals with urban rather than rural environments. In particular, regional cities, as an often overlooked area of study, are the focus of this study. Regional urban food environments are undergoing great change in the face of demographic and population shifts leaving disproportionate distributions of food shops[10].

10 Choi, Y. et al. *Food Deserts, Activity Patterns, & Social Exclusion: The Case of Tokyo, Japan*

1.5 Thesis Structure

This thesis is divided into three parts to firstly establish a framework for the study of foodscapes, then apply the framework to a specific urban environment in the form of a series of case studies, and finally evaluate the findings of the case studies against the framework. In this final part a discussion on the role of urban environments in the construction of foodscapes is made.

Part I establishes the framework for the study of food environments. It outlines the state of the field through existing studies on foodscapes and provides a general context for issues related to the study of foodscapes. It works to define foodscapes by charting their history and evolution as a term and field of investigation.

In order to relate foodscapes to architecture and urban planning it is necessary to firstly understand not only the evolution of food shops but also the nature of food shopping itself. To this end Chapter 2 investigates the nature of shopping behaviour, how people approach shopping as well as identify what kind of shopping food shopping is. Chapter 3 gives an overview of the development of food shop types in Japan. It outlines how specific shop formats have emerged out of an ongoing process of rationalisation.

Finally Part I introduces network analysis as a method to understand the underlying structure of food environments, or foodscapes. Chapter 4 introduces the key concepts of network analysis and applies them to the context of foodscapes. It outlines the key measurements and calculations relevant to the study of urban environments.

Due to the broad nature of this research which crosses architectural, sociological and economic boundaries the literature review is dealt with at each stage of this investigation.

Part II applies the strategies developed in the methodological review in a series of case studies. Based on the methodology developed in Part I, Part II applies network analysis to a series of specific urban environments in the form of case studies in Kashiwa City, a medium-sized regional city on the periphery of the Tokyo metropolitan.

Chapter 5 describes the method used to analyse Kashiwa's foodscapes including the collection and treatment of data. In any network analysis the application and relevance of the various measurements and algorithms available need to be understood in context. This chapter provides details on the specific algorithms and adjustments made for this research topic.

Chapter 6 gives an overview of the existing conditions in Kashiwa as a whole as each of the case study areas. It specifically focusses on the urban structure as it relates to food shopping and the general background information of the sample groups. The purpose of this chapter is to identify the similarities and the differences of the two factors across each of the case study areas.

Chapter 7 describes the findings of the analysis. The findings are divided into three parts; *The Shopping Behaviour of Households*, *The Structural Analysis of Foodscapes* and finally a *Comparison and Summary* of the findings.

The Shopping Behaviour of Households relates to the individual routines and shopping patterns as they manifest within the context of local urban environments while *The Structural Analysis of Foodscapes* focusses on the relationships created between food shops by shopping activity. *The Structural Analysis of Foodscapes* is further divided into two main sections; understanding the overall structure of each network, and secondly understanding the role of individual shops within the network. Finally the *Comparison and Summary* of the findings compares each of the areas comprehensively.

Part III considers the findings of the case study relative to the research questions defined in Part I and provides a discussion on the merits of this research as it relates to existing research of food environments and it's application to the practice of architecture and urban planning. Further, Part III identifies areas for development, future work and recommendations for the improvement of the method.

Part I

A Method to Map Foodscapes

Part I of the thesis looks at the methodology of foodscape studies. It identifies the key areas of existing research and the various approaches employed. It introduces network analysis as a method for understanding the complex interrelationship between food shops.

The study of food has been increasing in recent years in the face of issues such as health, food safety and security, sustainability and environmental issues as well as access to food in urban environments. This research hopes to contribute to this body of work by considering how architecture and urban planning relates to these issues.

This section outlines the context within which architecture places itself and the methodology relating to how to approach such research. In considering the role between architecture and food it is important to understand food in a wider context by incorporating economic and sociological principles. Due to the broad nature of this research the literature review is spread throughout this section as it relates to each issue.

The general flow of this section is to define foodscapes as the spatialisation of food shopping and then describe how food manifests in built form, largely through shops, and how this has changed over the modern age. Following, the basic principles of consumption as they relate to food shopping are outlined. The importance of these principles in the wider context of the form of the built environment are discussed. Finally a method to understand the relationship between these issues, namely network analysis, is presented.

The term foodscape has been used in a number of fields in varying ways. This section discusses and defines foodscapes and outlines the general approach to this enquiry. Food lies at the intersection of economic forces, technological and social development as well as cultural identity. Food shops themselves are a direct reflection of such pressures. One of the main uses of the term foodscape comes from health studies which looks to understand accessibility to food and the affect of foods shops on diet.

A similar term often cited in academia is *foodways*, which describes the relationship between the production, consumption and culture of food. While foodways manifest in a number of forms from cultural to practical, here foodscapes looks at the spatialisation of food, that is, the visualisation of food as it exists in urban environments.

Foodscapes and foodways have been discussed in a number of fields including health, geography and sociology and referred to in a number of ways. This research defines foodscapes as the spatialisation of food shopping; the time-space constraints related to the purchase of everyday food for household consumption and the physical manifestation of food shops and their various forms.

2

Food Shopping Behaviour

The term foodscapes has been used in a number of fields ranging from urban sustainability to health studies and cover areas such as urban agriculture, eating out as well as daily food shopping[1] . While the focus of such varying lines of research differs, the underlying commonality is the spatialisation of food, that is, where and how people access food. This research looks to extend the concept of foodscapes into architecture and urban planning by investigating the relationship between people and their local food environment.

In order to understand foodscapes it is necessary to understand what food shopping is and how it relates to other forms of consumption. This chapter shows how food shopping as a highly routinised, repeated activity that plays a fundamental role in everyday life. Different forms of food shopping develop in different social environments and so special attention is given to the Japanese context, the focus of this research, where the frequency of food shopping trips and the number of shops used is considerably higher than countries in Europe and the United Kingdom.

The influence of consumption on society has increased dramatically since the middle of the Twentieth Century. Where production had been the driver of social relations and community structure, consumption was considered simply an end point in the economic process. Since this time sociologists have recognised the increasing influence that consumption has on social relations[2]. Bourdieu's work looks at how taste and style are both the product of and driver of class segregation within French society. His concept of 'fields' acknowledges the networks or institutions where these roles are played out. At the advent of the Industrial Revolution production was the focus of the economy and with it social relations. As the standard of living increased

1 For example, see Morgan, K. et al. *The Urban Foodscape: World Cities and the New Food Equation to Geography and Health Studies* or Cummins, S. et al. *A Systematic Study of an Urban Foodscape: The Price and Availability of Food in Greater Glasgow*.
2 Bourdieu, P. *Distinction : A Social Critique of the Judgement of Taste.*

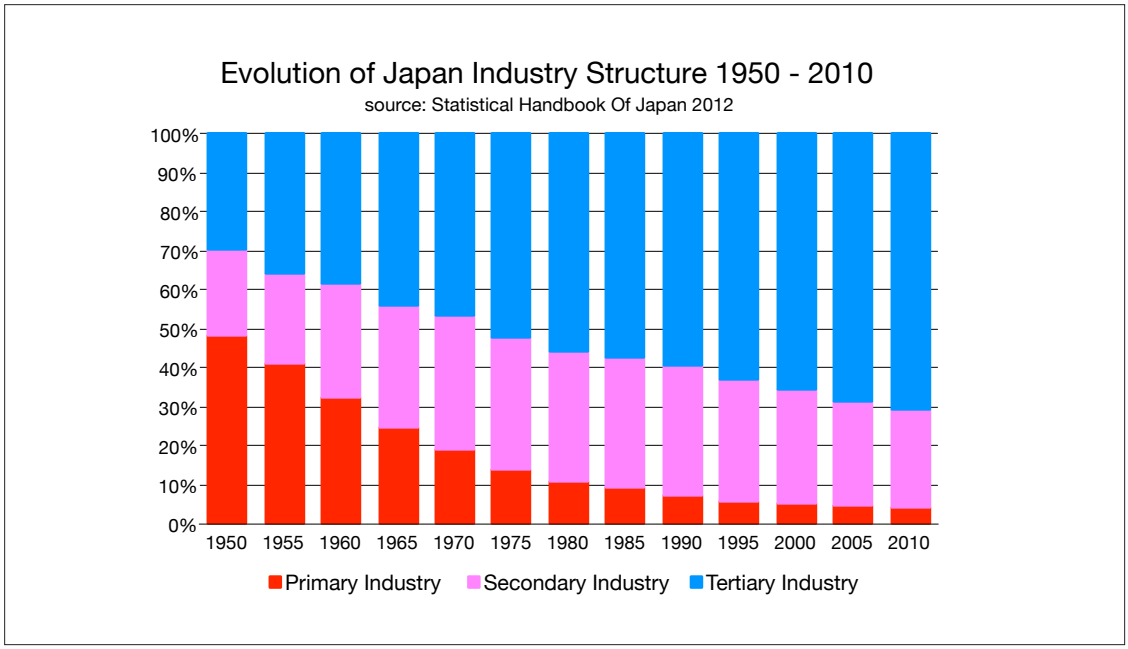


Figure 2.1 Evolution of Japanese Industry Structure 1950-2010.
Japanese Industry Structure By Number of Persons Employed. The Japanese economy transformed from a primary industry-based economy to manufacturing and to become dominated by tertiary industry on modern day Japan.

so to did demand for products which in turn refuelled the economy. As economies developed production became less important than capital realisation, the selling of goods to generate more capital to refuel the economy. As a result the shift from production to consumption caused a fundamental shift in urban structure[3]. Figure 2.1 shows the steady decline of primary industry in Japan from 1950 as the tertiary sector grew.

Clammer reiterates this point in the Japanese context when he claims that consumption rather than production dictate the underlying structure of communities in his work *Contemporary Urban Japan: A Sociology of Consumption*:

> *The premise here is that the study of consumption reveals cultural patterns and economic organisation in a clearer light than competing approaches that are central to understanding and explanation of Japanese social life*[4].

3 Gottdiener, M. *The Social Production of Urban Space*
4 Clammer, J. *Contemporary Urban Japan: A Sociology of Consumption,* pg 3.

2.1 The Role of Consumption in Social Life

Forms of consumption generally fall into two categories determined by the nature of the product. Where price and quality vary between brands and shops, consumption becomes an active, conscious practice where personal preferences and ideas of identity influence purchasing behaviour. In Japanese these kinds of products are referred to as *kaimawarihin*, literally 'shopping around goods' where shoppers 'do the rounds' to compare prices and quality. Shoppers are able to express their preferences and tastes directly through the selection of a product. Ideas and images associated with the product, the shop it is purchased in and even the area can contribute to the expression of self. Items such as music, clothing, household appliances, vehicles and so on are all examples of conscious expressions of identity. This 'conspicious' consumption has been the focus of research on consumption since the 1980's in Europe[1]. A second form of consumption, an 'ordinary' consumption, has in recent years come under greater focus as a subject of research. Ordinary consumption refers to repetitive, non-distinct forms of consumption. Based on products that are largely undifferentiated in quality, price and status, this form of consumption has been largely overlooked as a topic of research. Everyday goods such as petrol, electricity but also extended to household cleaning products and groceries, however apparently insignificant as they seem, have a profound affect on daily life and wider social practice.

> *When we are dealing with commodities, in the long run there will emerge consumption habits in the same way as all our other fields of activity are habitualised*[2].

While initially the purchase of everyday items requires careful, conscious decision-making, over time this action becomes behaviour then routine and habitual. Grocery shopping, for most people, is a mundane chore repeated ad infinitum. Shopping for products that vary little in price and quality are influenced more by convenience and routine. In Japanese these goods are known as *moyorihin*, often translated as 'convenience goods' but perhaps more accurately described as 'everyday goods' or 'daily goods'.

---

1 Gronow, J. ed. *Ordinary Consumption,* pg 1.
2 Weber, M. *The Theory of Social and Economic Organisation,* pg 372.

This is not to say that food shopping is bereft of expressions of style or taste, rather that, due to the highly repeated nature of grocery shopping, over time becomes ingrained and routine to the point of being carried out almost automatically. As Ilmonen points out routines and habits are key devices to reduce risk. Routines reduce the complexity of decision-making to 'save energy' and make the world safer and more habitable[3]. Routines allow us to navigate through problems efficiently and safely. Facing growing pressure and uncertainty over food safety, the nutritional value of food products and even household economics, routines are a device to mitigate risk[4].

Routines operate at different scales. Routines can be expressed in shop choice or shopping on certain days at certain times. Daily routines are organised to improve efficiency not only in terms of time but also in terms of stress. Trust in the knowledge of successful outcomes that come from routines allows one to spend energy focussing on other aspects of daily life. This blase attitude, as Simmel notes, is necessary product of urban life[5] .

At the level of the product, routines take the form of brand loyalty. They reduce the complexity of decision-making and allay fears related to food security and safety. In an increasingly globalised food environment fears over food safety and the origin of food products is a growing concern for households.

Further routines affect daily life at the level of shopping itself where they take the form of problem-solving or decision-making strategies. Where a staple brand is out of stock or shopping takes place in an unfamiliar shop, known, trusted decision-making processes can be used to reduce risk and increase confidence in justifications made for choices.

While routines have a number of benefits by reducing complexity and increasing trust, on the other hand, they also restrict opportunities for alternatives, closing off opportunities to try new products or shops. Once a routine is established, alternatives can seem overwhelmingly risky. To change brands, for example, is not simply an exercise in rational, conscious decision-making but an affront to safety and stability where tried and true, known processes must be put aside. As Giddens terms it structures can be 'resources' or 'restrictions'. In his theory of

3 Ilmonen, *op. cit.*
4 Bourdieu, *op. cit.*
5 Simmel, G. *The Metropolis and Mental Life,* pg 70.

structuration he states that these daily routines or structures are reproduced and reinforced as we repeat them, that as we react to our environment we reproduce it[6].

It is in this way that shopping for food plays an important role in the stability of daily life. Because of the highly repeated nature of food shopping it affects not only the planning of our daily life in the literal sense of the organisation of daily chores, but also at a structural level where the reliance on routines allows for smoother, less risk adverse daily lives.

Furthermore, these routines construct social norms or patterns of living shared by the community. As Gregson et al. states:

> *...shopping geographies are not pre-given, but are constituted by weaving together the particular ... and the general ... through situated practices ... - and that these practices themselves invest particular meanings in generic types of retail environments.*[7]

While shopping environments may seem generic, specific modes of operation develop in each community based on responses to not only the environment, but other peoples reactions to the environment.

> *Shopping as a social practice is thus to be understood as a socially conveyed, learned, and habitualised activity which consists of a variety of single, highly routinised, actions. Shopping is better described as a social accomplishment rather than as the exercise of sovereign choices made by isolated individuals.*[8]

Each community builds up a collective image of their shopping environment as they carry out their daily life. Actors at once influence and are influenced by their environment.

---

6 Giddens, A. *The Constitution of Society: Outline of the Theory of Structuration*.
7 Gregson, N. et al. *Shopping, Space, and Practice*, pg 607.
8 Everts, J. et al. *Modernisation and the Practices of Contemporary Food Shopping,* (cf Jackson and Holbrook)

Food can exclude and isolate people. Everyday life, within its rituals and routines, is in practice very much taken up with economics - the micro-economics of consumption decisions, shopping patterns, thinking about food not only in terms of nutrition but also in terms of affordability, its effect on one's figure and as an expression of lifestyle. Many patterns of everyday life are to be understood as dominated by consumption.[9]

Food shopping in particular is a significant part of community life. All households undertake food shopping to some degree and therefore food shopping affects all groups of society either directly or indirectly irrespective of age, ethnicity and socio-economic status. Shopping for food is not simply the exchange of money and goods but also a source of social interaction and a vessel for social practice. Food shopping performs a role as a kind of social infrastructure.

The relationship between social life and shopping has been well documented. Shopping creates social interaction and behavioural norms. From this point of view food shopping can be considered a kind of social infrastructure that has a variety of functions from Jane Jacob's "eyes on the street" where shop staff and customers become a form of security, or part of the "ballet of the street" that adds to the vibrancy of street life[10]. Goss outlines the integration of shopping and social relations manifest in the form of shopping malls which have become 'the main social space'[11]. In contrast, small shops also have a valuable social function for their ability to adapt to local needs across different social groups to provide a hub for the community[12].

9 Clammer, J. *Contemporary Urban Japan: A Sociology of Consumption*, pg 3.
10 Jacobs, J. *The Death and Life of Great American Cities.*
11 Goss, J. *The "Magic of the Mall": An Analysis of Form, Function, and Meaning in the Contemporary Retail Built Environment*, pg 19.
12 Clarke, I. et al. *The Economic and Social Role of Small Stores: A Review of UK Evidence.*

2.2 Food Shopping Behaviour - The Role of Routines

Although routines form the basis for shopping behaviour, they develop over time. There are a number of environmental factors that influence the establishment of routines that vary from learnt cultural practice to personal preference to space-time constraints. Figure 2.2 summarises the basic relationship between environmental conditions and routines, that is, shopping behaviour. It is important to note that routines have a recursive relationship with their social environment

Figure 2.2 Influences on Shopping Behaviour.
Shopping Behaviour, or routines, are formed through repeated behaviour. Once routines are established they also influence other factors that construct shopping behaviour.

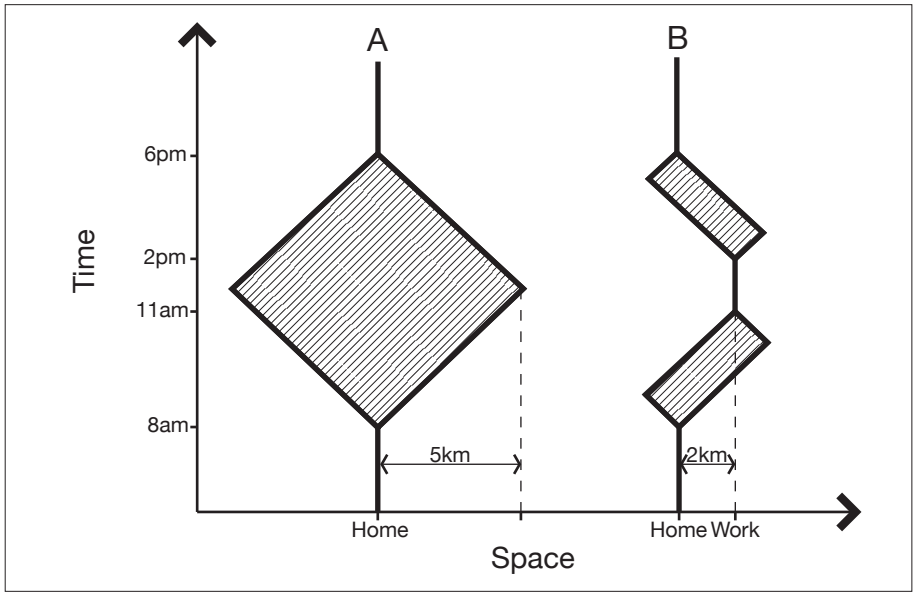


Figure 2.3 Hagerstrand's Time-Space Prism.
Movement is not only restricted in space but also time. Fixed appointments in daily life restrict scope of movement.

in that while, for example personal preferences, influence routines, they also influence personal preferences. This research holds that this is true for shops themselves too where the accessibility and format of shops influence routines and shops also adapt to the routines of shoppers in the form of shopping behaviour. Shops are the aggregation of community shopping behaviour and develop differently across communities. As Jackson et al. note, consumer practices are embedded in specific social contexts[1].

While the key concern of this research is the relationship between routines and food shops it is important to acknowledge the role of other factors on this relationship. What follows is a summary of existing research related to the interrelation of these factors.

Shopping for food consumes time and therefore affects the organisation of daily routines and other activities. The location of shops has a significant impact on the way that people organise their daily routine. Torsten Hagerstrand's recognition of the relationship between space and time highlights how our daily movement is restricted by time constraints[2]. Hagerstrand acknowledges the role of time on activity patterns. His time-geography research showed how we are not only restricted in space but also time. Access to shops is determined by the time available to reach it

1 Jackson, P. et al. *Retail Restructuring and Consumer Choice 2. Understanding Consumer Choice at the Household Level*
2 Hagerstrand T. *What About People in Regional Science?* See also Neutens, T. et al. *The Prism of Everyday Life: Towards a New Research Agenda for Time Geography.*

as well as hours of business. Therefore where a shop locates, or more correctly, where a shop locates relative to other daily activities such as work, school, banking, and so on affects the way we organise our daily routine. Figure 2.3 shows the basic diagram of time-geography. Food shopping is a significant part of daily life. Food shop choice is not simply a matter of what is available but also when it is available.

Cultural values also affect how food shops are accessed and the form that food shops take. Research such as Haddock-Fraser et al.[3], Maruyama[4], Saito et al.[5] and Hino[6] highlight how the supermarket format has developed differently across cultures in the UK, China, Taiwan, Japan and Israel. For example, Japanese consumers prefer to make more shopping trips to a number of shops whereas 'one-stop' shopping is preferred in the UK. Shop types are not uniformly viewed across social groups.

People are also restricted by the kinds of shops that are physically accessible. This relates directly to food shops. An individual can only make decisions about where to shop for food based on the options available to them. Then, based on those decisions, shops react and adapt to this shopping behaviour. For example, convenience stores in Japan were established to meet the needs of an increasing number of people working longer hours and living in single-person households. As a result these people, as well as others, took the opportunity to use convenience stores thereby growing the market and increasing the number of stores again[7]. It follows that changes in the availability of food shops affects the way we organise our daily lives, our eating habits and so on.

3 Haddock-Fraser, J. et al. *The Failure of Multinational Food Retailers in Japan: A Matter of Convenience?*
4 Maruyama, M. et al. *Quantifying Barriers Impeding the Diffusion of Supermarkets in China: The Role of Shopping Habits.*
5 Saito, S. et al. *An International Comparison of Daily Shopping Behavior Among Shanghai, Taipei, And Fukuoka.*
6 Hino, H. *Antecedents of Supermarket Formats' Adoption and Usage: A Study in the Context of Non-Westerners.*
7 Ryuutsuu Keizai Kenkyuujo コンビニエンス・ストア・マニュアル *(Konbiniensu Sutoa Manyuaru)*

2.3 Food Shopping in Japan

Food shopping trips are generally divided into major shopping trips and fill-in shopping trips. Kim[1]. Major shopping trips involve the purchase of a number of days, often one week, supply of food[2]. Major shopping trips are often taken in the weekends. Major shopping trips are supplemented by fill-in shopping which involves small purchases to top-up when stocks become low. It is common for major shopping trip shops to be different from fill-in shops where the shop choice is more highly routinised and fill-in shopping is motivated by convenience rather than cost.

Food shopping in Japan has it's own idiosyncrasies. In Japan major shopping trips are less common, rather shoppers prefer to make many small shopping trips over the course of the week. As a result food shopping is a significant part of daily life and the location and types of food shops available have a strong influence on daily routines[3].

Furthermore, in trying to understand the differences of the japan food shopping environment Haddock-Fraser et al. point out that compared to American and UK food retail markets Japan is less dominated by large format food shops such as hypermarkets. They find that Japanese consumers shop more often for food than their UK counterparts and that while the supermarket format is dominant, non-perishable food is bought at a wide range of formats such as speciality shops and discount stores. In addition compared to the UK where over 80 % of food shopping occurs at one-stop shops, Japan consumers use a wider range of shops. They also find that price, distance from home, access by car and product range are the four main drivers of shop choice. We can see that two of these reasons are related directly to the built environment; distance from home and access by car. While Flath and Nairu suggest that factors such as dense urbanisation, reliance on public transportation and a lack of storage space at home lead to a high number of shopping trips, Haddock-Fraser et al. find that quality and freshness are stronger influences on product choice and price is the strongest influence on shop choice while maintaining that car ownership is not a significant factor for shop choice[4].

---

1 Kim, B. et al. *Studying Patterns of Consumer's Grocery Shopping Trip.*
2 Axhausen, K. et al. *Observing the Rhythms of Daily Life: A Six-Week Travel Diary.*
3 Haddock-Fraser, J. et al. *op. cit.*
4 Flath, D. et al. *Is Japan's retail sector truly distinctive?*

In Japanese the use of multiple food shops for daily shopping is known as *kaiwake*, literally 'split shopping'. It manifests in two forms, firstly at the general level where different food items are bought at different shops, for example meat at a butchery and fruit and vegetables at a greengrocer, and secondly within food types, where the same food item or product may be bought at different shops. Reasons for this could range from different space-time locations where a shopper chooses a shop close to their current location, whether it be at home or on the way home from work, to price discounts to personal preferences. It is important to note that the supermarket format is dominant, and yet even within the supermarket format shoppers discriminate between shops for their food shopping needs.

2.4 Summary

Consumption plays a central role in social life. Groceries can be identified as *moyorihin* or everyday goods and as a result have a specific mode of operation. Food shopping is a highly repeated activity based on routines or shopping behaviour. Food shops play a critical role in the formation of shopping routines through their location and format. Food shops are a vessel for collective shopping behaviour as each shop influences and is influenced by shopper behaviour in a recursive relationship.

Food shopping is carried out by all households and therefore either directly or indirectly affects all parts of society. It therefore has social value and can be considered a kind of social infrastructure where individuals are active in the construction of their own environment. Shopping is one direct way that all inhabitants can participate in the design and construction of their built environment.

Because of this foodscapes develop in different ways across communities. For example, despite supermarkets being a ubiquitous shop format, it's use in Japan varies from that in the UK. Japanese consumers in general make more shopping trips than their UK counterparts and commonly employ *kaiwake* behaviour, that is, they use a number of shops to meet their shopping needs.

3

Food Shops

This chapter looks at the role of shops in food environments. Shops are the physical manifestation of food shopping. Where the previous chapter outlined the basic principles of food shopping and identified food shops as an influential player in the construction of shopping routines, this chapter looks at food shops in more detail by charting their rationalisation and evolution into distinct shop forms. Particular attention is paid to the Japanese context, the focus of this research.

Food shops have been researched in many fields but generally fall into two categories, economic and social. Economic research looks at ideas of accumulation, competition and distribution, while social-based research tends to focus on health related studies such as food deserts and to a lesser extent social exclusion. Across these fields, planning and regulation to mitigate these issues also affects the spatialisation of food in urban environments.

3.1 The Rationalisation of Food Shops

The Twentieth Century can be characterised by rationalisation. Modern food shops have evolved out of an ongoing process of rationalisation influenced by economic reform, technological development and social change. As with many other developed economies a number of distinct shop types have emerged in Japan. In particular the emergence of the self-service format dramatically changed food shopping and urban form. This section looks how the key shop types have evolved in Japan, their idiosyncrasies and how research to date has dealt with the relationships between these formats.

Rationalisation is the process of successive replacement of current values and traditions with apparently more logical, rational systems for the purposes of efficiency, predictability, calculability and control[1]. In food shopping the epitome of rationalisation is the self-service format.

In Japan, as in most developed countries, food shopping has undergone significant change since the beginning of the Twentieth Century. Technological progress, in the form of distribution (logistics, refrigeration) and motorisation have had a direct impact on the location of shops and therefore urban structure. As specific shop types have developed so to have develop styles or levels of service.

One of the most significant developments of the Twentieth Century was the emergence of the self-service format which allowed the establishment and spread of chain stores in the form of supermarkets and convenience stores. The introduction of the self-service format not only reduced risk but also allowed shops to be reproduced across space without the need for charisma. As a consequence the relationship between staff and customer changed. No longer was the staff the source of trust and information, rather the products and shop itself.

Furthermore, the separation of the shop owner from the customer and now customers are free to browse and choose items at their leisure[2]. Ritzer comments on the expansion of

1 Ritzer, G. *The McDonaldization of Society*.
2 du Gay, P. *Self-Service: Retail, Shopping and Personhood.*

chain stores which rely heavily on predictability and standardisation to maintain service and experience across all shops in order to establish trust between the store and the customer. As the importance of the personality of the shop owner decreased it became much easier for chain stores to reproduce the same experience and therefore expand. On the other hand, shops had to re-establish trust in other ways, namely predictability, efficiency, calculability and control. The standardisation of experience is one of the key tools in creating trust in chain stores. Customers know what to expect when they enter a store and therefore feel comfortable.

As a result, as opposed to local shops with individual identity, self-service formats are free to reproduce across multiple environments. Aided by technological development that increased the ease and range of the distribution of goods chain stores have spread throughout Japan.

As Everts notes, the emergence of these generic apparently non-site specific shops has been criticised for their impact on social relations. Citing Auge's research on 'non-places':

> *...The multiplication of what we may call empirical non-places is characteristic of the contemporary world. Spaces of circulation (freeways, airways), consumption (department stores, supermarkets), and communication (telephones, faxes, television, cable networks) are taking up more room all over the earth today. They are spaces where people coexist or cohabit without living together'.* [3]

In contrast to this Zukin sees that the introduction of the supermarket 'invited us to browse and shop more easily, eventually altering shopping routines including the products purchased'[4]. DuGay also found that the introduction of the supermarket liberated British housewives who when having to order directly form a shop clerk felt under pressure to order higher quality cuts of meat in order to maintain appearances [5].

Kansai Supermarket was the first supermarket in Japan, established in 1959 while Seven-Eleven opened their first convenience tore in Japan in 1974. Both based on American models they introduced the self-service format to Japan. Now, supermarkets are the dominant form of

---

3 Everts, J. et al. *Modernisation and the Practices of Contemporary Food Shopping,*
4 *ibid.*
5 du Gay, *op. cit.*

food shop in Japan. By definition supermarkets differ in Japan in that they are smaller. While in Japan a supermarket is defined as a predominantly food selling shop over 250m^2 in the UK a convenience Store is defined as less than 280m^2 and supermarkets less than 1400m^2. The ubiquitous convenience store was introduced to Japan in the 1970's and quickly formed it's own idiosyncrasies. Seen as a solution to Japan's labour shortage and changing working lifestyle, convenience stores were seen as modern, timely conveniences. These days convenience stores not only provide daily goods but also a number of services including courier services, ticketing and printing and copying[6].

In contrast Department Stores offer highly personalised service. The first department store established in Japan was Mitsukoshi in 1905. Previously an exclusive dry goods shop faced with economic and social pressure it reinvented itself based on foreign models. Where previously customers consulted with shop staff who then fetched goods from the store, the new department stores displayed goods in show windows and display cases, actively encouraged the middle classes to enter and peruse items for sale. Indeed, families were encouraged to spend whole days at the department store[7].

Department stores were later to become termini for railway companies as entertainment and leisure, in the form of consumption, increased in prominence. These days department stores are common in many cities across Japan and differentiate themselves from other forms of shopping through high levels of service. In terms of food, basement levels are filled with food shops selling a range of side dishes and ingredients.

In reaction to the growing power of department stores as they gradually encroached into mainstream markets, shotengai, or shopping streets, were organised as 'horizontal' department stores to compete[8]. The first arcaded shotengai was built in 1967 and remains an icon of Japan's Twentieth Century urban landscape. As Arata notes, shops in shotengai are linked by social bonds, and so personal connections are critical for business success. In Arata's thinking, the decline of shotengai represents a decline in local communities.

---

6 Terasaka, A. *Development of New Store Types: The Role of Convenience Stores*
7 Moeran, B. *The Birth of the Japanese Department Store*.
8 Arata, M. 商店街はなぜ滅びるのか：社会政治経済史から探る再生の道 *(Shotengai Ha Naze Horobiru No Ka: Shakai Seiji Keizaishi Kara Saguru Saisei No Michi)*

Research related to food shop formats tend to relate to generalised formats such as supermarkets or convenience stores and focuses on the attributes of respondents, such as sex or age, as a driver of shop choice decision-making. The overwhelming tendency is to analyse single trips, not how shops are used together. While a number of studies have acknowledged that especially Japanese consumers use a number of shops to meet their food needs, little research has looked at the relationship between shops.

Typical of this approach is Saito et al. who compare the daily shopping behaviour of three cities; Shanghai, Taipei and Fukuoka. They find that the three cities have developed specific social norms that influence shopping behaviour. In particular they find that in Fukuoka, supermarkets are the dominant format for fresh food in all demographics ranging from 63.8% use in over 50 year age group to 83.6% for the under 30s age group[9].

Fujino goes further by analysing the direct relationship between shopping behaviour and shop format and recognises that shoppers have a number of choices for food shopping and that shoppers have general tendencies toward certain food choices, i.e. that they have shopping behaviours that influence their decision-making. Fujino's findings highlight that these choices are related to regional conditions. The premise of this research is that although the same food items can be found in many different shop types, there is a variation between communities in which store types are used[10].

The method employed by Fujino categorised shops and consumer types based on the response of a questionnaire on shopping behaviour. Shops were categorised into four types; General Merchandise Store (broad range of goods), Supermarkets (middle range of goods), Speciality Stores (narrow range of goods) and convenience store (limited range of goods). Consumer types were then categorised as demanding shoppers, time-convenience shoppers, travel conscious shoppers, and price-conscious shoppers. Fujino's finds that shoppers shop across these shop formats depending on their needs[11].

---

9 Saito, S. et al. *An International Comparison of Daily Shopping Behavior Among Shanghai, Taipei, And Fukuoka*
10 Fujino, H. et al. *Store Choice Orientations and Intertype Shopping Behavior Toward Grocery Stores,*
11 ibid.

Nilsson also notes that it's problematic to categorise food shops by traditional shop formats as the same format can be used in multiple ways, for example, a convenience store can be used for major shopping and fill-in shopping[12]. Qualitative research such as Clarke et. al and Jackson et al. reveal the ongoing reaction and adaption to evolving retail formats[13]. As a result of their mode of operation, that is service style, each food shop type has developed a different level of embeddedness in communities. That is, they rely on different levels of social interaction and structures to operate. Local shops and shotengai, for example, rely on relationships based on personal connections within the neighbourhood while supermarkets and convenience stores have a certain level of detachment in order to provide fast, efficient service. The kaiwake behaviour of shoppers means that shoppers visit a number of shops each week. They therefore act as a conduit for the flow of ideas and expectations of levels of service, quality and price.

12 Nilsson, E. et al. *Who Shops Groceries Where and How? – The Relationship Between Choice of Store Format and Type of Grocery Shopping*

13 Clarke, I. et al. *Retail Restructuring and Consumer Choice 1. Long-Term Local Changes in Consumer Behaviour* and Jackson, P. et al. *Retail Restructuring and Consumer Choice 2. Understanding Consumer Choice at the Household Level*

3.2 Food Shop Location and Urban Structure

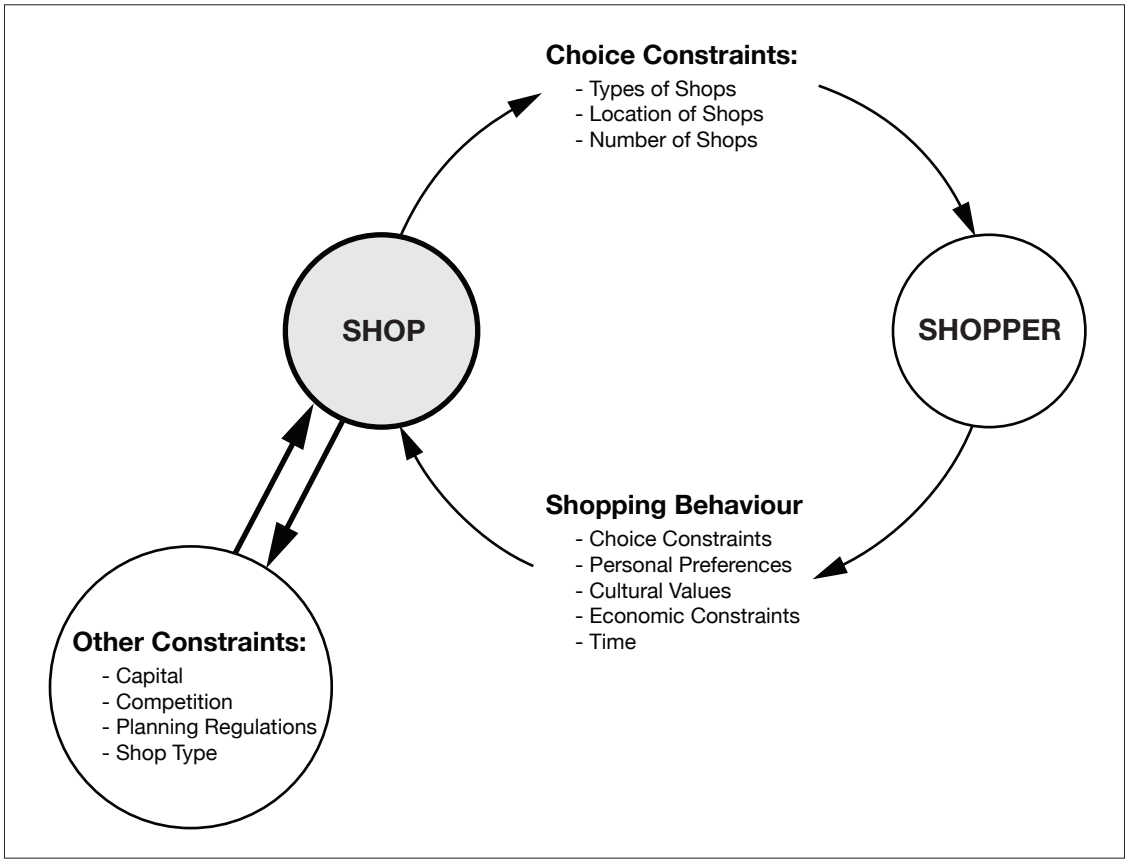


Figure 3.1 Diagram of Influences on Food Shops.

This section looks at the spatialisation of food shops in Japan, that is, their physical manifestation in the built environment. Urban form has a direct relationship with consumption, one that works both ways in a recursive relationship through the complex interaction of commodities and capital[1]. Figure 3.1 shows the influences on food shops.

The distribution system is closely related to the physical environment and therefore must constantly react and change according to spatial changes[2]. Hayashi notes that rapid motorisation of Japan in the 1960s and 1970s was one of the most fundamental changes to urban form that

1 Glenn, P. *Consumption, Consumerism and Urban Form: Historical Perspectives*
2 Hayashi, N. et al. *Spatial Patterns of the Distribution System in Japan and Their Recent Changes*, pg 120.

led to the development of retail facilities on the outskirts of metropolitan areas[3]. Research on the location of shops falls under two general themes; economic and social.

Economics

Japan has a relatively high number of retail shops compared to other developed countries. Research, such as that by Takaoka looks at the competing forces of globalisation and traditional family values as it manifests in the economic sphere of distribution, and comments on the relationship between shopping behaviour and the physical distribution of shops:

> *...it is clear that applied microeconomists invariably ascribe the high density of retail stores in Japan to the behavioural patterns of consumers or to their limited ability to perform distributive tasks.*[4]

Commercial activities have had a profound affect on urban form and much research focussed on consumption and space were focussed on economic principles such as Central Place Theory.[5] Specifically related to this research is studies on the connections between shops. Research related to economic aspects of food shopping are heavily focussed on spatial connections, that is, the clustering or avoidance of shops of the same type.

Research such as Akiyama et al. and Sengoku et al. investigate the accumulation of commercial activities in Japan. Focussing on dense agglomerations of commercial activities they overlook isolated shops as 'noise'. Their general approach is to concentrate efforts for redvelopment and regeneration in these dense areas[6].

---

3 Hayashi, N. et al. *Spatial Patterns of the Distribution System in Japan and Their Recent Changes.*
4 Takaoka, M. *Japan's 'Distribution Revolution' and Chain Store Supermarkets.*
5 Miles, S. et. al. *Urban Consumption: An Historiographical Note.*
6 Akiyama, Y. et al. *Automatic Detection and Spatio-Temporal Analysis of Commercial Accumulations Using Digital Yellow Page Data* and Sengoku, H. et. al. *Determining Spatial Extent of Shopping Areas using Store Density: An Approach with Kernel Density Estimation.*

Another approach to understanding the economic aspects of commercial activity focuses on competition between shops of the same type with a view to understanding which shop types tend to cluster together spatially and which types of shop prefer to differentiate themselves by locating away from other shops of the same type. Krider et al. highlights shopping behaviour as one driver of this type of location planning where products or shops that prefer to promote comparison shopping, that is *kaimawari,* prefer to locate nearby. *Kaimawari* shopping occurs where there is price or quality differentiation between shops. Krider et al. finds that in an investigation between two cities, Vancouver and Calgary, supermarkets tend to avoid each other in both cities while butcheries and convenience stores showed avoidance in Calgary but not in Vancouver. Krider et al. concludes that relationships between shops do vary by urban environment, at least at the city scale and that further investigation into other factors or drivers of shop location is required[7].

In contrast to Akiyama et al., Sadahiro looks at the clustering of retail shops by shop type or product to understand tendencies to cluster. By evaluating a finely detailed list of shop and product types he concludes that comparison shopping activities such as men's clothing, accessory, and women's clothing tend to agglomerate while 'convenience good' shopping, that is moyorihin, such as 'green grocery, meat, bakery, milk, and tofu' tend to shops of a similar type. Sadahiro suggests that one explanation for this is that these traditional retail activities have been replaced gradually by suburban supermarkets and discount stores as in the UK and the USA and that 'multipurpose shopping effects have changed from traditional retail centers consisting of small stores to isolated supermarkets and discount stores'. [8]

Food Deserts

In recent years interest in the relationship between health and the location of food shops has become more prevalent. With the increasing phenomena of food deserts in many urban centres access to food has become a focus of research. Access to food, or more accurately access to healthy food, is seen as one of the factors contributing to general health and social well-being.

7 Krider, R. et al. *Which Birds of a Feather Flock Together? Clustering and Avoidance Patterns of Similar Retail Outlets*
8 Sadahiro, Y. *A PDF-based Analysis of the Spatial Structure of Retailing.*

Leete et al. draw a direct relationship between access to food and social well-being. In general research on food deserts focuses on underprivileged areas where the viability of commercial activities is limited and the community have restricted mobility[9].

As a result of this kind of research the distribution of shops is weighted by population, usually in the form of census tracts. This is a reasonable approach in underprivileged areas where movement and choice is restricted. An assumption is made that individuals, in an economically rational way, utilise the nearest available option. Sparks et al. provide an overview of varying approaches and methods to analyse food deserts. In communities with greater choice and mobility the use of census tracts is problematic as they tend not to consider daytime populations or populations in transit[10].

In urban centres, the population of potential customers, or demand density, varies considerably. Choi et al. reveal an uneven distribution of food shops in Tokyo by analysing food access in the Tokyo metropolitan area based on walking distances and weighted by individual constraints such as the limited mobility of the elderly[11].

Further research into food deserts focuses on the attributes of individuals or households such as socio-economic status, age and sex[12]. With all of these examples, the focus is on the nearest available food shop and assumes that all supermarkets are the same. This is reaffirmed by Yakushiji et al. who compares rural and urban environments by the nearest available shop. While this approach is relevant for deprived areas, it is not conducive to Japanese social practices of using a number of shops to meet shopping needs[13].

A third strain of research that investigates the relationship between food shop location and urban structure relates to planning regulations. The Large Scale Retail Act, in it's various forms has had a large impact on urban structure and the evolution of shop types. In reaction to the

---

9 Leete, L. et al. *Congruence and Coverage: Alternative Approaches to Identifying Urban Food Deserts and Food Hinterlands.*
10 Sparks, A. et al. *Comparative Approaches to Measuring Food Access In Urban Areas: The Case of Portland, Oregon.*
11 Choi, Y. et al. *Food Deserts, Activity Patterns, & Social Exclusion: The Case of Tokyo, Japan.*
12 for example, see LeDoux, T. et al. *Going Outside the Neighborhood: The Shopping Patterns and Adaptions of Disadvantaged Consumers Living in the Lower Eastside Neighborhoods of Detroit, Michigan*, Cannuscio, C. et al. *Urban Food Environments and Residents' Shopping Behavior*, Kolodinsky, J. et al. *It is Not How Far You Go, It is Whether You Can Get There: Modeling the Effects of Mobility on Quality of Life in Rural New England*, Chen et al. goes further by acknowledging the affect of time constraints on access to food., Chen, X. et. al. *Interactive Three-Dimensional Geovisualization of Spacetime Access to Food*.
13 Yakushiji, T. et. al. *Accessibility to Grocery Stores in Japan: A Comparison Between Urban and Rural Areas By Measuring Distance to Stores.*

growing pressure of large corporations on small business the Large Scale Retail Act looked to protect local communities by limiting the construction of large retail outlets. This was one of the factors, along with technological developments such as motorisation that pushed a lot of food shopping into the suburbs[14]. In 2000 the Large Scale Retail Act was repealed to be replaced with prefectural level regulation and a shift in focus from economic control to environmental control.

One study to make a connection between planning systems and food is Lamichhane et al. who conclude in their research based in the US on obesity and food shopping that planning regulations contribute to the co-location of supermarkets and fast-food restaurants. Wrigley et al. also find correlations between the regulatory control of retail space and social exclusion[15].

Finally market saturation has also been identified as a driver for the development of new shop formats. Langston argues that in the UK the saturation of supermarkets pushed shops to change their format and size rather than the number of shops[16].Similarly, Tsuchiya et al. discuss the 're-rising' of small retail formats driven by regulatory constraint and as well as demographic and population change in Japan since 2000[17].

14 see Grier, J. *Japan's Regulation of Large Retail Stores: Political Demands Vs. Economic Interests.*
15 Wrigley, N. et. al. *Urban regeneration, Social Inclusion and Large Store Development: The Seacroft Development in Context.*
16 Langston, P. et al. *Retail Saturation, Retail Location, and Retail Competition: An Analysis of British Grocery Retailing.*
17 Tsuchiya, J. *Geographical Studies on Retail Chain Development and Restructuring of Retail Systems in Japan*.

3.3 Summary

Research on food shops is driven by two main themes; the categorisation of shop types based on shopping behaviour, and the influence of food shops on urban structure. Based on these approaches we can summarise the affects of external factors on shop form. Due to these factors food shops are constantly changing, reacting to external pressures to change styles, locations and numbers.

Japan has a relatively large number of food shops compared to Western countries, and the distribution of food shops, Japan's food environment has some unique characteristics which has led to distinct shop formats.

Research related to shopping behaviour tends to categorise shop types generally into groups such as 'General Merchandise Stores' or 'Supermarkets'. While these groups are readily identifiable it contrasts with the previous chapter's discussion on shopping behaviour which found that in Japan shoppers use a number of shops, even within the same shop format, to meet their needs. Fujino goes some way to admitting shoppers move between types of shops and styles of shopping depending on their needs.Research related to urban structure focuses on two main aspects; economic considerations and access to food shops. The methods used to understand economic aspects of commercial activity are based largely on the location of shops. Further location is assessed in relation to densities of commercial activities or in relation to other shops of the same type.

Research concerning access to food shops usually relates to food deserts. As such it concentrates on deprived areas and focuses on the attributes of shoppers as drivers for shopping behaviour. The methods used in these types of research identify distance as the key relation between shops; that is, that shops that are close together have a stronger relation than shops that are far away. In the next chapter this research challenges this assumption and posits that network analysis, in being able to transcend physical distance as being the driving force in understanding the relationship between shops, can provide insight into the underlying structure of foodscapes.

4

Food Shopping as a Network

While existing research looks at specific locations or individual shops, this research posits that shopping behaviour is much more complex. People utilise a number of shops to meet their household food needs. Reasons for using more than one shop vary from personal preference to buying food from speciality food shops to shopping for food during different daily routines, for example shopping on the way home from work or shopping at the weekend. Because of this *kaiwake* behaviour shops can be considered connected, or networked, by shopping behaviour.

> *... a better model than the community one for understanding Japanese urban neighborhoods is that of the network - patterns of relationship (friendship, work or common interests) often based on consumption activities (shopping, eating, producing, selling) and which in many cases transcend the boundaries of any particular locality. While geography and spatial patterns (e.g. place of residence) greatly influence the empirical form that these networks take, networks are not identical with locality and, unlike place, may be multiple in nature, are dynamic in character and appear and disappear over time.*[1]

The idea of networks is not new to urban planning or architecture. Connections between shops exist in the form of physical co-presence, for example, shopping malls and *shotengai*, or at an institutional level in the form *shotenkai* and commercial associations or even point cards[2]. Connections are also made between shops through distribution and logistical networks. However, shopping behaviour often transcends these boundaries; shoppers do not confine their

1 Clammer, J. *Contemporary Urban Japan: A Sociology of Consumption*, pg 34.

2 In recent years 'point cards' or loyalty cards have proliferated exponentially. Point cards reward repeat customers with discounts or other benefits. A number of point card systems have expanded beyond the original shop, for example the T card that originated at the video rental chain Tsutaya but can know be used at a number of shops such as Family Mart convenience stores to collect points.

shopping to one location or shop but rather use a number of shops and locations to meet daily shopping needs.

The idea of networking shops through user activity has been raised by Crewe in giving an overview of the social aspects of shopping noting that research tends to contrast shops rather than look for shop space as 'a tapestry of different spaces, woven together to compromise personal, accumulated shopping geographies that are routinely reproduced, and extended, through practice… What this in turn implies is that we must see consumers in context, as entangled within the domain of the shop, not separated from it'.[3]

This thesis looks to investigate the interconnection of food shops from the point of view of shopping behaviour, that is, from the point of view of the inhabitants of an urban environment. The nature of the connection between food shops through shopping behaviour needs to be understood clearly. As each shopper 'weaves' shops together through their shopping activities they produce an image of their environment. This image is then reproduced in other aspects of daily life to create social norms and practices. Shopping for food, as a mundane, routine activity, does not typically create direct relationships between shoppers; personal interaction between shoppers at a supermarket, for example, is often very limited. However, while shopping for food may not directly make connections between shoppers, shared practice creates a collective understanding within a community. As Clammer says:

> *While it is true that consumption does not necessarily create horizontal links between individual shoppers, it may do so in the form of creating networks of friends or members of consumer co-operatives. Furthermore, it is a mistake to confine the idea of consumption to , shopping alone. Consumption creates a common culture to a very great extent, and Japanese consumers are certainly aware of links between themselves and other consumers by way of shared information, through purchases of similar items and services and most importantly in a diffuse but real sense of sharing in common culture.*[4]

3 Crewe, L. *Geographies of Retailing and Consumption: Markets in Motion*, pg 356.

4 Clammer, J. *ibid.* pg 36.

In addition, as shops adjust and adapt to changing shopping behaviours, shopping behaviours also adjust to changing shops. In this way food environments can be understood as the physical manifestation of shoppers attitudes towards food. They are a repository or infrastructure for shared practice and social norms.

Network analysis theory provides a method of understanding the structure of foodscapes and how they reflect and support the behaviour of local communities. Network analysis has been used in a myriad of fields from sociology to ecology. A network is a group of interconnected entities, known as actors. Actors can take on any form, from people to websites to plants. Furthermore, relationships between actors, or ties, can take on any form from the exchange of money to friendship to shared opinions. In Network City, Craven notes that even impersonal ties have value in urban environments and can provide useful insight into urban social structures[5].

Network theory acknowledges that actors are constrained not only by their individual capacity to act but also the relationships they have with others. It recognises that individuals are constrained, or enabled, by their position in a network, or that individuals have varying levels of influence on their environment. Behaviour, the foundation of routine, is a combination of agency (individual capacity to act) and structural position (relationships to others).

5 Craven, P. et al. *The Network City.*

4.1 Bipartite Networks

Networks can be represented as graphs where actors are represented as nodes and relationships between nodes as ties. The manor in which nodes are connected endows them with more or less power or influence within the network. A multitude of measures exist to understand the structure of networks and how information might flow through the network. The overall qualities of a network can be understood in terms of it's size, density and the distribution of ties within the network. The qualities of individual nodes can be understood in terms of their centrality, that is, the degree of influence that a node has on other nodes.

In particular, a foodscape can be understood as a bipartite network, a network with two mutually-exclusive sets of actors, in this research food shops and households.

Typically bipartite networks are used as affiliation networks as a proxy for real ties that cannot be studied directly. The premise is that people who share some commonality, for example, working on the same board of directors, have a relationship. Where it is difficult to collect data about specific ties in a group of people, the sharing of events or spaces can be used to infer a social tie. Common examples of this are the Southern Women study that constructed ties based on the social events attended by a group of women, or the widely known 'Six Degrees of Kevin Bacon' where a connection between Kevin Bacon and any other actor can be made by movie co-stars they have worked with in no more than seven steps, or movies. Faust, for example, uses participation at political events to assume affiliations between Soviet politicians[1]. While the use or attendance of the same events does not guarantee that a relationship exists, it does suggest the potential for co-presence and certainly suggests the establishment of shared experience. This is important when considering collective action that begins to form social practice. These shared experiences help to create a common ground on which communities can meet, interact and communicate.

The use of 'affiliation' networks tends to focus on one set of actors. It is important to note that typically the secondary set of actors in affiliation networks are seen as passive, that they are

1 Faust, K. et al. *Scaling and Statistical Models for Affiliation Networks: Patterns of Participation Among Soviet Politicians During the Brezhnev Era.*

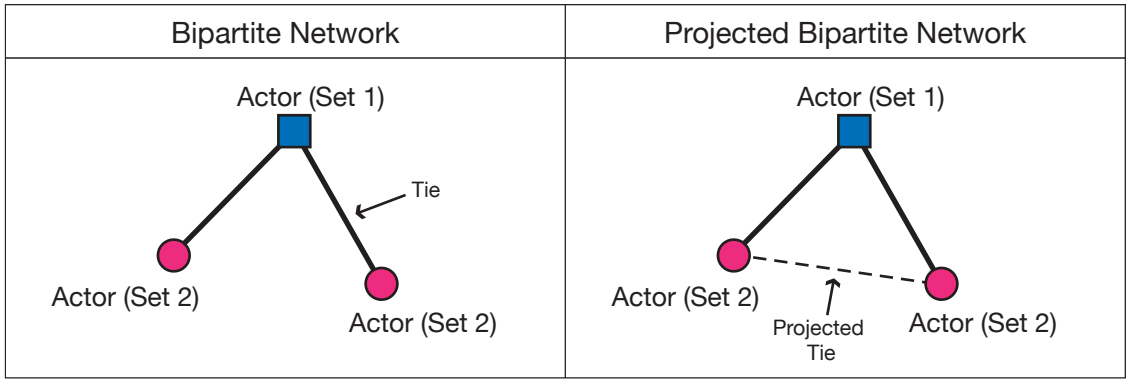


Figure 4.1 General Diagram of Bipartite Network.
Bipartite networks are made up of two mutually-exclusive sets of actors; in this research shops and households. In a graph, actors are represented as nodes and relationships are represented as ties between nodes. Where one actor (household) has a relationship with two actors in the other set (shops), a connection is implied between these two actors. This is known as 'projection'.

constructions of the primary set of actors. Foodscapes, in contrast, are made up of two sets of autonomous actors; shops and shoppers. Shops have the ability to adapt and evolve of their own volition. As such it is important to acknowledge that analysis of both sets of actors has value.

As noted in the previous chapters, as routines become ingrained in daily practice any changes to these routines have a significant effect on not only the daily life of the individual but also the food shops associated to the routine. This in turn affects the wider community. As a result network analysis provides a powerful method to understand the underlying structure of food environments and how changes within the network, either in the form of changes in lifestyle or changes in shops themselves, affect one another.

The analysis of a network of events or spaces is of particular interest to architecture as it suggests the extent to which the use of events or spaces connect or structure the wider spatial environment. The built environment is directly related to routines as daily activities have a spatial component. As seen with Hagerstrand's theory of time-geography, people are constrained in space and time; that is, their daily patterns of movement are affected by the built environment.

4.2 Outline of Network Analysis Methods

Network analysis is a broad field with many applications. Network analysis deals with a set of actors who are connected by ties. Ties can be formed from any kind of relationship such as membership of the same class at school or the flow of money between doors and political parties. These structures can be visualised as graphs where actors are represented as ’nodes’ and ties between actors are represented as ‘edges’.

Ties in networks represent connections or relationships between actors and therefore implies some kind of flow of some kind of information other measurable quality. As Everts states; ‘the agent is a carrier of practices as a corporeal and mental actor[1]. It is important to understand what is being transferred in a foodscape. In a foodscape network, shopping experience is being transferred on to food shops. As a shopper travels from one shop to another they carry their past experiences with them. For example, when a shopper visits a convenience store, they carry with them past experiences of other food shop formats such as a department store. The shopper carries the experience of high level service at the department store and pass those expectations on either directly or indirectly. In this way we can see how shopping behaviour influences food shops and vice versa. Food shops are constructed by shopping behaviour and also construct behaviour.

This research is interested in both sets of actors, shoppers and shops, as both are active in constructing relationships; shoppers through their preferences and use of shops, and shops through their advertising and adaptation to maintain or increase sales. Figure 4.2 shows the basic construction of a bipartite network for this research. Ties are made between food shops and households; the ultimate recipients of the shopping activity. Where a household uses two shops a tie is made between those two shops. The opposite case where a tie is made between two households who use the same shop can also be made. The construction of these intra-set ties is known as projection. Based on ties created by projection we can understand how groups of shops, or groups of households, are connected by their shared use.

1 Everts, J. et al. *Modernisation and the Practices of Contemporary Food Shopping.*

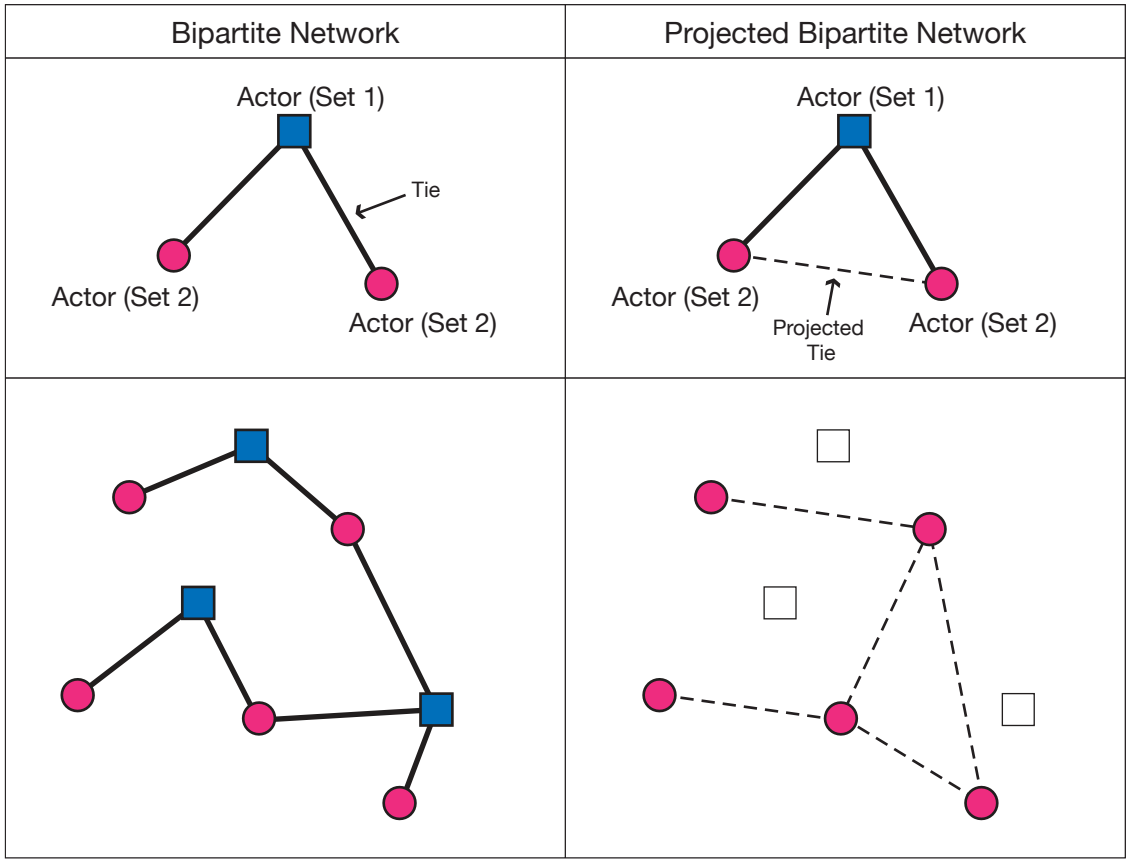


Figure 4.2 Detailed Diagram of Bipartite Network.
In a graph, actors are represented as nodes and relationships are represented as ties between nodes. Where one actor (household) has a relationship with two actors in the other set (shops), a connection is implied between these two actors. This is known as 'projection'.

The strength of a relationship between a shop and a household can be measured in different ways. It could be based on the number of visits to a shop, the amount of money spent at the shops or the be related to the importance of the product bought. As this research is concerned with routine behaviour the degree of association of a food item to a food shop provides insight into how shoppers imagine their food environment. Where a shopper associates a specific food item with a specific food shop, for example buying bread at a favourite bakery, the strength of the relationship is stronger. Existing research, such as Saito et al. typically use frequency as a measure of the tie strength[2]. However, with this approach there is a strong bias towards supermarkets, the dominant food shop format. It can also be argued that a once in a month trip to a confectionery shop to buy *wagashi* has a deeper affect than an almost unconscious trip to a supermarket twice a week ti buy milk. By understanding the association of food to specific shops we can understand how inhabitants visualise or imagine their local foodscape.

2 Saito, S. et al. *An International Comparison of Daily Shopping Behavior Among Shanghai, Taipei, And Fukuoka.*

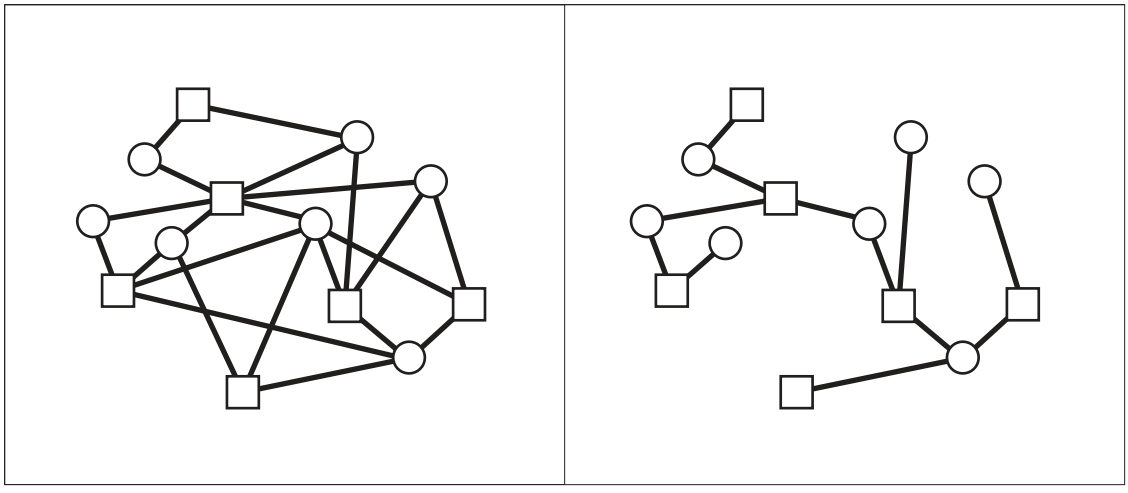


Figure 4.3 Diagram of Network Density.
The density of a network indicates the breadth of shop choices by a household.

Graphs can be analysed at two levels; firstly the overall qualities of the network, for example the number of nodes and edges and how edges are distributed across the graph, and secondly the location of specific nodes within the graph. In network theory location refers to the position of a node relative to other nodes. Based on this location, or relationship to other nodes, power or influence is created. This power manifests in the form of capacity to control the flow of information as it travels through a network.

4.2.1 The Overall Structure of Foodscapes

The overall qualities of a graph can be understood in a number of ways. Firstly, the size of a graph is simply how many nodes there are. Density refers to the number of edges in a graph and is calculated by dividing the number of edges in the graph by the maximum number of possible edges. Figure 4.3 shows two networks with high and low density. In terms of this research, high density in a network would suggest the use of a number of shops to meet shopping needs while low density suggests either a lack of choice or loyalty to a limited number of shops.

Furthermore the distribution of edges within a graph provides insight into the presence of clusters of nodes, that is, a sub-group of nodes within a graph that are more highly interconnected

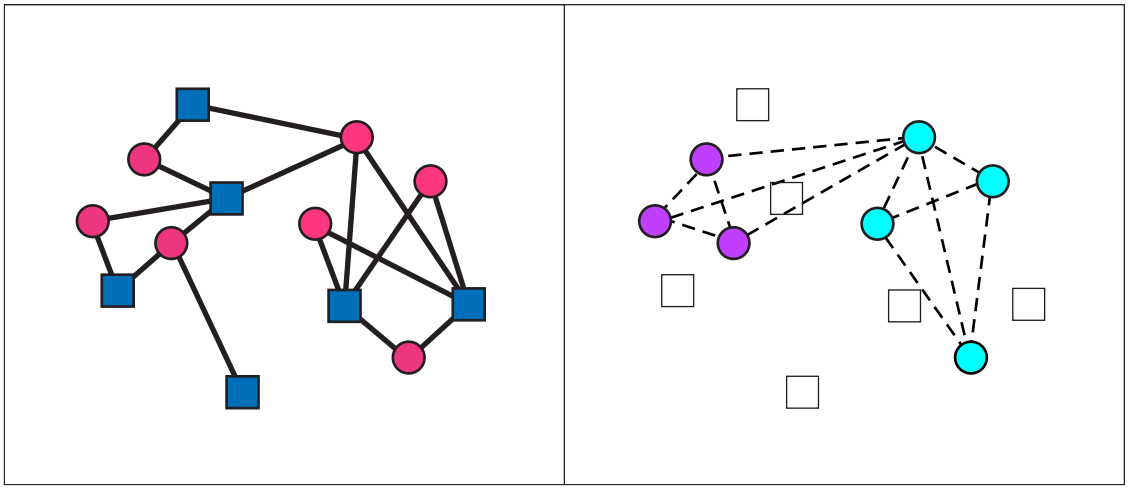


Figure 4.4 Community Detection in Networks.
Concentrations of edges can be used to detect the presence of groups or communities of nodes. In this diagram communities of nodes are detected in projected networks.

than other nodes. These clusters, also known as communities, give insight into how information might flow through the graph. One of the measures that indicates the presence of these communities is the global clustering coefficient. A number of algorithms to calculate the global clustering coefficient but the general approach is calculate the local clustering coefficient for each node and then define the global clustering coefficient as the average of all local clustering coefficient values. The local clustering coefficient is discussed fully in the next section.

Identifying clusters within a graph provides valuable insight into the structure of a food environment. Again, a number of algorithms exist to detect these clusters. However, most of these algorithms are only applicable to non-bipartite networks. One solution is to detect communities on projected networks of each set of actors and then recombine the nodes into a bipartite network.

In terms of foodscapes, a community of nodes belonging to the shop set of actors, referred to as ‘shop communities’, would indicate the shared or complimentary use of food shops by households, or in other words, that a group of households share the same shopping patterns. It also implies a certain level of complementarity, that food shops are ‘working together’ to meet the needs of a household.

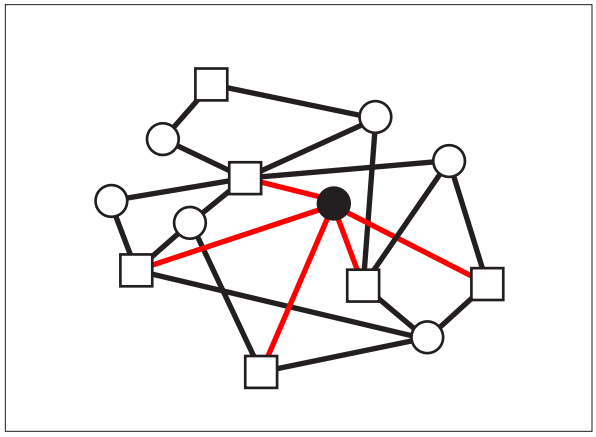


Figure 4.5 Node Weighted Degree Centrality.
Degree Centrality refers to the number of connections a node has to other nodes.

4.2.2 The Role of Food Shops in Foodscapes

A second approach to understanding the structure of a foodscapes is to analyse the role of individual food shops within a network. The location of a node in a graph gives insight into it's ability to influence, or be influenced by, other nodes in the graph.

One of the most common approaches is to analyse centrality. Centrality refers to how important a node is in a network, that is, the level of influence and control on the flow of information that it's position affords. The definition and evaluation of importance varies by context. Although a number of measures of centrality exist, the most commonly referred to were developed by Freeman[3]. Freeman identified two widely used measures of centrality; degree, betweenness that are relevant to the study of foodscapes.

Degree centrality refers to the number of ties connected to a particular node where nodes with higher numbers of connections have greater importance. This is a common measurement in a number of studies on shops and shopping in different forms, for example the number of customers at a shop, the amount of sales and so on. Figure 4.5 shows a basic diagram of degree centrality. The degree .centrality value can be weighted to reflect the strength of the ties. A node with a high weighted degree score suggests that the shop is commonly used by a number of households.

3 Freeman, L. *Finding Social Groups: A Meta-Analysis of the Southern Women Data*

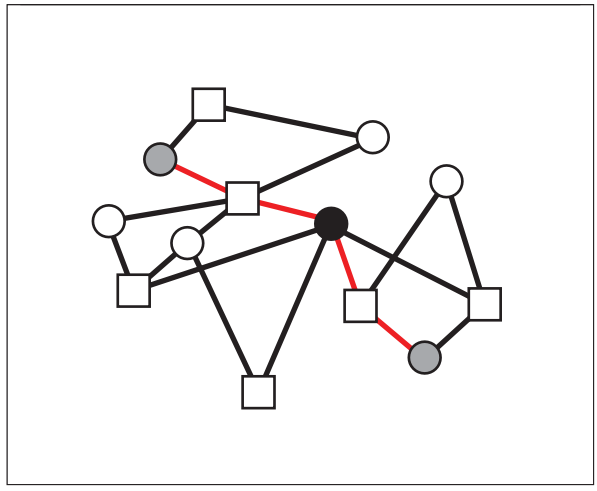


Figure 4.6 Node Betweenness Centrality.

Betweenness Centrality looks at how information flows through a network and a nodes value as a conduit of that information. By counting the number of times a node appears on the shortest path between every combination of nodes the importance of a node to connect between other nodes can be calculated. High betweenness scores usually indicate a nodes role as a 'bridge' between distant parts of a network and therefore have importance as a conduit of new ideas, or conversely, power to control the flow of information, into a community. Typically nodes with high betweenness scores are located on the periphery of a community. In terms of foodscapes, a food shop with high betweenness centrality indicates it's use by a number of different communities and has the ability to draw or connect shoppers with otherwise disparate shopping patterns

Existing research in architecture and urban planning that utilises network theory to understand user environments is limited.. One such example to understand how inhabitants organise urban space is Tomko et al. who utilise network analysis methods to understand the cognitive hierarchy of streets[4]. In particular they use closeness and betweenness centrality measures look to understand the nodes that are influential in controlling the flow of information.

Another measure of a nodes importance is the local clustering coefficient. The local clustering coefficient measures the degree that a node is embedded in it's immediate environment. This is

4 Tomko, M. et al. *Experiential Hierarchies of Streets.*

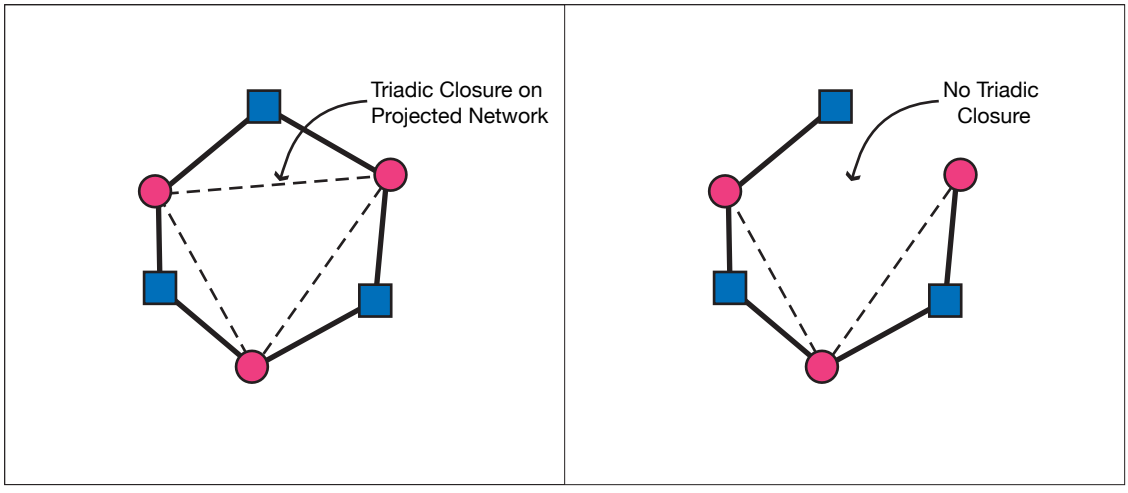


Figure 4.7 Clustering Coefficient

done by calculating the number of ties between the 1st-order neighbours of a node. A food shop with a high local clustering coefficient suggests that it has a core role inside a community, that it makes connections within a defined shopping pattern. The average of local clustering coefficient values for a network is commonly used to calculate the global clustering coefficient, an overall measure of clustering within a network.

One of the key concepts of embededdness is triadic closure. Triadic closure occurs where three nodes share ties between them effectively closing the loop. This suggests a strong relationship. Triadic closure in bipartite networks is not directly possible as ties within sets of actors are not possible. Opashl has one novel approach where triadic closure is calculated on 4-path cycles. This method allows for the calculation of clustering coefficients of weighted bipartite networks without the need for projection[5].

4.2.3 The Spatial Embeddedness of Food Shops

This research is concerned with the spatialisation of food shops. As well as understanding how shops are connected through shared shopping behaviour the spatial embeddedness of food shops can also provide insight into the way that inhabitants view their urban environment.

5 Opashl, T. *Triadic Closure in Two-Mode Networks: Redefining Global and Local Clustering Coefficients.*

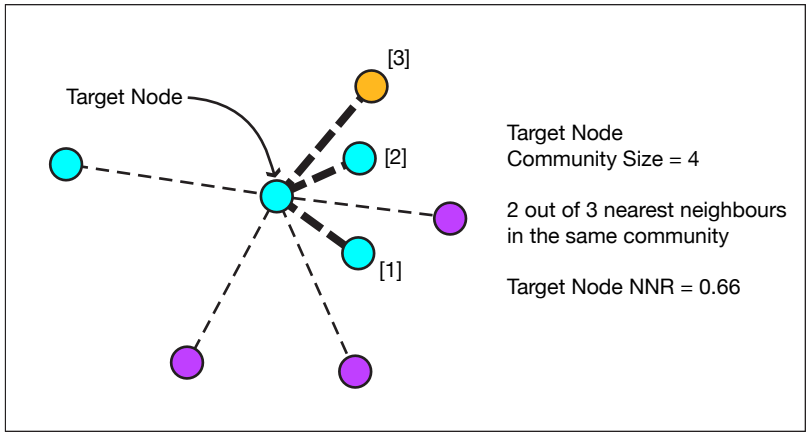


Figure 4.8 The Nearest Neighbour Ratio.
The Nearest Neighbour Ratio is proposed in this research as a measure to understand the spatial correlation of shop communities

Research into the spatial location of social networks is limited. One example of the use of social network analysis combined with spatial data can be found in Faust. Faust et al. use bipartite analysis method's to understand the socio-spatial layering of rural villages in Thailand. By investigating activities such as the loaning of tractors between villages they are able to map the social interactions across a region. Faust's study bases the clustering of 'nodes' on their spatial location. However, this research proposes detecting clusters on shopping behaviour and then correlating the clusters with their physical relationship. With this approach, the assumption that physical location is the basis of community forming is avoided and movement through shopping activity can be analysed free from this bias.

In order to understand the relationship between food shops and the built environment in this way, this research proposes the Nearest Neighbour Ratio as a measure to understand the correlation of shopping patterns to location. Figure 4.8 shows the calculation of the Nearest Neighbour Ratio. The Nearest Neighbour Ratio is calculated by counting the number of k-nearest food shops that belong to the same shop community, where k is the total number of shops in that shop community. A value of 1 would indicate total spatial embeddedness where neighbouring shops belong to the same shopping pattern whereas a value of 0 indicates that a shop belongs to a shopping pattern distinct from it's nearest neighbours.

4.3 Summary

This research is interested in how food shops interrelate and the roles that they play in this environment. Network Analysis provides tools to help understand shopping as a network. Of particular interest is the overall structure of the network and secondly the role of individual shops. These roles can be defined by analysing the embeddedness and betweenness of food shops.

By utilising network analysis methods we can begin to understand how relationships between shops are built up beyond traditional spatiocentric ideas. This alternative way of understanding the urban environment could be useful in understanding how certain forms of shops are empowered across different urban environments. With the decrease of traditional community ties and increased movement, the way that communities form is changing.

It is important to note that while the betweenness centrality value and local clustering coefficient value for a node is influenced by the specific connections to neighbouring nodes, degree centrality values, in contrast, do not. Typically in research associated with shop choice data is collected on shop use is a kind of degree centrality value; how many customers use a shop, the sales revenue of a shop and so on but does not consider how shops are used in conjunction with other shops.

Social network analysis methods can be combined with spatial analysis to give indications of the correlation of shopping behaviour and shop location. This can indicate the extent to which local shops are working together or independently to support local lifestyle.

Using networks to unveil structures of shopping and how to describe spatial conditions related to food in a meaningful way. The hypothesis is that the number, distribution, type of food shops in a community affects and is affected by shopping behaviour. Through an analysis of shopping behaviour we can see the form of a local food environment, or foodscape.

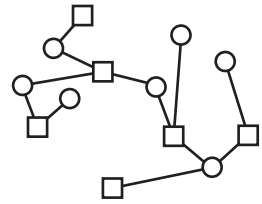
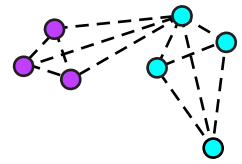
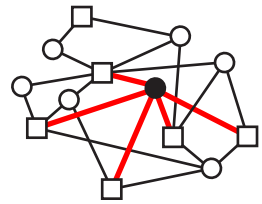
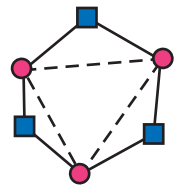
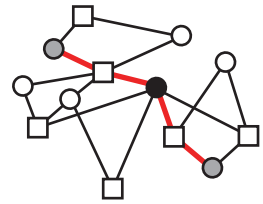
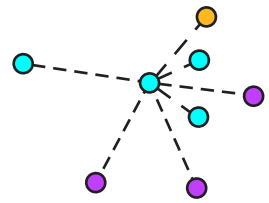
Measure	Definition	Intepretation	Diagram
Density	The number of ties relative to the number of nodes in a network	Low density suggests a lack of choice or loyalty to a shops. High density suggests the use of a number of shops.	
Community	The distribution of ties within a network	The presense of defined shopping patterns	
(Weighted) Degree	The sum of the tie weights connected to an individual node	The level of reliance on a particular shop	
Local Clustering Coefficient	The extent to which a neighbours of a node are interconnected	The extent to which a shop connects to similar shopping patterns; a local measure of embeddedness	
Betweenness Centrality	The extent to which a node lies on the shortest path between other nodes in a network	The extent to which a shop connects different shopping patterns; a global measure of flow	
Nearest Neighbour Ratio	The proportion of nearest neighbours (by geographic location) in the same community	The level that a shop is physically embedded in a place	

Figure 4.9 Summary of Network Analysis Methods for Foodscapes

Part II

Case Study: Foodscapes in Kashiwa City

Part II of this thesis applies the principles developed in Part I to a series of case studies. As discussed, shopping behaviour is influenced by many factors. The focus of these case studies is to isolate urban factors affecting shopping decisions by controlling for other factors such as life-stage, sex and time constraints.

To this end, a questionnaire was carried out in five junior high schools in Kashiwa City, a regional city 30 kilometres north-east of Tokyo. Junior high schools provide a narrow sample group located within defined areas.

Part II is divided into 3 chapters. Firstly, Chapter 5 outlines the method used to collect data, it's treatment, and the specific calculations to be performed in the analysis. Chapter 6 gives an overview of the case study areas, confirming the uniformity of the respondents' backgrounds for each area and comparing the variations in urban conditions.

Chapter 7 applies network analysis methods to the data by constructing bipartite graphs for each of the areas. Chapter 7 itself is divided into three sections. Firstly, the overall shopping behaviour of respondents is analysed in terms of the number and kind of shops used, travel distances and shopping frequency. Chapter 7.2 analyses the structure of each of the areas and finally Chapter 7.3 compares each of the areas to reveal the relationship between the urban environment and shopping behaviour.

5

Method

In order to understand the complex relationship between food shops and shopping behaviour the methods developed in Part I were applied to a defined urban environment as a case study.

Kashiwa City is a regional city with a population of 400,000 located approximately 30km North-East of Tokyo, Japan. It represents a typical medium-sized Japanese city with a range of shopping environments ranging from large nationwide chain stores to suburban supermarkets to local shopping streets. Shopping behaviour data was collected through a survey conducted in five areas of Kashiwa. In total 363 valid responses were collected from which bipartite graphs were constructed for each of the areas and then analysed.

The analysis consists of three parts; understanding the overall structure of each network, analysing the role of food shops for food shopping across all food types, and thirdly, understanding the shopping behaviour within each food type. Finally the five areas were compared and discussed.

In order to understand the relationship between food shops and shopping behaviour it is necessary to isolate other factors that influence shop choice behaviour. Part I found that other factors such as personal preferences and cultural values play a role in shop choice behaviour.

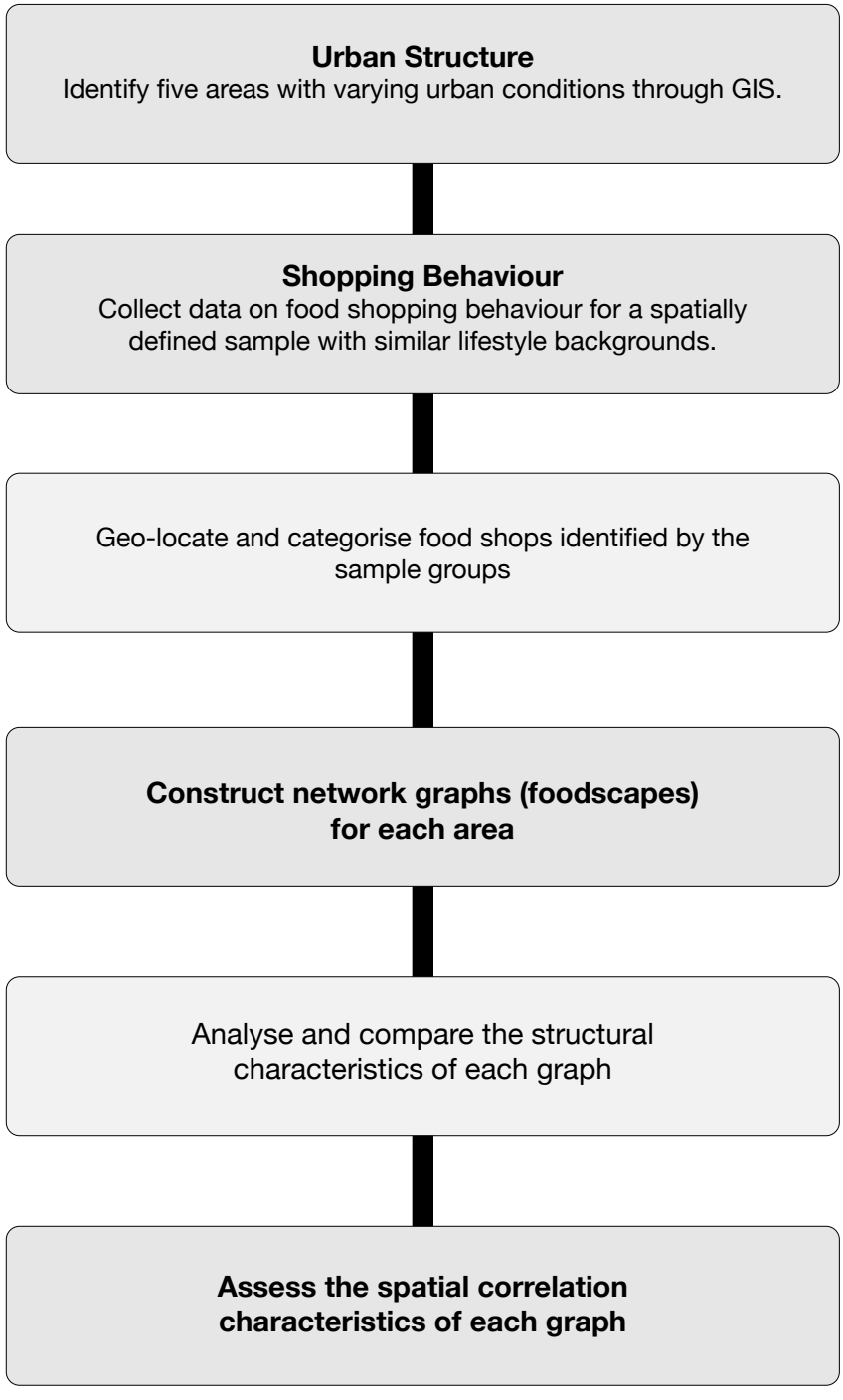


Figure 5.1 Diagram of Research Process

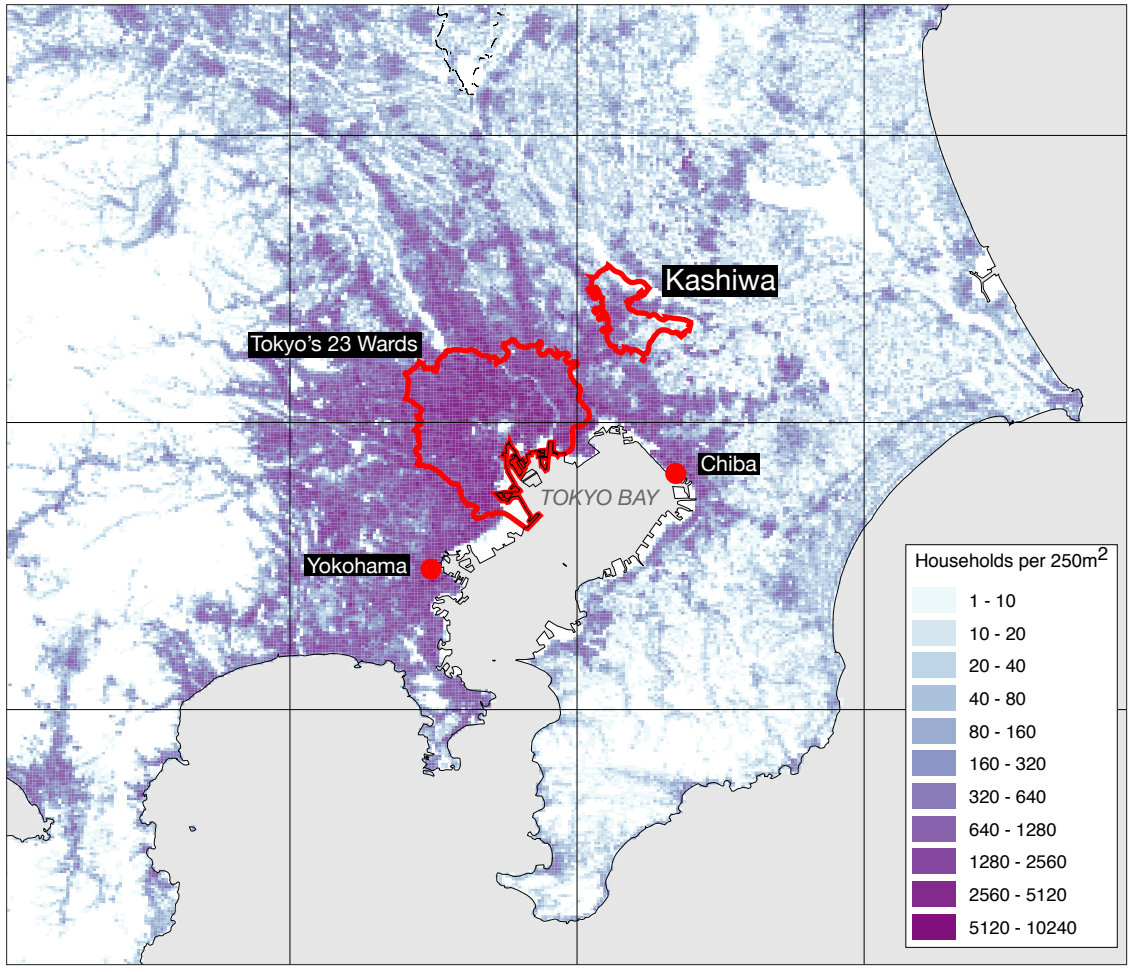
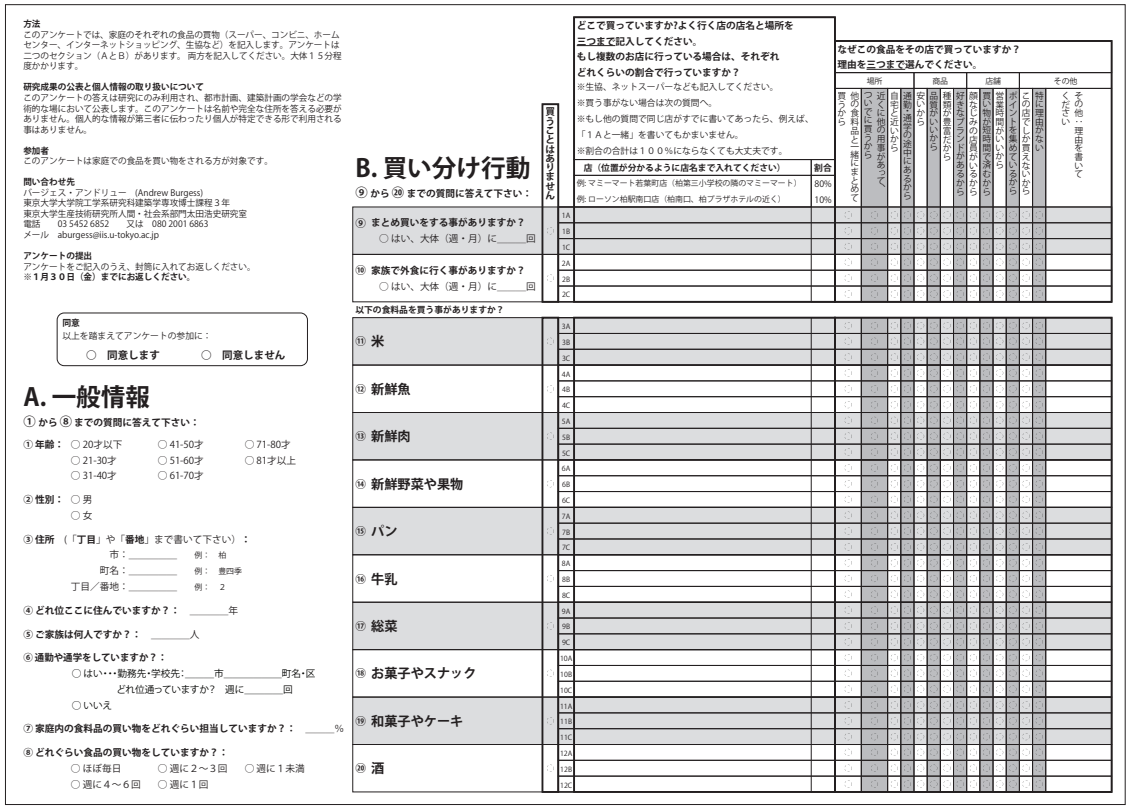


Figure 5.2 Location of Kashiwa City.
Kashiwa City is located approximately 30km North-East of Tokyo. Shaded areas reflect number of households per 250m^2. Source: Japan National Census Data 2010.

In order to isolate the influence of shops themselves a sample group that has similar lifestyle backgrounds is one way of controlling for these factors.

As a result, Junior High Schools were approached for five areas of Kashiwa City. Junior High Schools not only represent a significant urban unit in Japan, but are also based on a zoning system. The student population for each area, except in special cases, reside within the catchment area. As a result, Junior High Schools represent a general cross-section of the local socioeconomic conditions.

By limiting the sample group to Junior High School families we can make assumptions about lifestyle patterns; respondents are of a similar age, have at least one school-aged child, live in the same area with similar space-time constraints and therefore have a similar world view



方法
このアンケートでは、家庭のそれぞれの食品の買物（スーパー、コンビニ、ホームセンター、インターネットショッピング、生協など）を記入します。アンケートは二つのセクション（AとB）があります。両方を記入してください。大体１５分程度かかります。

研究成果の公表と個人情報の取り扱いについて
このアンケートの答えは研究にのみ利用され、都市計画、建築計画の学会などの学術的な場において公表します。このアンケートは名前や完全な住所を答える必要がありません。個人的な情報が第三者に伝わったり個人が特定できる形で利用される事はありません。

参加者
このアンケートは家庭での食品を買い物をされる方が対象です。

問い合わせ先
バージェス・アンドリュー （Andrew Burgess）
東京大学大学院工学系研究科建築学専攻博士課程３年
東京大学生産技術研究所人間・社会系部門太田治史研究室
電話　03 5452 6852　　又は　080 2001 6863
メール　aburgess@iis.u-tokyo.ac.jp

アンケートの提出
アンケートをご記入のうえ、封筒に入れてお返しください。
※**１月３０日（金）までにお返しください。**

同意
以上を踏まえてアンケートの参加に：
○ **同意します**　　○ **同意しません**

A. 一般情報

① から ⑧ までの質問に答えて下さい：

① 年齢： ○ 20才以下　○ 41-50才　○ 71-80才
○ 21-30才　○ 51-60才　○ 81才以上
○ 31-40才　○ 61-70才

② 性別： ○ 男
○ 女

③ 住所 （「**丁目**」や「**番地**」まで書いて下さい）：
市：_____　例：　柏
町名：_____　例：　豊四季
丁目／番地：_____　例：　2

④ どれ位ここに住んでいますか？： _____年

⑤ ご家族は何人ですか？： _____人

⑥ 通勤や通学をしていますか？：
○ はい･･･勤務先・学校先：_____市_____町名・区
どれ位通っていますか？　週に_____回
○ いいえ

⑦ 家庭内の食料品の買い物をどれぐらい担当していますか？： _____%

⑧ どれぐらい食品の買い物をしていますか？：
○ ほぼ毎日　○ 週に２～３回　○ 週に１未満
○ 週に４～６回　○ 週に１回

B. 買い分け行動

⑨ から ⑳ までの質問に答えて下さい：

どこで買っていますか?よく行く店の店名と場所を三つまで記入してください。
もし複数のお店に行っている場合は、それぞれどれくらいの割合で行っていますか？
※生協、ネットスーパーなども記入してください。
※買う事がない場合は次の質問へ。
※もし他の質問で同じ店がすでに書いてあったら、例えば、「１Aと一緒」を書いてもかまいません。
※割合の合計は１００%にならなくても大丈夫です。

店（位置が分かるように店名まで入れてください）	割合
例: マミーマート若葉町店（柏第三小学校の隣のマミーマート）	80%
例: ローソン柏駅南口店（柏南口、柏プラザホテルの近く）	10%

なぜこの食品をその店で買っていますか？理由を三つまで選んでください。

買うことはありません		場所：例の食料品と一緒にまとめて買うから	場所：近くに他の用事があってついでに買うから	場所：自宅と近いから	場所：通勤・通学の途中にあるから	商品：品質がいいから	商品：安いから	商品：種類が豊富だから	店舗：好きなブランドがあるから	店舗：親しみの店員がいるから	店舗：買い物が短時間で済むから	店舗：営業時間がいいから	その他：ポイントを集めているから	その他：この店でしか買えないから	その他：特に理由はない	その他：その他：理由を書いてください
⑨ まとめ買いをする事がありますか？ ○ はい、大体（週・月）に_____回	1A															
	1B															
	1C															
⑩ 家族で外食に行く事がありますか？ ○ はい、大体（週・月）に_____回	2A															
	2B															
	2C															
以下の食料品を買う事がありますか？																
⑪ 米	3A															
	3B															
	3C															
⑫ 新鮮魚	4A															
	4B															
	4C															
⑬ 新鮮肉	5A															
	5B															
	5C															
⑭ 新鮮野菜や果物	6A															
	6B															
	6C															
⑮ パン	7A															
	7B															
	7C															
⑯ 牛乳	8A															
	8B															
	8C															
⑰ 総菜	9A															
	9B															
	9C															
⑱ お菓子やスナック	10A															
	10B															
	10C															
⑲ 和菓子やケーキ	11A															
	11B															
	11C															
⑳ 酒	12A															
	12B															
	12C															

Figure 5.3 Questionnaire Form
Sample of questionnaire distributed to five Junior High Schools in Kashiwa. See Appendix also.

or value system. Furthermore, the education system in Japan has a strong PTA system which organises events and communication between families. With this particular group information about community and daily life is often shared informally. We can say that respondents in the same area have access to the same information of food shop choices.

The collection of shopping behaviour data was carried out in the form a questionnaire. The Kashiwa City Board of Education was approached and following examination and discussion of the contents of the questionnaire five schools were contacted for participation. A questionnaire along with a letter of introduction from the school was distributed to each 1st and 2nd year student who took the questionnaire home and returned it the completed one week later. The questionnaire was targeted at the person in the household most responsible for food shopping who was then required to complete the it and return it via the student. The completed questionnaires were then collected from each school. Participation in the survey was voluntary and respondents were required to indicate their understanding and acceptance of the contents of the questionnaire and it’s use in research.

Questions
Section A
1. How old are you?
2. What is your sex?
3. Where do you live?
4. How long have you lived there?
5. How many people are there living in your household?
6. Do you work or study? Where? How many times per week?
7. What proportion of responsibility do you have for household food shopping?
8. How often do you go shopping?
Section B
9. Do you do major shopping trips? How Often?
10. Do you dine out as a household? How Often?
11. Do you buy rice?
12. Do you buy fish?
13. Do you buy meat?
14. Do you buy fruit & vegetables?
15. Do you buy bread?
16. Do you buy milk?
17. Do you buy souzai?
18. Do you buy snacks?
19. Do you buy wagashi and cakes?
20. Do you buy alcohol?
Respondents were also asked to answer the following for Questions 9-20:
a. Please list up to three shops that you usually use to buy this food.
b. What proportion of your shopping is done at this shop?
c. Please list up to three reasons why you choose this shop:
R1: Because I buy other food at this shop.
R2: Because I have other errands nearby
R3: Because it's near my home
R4: Because it's on the way to work/school
R5: Because it's cheap
R6: Because the products are high quality
R7: Because there are a wide range of products
R8: Because they sell a brand that I like
R9: Because I'm firendly with the staff
R10: Because I can complete my shopping quickly
R11: Because the business hours are good
R12: Because I can collect points
R13: Because only this shop sels this product
R14: No special reason
R15: Other

Table 5.1 Questions from Survey.
Respondents were asked to record information about shopping habits for 10 everyday food items. See Appendix for sample survey form.

The areas analysed were Kazahaya Junior High School, Nanbu Junior High School, Kashiwa No. 4 Junior High School, Hikarigaoka Junior High School and Kashiwa Junior High School.

Respondents were asked to record their routine shopping habits for 10 food items. They were asked to list up to three shops per food item that they routinely use to buy that item as well as how often they use that shop as a percentage and up to three reasons for choosing that shop for that food item. Therefore the responses reflect the strength of association of a particular food item to a specific food shop.

Responses for each area were then geocoded and mapped onto physical space and network graphs constructed.

The daily food shopping activity of households constitutes an bipartite network consisting of two distinct sets of actors; households and shops, connected by 'ties', which in this research is routine shopping behaviour. This chapter analyses the structural qualities of bipartite networks constructed for each of the five areas surveyed.

An array of metrics can be applied in network analysis relating to the overall nature of the network down to the role that individual actors play in the network. In this research the prime interest lies in the overall structure of a network, that is, it's density and degree of clustering, the presence of distinct communities within the network, and the influence, commonly refereed to as centrality in social network analysis, or the distribution of influence of actors across the network.

5.1 Data Set

The data set is made up of geocoded shopping behaviours weighted by association of foods to specific shops.

The questionnaire comprised of two sections; Section A related to general background information while Section B related to shopping behaviour. The questionnaire did not require identifying information such as names and full physical addresses thereby automatically anonymising all responses. Section A recorded information such as age, sex, address (to the home/suburb level to maintain anonymity), employment status, the amount of responsibility for household shopping, and shopping frequency. The purpose of this was to confirm the spatial and time constraints of the respondent as well as confirm the uniformity of respondents' backgrounds.

Section B related to food shopping behaviour. Respondents were asked to record shops, both name and location, that they routinely used in their daily lives. A total of 10 food types were chosen as well as major shopping trips and eating out. The food types were rice, fish, meat, fruit and vegetables, milk, bread, *souzai*[1], snacks, *wagashi*[2] and cakes, and alcohol. Respondents were able to list up to three shops per food type and were also asked to record the proportion of use of that shop. Further, respondents were asked to list up to three reasons from a list of 15 options for choosing that shop. The reasons related to location-based reasons, product-based reasons including quality and price, and service-related reasons such as quick service, friendly staff and so on. Respondents were also given the opportunity to record an additional reason not covered in above groups. Table 5.1 shows the complete list of questions and reasons. Refer also to Appendix A for the details of the questionnaire.

---

1 *Souzai* are commonly translated as 'side dishes' and can generally be described as pre-prepared food items ranging from salads to *hijiki* to meat dishes such as *tonkatsu*. They can be found in a kind of 'deli' section at any supermarket as well as butcheries. They are often bought on the way home from work to supplement a family meal and provide a cheap and easy way add variety to meals.

2 *Wagashi* are Japanese sweets made from traditional ingredients such as *mochi* and *anko*. They are a significant part of Japanese culture and are associated with guests. They therefore have a higher status than other confectionery. *Wagashi* are sold in a number of places such as department stores and specialist Japanese confectionery shops and can also be found in common supermarkets.

From this data set bipartite networks can be constructed from the two sets of actors, households (Section A) and shops (Section B), which are represented as nodes, connected by ties, their daily shopping activity, represented as edges. Each edge between a household and a shop is weighted by the proportion of use. The greater the proportion of use the heavier the weighting of the tie.

Spatial information for shops was extracted from the 2010 Telepoint Pack! database, a database of phone numbers cross-referenced with Zenrin's Zmap Town II to provide spatial point data of both residential and commercial addresses throughout Japan. Both data sets provided by the Center for Spatial Information Science (CSIS) at the University of Tokyo. The Telepoint Pack! database provides a valuable opportunity to understand the city as an non-aggregated environment. Typically spatial data is provided as meshes of aggregated values. The ability to understand commercial data at this fine level of detail enables critical distinctions to be made between individual shops.

The Telepoint Pack! database contains information for commercial facilities in the form of the name of the business, spatial coordinates, address and a business type. Business are categorised into over 2200 types including specific codes for chain stores.

5.2 Response and Data Treatment

The location of households were geocoded from responses in Section A of the questionnaire. Respondents were asked to record their address only to the chome, or neighbourhood, level. Where addresses were only recorded to the suburb level, the centre of the suburb was used.

In order to construct a graph from the responses it is critical to be able to identify the particular shop and the proportion of use. Responses with less than 80% of entries recorded with this information correctly were discarded completely. For other responses where the shop information was recorded correctly but the proportion of use was missing, the proportion was interpolated by recording responses with one shop as 100% use, responses with two shops with 50% each, and responses with three shops recorded as 30% each.

Spatial data for the Telepoint data set was also formatted as follows. Information is stored by phone number. Therefore it is possible that a shop with more than one phone number is listed multiple times and that shops in the same building, for example a shopping mall, will have the same address. For the purposes of this research, matching shop names took precedence over matching addresses, that is, entries with the same shop name but different phone numbers were combined to form one entry, and entries with the same address but different shop names were kept as separate entries.

The survey was undertaken between 23rd and 30th of January 2015. Table 5.2 summarises the response rates. A total of 1484 questionnaires were distributed across the five schools with 363 valid responses. The number of valid responses across all schools was 24.5%. Response rates varied between 25.5% and 27.5% for Areas B, C, D and E while Area A returned 12.4%.

Eating out was discarded completely due to the lack of response. Many respondents recorded eating out frequency but not the shops used, some noting that there was no particular restaurant they routinely used. As a result a robust sample could not be found.

The details of the response to the survey are discussed in more detail in the findings.

	Case Area A	Case Area B	Case Area C	Case Area	Case Area E
Survey					
Date of Survey	23 ~ 30 January 2015	23 ~ 30 January 2015	23 ~ 30 January 2015	23 ~ 30 January 2015	23 ~ 30 January 2015
Number of Questionnaires Distributed	201	286	251	385	361
Number of Valid Responses	25	73	64	106	95
Response Rate	12.40%	25.5%	25.5%	27.5%	26.3%
Household Information					
Average Size of Household (persons)	4.20 sd 1.2	4.22 sd 0.85	4.25 sd 1.06	4.22 sd 0.90	4.11 sd 0.86
Average Length of Residence (years)	12.88 sd 9.53	12.25 sd 5.73	12.03 sd 6.62	13.29 sd 9.89	13.01 sd 8.94
Average Number of Dining-Out Trips (weekly)	0.52 sd 0.55	0.44 sd 0.38	0.43 sd 0.45	0.39 sd 0.31	0.53 sd 0.49
Shopper Information					
Average Age (years)	43.00 sd 5.66	41.71 sd 5.73	44.38 sd 4.96	44.53 sd 5.02	43.95 sd 4.47
Sex	F: 96.0% M: 0.0%	F: 93.2% M: 2.7%	F: 93.8% M: 3.1%	F: 93.4% M: 2.8%	F: 94.7% M: 1.1%
Average Household Shopping Burden	94.88% sd 11.09%	90.54% sd 17.67%	95.81% sd 12.24%	95.1% sd 9.31%	94.88% sd 10.41%
Employment Status:					
• Not employed	28.0%	24.7%	32.8%	34.0%	25.3%
• Part-time (less than 4 days per week)	12.0%	13.7%	15.6%	13.2%	24.2%
• Full-time (4 or more days per week)	52.0%	57.5%	43.8%	50.9%	48.4%

Table 5.2 Summary of General Responses to Questionnaire.
General comparison of response and background information of respondents.

5.3 Network Modelling & Calculations

The data was modelled in QGIS version 2.8 and coded in python 2.7 using the packages Networkx and Igraph. R was also used for the calculations of clustering coefficients. The bipartite graphs were modelled in python using the network analysis packages Networkx, version 1.9.1, and Igraph, version 0.7.0. Responses from the questionnaire were cross-referenced with the spatial data extracted from the Telepoint Pack! database and the combined model analysed with the open-source application QGIS, version 2.8.

Community Detection

Community detection was carried out using Igraph's walktrap algorithm. This algorithm detects variance in the distribution of weighted ties by making series of random walks based on the assumption that short random walks will tend to occur within communities. Community detection was carried out on each projected graph and then mapped back onto the two-mode graph.

Clustering Coefficient

A number of methods exist to define and calculate clustering coefficients. Global and local clustering coefficients were calculated using R's tnet library because of it's ability to accommodate weighted two-mode networks. Due to the large variation between tie weights the geometric mean was used to calculate coefficient values. This was done purposely to maintain the influence of these imbalances.

Visualisation

A number of algorithms to visualise graphs exist. This research uses the Fruchterman-Reingold algorithm to visualise graphs. The Fruchterman-Reingold algorithm utilises tie weights and betweenness values to locate nodes, where shorter tie lengths reflect stronger connections between nodes. The strength of ties was further pronounced by placing ties between nodes in the same community which were then hidden when rendered.

Betweenness Centrality

Betweenness centrality values were calculated using python's networkx package. Betweenness values reflect non-normalised values for two-mode graphs. That is, betweenness centrality values are calculated on unprojected graphs.

Density

The density of a graph is typically calculated as the ratio of the number of actual edges to the number of possible edges in a graph. Due to the nature of the questionnaire, where respondents were only able to list up to three shops per food item, the number of possible edges is limited to 3 times the number of food items bought. Therefore the density calculation was adjusted to reflect this.

Weighted degree

Weighted degree values were calculated by dividing each tie weight by the sum of tie weights for each respondent. These values were then divided by the total number of respondents in order to comparison across each case study area.

Nearest Neighbour Ratio

In order to understand the spatial correlation of shopping behaviour this research introduces the Nearest Neighbour Ratio, a simple algorithm to evaluate the relation of shopping behaviour and food shops.

The Nearest Neighbour Ratio (NNR) takes the n-nearest neighbours of each food shop, where n is the size of the shop community, and calculates the ratio of shops matching the shop community. NNR values sit between 0 and 1 where values of 1 reflect toilet embeddedness of shops and location and values of 0 reflect complete independence of location and shopping behaviour.

6

Case Study Area Overview

This chapter looks at the current condition of the five case study areas, compares them spatially and also confirms the degree of variation amongst the respondents. The urban structure of each area is understood in terms of number of shops, zoning and transportation and accessibility and the accumulation of shops The general background information for each of the respondents is also analysed. These areas are then compared to establish similarities and differences.

6.1 Sample Groups

The premise of this case study is that the urban structure and food have a recursive relationship. That is, one influences the other and is simultaneously influenced by the other. Food shopping is a complex activity made up of many factors. In order to isolate this relationship a sample group with similar lifestyle backgrounds was selected to control for factors such as time constraints, personal preferences and social values.

Junior high schools provide such a sample group. Junior high schools in Japan have defined catchment areas therefore households are located in the same location, parents are of a similar age and households have at least one child. Furthermore, the Parent Teacher Associations (PTA) in each school are strong, organising events and sharing information. It can also be assumed that households in the same junior high school have similar access to information about the community and ties within the community.

This section gives an overview of the characteristics of each of the households surveyed in each area. The overview looks at the household characteristics such as size and years of residence as well as the age, sex, employment status and shopping burden for each area

Table 6.1 shows the household and shopper information for each of the five areas. The questionnaire asked respondents about the general nature of the household. Respondents were asked to give the size of the family, the number of years of residence and the number of dining-out experiences as a family per week. Responses were largely uniform across all areas. The average household size varied between 4.11 (sd 0.86) in Case Area E and 4.25 (sd 1.06) in area C. The average length of residence ranged between 12.03 in Case Area C and 13.29 in Area D. The standard deviation for Areas B (sd 5.73) and C (sd 6.62) was lower than Areas A (sd 9.53), D (sd 9.89) and E (sd 8.94). The average number of dining-out experiences was similarly uniform ranging from 0.39 to 0.53 trips per week.

Respondents were also asked to give information about their individual backgrounds. Ages were recorded in 10 year increments. The average age of shoppers most responsible for household food shopping varied between 41.71 years (sd 5.73) in Case Area B and 44.53 years

	Case Area A	Case Area B	Case Area C	Case Area	Case Area E
Survey					
Date of Survey	23 ~ 30 January 2015	23 ~ 30 January 2015	23 ~ 30 January 2015	23 ~ 30 January 2015	23 ~ 30 January 2015
Number of Questionnaires Distributed	201	286	251	385	361
Number of Valid Responses	25	73	64	106	95
Response Rate	12.40%	25.5%	25.5%	27.5%	26.3%
Household Information					
Average Size of Household (persons)	4.20 sd 1.2	4.22 sd 0.85	4.25 sd 1.06	4.22 sd 0.90	4.11 sd 0.86
Average Length of Residence (years)	12.88 sd 9.53	12.25 sd 5.73	12.03 sd 6.62	13.29 sd 9.89	13.01 sd 8.94
Average Number of Dining-Out Trips (weekly)	0.52 sd 0.55	0.44 sd 0.38	0.43 sd 0.45	0.39 sd 0.31	0.53 sd 0.49
Shopper Information					
Average Age (years)	43.00 sd 5.66	41.71 sd 5.73	44.38 sd 4.96	44.53 sd 5.02	43.95 sd 4.47
Sex	F: 96.0% M: 0.0%	F: 93.2% M: 2.7%	F: 93.8% M: 3.1%	F: 93.4% M: 2.8%	F: 94.7% M: 1.1%
Average Household Shopping Burden	94.88% sd 11.09%	90.54% sd 17.67%	95.81% sd 12.24%	95.1% sd 9.31%	94.88% sd 10.41%
Employment Status:					
• Not employed	28.0%	24.7%	32.8%	34.0%	25.3%
• Part-time (less than 4 days per week)	12.0%	13.7%	15.6%	13.2%	24.2%
• Full-time (4 or more days per week)	52.0%	57.5%	43.8%	50.9%	48.4%

Table 6.1 Overview of Shopper Backgrounds

(sd 5.02) in Case Area D. Between 93.2% and 96.0% of respondents were female and the main shopper shouldered between 90.54% (Case Area B) and 95.81% (Case Area C) of the household shopping burden.

In terms of employment status, between 43.8% (Case Area C) and 57.5% (Case Area B) of the respondents worked full-time, defined in this research as working at least 4 days per week. In Areas A, B, C and D between 12.0% and 15.6% of respondents worked part-time, up to 3 days per week, a figure which was higher in Case Area E (24.2%).

These results suggest uniformity of the sample groups across all of the five case study areas where variations in age, sex, household size and shopping burden are nominal. Differences in employment status suggest varying time constraints in that a shopper in full-time employment has limited time and spatial movement to undertake shopping duties. However, this was not reflected in variations in the shopping burden.

6.2 Urban Structure

Kashiwa City is a commuter town that lies 30km North-East of Tokyo. As of the 2010 census it has a population of 404,012. It is classed as a core city meaning that it has a certain level of administrative autonomy not enjoyed by smaller cities. There are currently 41 core cities, 19 of which are within commuting distance of the major metropolitan areas of Tokyo, Osaka, Nagoya and Fukuoka.

Kashiwa has undergone rapid development since the 1950's when Kashiwa Station was converted into an express stop on the Joban line in 1953. In 2005 Shonan City to the east was merged with Kashiwa and the Tsukuba Express line running through the western part of the city was opened. National Route 6 which connects Tokyo to Tohoku and the northern ares of Japan runs adjacent to the Joban line cutting through the centre of the city and National Route 16, a major arterial route that surrounds the Tokyo Metropolitan area connecting Chiba, Saitama, Tokyo and Yokohama, runs through the North of the city centre from north-west to south-east.

As a result of years of development a wide range of commercial environments have emerged in Kashiwa. The main commercial area centres around Kashiwa Station and accommodates three major department stores, Takashimaya, Marui and SOGO, a number of *shotenkai* with a variety of retail shops and entertainment facilities. Since the opening of the Tsukuba Express Line major shopping malls have opened at Kashiwanoha-Campus and the Nagareyama-Otakanomori SC in nearby Nagareyama City and residential development has dramatically increased in the western part of the city. To the east of the Joban Line lies more established residential areas serviced by the Tobu Urban Park line. The Urban Park line consists of a number of local stations that have small shops and the odd supermarket. In recent years suburban shopping malls such as Aeon Shopping Mall and Mallage have been established within these more mature areas and Minami-Kashiwa Station has been developed with two major supermarkets, a number of chain stores and high-rise apartments. Kashiwa currently has 43 *shotenkai*.

Fig 6.1 shows the rationalisation of shops and population in Kashiwa since 1970. The population of Kashiwa has increased steadily since the 1970s and rose sharply in 2005 when Shonan City was absorbed into Kashiwa City. This merger pushed the population of Kashiwa over

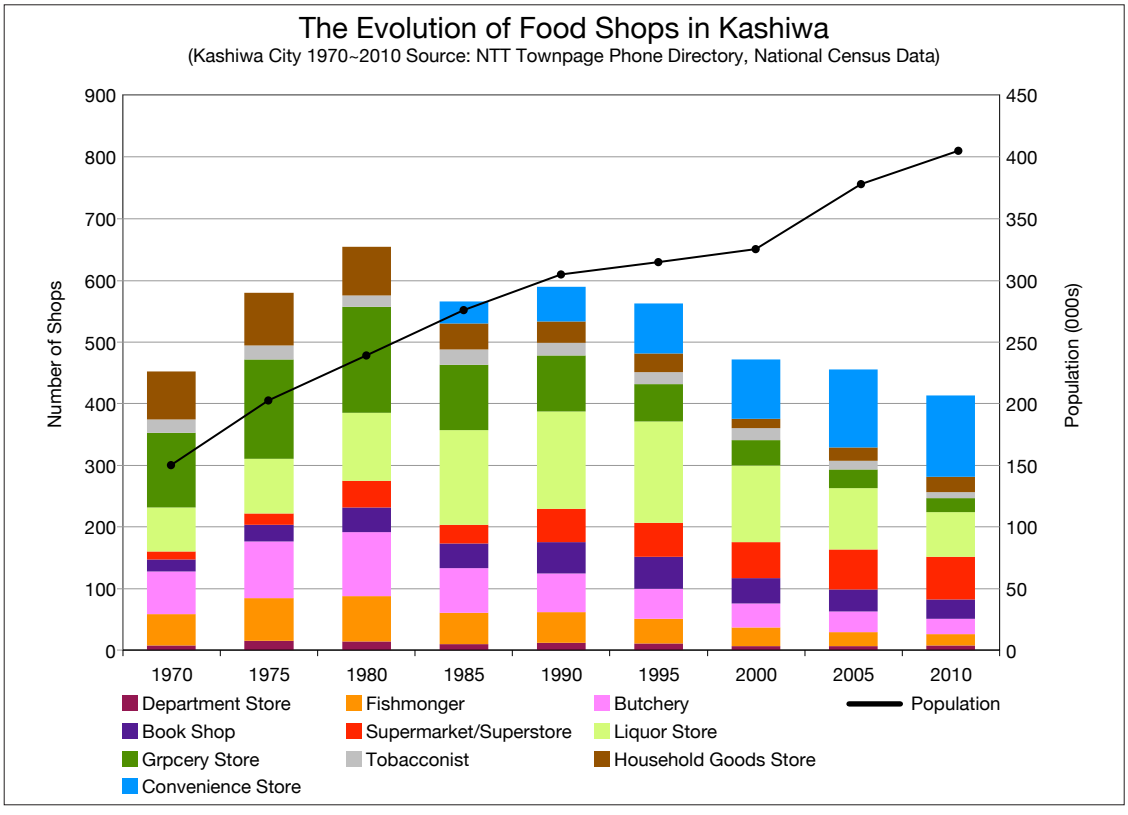


Figure 6.1 The Evolution of Food Shops in Kashiwa.
While the population of Kashiwa has steadily increased the overall number of food shops has decreased and been rationalised into three major shop types. Source: NTT Townpage 1970-2010, Japan National Census Data 1970-2010.

350,000, and increased the size of the municipality to over 100km^2, one of the basic requirements for a city to be designated as a Core City, a status that it reached in 2008. Status as a core city gives a municipality certain administrative freedoms including permission for construction within town planning implementation areas and redevelopment project implementation areas.

Shop types and numbers were extracted for Townpage telephone directories from the 1970 to 2010. While the population of Kashiwa has increased dramatically, the rationalisation of food shopping has led to an overall decrease in the number of shops. Furthermore, since the introduction of the convenience store category in Townpage in 1985 the types of food shops have been consolidated into three dominant groups; convenience stores, liquor stores and supermarkets.

Figure 6.2 shows the case study areas and location of everyday life facilities in the Kashiwa area. Retail shops and social infrastructure associated with basic functions of everyday life are

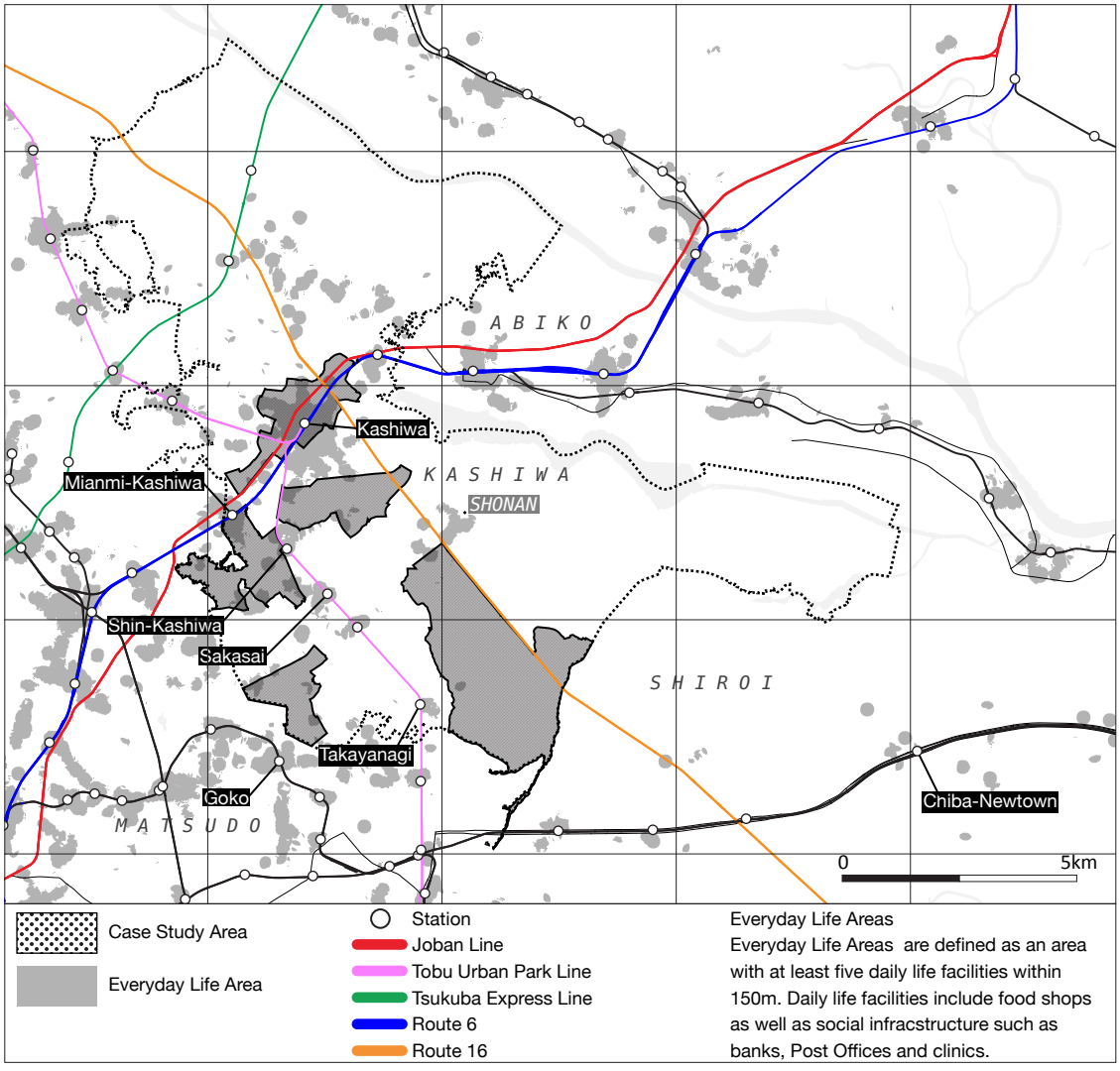


Figure 6.2 Location of Case Study Areas.

shown. Concretely, food shops, clinics, hair salons, banks, post offices are extracted from the telepoint database.

6.2.1 Case Area A Overview

Kazahaya Junior High School is located in the old Shonan City area, which amalgamated with Kashiwa City in 2005. It lies approximately 6 kilometres south-east of Kashiwa Station. The Shonan area is bisected by National Route 16 which is lined with big box type chain stores including discount stores and supermarkets. There are a number of suburban supermarkets.

Public transportation is minimal. A bus service connects the area to the central Kashiwa area by a single route and households rely heavily on private transportation in their daily lives.

The food shopping environment consists of a number of scattered shops. There is no strongly defined shopping area, rather an accumulation of shops in the old Shonan City Centre.

Figure 6.3 shows the location food shops relative to other social infrastructure. Food shops tend to line major roads. In other areas of the Kazahaya JHS catchment area shops are isolated. There nearest shopping areas are located at Sakasai Station and Takayanagi Station.

	Case Area A
Survey	
Date of Survey	23 ~ 30 January 2015
Number of Questionnaires Distributed	201
Number of Valid Responses	25
Response Rate	12.40%
Household Information	
Average Size of Household (persons)	4.20, sd 1.2
Average Length of Residence (years)	12.88, sd 9.53
Average Number of Dining-Out Trips (weekly)	0.52, sd 0.55
Shopper Information	
Average Age (years)	43.00, sd 5.66
Sex	F: 96.0% M: 0.0%
Average Household Shopping Burden	94.88%, sd 11.09%
Employment Status:	
• Not employed	28.0%
• Part-time (less than 4 days per week)	12.0%
• Full-time (4 or more days per week)	52.0%

Table 6.2 Overview of Shopper Backgrounds - Case Area A

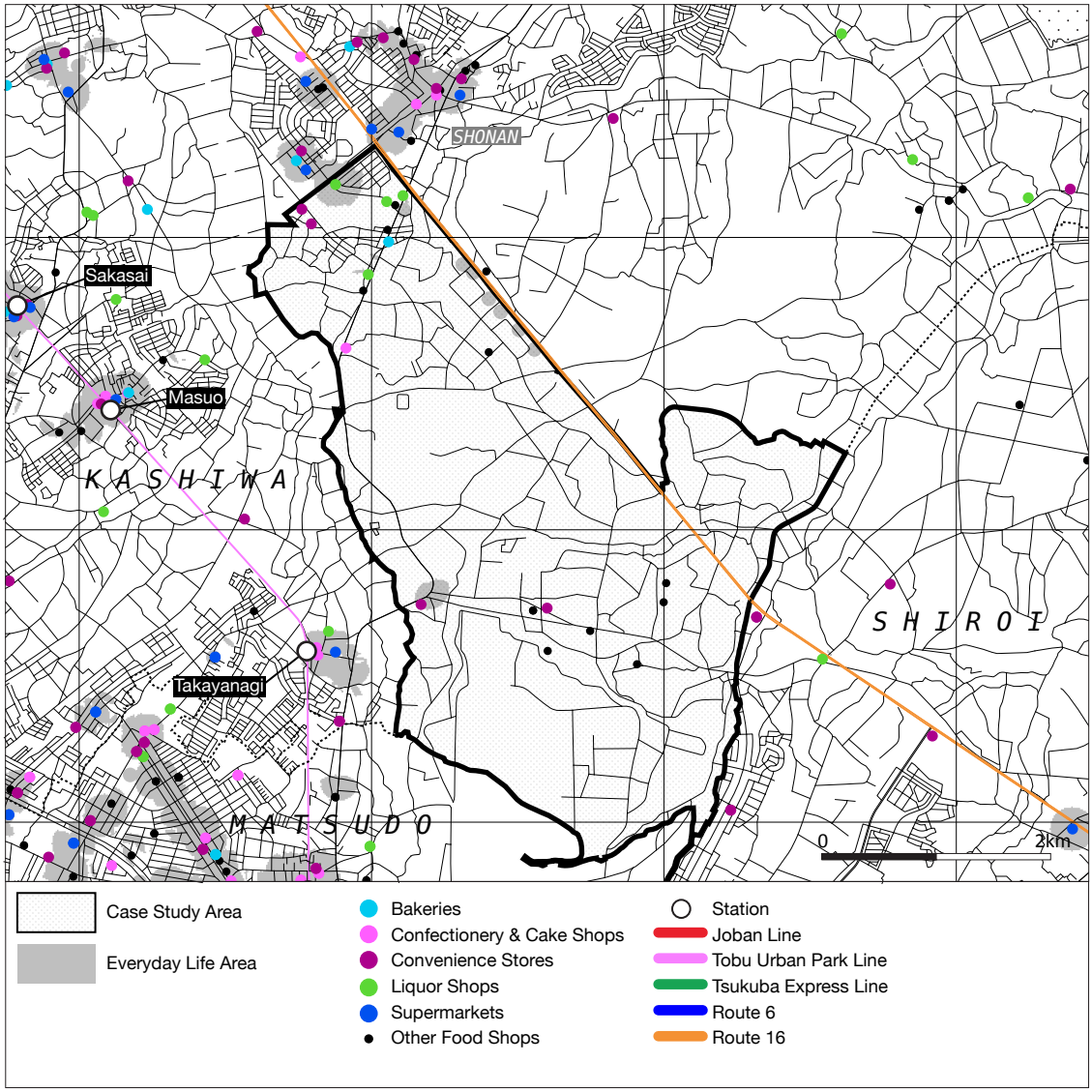


Figure 6.3 Overview of Case Study Area A

Figure 6.4 shows the land use zones for Case Area A. The actual catchment area is largely unzoned, and the more densely populated areas are a mixture of low-density and mid/high density residential. There are two neighbourhood commercial areas nearby in the old Shonan City Centre.

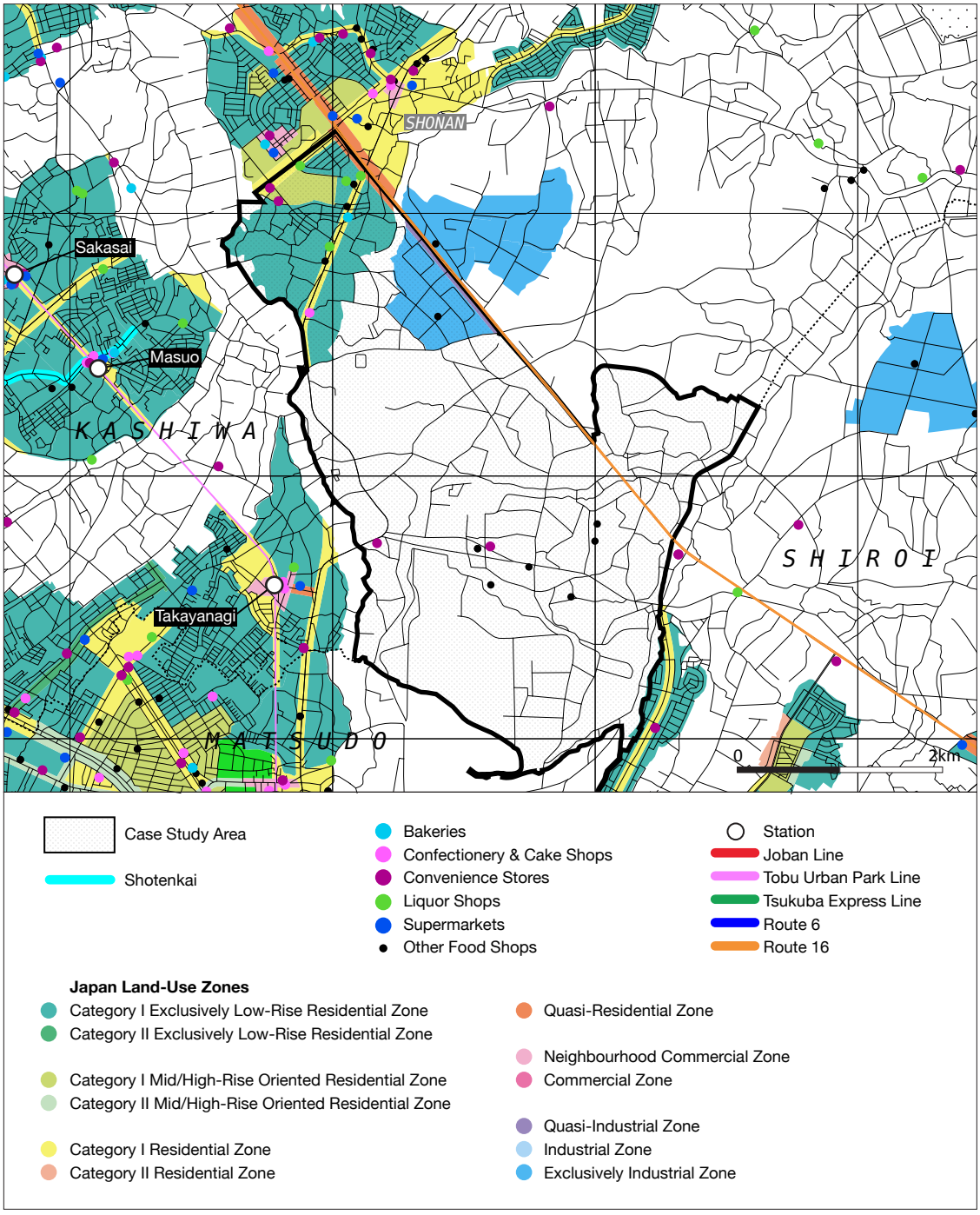


Figure 6.4 Planning & Regulation of Case Study Area A

6.2.2 Case Area B Overview

Nanbu Junior High School is located in the southern most part of Kashiwa City and borders Matsudo City. It is a largely residential area without a central shopping area; it lies between Sakasai Station to the north-east and Goko station to the south. A major urban road running to the north of the Nanbu JHS catchment area is lined sporadically with social infrastructure. Major shopping areas lie 1.5 km to the south around Goko Station and to the north-west.

While there are few shopping choices within 500m of the average household, options increase considerably at greater distances, particularly towards Tokiwaidara Station and Goko Station. These options tend to consist of small suburban supermarkets, drug stores and discount stores.

The catchment area of Nanbu JHS is predominantly low-density residential with commercial areas at Tokiwadaira Station and Goko Station. Food shops are scattered over the area.

	Case Area B
Survey	
Date of Survey	23 ~ 30 January 2015
Number of Questionnaires Distributed	286
Number of Valid Responses	73
Response Rate	25.5%
Household Information	
Average Size of Household (persons)	4.22, sd 0.85
Average Length of Residence (years)	12.25, sd 5.73
Average Number of Dining-Out Trips (weekly)	0.44, sd 0.38
Shopper Information	
Average Age (years)	41.71, sd 5.73
Sex	F: 93.2% M: 2.7%
Average Household Shopping Burden	90.54%, 17.67%
Employment Status:	
• Not employed	24.7%
• Part-time (less than 4 days per week)	13.7%
• Full-time (4 or more days per week)	57.5%

Table 6.3 Overview of Shopper Backgrounds - Case Area B

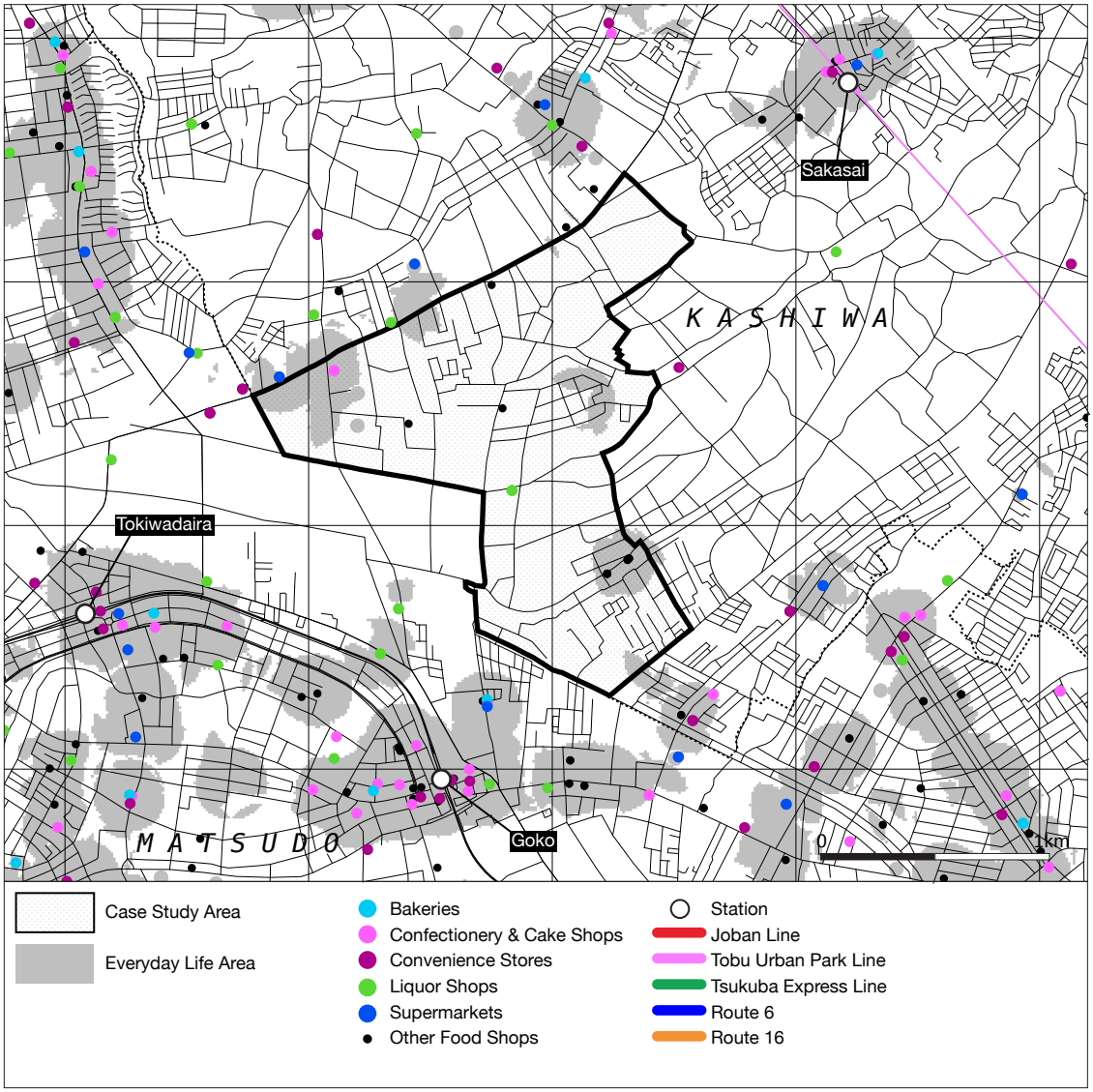


Figure 6.5 Overview of Case Study Area B.

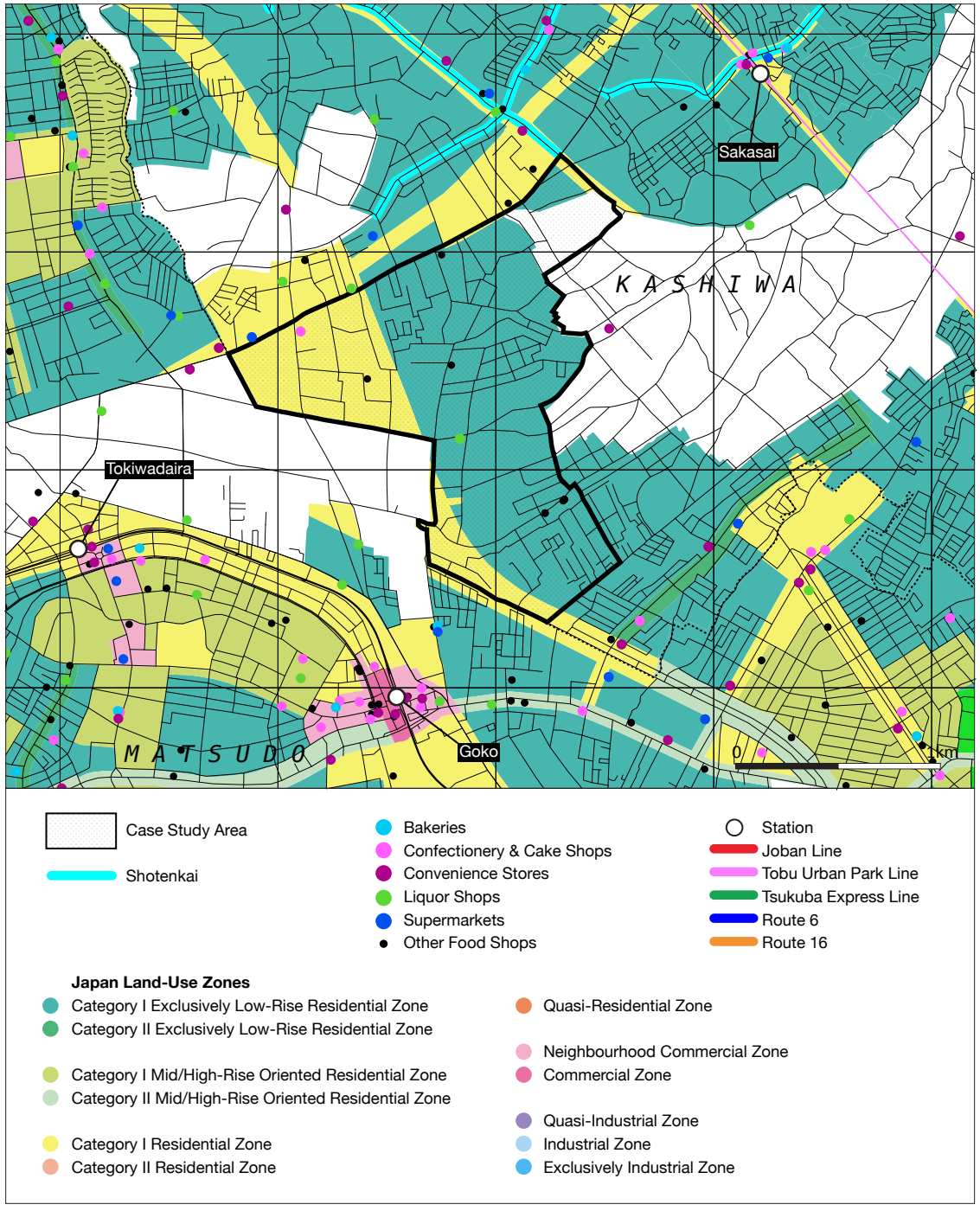


Figure 6.6 Planning & Regulation of Case Study Area B.

6.2.3 Case Area C Overview

Kashiwa No. 4 Junior High School is located approximately 2.5km from Kashiwa Station. It is a predominantly residential area without a recognised shopping area. The nearest shopping area is at Shin-Kashiwa Station where there are two suburban supermarkets. The food environment is dominated by suburban supermarkets at Shin-Kashiwa Station and on major urban roads connecting the area to Kashiwa Station.

The catchment area for Kashiwa No.4 is zoned as low-density residential and the area around Shin-Kashiwa Station as neighbourhood commercial.

	Case Area C
Survey	
Date of Survey	23 ~ 30 January 2015
Number of Questionnaires Distributed	251
Number of Valid Responses	64
Response Rate	25.5%
Household Information	
Average Size of Household (persons)	4.25, sd 1.06
Average Length of Residence (years)	12.03, sd 6.62
Average Number of Dining-Out Trips (weekly)	0.43, sd 0.45
Shopper Information	
Average Age (years)	44.38, sd 4.96
Sex	F: 93.8% M: 3.1%
Average Household Shopping Burden	95.81%, sd 12.24%
Employment Status:	
• Not employed	32.8%
• Part-time (less than 4 days per week)	15.6%
• Full-time (4 or more days per week)	43.8%

Table 6.4 Overview of Shopper Backgrounds - Case Area C

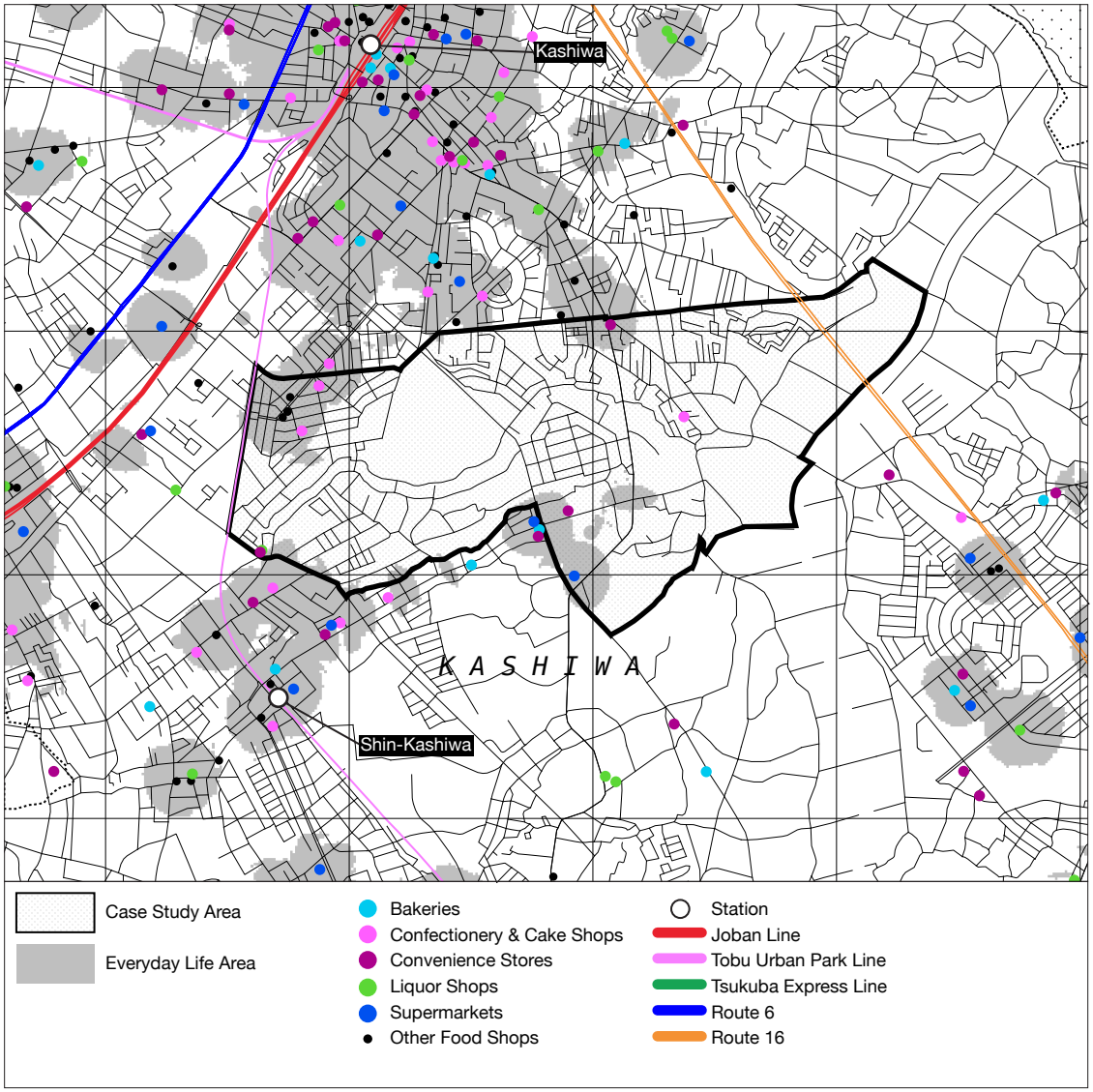


Figure 6.7 Overview of Case Study Area C.

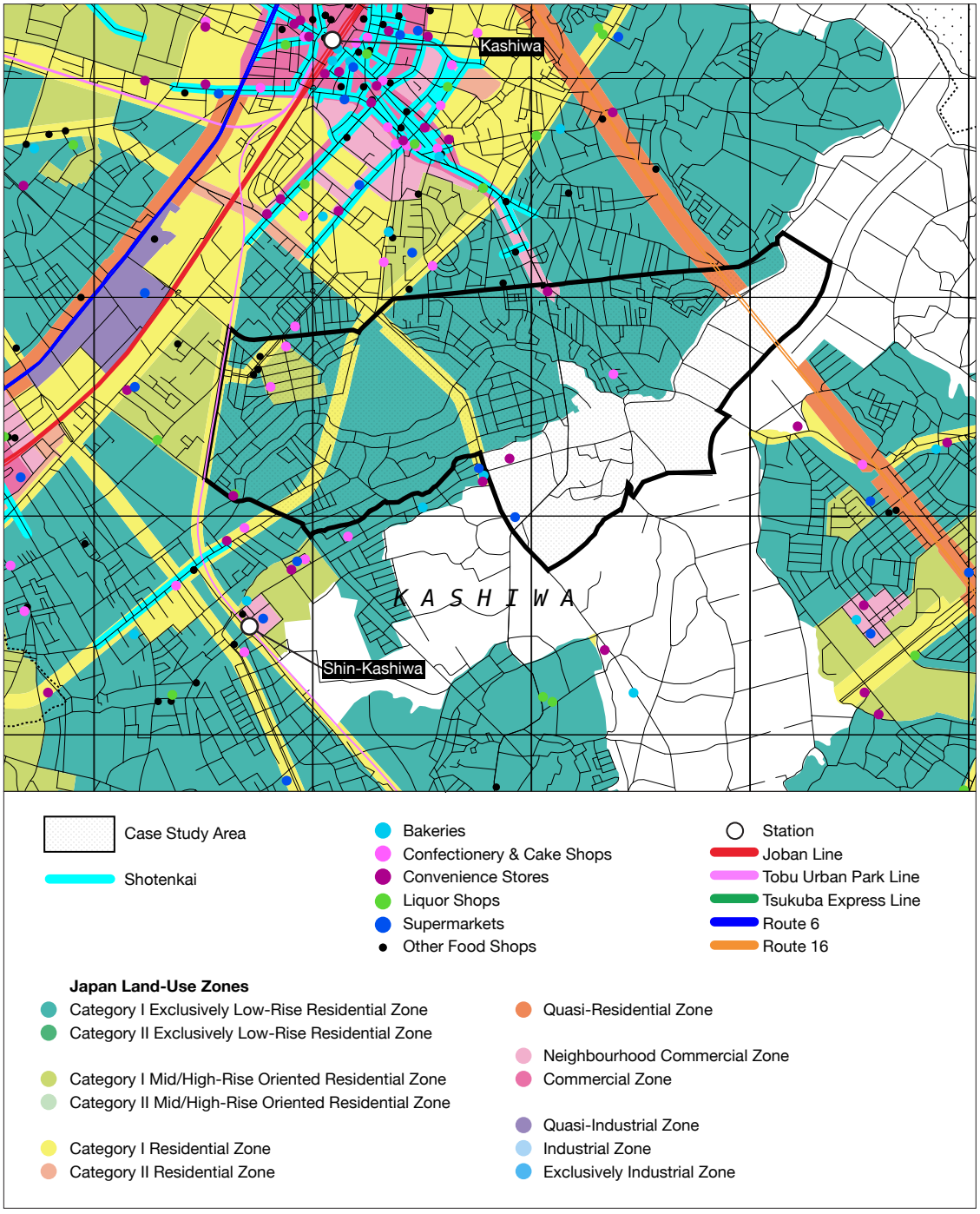


Figure 6.8 Planning & Regulation of Case Study Area C

6.2.4 Case Area D Overview

Hikarigaoka Junior High School is a mature residential area sitting between Minami-Kashiwa Station and Shin-Kashiwa Station. It has a number of defined shopping areas in the form of *shotenkai* shopping streets and around Minami-Kashiwa Station as well as a number of suburban supermarkets and drug stores. Figure 6.9 shows the accumulation of social infrastructure around *shotenkai* areas. As well as the local shopping choices, Route 6 provides ready access by car to Aeon Shopping Mall approximately 1km to the north and Kashiwa Station beyond. Minami-Kashiwa Station is one stop from Kashiwa Station on the Joban Line.

Figure 6.10 shows the zoning for Case Area D. Commercial areas are shown around the stations. Residential areas are zone as low-density and Mid/High-density creating a number of urban textures. Major roads are zoned as Category I Residential allowing for more relaxed commercial restrictions.

	Case Area D
Survey	
Date of Survey	23 ~ 30 January 2015
Number of Questionnaires Distributed	385
Number of Valid Responses	106
Response Rate	27.5%
Household Information	
Average Size of Household (persons)	4.22, sd 0.90
Average Length of Residence (years)	13.29, sd 9.89
Average Number of Dining-Out Trips (weekly)	0.39, sd 0.31
Shopper Information	
Average Age (years)	44.53, sd 5.02
Sex	F: 93.4% M: 2.8%
Average Household Shopping Burden	95.1%, sd 9.31%
Employment Status:	
• Not employed	34.0%
• Part-time (less than 4 days per week)	13.2%
• Full-time (4 or more days per week)	50.9%

Table 6.5 Overview of Shopper Backgrounds - Case Area D

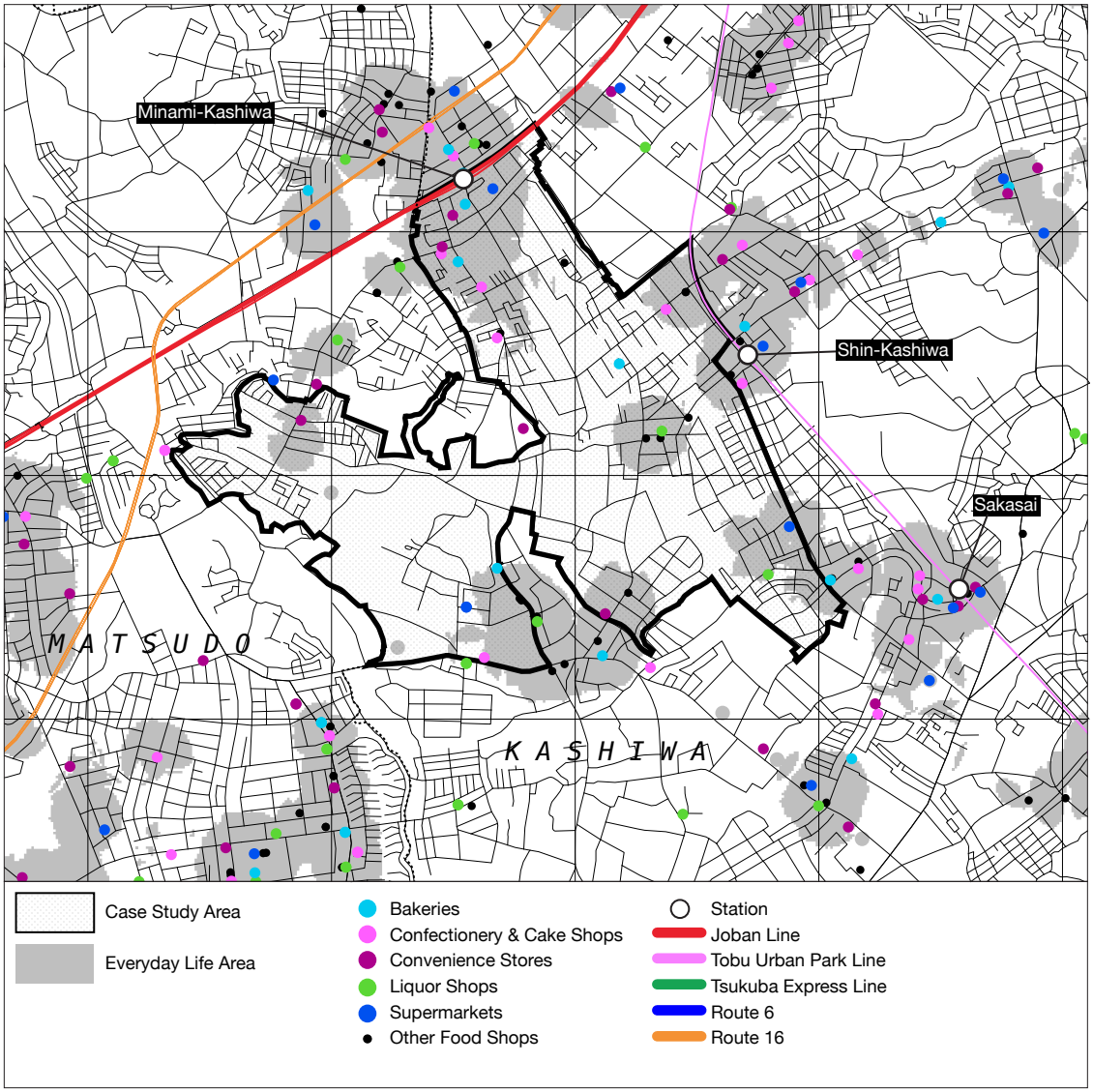


Figure 6.9 Overview of Case Study Area D

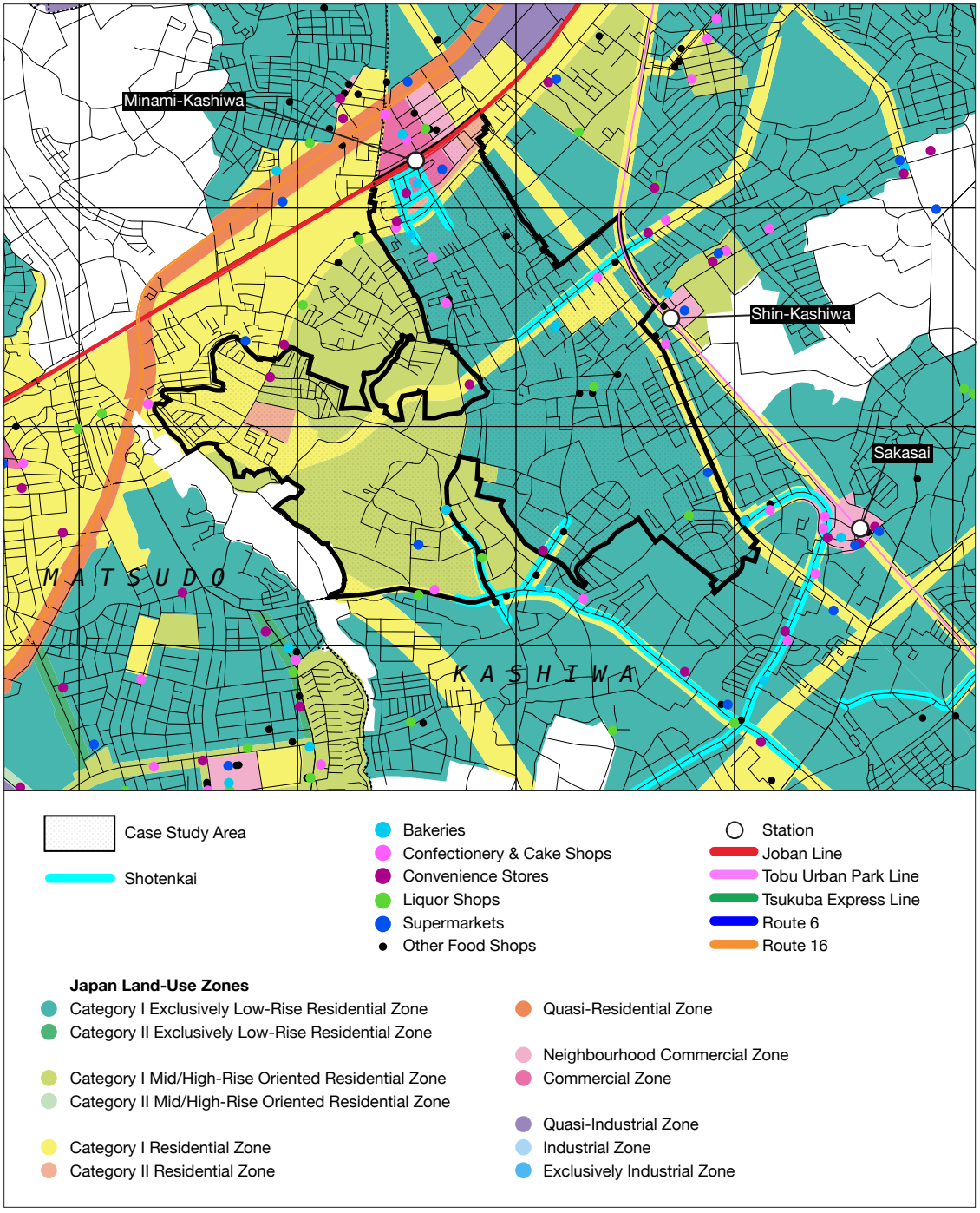


Figure 6.10 Planning & Regulation of Case Study Area D

6.2.5 Case Area E Overview

Kashiwa Junior High School is located around the Kashiwa Station area. It is a mixture of residential and urban conditions. Kashiwa Station is a major commercial hub for the area and an express stop on the Joban Line as well as stop on the Tobu Urban Park Line that connects the suburban areas of Kashiwa.

Figure 6.11 shows the distribution of food shops and daily life for Case Area E. The local food environment consists of major department stores such as Takashimaya around the station, a number of local specialty food shops and shopping streets. Route 6 and Rout 16 provide easy access to major Shopping Malls such as Aeon and Mallage approximately 1.5km and 2.5km from Kashiwa Station respectively.

Figure 6.12 shows the landuse zones for Case Area E. The area surrounding Kashiwa Station is zoned as commercial and the immediate area around it neighbourhood commercial.

	Case Area E
Survey	
Date of Survey	23 ~ 30 January 2015
Number of Questionnaires Distributed	361
Number of Valid Responses	95
Response Rate	26.3%
Household Information	
Average Size of Household (persons)	4.11, sd 0.86
Average Length of Residence (years)	13.01, sd 8.94
Average Number of Dining-Out Trips (weekly)	0.53, sd 0.49
Shopper Information	
Average Age (years)	43.95, sd 4.47
Sex	F: 94.7% M: 1.1%
Average Household Shopping Burden	94.88%, sd 10.41%
Employment Status:	
• Not employed	25.3%
• Part-time (less than 4 days per week)	24.2%
• Full-time (4 or more days per week)	48.4%

Table 6.6 Overview of Shopper Backgrounds - Case Area E.

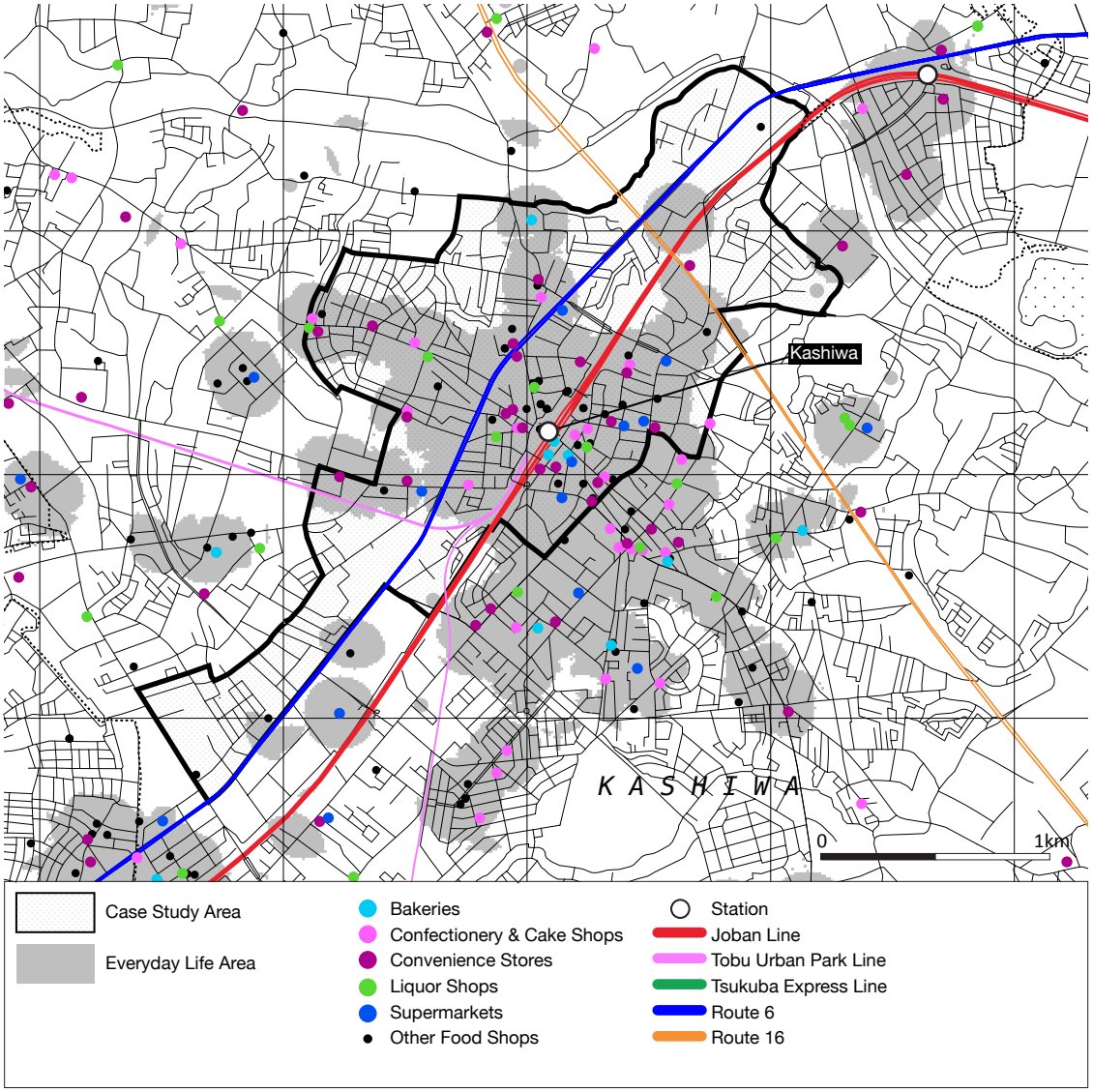


Figure 6.11 Overview of Case Study Area E.

The surrounding residential area are a mixture of low-density, mid/high density urban environments.

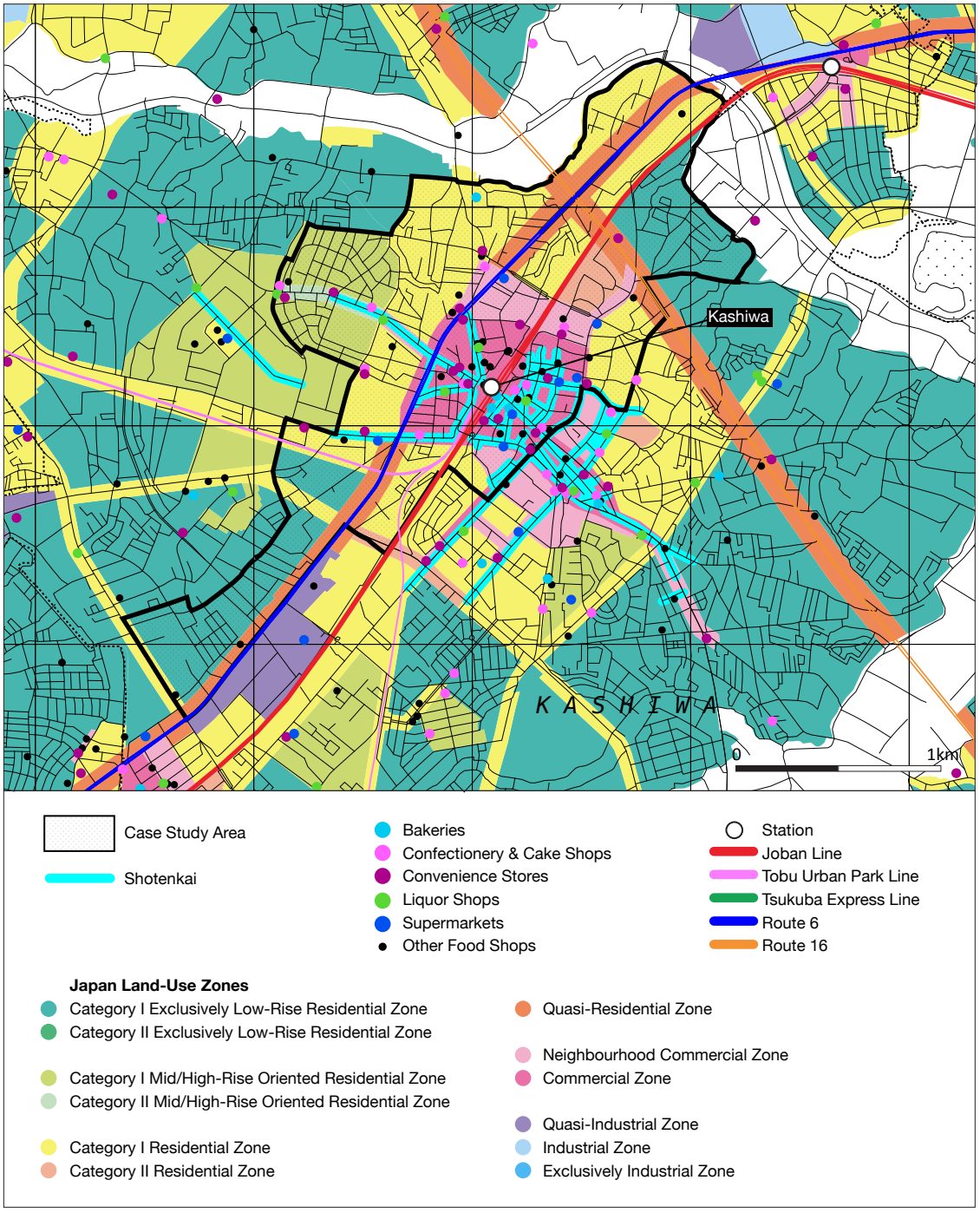


Figure 6.12 Planning & Regulation of Case Study Area E.

6.2.6 Summary

Each of the areas have varying levels of access to food shops. Figure X shows the number of shops accessible for each household. Case Area E has the highest number of food shops locally, that is, within 500m, while Case Area A, Kazahaya JHS, has the lowest number of shops. As the distance increases the difference between the areas becomes clearer. At 1500m Case Area E's options increase at a greater rate than the other areas. Areas B, C and D have similar numbers of choices while the island nature of Kazahaya JHS, Case Area A, becomes more pronounced. At 2500m Areas B, C, D and E have similar numbers of food shopping options whereas Case Area A remains isolated. Therefore, while shopping options are similar in all areas within walking or cycling distance, options increase significantly by car with the exception of Case Area A where, even Even with significant driving time, options for food shopping do not markedly increase.

Table 6.7 summarises the major differences between the case study areas. The five areas can generally be categorised as follows. Case Area A, Kazahaya JHS, is a residential area with few local choices and distant from major shopping areas. Case Areas B, Nanbu JHS, and C, Kashiwa No. 4 JHS, are residential areas without defined shopping areas but within reasonable driving distance of a variety of shopping choices. Case Area D, Hikarigaoka JHS, is a residential area with a number of shopping areas and within driving distance of a number of larger shopping

	Case Area A	Case Area B	Case Area C	Case Area D	Case Area E
Land Use	•Residential Suburban •Rural	•Residential Suburban	•Residential Suburban	•Residential Suburban	•Residential Suburban •Urban
Public Transport	•Bus	•Bus	•Bus	•Bus •Local Train	•Bus •Local Train •Express Train
Defined Shopping Areas	No	No	No	Few	Many
Local Shopping Options	•Roadside •Suburban Chains	•Suburban Chains	•Suburban Chains	•Suburban Chains •Local Shops •Shotenkai	•Local Shops Shopping Centres •Shotenkai •Department Stores
Nearby Shopping Options	No	Few	Few	Some	Many
Summary	**Island Roadside**	**Isolated Suburban**	**Peripheral Suburban**	**Central Suburban**	**Major Urban**

Table 6.7 Summary of Urban Structure by Case Study Area.

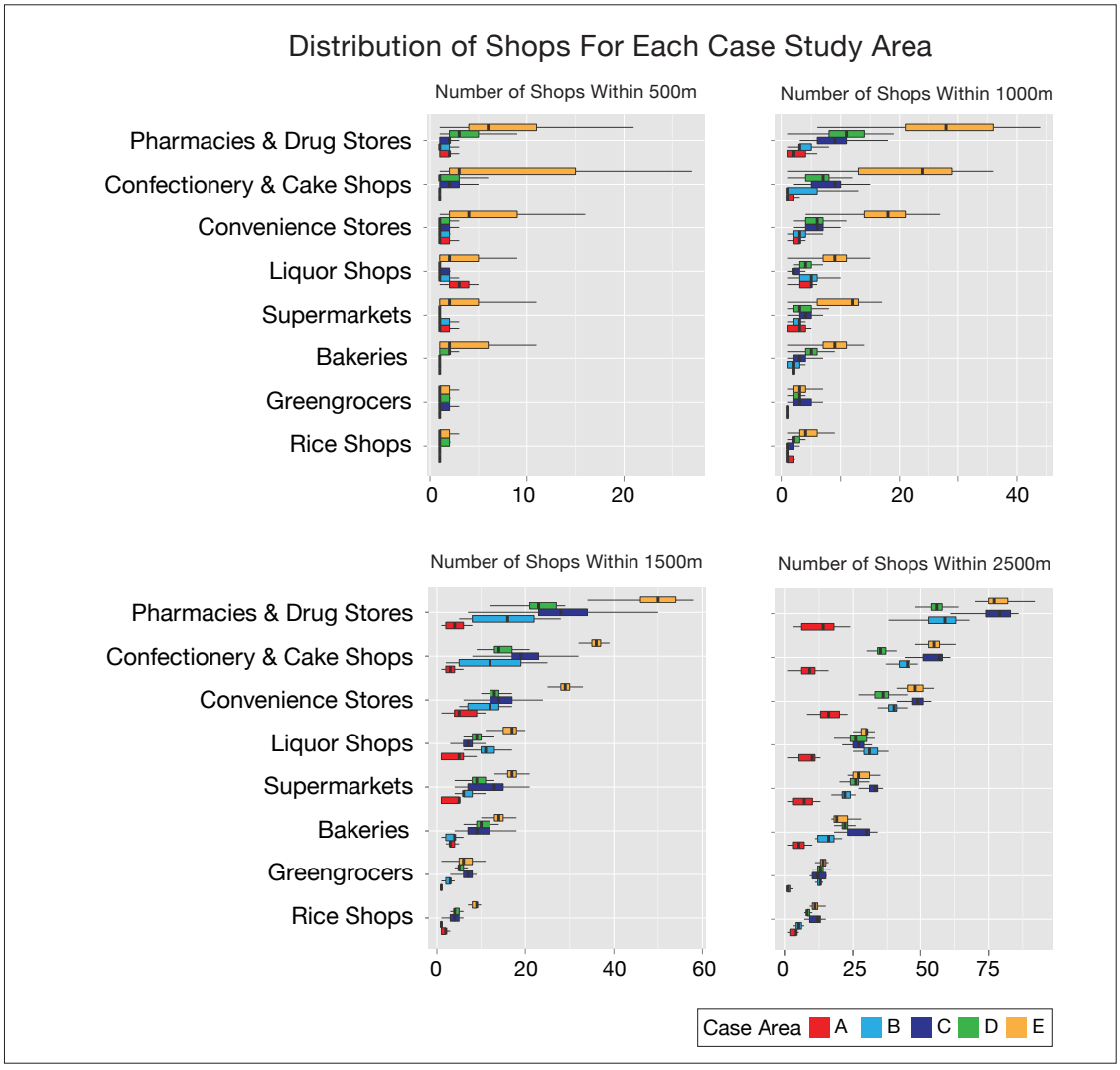


Figure 6.13 Distribution of Shops by Case Study Area.

areas. Case Area E, Kashiwa JHS, is a mixture of residential and denser urban environments with a number of shopping options including department stores and shopping malls as well as smaller local shops.

As a result we can describe Case Area A as an 'island roadside' environment. Areas B, C and D are predominantly low-density residential areas. Their urban environments vary in terms of the number and distribution of food shops. Area B contains a few food shops but lacks a defined shopping area. A number of small shopping areas are accessible within short driving distance so this area can be considered 'isolated suburban'. Area C similarly has no defined shopping area but is within short driving distance of a major shopping area at Kashiwa Station as well as Aeon

Shopping Mall, and smaller shopping areas at Shin-Kashiwa Station. It is therefore labelled ‘Peripheral Suburban’.

In contrast to Areas B and C, Area D has many local shopping areas in the form of *shotenkai* and suburban supermarkets. It has ready access to Aeon Shopping Mall. It can therefore be considered a ‘central suburban’ environment.

Finally, Case Area E is a major shopping destination not only for the immediate area but also the wider city. As a result, it is labelled ‘Major Urban’.

6.3 Summary

The five areas can generally be categorised as follows. Kazahaya is a residential area with few local choices and distant from major shopping areas. Nanbu and Kashiwa No. 4 are residential areas without defined shopping areas but within reasonable driving distance of a variety of shopping choices, Hikarigaoka is a residential area with a few shopping areas and within driving distance of a number of larger shopping areas, and Kashiwa is a mixture of residential and denser urban environments with a number of shopping options including department stores and shopping malls as well as smaller local shops.

Each of the areas have varying levels of access to food shops. Kashiwa has the highest number of food shops locally. Kazahaya has the least amount of shops. While Kashiwa has the greatest number of shops at a local level, at a range of 2500 metres Nanbu, Hikarigaoka and Kashiwa No. 4 have comparable numbers, therefore within driving distance a number of shopping choices are available. In contrast, Kazahaya has significantly less accessible shops at 2500 metres reflecting it's 'island' nature. Even with significant driving time, options for food shopping do not markedly increase.

7

Findings

This chapter presents the results of this research. The analysis is divided into three sections; the shopping behaviour of households in each of the five areas, the structural analysis of the foodscapes for each of the case study areas, and finally a comparison of the areas.

The shopping behaviour of households investigates the variation of shopping routines across each of the case study areas. This is done by evaluating the number of shopping trips per week, the number of shops a household uses to meet their food shopping needs and the main motivations for choosing particular shops. The shops listed in the response to the questionnaire are mapped and travel distances calculated. Significantly, values for travel distances and degree, that is the number of households that use a particular shop, is weighted by each respondents level of association to that shop. This weighting provides a more finely detailed image of the distribution of each areas shopping behaviour.

It is important to note that the degree measures discussed above reflect the direct relationship between a household and a shop. In contrast to other structural measures such as betweenness centrality and local clustering coefficients where relationships between other nodes in the network affect scores, degree values are independent of other nodes in the network. This kind of calculation is similar to more traditional methods of calculating the importance of shops, that is, by evaluating a shops importance by the number of customers, sales revenue or floor area.

7.1 The Shopping Behaviour of Households

This section investigates the overall shopping habits of households for each case area. Based on the responses to the questionnaire distributed to junior high schools in each of the five case study areas information regarding the shopping frequency, shop choice and motivating factors can be analysed.

The questionnaire asked respondents to name specific shops, degrees of attachment or association to those shops. These degrees of association were used to weight ties between households and shops to give a weighted degree score. The weighted degree score for each shop reflects the aggregated association by a community to a shop normalised by the sample group size. From these responses the location of shops can also be mapped and travel distances extracted. A weighted travel distance was calculated by multiplying the actual travel distance by the proportion of degree values associated to that shop. The weighted travel distance acknowledges the varying strengths of ties between shops and households. This list of shops can also be used to extract information about the number of food types purchased, and the number of shops used by each household.

In addition the questionnaire also asked respondents to give up to three reasons for choosing each shop as well as the average number of shopping trips per week. This gives insight into the variation of shopping routines and motivations for shopping among the case study areas.

This investigation aims to clarify how associations to food are mapped onto food shops in each of the case areas as well as how daily routines, in the form of shopping trips, the number of shops used and the motivations for shop choices, vary between households.

7.1.1 Case Area A

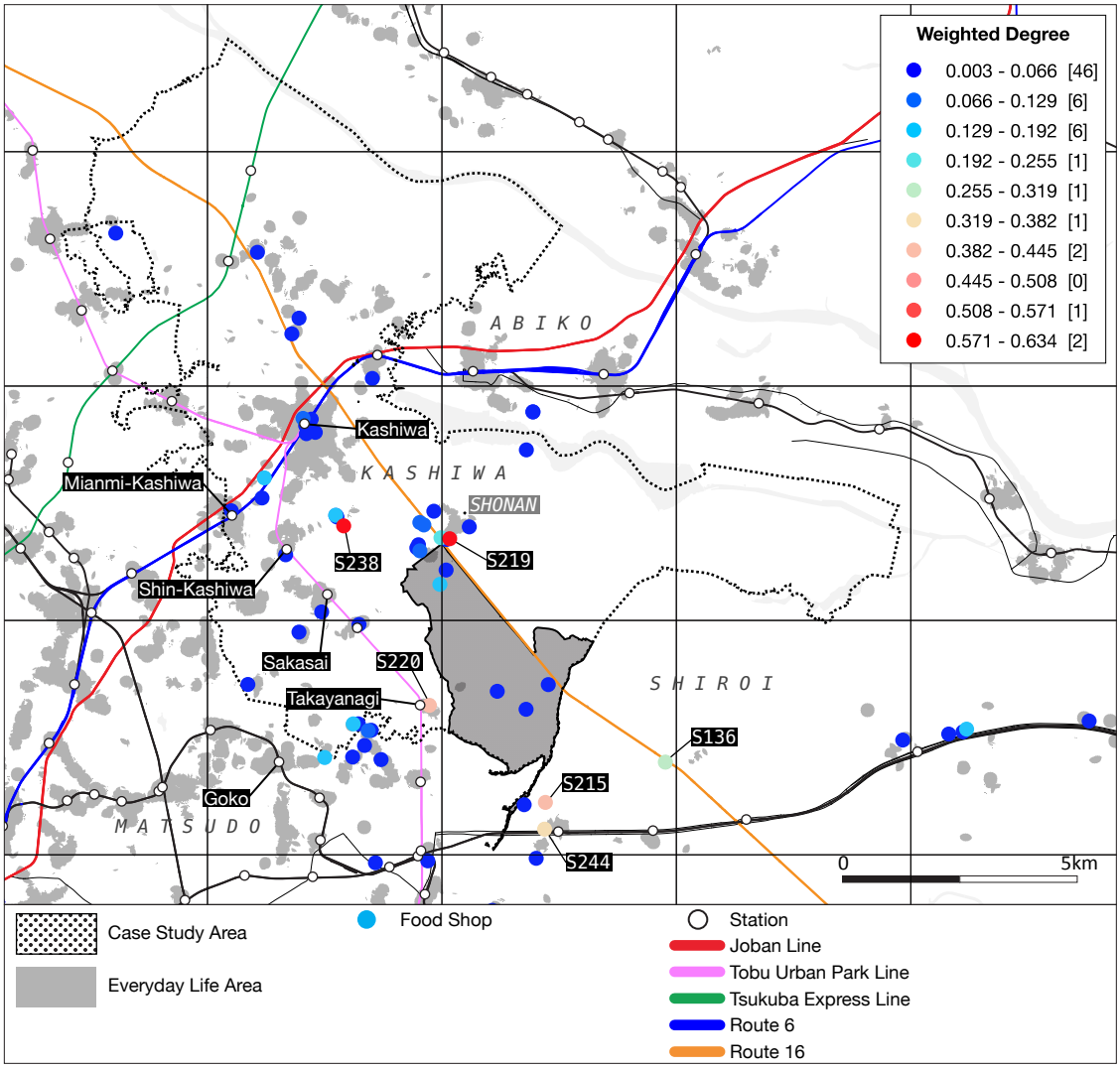
Food shopping in Case Area A, Kazahaya JHS, while dominated by supermarkets, in contrast to other case areas is spread evenly across a number of shops. Apart for the old Shonan City centre area, there are no shopping areas even within short driving distance. Route 16, a major arterial route running through the Kazahaya area provides access to shopping areas at Kashiwa Station and Chiba-Newtown, an area with large hypermarkets such as Costco, almost 10km away.

Table 7.1.1 shows the average shopping behaviour for respondents to the questionnaire. Respondents make on average 3.72 shopping trips per week and use 5.88 different shops to meet their food needs. The average distance travelled to food shops is the largest of all the areas, 3.066km. The weighted travel distance, that is the travel distance weighted by degree of association, is 2.514km.

	All Respondents
Number of Shopping Trips Per Week	3.72, sd 1.77
Number of Major Shopping Trips Per Week	1.08, sd 0.88
Number of Food Types Purchased	8.80, sd 1.02
Number of Shops Used	5.88, sd 2.85
Average Distance to Shops (km)	3.066, sd 1.472
Average Weighted Distance to Shops (km)	2.514, sd 1.306

Table 7.1.1 General Household Shopping Behaviour - Case Area A.

Figure 7.1.2 shows the location of food shops. The nodes are coloured by weighted degree and the food shops with values in the 90th percentile are notated. Food shops for Case Area A are dispersed across a wide distance in varying directions. Of these eight shops seven are supermarkets, the other being Co-op. The shop with the highest weighted degree score, Maruya (Shonan), part of a suburban supermarket chain, is located locally in the old Shonan City Centre area and the second highest scoring shop York-Mart (Shin-Kashiwa) lies 2km from Maruya in a



ID	Shop Name	Shop Type	Dw	Location	Products	Service	Other
S219	Maruya (Shonan)	Supermarket	0.634	0.34	0.36	0.29	0
S238	York-Mart (Shin-Kashiwa)	Supermarket	0.608	0.62	0.14	0.24	0
S292	Co-op	Delivery & Consumer Co-ops	0.529	0.55	0.31	0.12	0.02
S215	Maruei (Shiroi)	Supermarket	0.427	0.63	0.16	0.11	0.11
S220	Maruya (Takayanagi)	Supermarket	0.424	0.5	0.18	0.2	0.13
S244	Landrome (Nishi-Shiroi)	Supermarket	0.331	0.5	0.3	0.17	0.02
S136	Taiyo (Shiroi)	Supermarket	0.285	0.51	0.39	0.1	0
S166	Big A (Otsugaoka)	Supermarket	0.23	0.38	0.32	0.3	0

Figure 7.1.1 Location of Food Shops by Weighted Degree - Case Area A
Location of food shops for all food types. Colour of nodes reflects weighted degree values. Case Area A has an even distribution of food shops.

roadside area. Other prominent shops are located near Takayanagi and Nishi-Shiroi Stations as wells along Route 16.

7.1.2 Case Area B

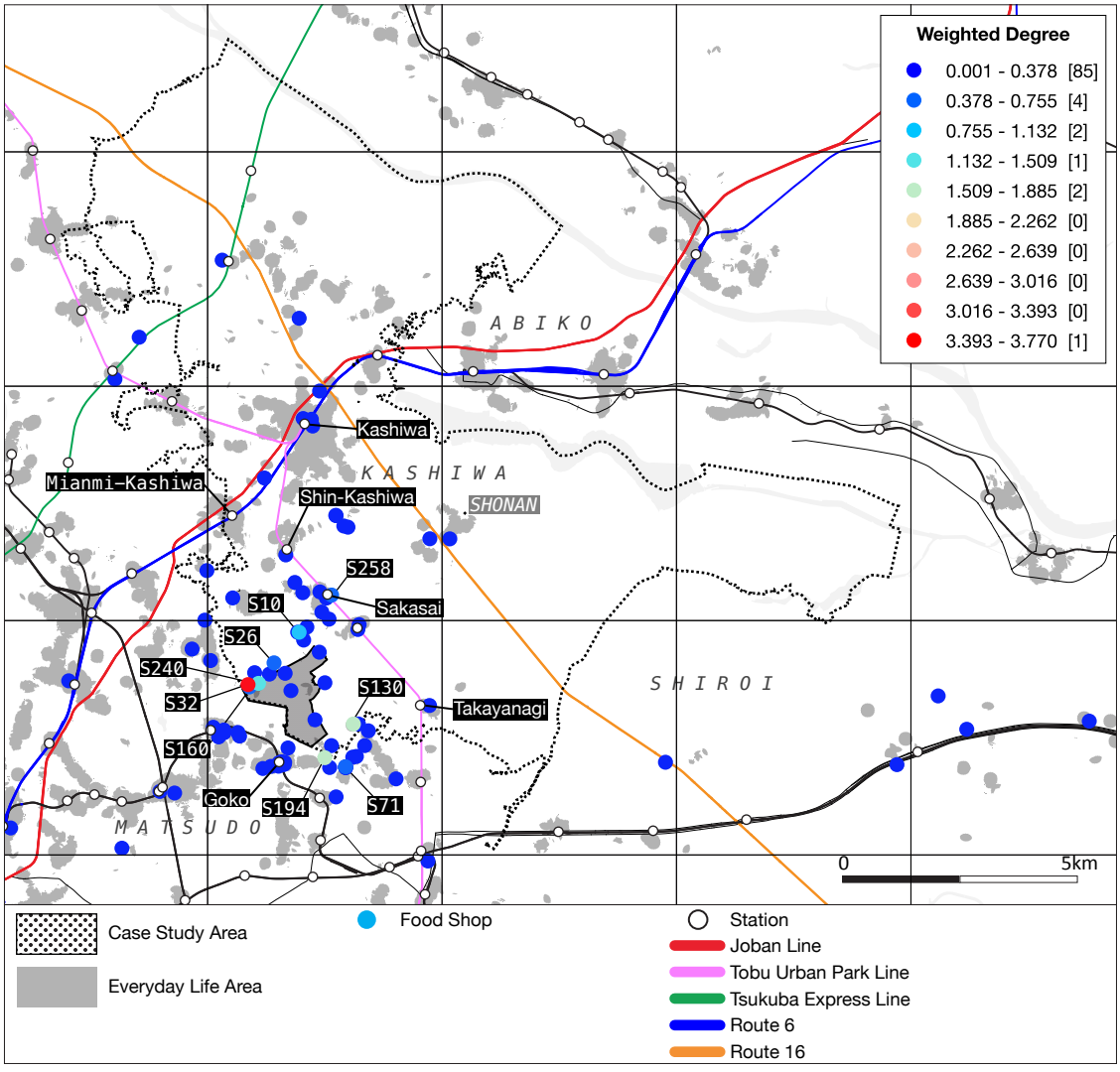
Case Area B, Nanbu JHS, while not having a defined shopping area within it's catchment area, has reasonable access to food shops in most directions. Goko Station on the Shin-Keisei Line lies to the south of the case area and Sakasai Station on the Tobu Urban Park Line lies to the east. Between these two shopping areas lie a number of suburban supermarkets, drug stores and discount shops and the major urban route 51.

Table 7.1.2 shows the shopping behaviour for respondents to the survey. Households make 3.95 shopping trips per week on average to 4.99 different food shops. As a reflection of the lack of local shopping choices, the average travel distance is 1.978km and 1.516km when weighted by the degree of use.

	All Respondents
Number of Shopping Trips Per Week	3.95, sd 1.80
Number of Major Shopping Trips Per Week	1.00, sd 0.94
Number of Food Types Purchased	8.85, sd 1.07
Number of Shops Used	4.99, sd 2.55
Average Distance to Shops (km)	1.978, sd 1.704
Average Weighted Distance to Shops (km)	1.516, sd 1.346

Table 7.1.2 General Household Shopping Behaviour - Case Area B.

Figure 7.1.2 shows the location of shops used for food shopping for households in Case Area B. Food shopping is dominated by supermarkets. The local suburban supermarket York-Mart (Aobadai) dominates. The food shop with the fourth highest weighted degree value, Hallo!Mart (Minami-Masuo) lies less than 200m away. The other two major supermarkets, Selection (Shinokidai) and Belx (Goko) are located in the same cluster of shops to the south of the Nanbu area.



ID	Shop Name	Shop Type	Dw	Location	Products	Service	Other
S240	York-Mart (Aobadai)	Supermarket	3.77	0.54	0.25	0.18	0.04
S130	Selection (Shiinokidai)	Supermarket	1.602	0.48	0.45	0.07	0.01
S194	BeLX (Goko)	Supermarket	1.589	0.65	0.3	0.04	0.01
S160	Hallo!Mart (Minami-Masuo)	Supermarket	1.36	0.49	0.29	0.18	0.03

Figure 7.1.2 Location of Food Shops by Weighted Degree - Case Area B.
Location of food shops for all food types. Colour of nodes reflects weighted degree values. Case Area A has an even distribution of food shops.

7.1.3 Case Area C

Food shopping in Case Area C, Kashiwa No. 4 JHS, is dominated by the supermarket York-Mart (Shin-Kashiwa). Case Area C is a suburban residential area without a major shopping area. There are a number of shopping options locally at Shin-Kashiwa Station and within driving or commuting distance at Kashiwa Station.

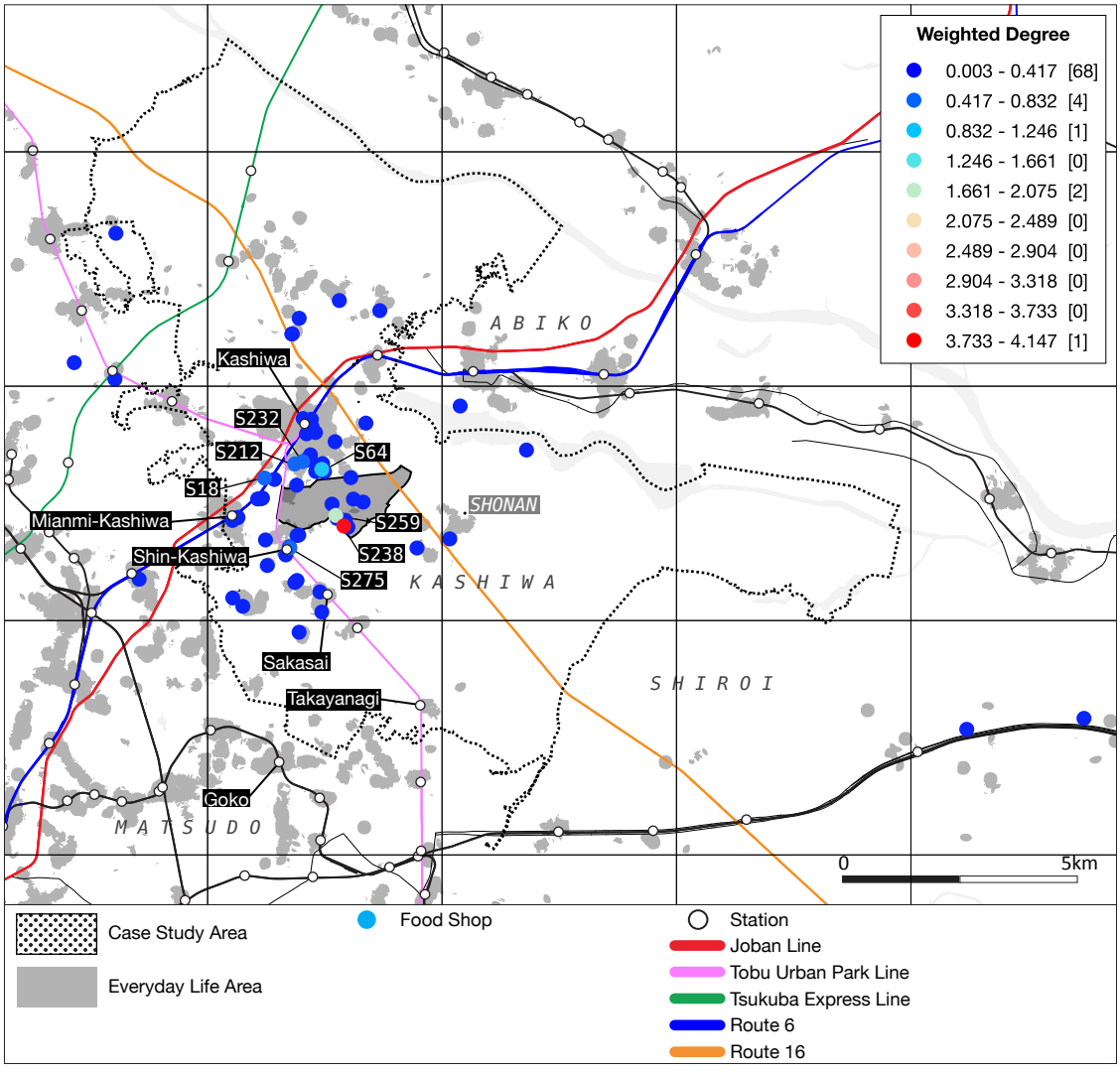
Table 7.1.3 shows the shopping behaviour for Case Area C. Respondents make on average 4.30 shopping trips per week and use 6.06 different shops to meet their needs. The average travel distance to food shops is 1.443km, and when weighted by the level of association, 1.132km.

Figure 7.1.3 shows the location of food shops used by respondents. The location of shops is spread in all directions around the case area, with clusters of shops around Shin-Kashiwa Station, in a suburban area within the Kashiwa No.4 catchment area and in a suburban area

	All Respondents
Number of Shopping Trips Per Week	4.30, sd 1.87
Number of Major Shopping Trips Per Week	0.86, sd 0.91
Number of Food Types Purchased	8.81, sd 1.20
Number of Shops Used	6.06, sd 2.42
Average Distance to Shops (km)	1.443, sd 1.046
Average Weighted Distance to Shops (km)	1.132, sd 0.926

Table 7.1.3 General Household Shopping Behaviour - Case Area C.

lying on a major road connecting the case study area to Kashiwa Station 1.5km away. York-Mart (Shin-Kashiwa), the food shop with the highest weighted degree score, is a roadside suburban supermarket located approximately 1.5km from Shin-Kashiwa Station. The second highest score, Watanabe (Shin-Kashiwa) is located on the same road less than 300m away.



ID	Shop Name	Shop Type	Dw	Location	Products	Service	Other
S238	York-Mart (Shin-Kashiwa)	Supermarket	4.147	0.65	0.25	0.08	0.02
S259	Watanabe (Shin-Kashiwa)	Supermarket	1.749	0.55	0.41	0.02	0.01
S292	Co-op	Delivery & Consumer Co-ops	1.695	0.35	0.41	0.02	0.22

Figure 7.1.3 Location of Food Shops by Weighted Degree - Case Area C.
Location of food shops for all food types. Colour of nodes reflects weighted degree values. Case Area A has an even distribution of food shops.

7.1.4 Case Area D

Case Area D, Hikarigaoka JHS, has ready access to train stations at Minami-Kashiwa and Shin-Kashiwa and a number of large supermarkets, drug stores and discount shops. Aeon Shopping Mall lies 1km north of Minami-Kashiwa Station.

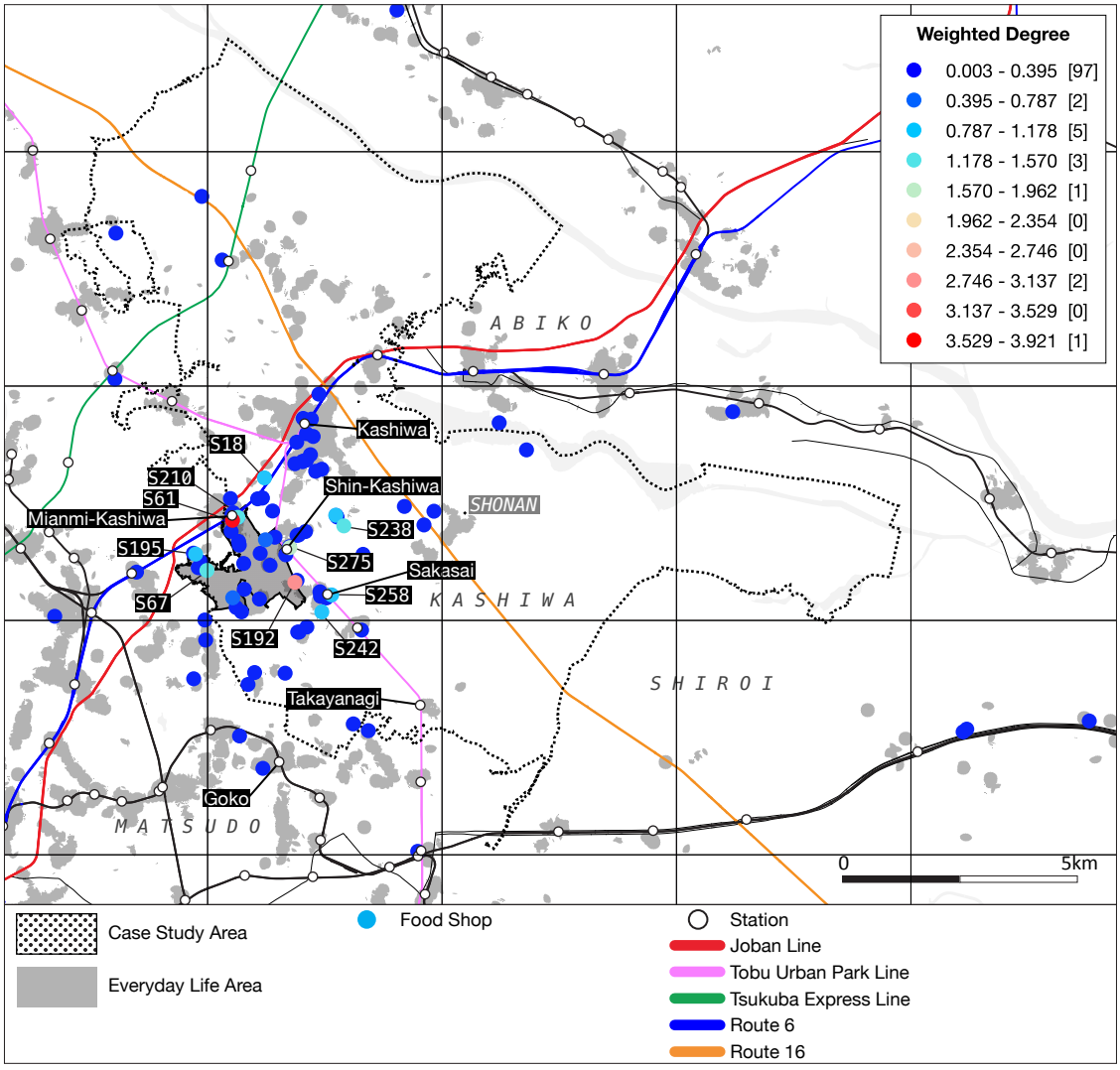
Table 7.1.4 shows the average shopping behaviour for households in Area D. Respondents make 4.17 shopping trips per week on average with an average travel distance of 2.034km and an average weighted travel distance of 1.227km. The high number of shopping trips and the low travel distances are reflective of the high number of shop choices in the area.

Figure 7.1.4 shows the distribution of food shops used by respondents. Shopping within this area occurs mainly nearby among the plethora of suburban supermarkets. Of the seven shops with weighted degree values in the 90th percentile, six of them are supermarkets, the

	All Respondents
Number of Shopping Trips Per Week	4.17, sd 1.89
Number of Major Shopping Trips Per Week	1.09, sd 0.95
Number of Food Types Purchased	9.08, sd 0.95
Number of Shops Used	5.99, sd 2.45
Average Distance to Shops (km)	2.034, sd 2.087
Average Weighted Distance to Shops (km)	1.227, sd 0.944

Table 7.1.4 General Household Shopping Behaviour - Case Area D.

seventh shop being Co-op. Kasumi (Minami-Kashiwa) is located at Minami-Kashiwa Station. Belx (Tsukushigaoka) is located inside the Hikarigaoka JHS catchment area, however York-Mart (Shin-Kashiwa) is located more than 2km from Minami-Kashiwa Station and more than 1km from Shin-Kashiwa Station.



ID	Shop Name	Shop Type	Dw	Location	Products	Service	Other
S61	Kasumi (Minami-Kashiwa)	Supermarket	3.921	0.65	0.24	0.1	0.02
S292	Co-op	Delivery & Consumer Co-ops	3.121	0.31	0.37	0.15	0.17
S192	BeLX (Tsukushigaoka)	Supermarket	2.86	0.69	0.23	0.05	0.03
S275	Tobu Store (Shin-Kashiwa)	Supermarket	1.603	0.57	0.18	0.22	0.03
S210	Mami-Mart (Minami-Kashiwa)	Supermarket	1.417	0.54	0.22	0.17	0.08
S238	York-Mart (Shin-Kashiwa)	Supermarket	1.256	0.6	0.23	0.09	0.08
S67	Kasumi (Nakashinjuku)	Supermarket	1.24	0.7	0.21	0.09	0

Figure 7.1.4 Location of Food Shops by Weighted Degree - Case Area D
Location of food shops for all food types. Colour of nodes reflects weighted degree values. Case Area A has an even distribution of food shops.

7.1.5 Case Area E

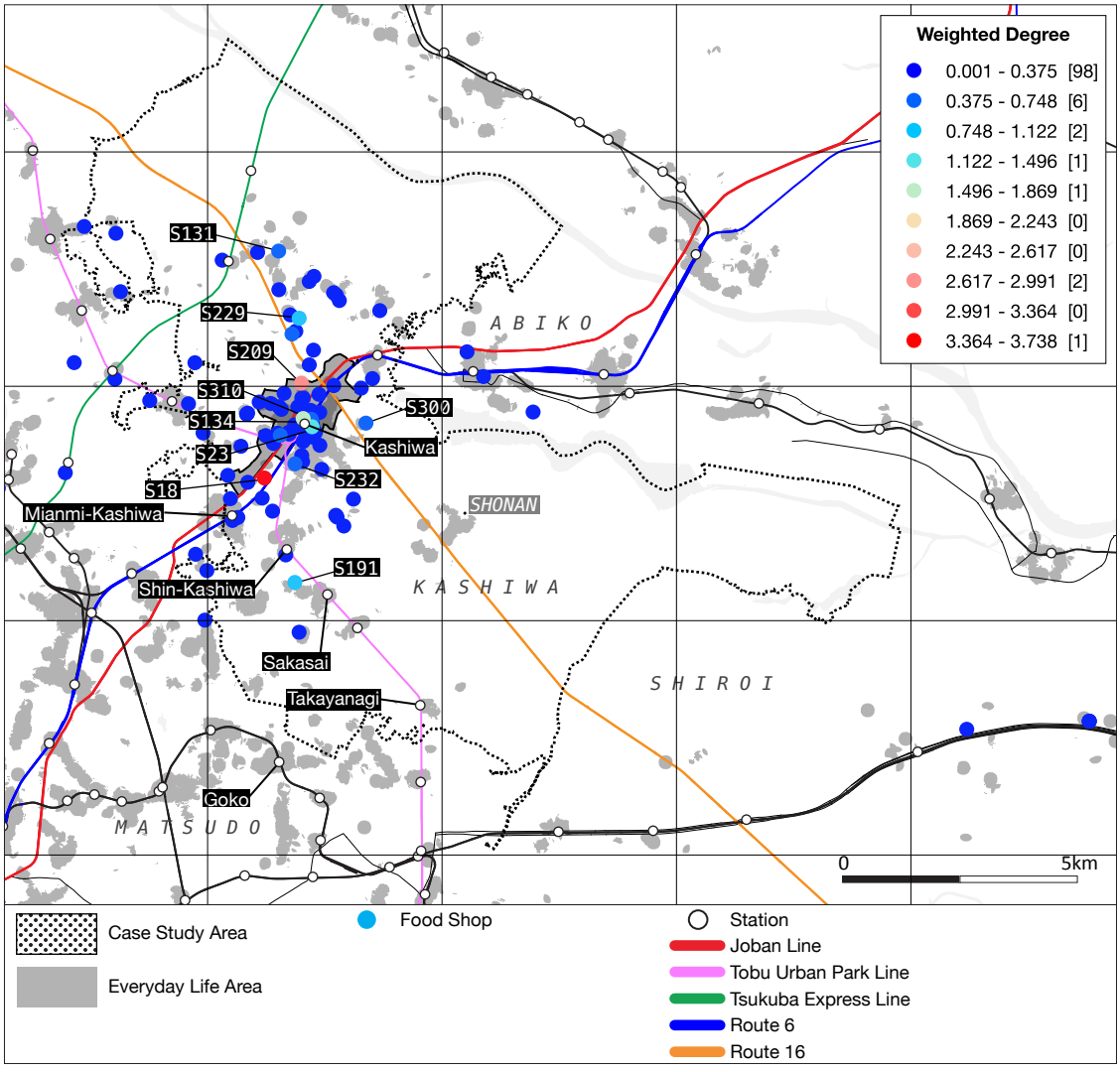
Case Area E, Kashiwa JHS, accommodates a number of shopping choices from major department stores to large suburban shopping malls and local shopping streets. It is intersected by two major arterial routes, Routes 6 and 16, as well as two train lines; the Joban Line that connects to Tokyo and the Tobu Urban Park Line which provides access to the local suburban areas of Kashiwa. Food shopping for the Kashiwa JHS area centres largely on the Kashiwa Station area and along the major arterial routes Route 6 and Route 16.

Table 7.1.5 shows the typical shopping routines for households. Respondents to the survey made on average 3.66 shopping trips per week and used 5.31 shops with a standard deviation of 2.17 to meet their food shopping needs. The average weighted distance between households and shops is 1.310km with a standard deviation of 1.032km.

	All Respondents
Number of Shopping Trips Per Week	3.66, sd 1.72
Number of Major Shopping Trips Per Week	1.06, sd 0.93
Number of Food Types Purchased	8.95, sd 1.01
Number of Shops Used	5.31, sd 2.17
Average Distance to Shops (km)	1.764, sd 1.640
Average Weighted Distance to Shops (km)	1.310, sd 1.032

Table 7.1.5 General Household Shopping Behaviour - Case Area E.

Figure 7.1.5 shows the location of food shops for Case Area E. Node colours represent weighted degree scores. Shops in the 90th percentile range are notated. Weighted degree scores reveal that there are five major shops. Aeon Shopping Mall, located 1.5 km south of Kashiwa Station is the most strongly recognised food shop followed by Co-op, the suburban supermarket Mami-Mart (Akebono), the large Department Store at Kashiwa Station, Takashimaya, and Ito-Yokado, a supermarket located near Kashiwa Station.



ID	Shop Name	Shop Type	Dw	Location	Products	Service	Other
S18	Aeon Mall (Kashiwa)	Shopping Malls & Department Stores	3.738	0.66	0.19	0.14	0.01
S292	Co-op	Delivery & Consumer Co-ops	2.865	0.35	0.39	0.04	0.22
S209	Mami-Mart (Akebono)	Supermarket	2.681	0.59	0.21	0.19	0.01
S310	Takashimaya (Kashiwa)	Shopping Malls & Department Stores	1.753	0.29	0.59	0.05	0.07
S23	Ito-Yokado (Kashiwa)	Supermarket	1.481	0.55	0.24	0.18	0.03

Figure 7.1.5 Location of Food Shops by Weighted Degree - Case Area D.
Location of food shops for all food types. Colour of nodes reflects weighted degree values. Case Area A has an even distribution of food shops.

7.1.6 Comparison and Summary

The shopping behaviour of households in each of the case study areas is largely consistent. Table 7.1.6 shows a summary of shopping behaviour. The number of shopping trips ranges from 3.66 in Area E to 4.3 in Area C. The two lowest values, 3.66 in Area E and 3.72 in Area A correspond to the areas with the highest number of shop choices and the lowest number of shop choices respectively. Furthermore, the number of shops used ranges from 4.99 in Area B to 6.06 in Area C where Area E households use 5.31 shops on average compared to 5.88 in Area A.

Considering the time constraints involved in travelling large distances for food shopping, the variation in the number of accessible shops does not influence the number of shopping trips nor the number of shops used by the households surveyed.

Figure 7.1.6 shows a comparison of reasons given for shop choices. As shown, the motivations for shop choice are uniform across each of the areas in that there is little variation within reasons. Furthermore, in each of the areas, the top for reasons for shop choice are consistent; combined food shopping ("I buy other food at the same time"), proximity to home ("It's near my home"), price ("It's cheap") and the quality of products ("The products are high in quality"). Combined food shopping is the main reason for shop choice in all of the areas, and the remaining top four

	Area A	Area B	Area C	Area D	Area E
Number of Shopping Trips Per Week	3.72, sd 1.77	3.95, sd 1.80	4.30, sd 1.87	4.17, sd 1.89	3.66, sd 1.72
Number of Major Shopping Trips Per Week	1.08, sd 0.88	1.00, sd 0.94	0.86, sd 0.91	1.09, sd 0.95	1.06, sd 0.93
Number of Food Types Purchased	8.80, sd 1.02	8.85, sd 1.07	8.81, sd 1.20	9.08, sd 0.95	8.95, sd 1.01
Number of Shops Used	5.88, sd 2.85	4.99, sd 2.55	6.06, sd 2.42	5.99, sd 2.45	5.31, sd 2.17
Average Distance to Shops (km)	3.066, sd 1.472	1.978, sd 1.704	1.443, sd 1.046	2.034, sd 2.087	1.764, sd 1.640
Average Weighted Distance to Shops (km)	2.514, sd 1.306	1.516, sd 1.346	1.132, sd 0.926	1.227, sd 0.944	1.310, sd 1.032

Table 7.1.6 Comparison of Shopping Behaviour by Area

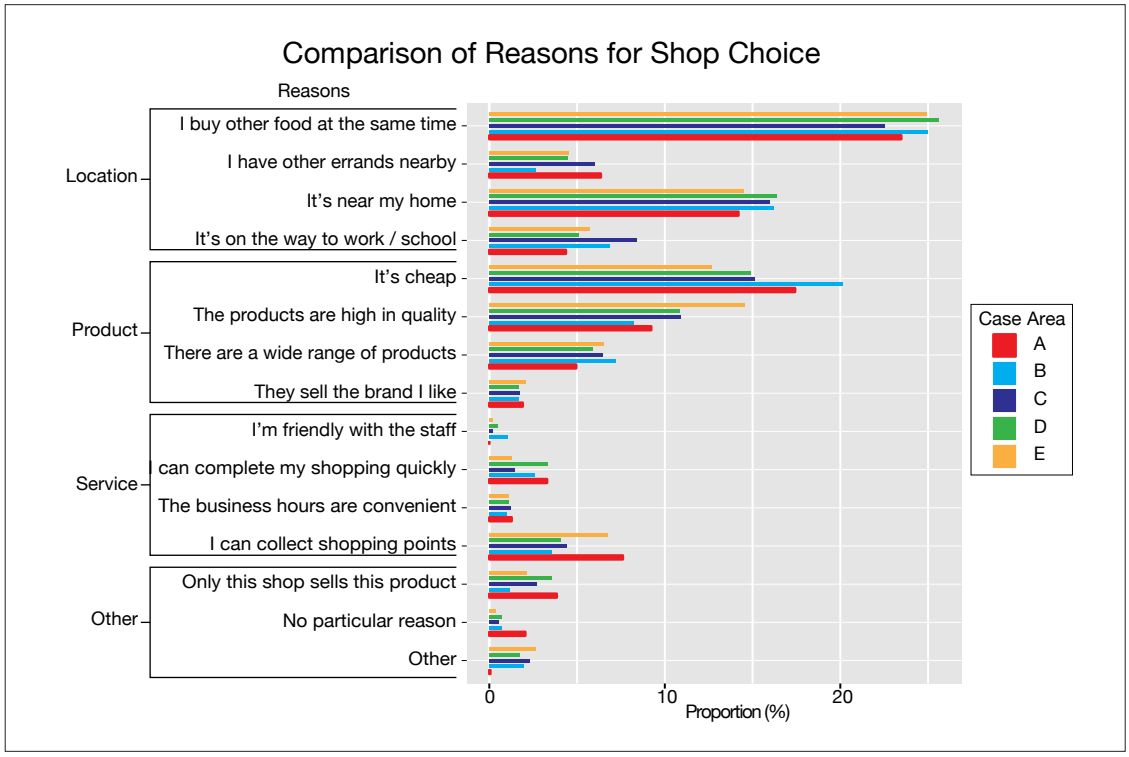


Figure 7.1.6 Comparison of Reasons for Shop Choice
Respondents were asked to give up to three reasons for shop choices for each of the food types. This graph shows the aggregated proportion of reasons for all food types.

reasons are ranked slightly differently. Despite the large differences in travel distances all of the areas rank proximity to home as one of the main motivations for shop choice.

In contrast to the uniformity of shopping routines across the five case ares, the location of food shops does vary by each case study area. Figure7.1.7 shows that Case Areas A and B, the areas with the fewest food shop choices, have the greatest travel distances. Rather than concentrating their food shopping activities on the few local shops available, the weighted distance values show that these areas are prepared to travel great distances to meet their food shopping needs. Areas with more shop choices generally involve shorter travel distances.

Table 7.1.7 summarises each of the case study areas. Supermarkets dominate all of the case area foodscapes. The distribution of weighted degree scores also varies across case areas where Area A has the most even distribution and Area C has the most disproportionate balance of scores. By mapping the location of the food shops the spatial distribution can be visualised. Area A has the most dispersed distribution of shops, a reflection of the lack of local choices that necessitate greater travel distances. Area C has the most condensed foodscape. While Area E as

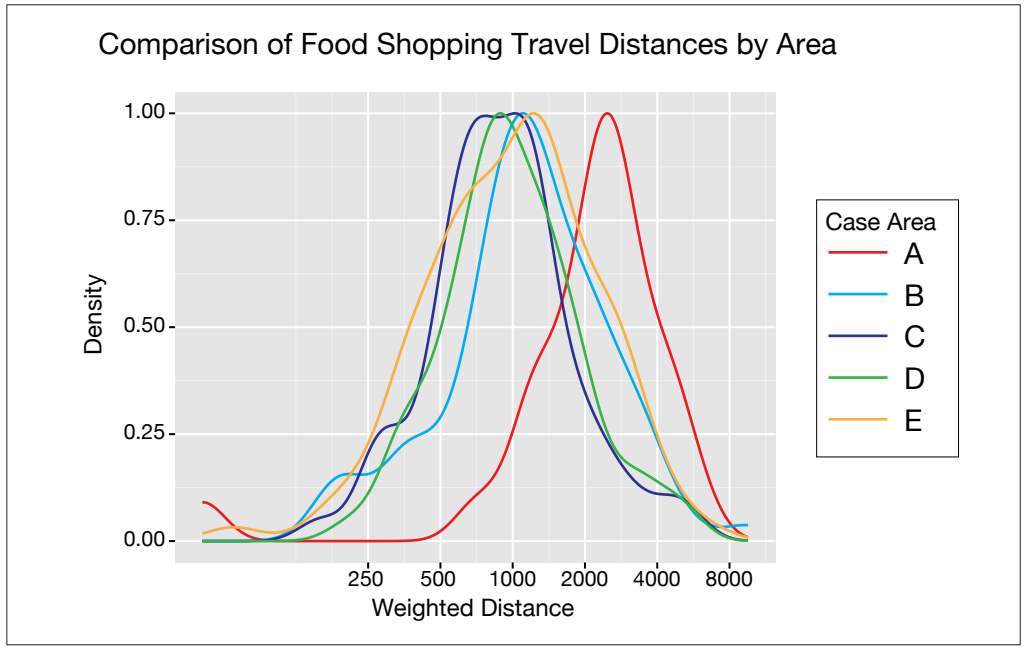


Figure 7.1.7 Comparison of Distribution of Weighted Distance Values

the greatest abundance of food shop choices, in contrast to Area C, it is has ready access to other areas via major arterial routes and train lines. As a result Aeon Shopping Mall, despite being relatively distant from the centre of Areas E's centre, has the highest weighted degree value. Co-op features in the 90th percentile for four of the five areas reflecting its embeddedness even in areas with many shop choices.

	Case Area A	Case Area B	Case Area C	Case Area D	Case Area E
Land Use	•Residential Suburban •Rural	•Residential Suburban	•Residential Suburban	•Residential Suburban	•Residential Suburban •Urban
Public Transport	•Bus	•Bus	•Bus	•Bus •Local Train	•Bus •Local Train •Express Train
Defined Shopping Areas	No	No	No	Few	Many
Local Shopping Options	•Roadside •Suburban Chains	•Suburban Chains	•Suburban Chains	•Suburban Chains •Local Shops •Shotenkai	•Local Shops Shopping Centres •Shotenkai •Department Stores
Nearby Shopping Options	No	Few	Few	Some	Many
Summary	**Island Roadside**	**Isolated Suburban**	**Peripheral Suburban**	**Central Suburban**	**Major Urban**

Table 7.1.7 Summary of Shopping Behaviour by Area

7.2 Structural Analysis of Foodscapes

This section looks at the structural qualities of the foodscapes for each area. The structure of a foodscape, represented as a graph, reflects the position of a shop or household within the wider context of shopping behaviour. The analysis of networks focusses on the relationships between actors as indications of constraint or resource. It therefore looks at how power or influence is constructed by the wider community.

This research considers how similar shopping patterns congregate around certain shops in the form of 'shop communities'. Community detection is a fundamental part of network analysis that can provide critical insight into the movement and flows of routine shopping behaviour.

Furthermore, as a result of their position within a network, actors, that is, shops and households, take on varying roles of influence and power. The definition of power or influence is not fixed in network theory; an actor may exhibit power in one context but not in others. For example, an actor with high betweenness centrality is influential from the point of view of being a conduit for information, whereas another node with a high local clustering coefficient value can be considered influential due to it's connectivity to adjacent or other local actors. This chapter looks at how ideas of power are distributed across actors within foodscapes.

The section is organised by giving a brief overview of the overall structural qualities of the graphs for each area before analysing the networks of each of the case study areas in greater detail. Finally the structure of these networks is compared and discussed. It is through this comparison that the influence or role of the urban environment can be understood more clearly.

The shopping behaviour of the respondents for each area was modelled as a bipartite graph where shops form one set of nodes and households the second set of nodes. The use of a shop by a household constitutes a tie, or edge, between that household and the shop.

Table 7.2.1 shows the structural characteristics of each area. The ratio of shops to households shows the relative size of a network; higher values show that an area is using a wider number of shops. Table 7.2.1 shows that Area A has a significantly higher value than the other areas.

	Area A	Area B	Area C	Area D	Area E
	Island Roadside	Isolated Suburban	Peripheral Suburban	Central Suburban	Major Urban
Number of Households	25	73	64	106	95
Number of Shops	66	96	76	113	113
Ratio of Shops to Households	2.64	1.32	1.19	1.07	1.19
Number of Ties	456	1180	1196	1912	1727
Number of Unique Ties	147	364	388	635	504
Density	0.227	0.190	0.231	0.221	0.197
Global Clustering Coefficient	0.233	0.453	0.647	0.639	0.562

Table 7.2.1 Comparison of Case Area Network Structures.

In contrast, Area E, despite have a higher number of local shops compared to the other areas, doesn't exhibit any greater range of shopping choices.

The density of a network refers to the number of ties within a network. Where density is typically calculated as the number of ties in a network to the number of possible ties, this calculation has been adjusted to reflect the method of data collection. Respondents were only able to list three possible shops per food item thereby limiting the actual number of possible ties. In this research a dense network results from shoppers spreading their shopping activities over a number of shops while a sparse network results from shoppers confining their shopping to a limited number of shops. Not only do Area A shoppers utilise a wide range of shops, they also spread their shopping over a high number of shops. Areas B and E exhibit the most restrictive shopping practices.

The global clustering coefficient analyses the distribution of ties within a network effectively unveiling clusters or communities of nodes. The clustering coefficient of a network reflects the extent to which a network clusters, that is, the extent to which a particular group of nodes within a network has a higher proportion of ties than the network as a whole.

High global clustering values suggest the clustering of nodes which in this research equates to the sharing or similarity of shopping habits. Specifically, this means that shoppers use the same or similar groups of shops. Areas C, D and E have higher values suggesting the presence of communities while Area A is significantly lower. This suggests more individual or unique shopping patterns, which is reinforced by the high shop to households ratio.

7.2.1 Case Area A

Figure 7.2.1 shows a visualisation of the bipartite network for Case Area A, Kazahaya JHS, where square nodes represent households and circle nodes represent shops. The network for Area A forms 3 distinct household communities and 6 shop communities. The shop communities comprise two major communities of 22 and 21 shops and four smaller groups.

Household community PC0 shows strong affiliation with shop community SC1 while household community utilises shop communities SC0 and SC3. The distance between groups for both shops and households are generally well defined suggesting that shopping patterns are distinct also.

The graph can be simplified by aggregating each community into a single node. Figure 7.2.2 shows the simplified graph for Area A. The size of nodes reflects the number of shops or households in the community and the thickness of the ties reflects the sum of the weighted degree ties. Thicker edges show stronger ties, while thinner edges weaker connections. From this graph the relative size of communities and the strength of connections in terms of use can be understood. The three household communities exhibit individualised, exclusive shopping patterns where household community PC0 uses shop community SC1 almost exclusively, community PC1 uses SC4 exclusively and dominates SC0 and SC9, and household community PC2 concentrates on SC2.

This kind of network can be described as polymodal where three groups of shop communities can be seen serving three household communities. Area A can be further described as exclusive in that household communities tend to connect to specific shop communities at the exclusion of other household groups.

Figure 7.2.3 shows the location of shop communities. It becomes apparent that households utilise a number of locations to meet their shopping needs. There is some clustering of SC1 to the south and SC2 to the central and northern areas. Applying the Nearest Neighbour Ratio calculation to Area A reveals highest values in the old Shonan City Centre and further to the south near Takayanagi Station. The large shopping area at Kashiwa Station provides low spatial correlation suggesting that shoppers tend to use this area for one-off shopping or specific items,

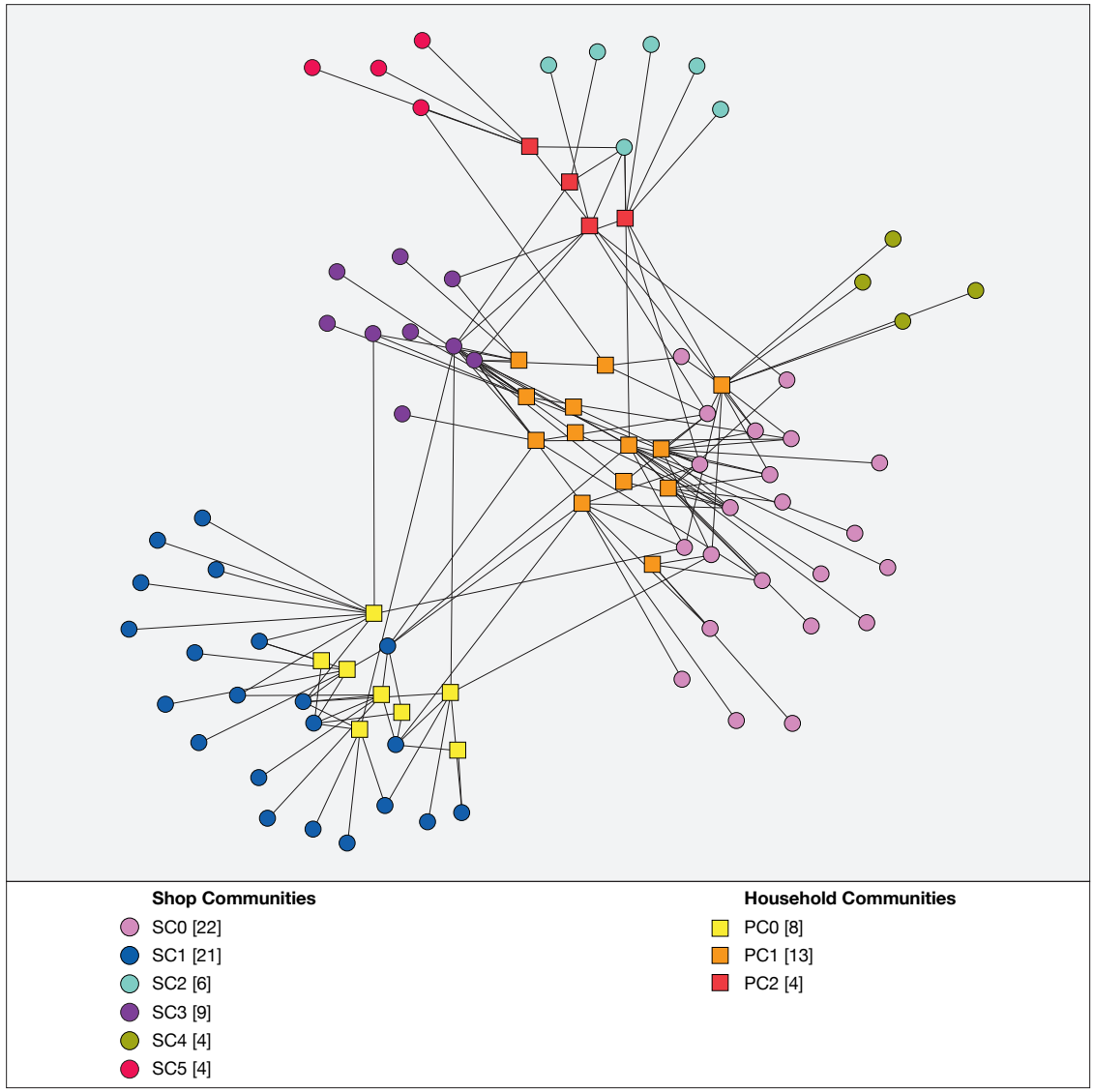


Figure 7.2.1 Network Visualisation of Case Area A.
Graph representing shopping behaviour of Case Area A using the Fruchterman–Reingold algorithm. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

while in central Shonan and Takayanagi shoppers tend to use a number of shops in the area to meet their needs.

Figure 7.2.5 shows the distribution of influence across food shop types for Area A. As discussed previously, different positions in a network empowered different levels of power or influence. While many measures of influence abound this research focusses on weighted degree, betweenness centrality and local clustering coefficient values to determine power roles. Values for betweenness centrality and local clustering coefficients for the upper quartile range only are shown to highlight the imbalances of power distribution in the network.

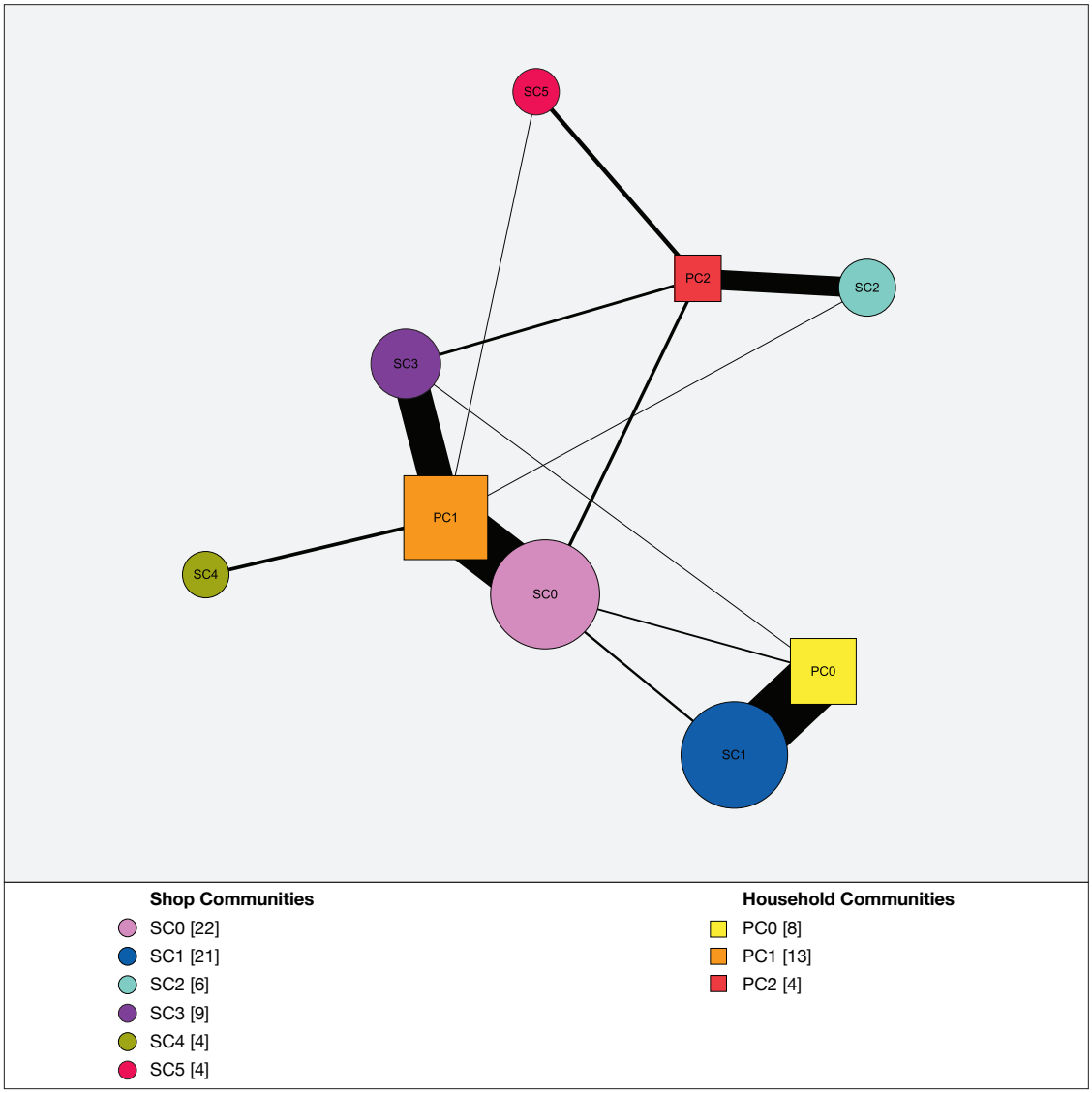


Figure 7.2.2 Simplified Graph of Case Area A.
Graph representing shopping behaviour of Case Area A using the Fruchterman–Reingold algorithm. actors in the same community are represented as a single node. The size of the node represents number of actors in the community. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

Supermarkets dominate the network. In terms of the number of shops used, a wide variety of Confectionery & Cake Shops are used by this area. The lower betweenness centrality value in contrast with the local clustering coefficient value suggests supermarkets play a central role in the network. While Shopping Malls & Department Stores, Pharmacies & Drug Stores, Liquor shops, Discount Shops, Confectionery & Cake Shops and Bakeries have lower weighted degree values, they have high betweenness values highlighting their role as bridges between groups. Shopping Malls & Department Stores and Discount Shops also have a high proportion of local clustering coefficient values showing that the role of these shop types varies by use.

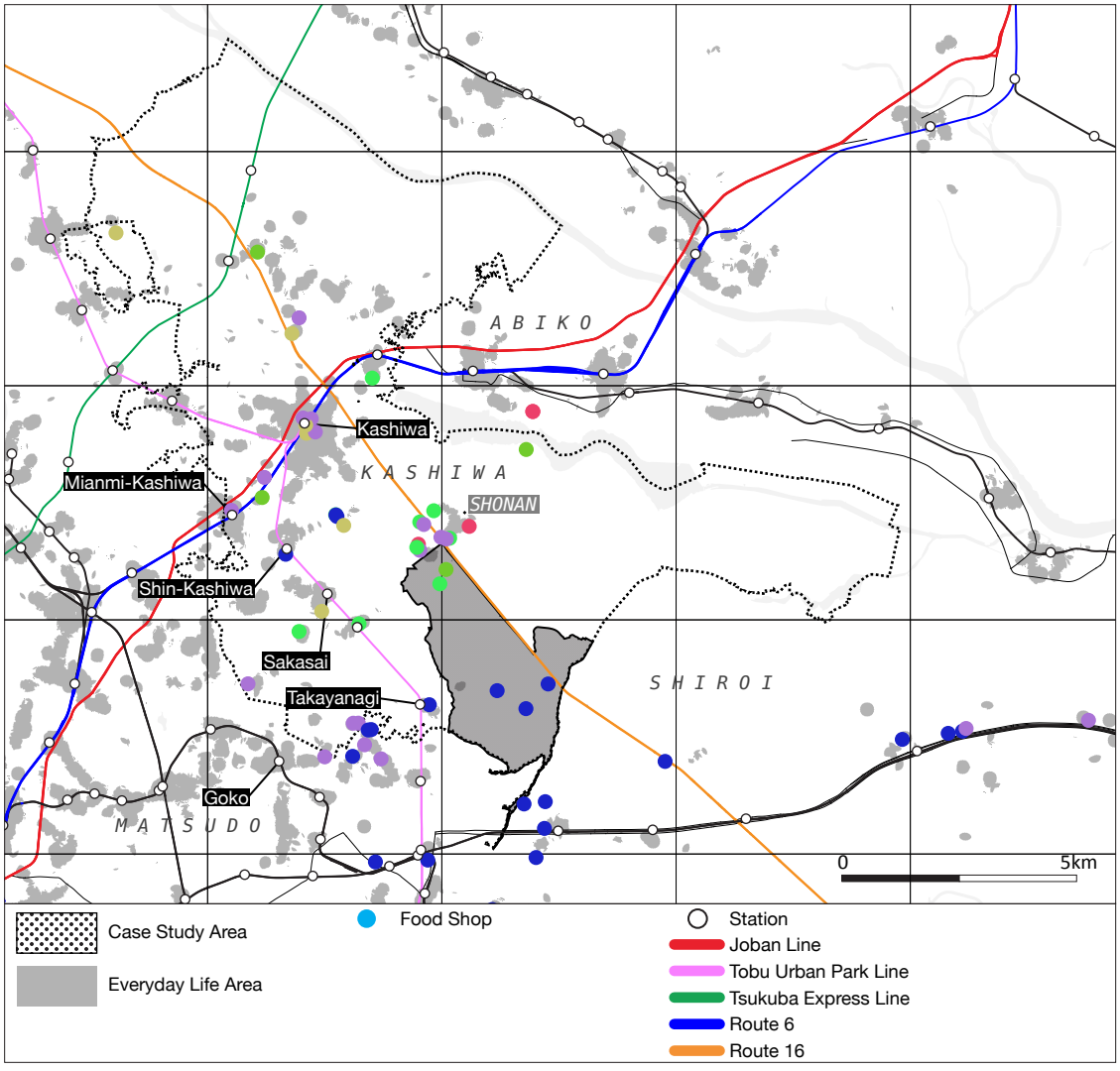


Figure 7.2.3 Location of Food Shops by Community - Case Area A.

Figure 7.2.6 shows the relationship between individual food types and shop types for Area A. By reading values vertically comparisons can be made between food types. The purchase of alcohol is spread across a number of shops including Pharmacies & Drug Stores, Home Centres and Convenience Stores however, most purchases occur between Supermarkets and Liquor Shops. Liquor shops account for all 'bridges' in this network.

The prevalence of roadside shops such as Discount Shops and Liquor Shops can be seen in the Area especially for the purchase of generic items such as alcohol and snacks.

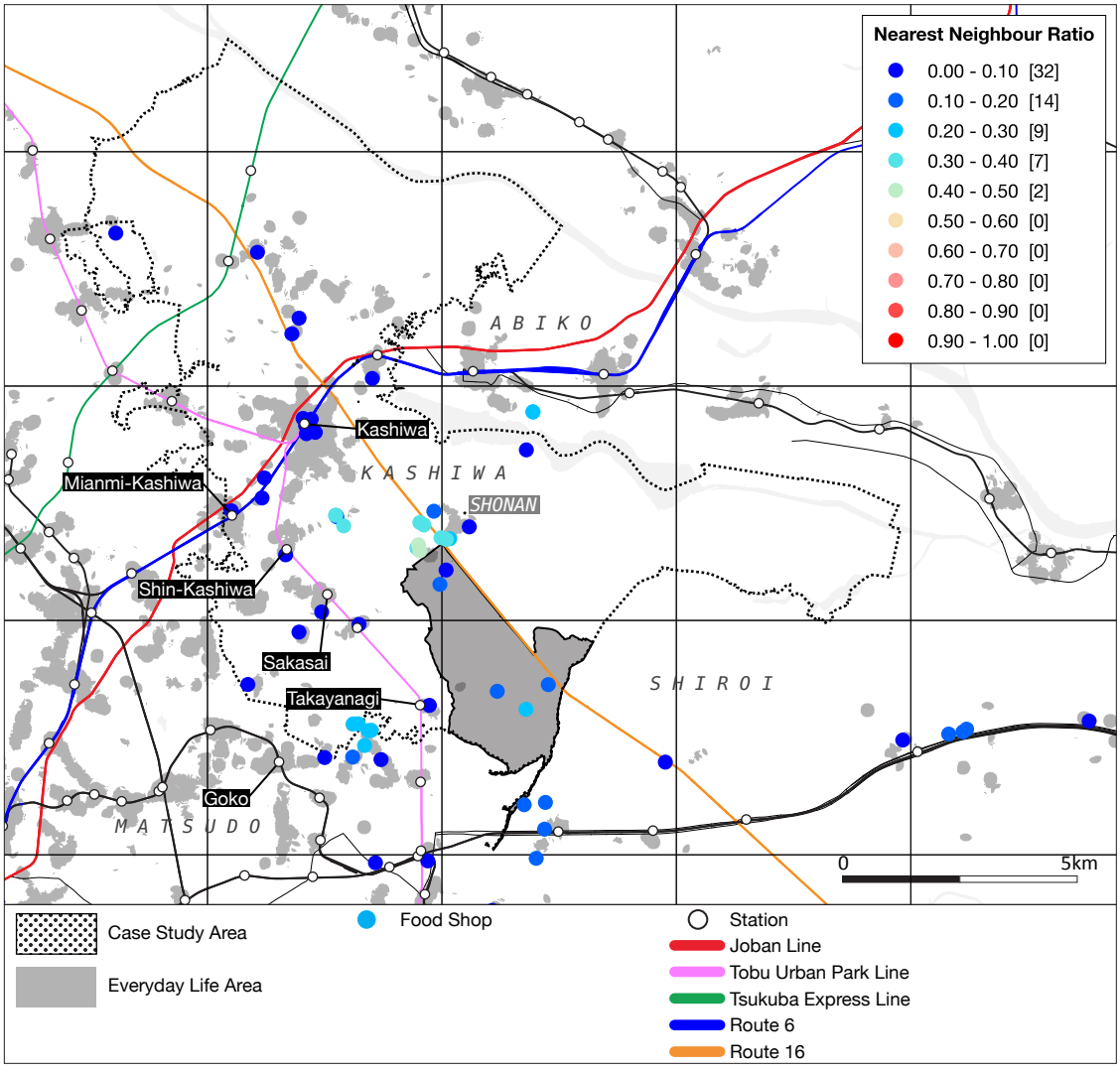


Figure 7.2.4 Location of Food Shops by Nearest Neighbour Ratio - Case Area A.

In terms of the degree of association of food to shops, Wagashi & Cakes, in the form of Confectionery & Cake Shops, and Rice, in the form of Delivery & Consumer Co-ops, provide the greatest resistance to the supermarket format.

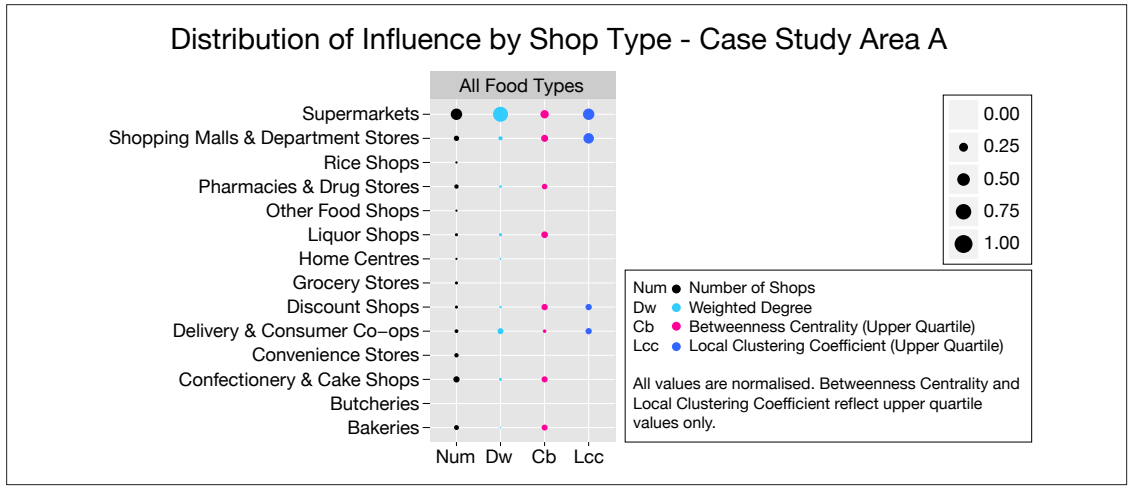


Figure 7.2.5 Distribution of Influence by Shop Type - Case Area A.

Figure 7.2.6 Distribution of Influence of Shop Type by Food Type - Case Area A.

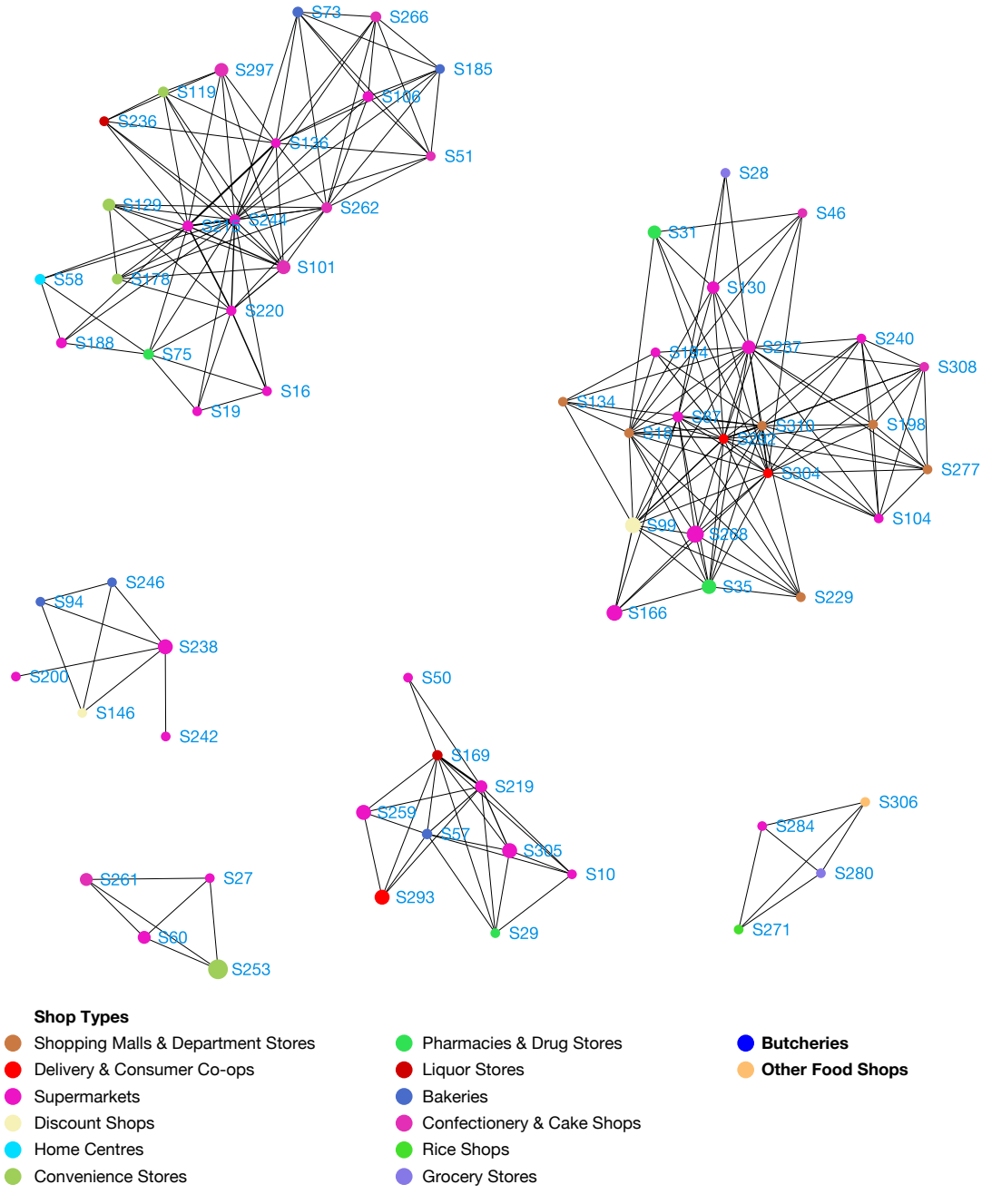


Figure 7.2.7 Composition of Shop Communities - Case Area A.

Community	SC0	SC1	SC2	SC3	SC4	SC5
Size	22	21	6	9		
Total Weighted Degree	1.94	1.95	0.66	1.21	0.12	0.15
Total Betweeness Centrality	6198	2902	540	2986	360	360
Average Local Clustering Coefficient	0.29	0.2	0.19	0.23		0.25
Average Nearest Neighbour Ratio	0.13	0.12	0.06	0.16	0	0.25
Supermarkets	8	8		5	1	2
Shopping Malls & Department Stores	6					
Rice Shops					1	
Pharmacies & Drug Stores	2	1		1		
Other Food Shops					1	
Liquor Shops		1		1		
Home Centres		1				
Grocery Stores	1				1	
Discount Shops	1		1			
Delivery & Consumer Co-ops	2			1		
Convenience Stores						1
Confectionery & Cake Shops	2	5				1
Butchers						
Bakeries		2	2	1		

Table 7.2.2 Composition of Shop Communities - Case Area A.

7.2.2 Case Area B

Figure 7.2.8 shows the bipartite graph for Nanbu JHS, Case Area B. Area B is made up of 8 shop communities, shown as circles, and is dominated by two large shop communities. Of the eight household communities, shown as squares, most of the households are evenly spread across four groups with an additional four smaller communities. Node communities tend to be less defined than Case Area A with the major shop community, SC46, interspersed between two household communities. Based on the size of the communities, similar to Case Area A, Case Area B appears to be bimodal in that there are two major shop communities. However, in contrast, the shop communities are less exclusive and the tie weights reveal that one shop community and a single household community dominate the network. The simplified graph, Figure 7.2.9, showing the aggregation of communities into single nodes, reveals the 'sharing' of shop communities between household communities. While PC3 and PC1 both interact strongly with SC1, the connection between SC1 and PC1 is significantly stronger. Furthermore, while SC2 is a relatively large group, PC0 and PC2 sit between SC1 and SC2 showing that these household communities split their shopping behaviour between these shops. As a result Case Area B exhibits bimodal characteristics, albeit shared across each of the major household communities to varying degrees.

As noted in the previous section, shop locations are concentrated between two local stations, Goko Station on the Shin-Keisei Line and Sakasai on the Tobu Urban Park Line. Figure X shows the location of shops for each shop community. Concentrations of similar shop communities can be seen split to the north of the Nanbu area and the south. The Nearest Neighbour Ratio values shown in Figure 7.2.11 show the high correlation of communities in these ares in the immediate vicinity of Nanbu, with lower values at greater distances.

Figure 7.2.14 shows the composition of each shop community. Even in the smallest communities the walk trap algorithm detected supermarkets in each community suggesting the appropriateness of this method to understand shopping patterns. Communities SC1 and SC2 account for most of the shops and have a diverse range of shop types. SC3 contains a single supermarket and a disproportionately high three convenience stores suggesting a specific variant pattern of shopping.

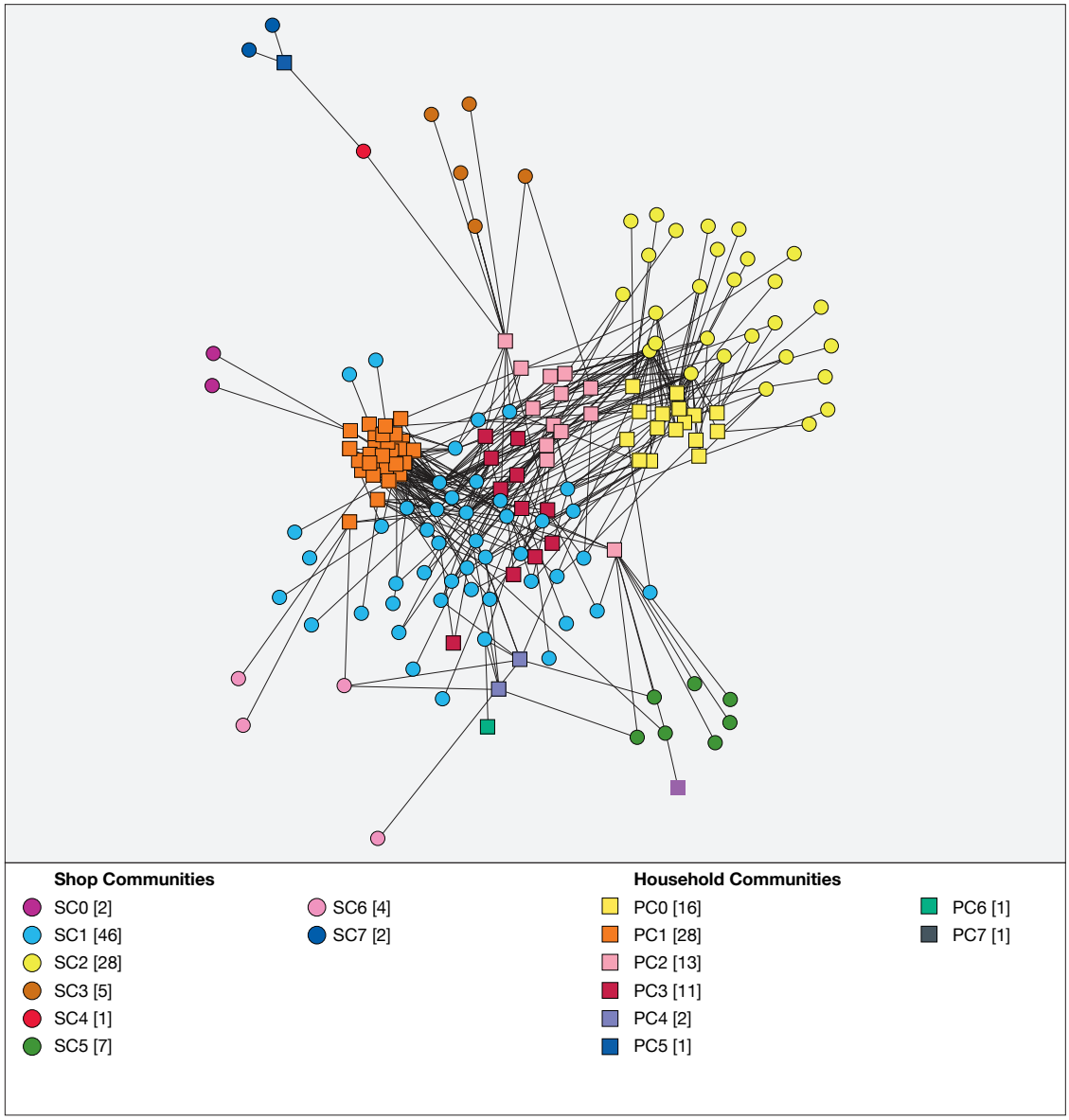


Figure 7.2.8 Network Visualisation of Case Area B.
Graph representing shopping behaviour of Case Area B using the Fruchterman–Reingold algorithm. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

Figure 7.2.12 shows the distribution of power amongst shops for Case Area B. Supermarkets are the dominant shop form with some use of Delivery & Consumer Co-ops and Confectionery & Cake Shops. While the weighted degree value is low for Confectionery & Cake Shops these shops have a disproportionately high betweenness centrality score. Pharmacies & Drug Stores as well as Home Centres also have high values. Scores for local clustering coefficients are spread across these groups too and additionally Discount Shops, Delivery & Consumer Co-ops and Convenience Stores.

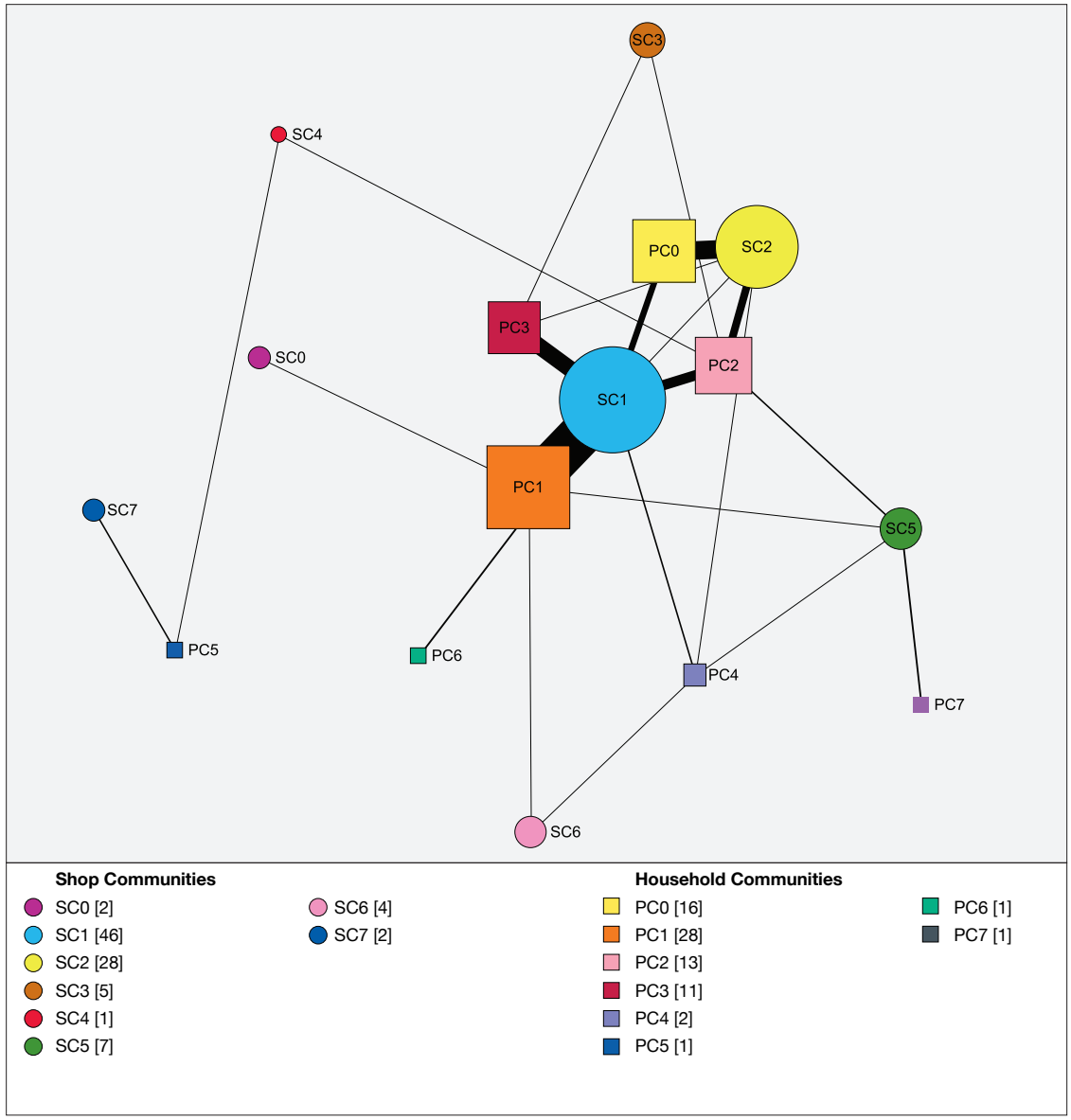


Figure 7.2.9 Simplified Graph of Case Area B.
Graph representing shopping behaviour of Case Area B using the Fruchterman–Reingold algorithm. actors in the same community are represented as a single node. The size of the node represents number of actors in the community. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

Alcohol, Rice, Snacks and Wagashi & Cakes show the greatest resistance to the supermarket form. Figure 7.2.13 shows how individual food types are translated on to shop types. As well as Pharmacies & Drug Stores, traditional Liquor Shops share a high proportion of betweenness centrality and local clustering coefficient values. Staples such as Bread, Fish, Meat and Fruit & Vegetables are uniformly translated on to supermarkets. Pharmacies & Drug Stores are prominent across Alcohol, Rice and Snacks; all foods with a long shelf life and ubiquitous brands. Confectionery & Cake Shops attract high values for Wagashi & Cakes.

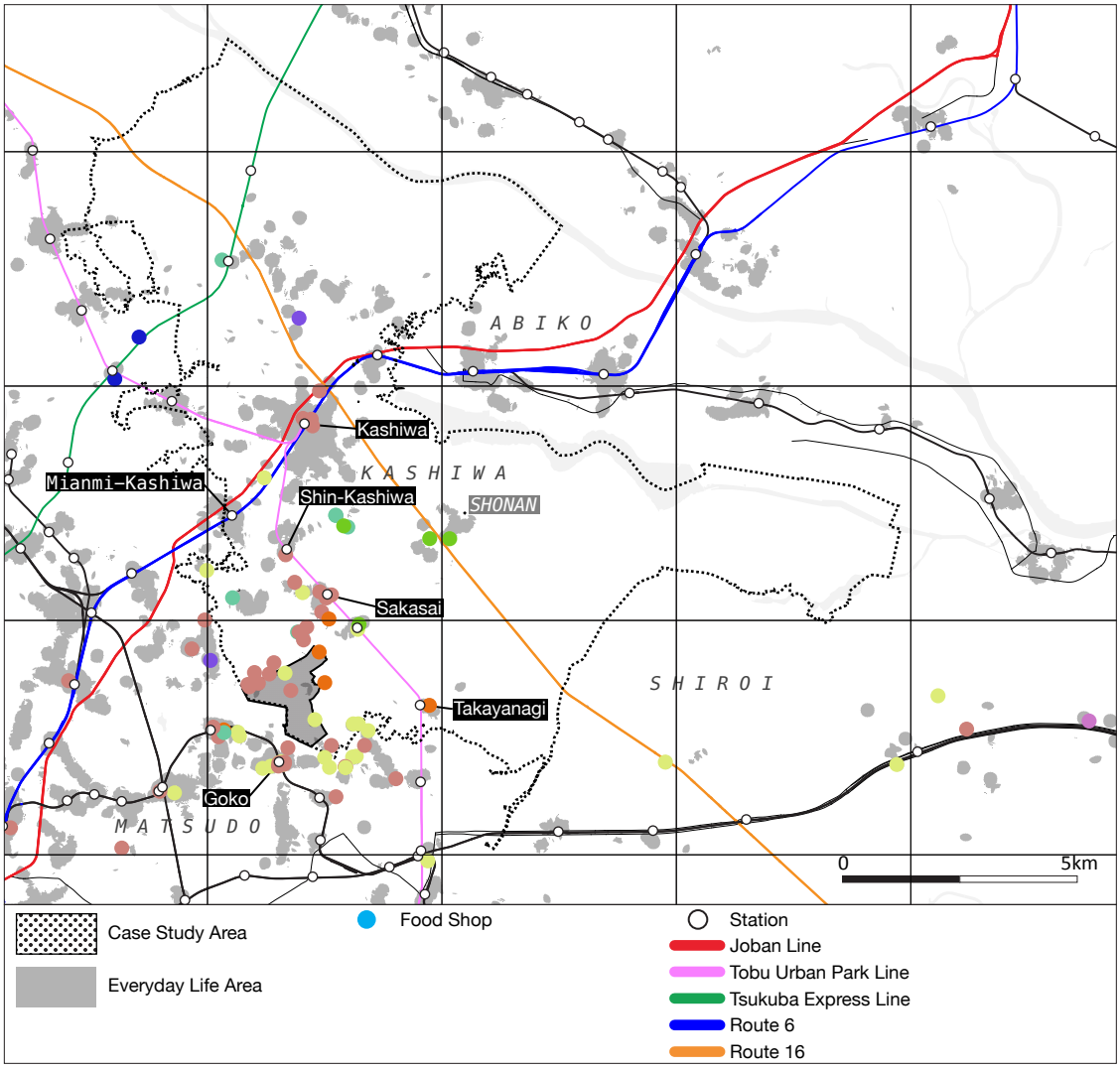


Figure 7.2.10 Location of Food Shops by Community - Case Area B.

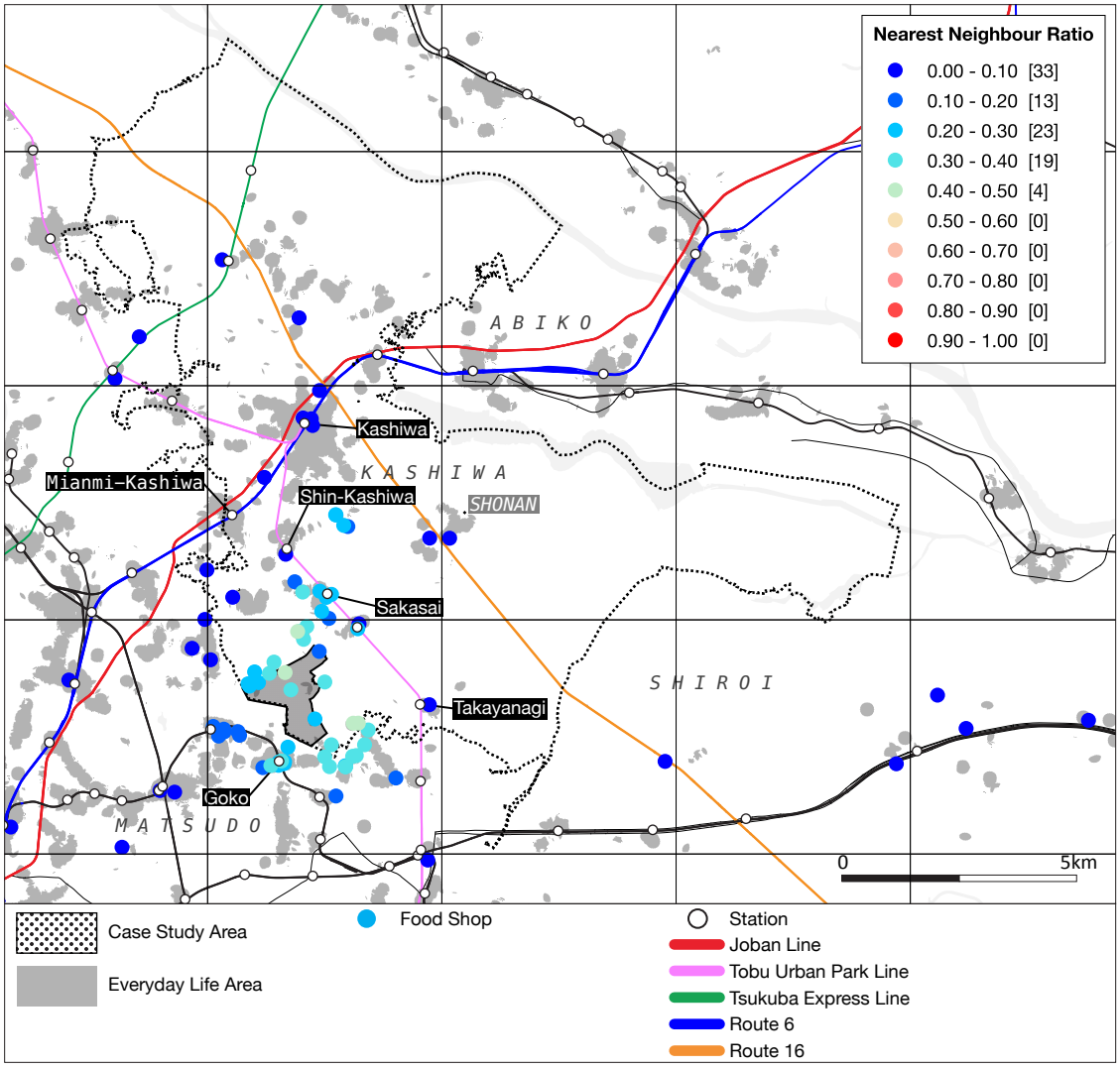


Figure 7.2.11 Location of Food Shops by Nearest Neighbour Ratio - Case Area B.

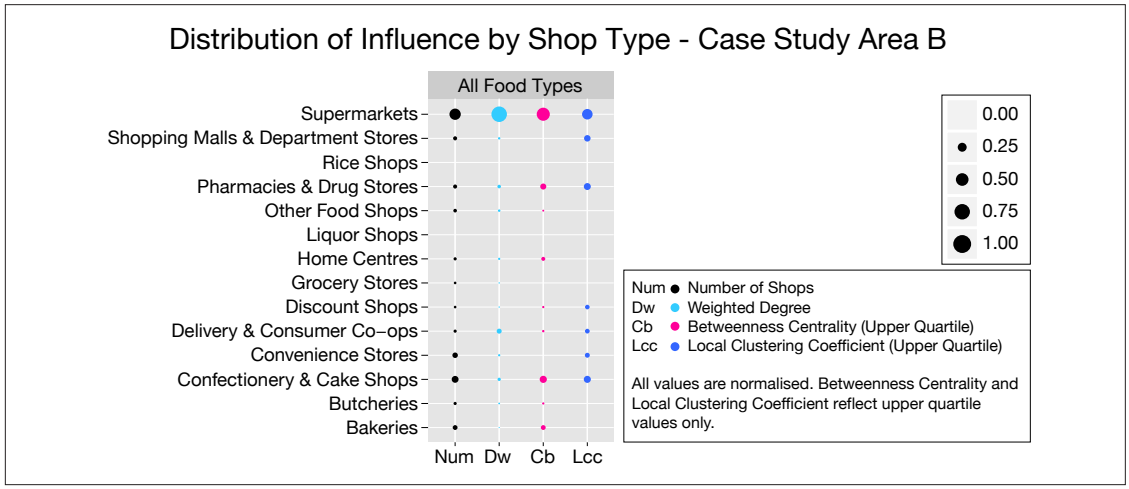


Figure 7.2.12 Distribution of Influence by Shop Type - Case Area B.

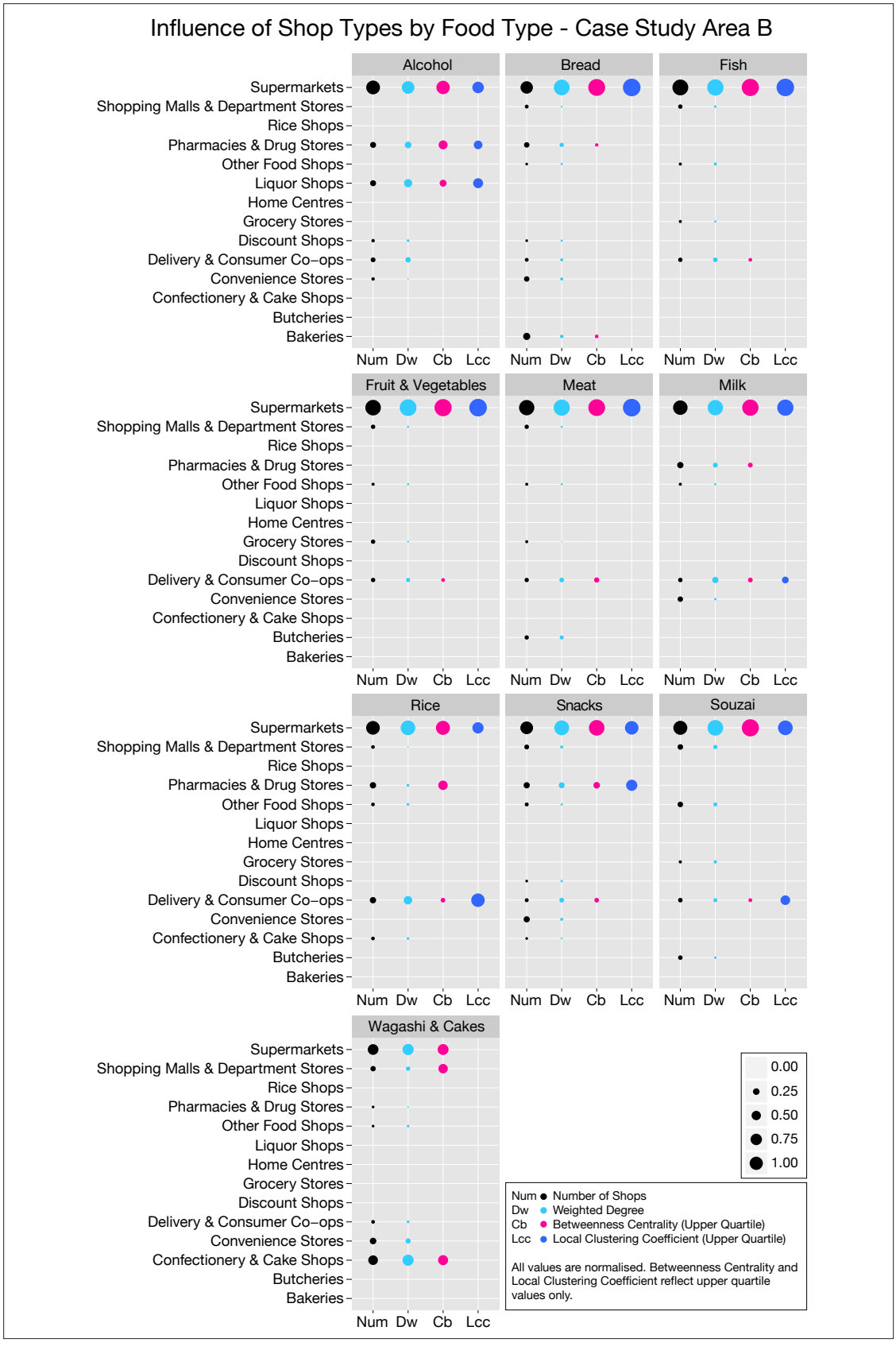


Figure 7.2.13 Distribution of Influence of Shop Type by Food Type - Case Area B.

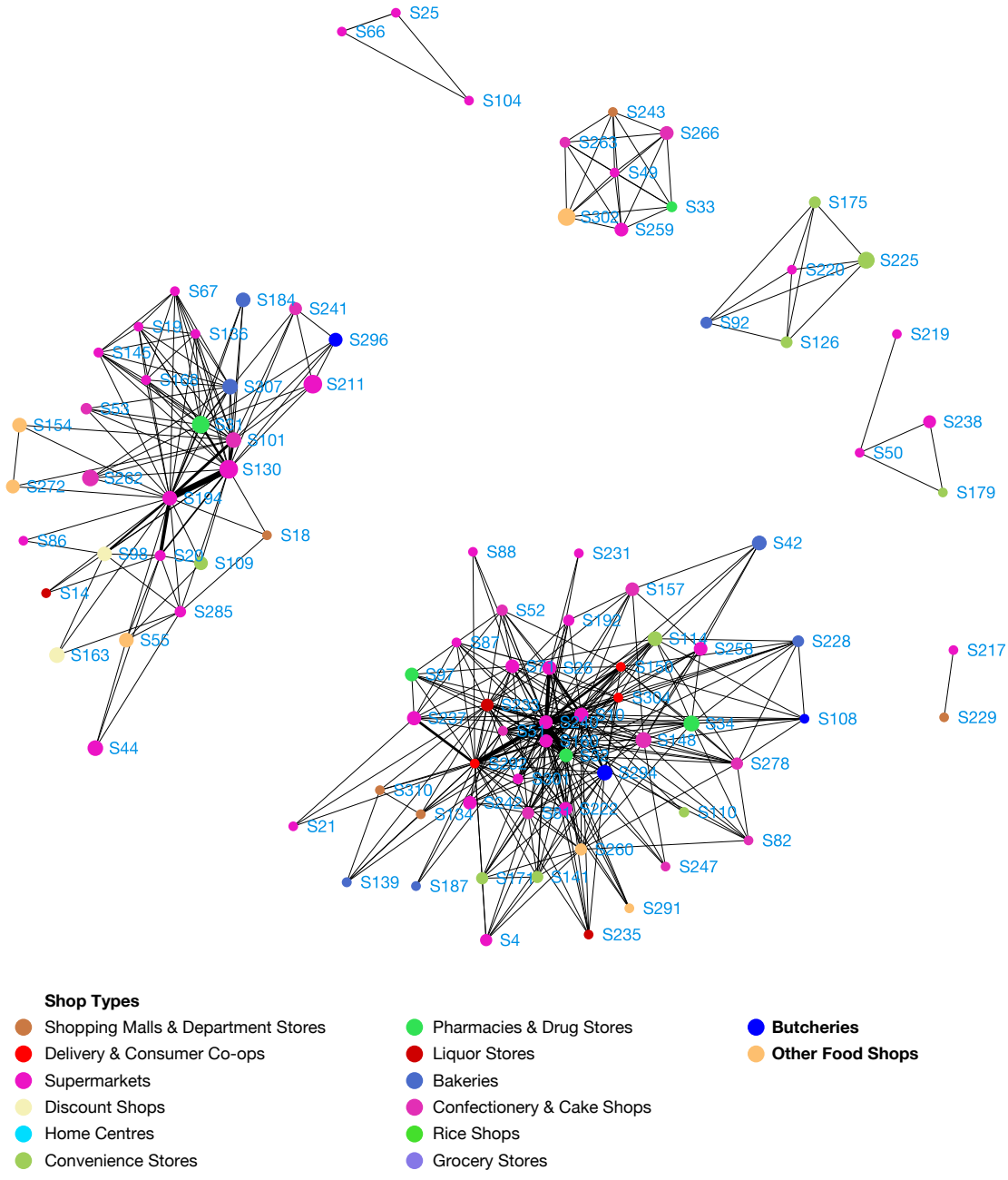


Figure 7.2.14 Composition of Shop Communities - Case Area B.

Community	SC0	SC1	SC2	SC3	SC4	SC5	SC6	SC7
Size	2	46	28		1	7	4	2
Total Weighted Degree	0.14	12.38	4.21	0.16	0.05	0.61	0.2	0.23
Total Betweeness Centrality	334	27880	11946	835	659	1349	668	334
Average Local Clustering Coefficient		0.51	0.43	0.15	0	0.22	0.36	
Average Nearest Neighbour Ratio	0	0.18	0.24	0.2	0	0.18	0.06	0
Supermarkets	1	16	12	1	1	2	3	2
Shopping Malls & Department Stores	1	2	1			1		
Rice Shops								
Pharmacies & Drug Stores		3	1			1		
Other Food Shops		1	2			1		
Liquor Shops		2	1					
Home Centres								
Grocery Stores		1	1					
Discount Shops			2					
Delivery & Consumer Co-ops		3						
Convenience Stores		4	1	3			1	
Confectionery & Cake Shops		8	4			2		
Butchers		2	1					
Bakeries		4	2	1				

Table 7.2.3 Composition of Shop Communities - Case Area B.

7.2.3 Case Area C

The bipartite graph for Kashiwa No.4 JHS reveals a number of tightly knit household communities supported by loosely bound shop communities. While the household communities are divided into 4 generally evenly sized communities with two smaller communities, the shops are dominated by one large community, SC4, containing 35 shops, over half of the total number of shops.

The dominance of this shop community can be easily seen in the simplified graph, Figure 7.2.16. The main household communities are shown adjacent to SC4. In particular, there is a strong connection between SC4 and PC0. This network can therefore be described as monomodal. It is important to note that monomodal does not imply a singular shopping pattern, rather that distinct patterns could not be discriminated within this group of shops. In reality, this can be read as households not having particularly matching shopping patterns where households can be meaningfully distinguished from other groups.

Figure 7.2.17 shows the location of shops by community. The dominant shop community, SC4, is scattered in all directions but proximate to the case study area. The Nearest Neighbour Ratio analysis reveals the highest scores in all five of the case study areas, concentrated in one area containing the supermarkets Watanabe and York-Mart as well as the bakery Couronne, and in a second area between the case study area and Kashiwa Station. This area contains a high number of suburban supermarkets such as Mami-Mart, Yaoko and Food-Off.

Figure 7.2.19 shows the distribution of power amongst shops in Case Area C. While a variety of shops types are used for daily food shopping weighted degree scores show that Supermarkets and Delivery & Consumer Co-ops dominate this foodscape. Betweenness centrality values are spread across Supermarkets and Shopping Malls & Department Stores, and to a lesser extent, Confectionery & Cake Shops and Bakeries. In particular, Convenience Stores have a high value for local clustering coefficient.

Analysis of the influence of individual food types shows that Rice and Wagashi & Cakes are the most resistant to the dominance of the Supermarket shop type where Delivery & Consumer Co-ops are often used for purchasing Rice and Confectionery & Cake Shops for Wagashi &

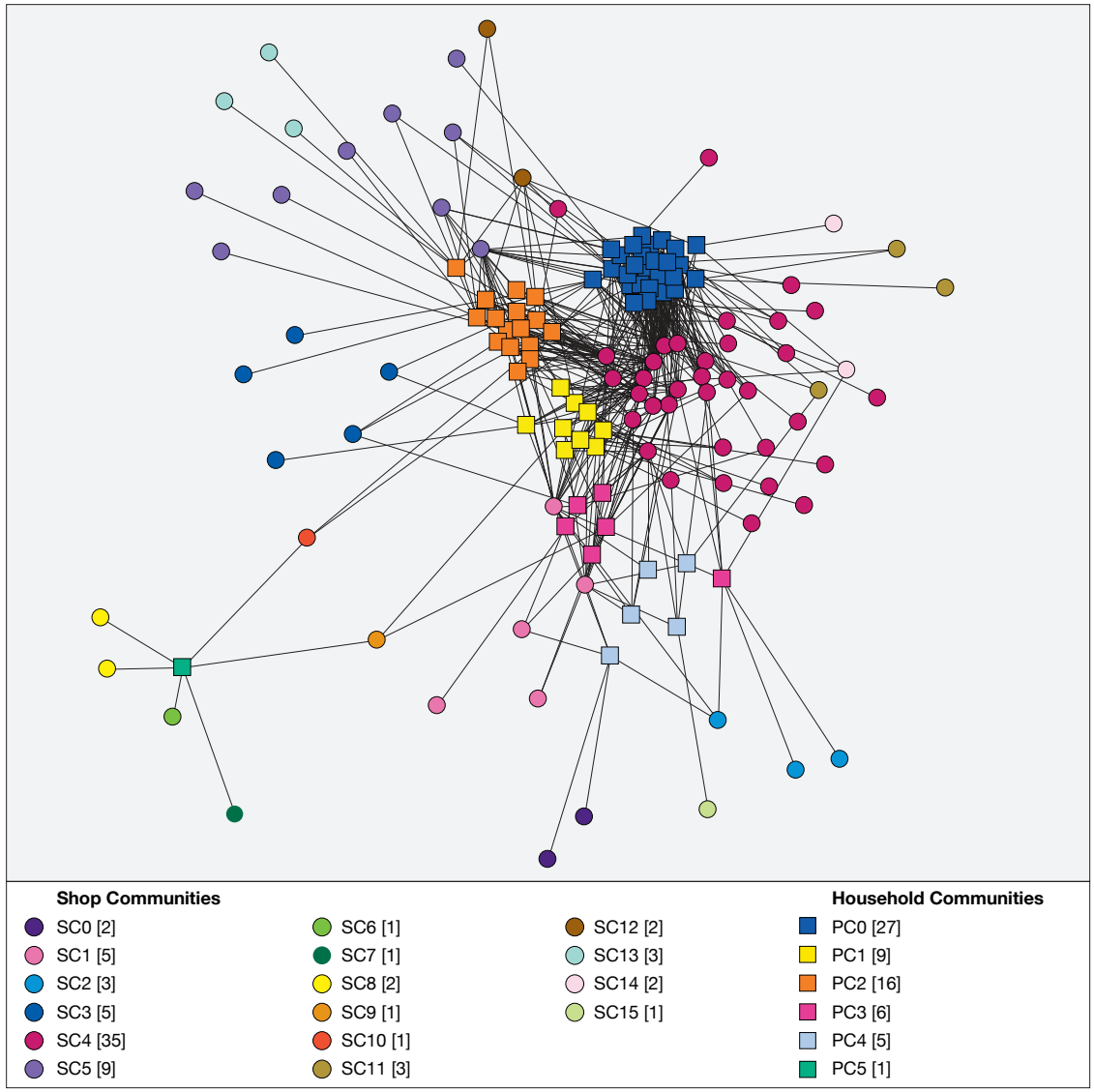


Figure 7.2.15 Network Visualisation of Case Area C.
Graph representing shopping behaviour of Case Area C using the Fruchterman–Reingold algorithm. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

Cakes. Delivery & Consumer Co-ops, as with Supermarkets, features to varying degrees across all of the food types.

The comparison of the composition of shop communities, shown in Figure 7.2.21 and Table 7.2.4, show Supermarkets distributed across most of the communities. Shop community SC4 has a value of 0.24, which is significantly high considering the size of the community, as well as a high average local clustering coefficient score of 0.71; the highest for this foodscape.

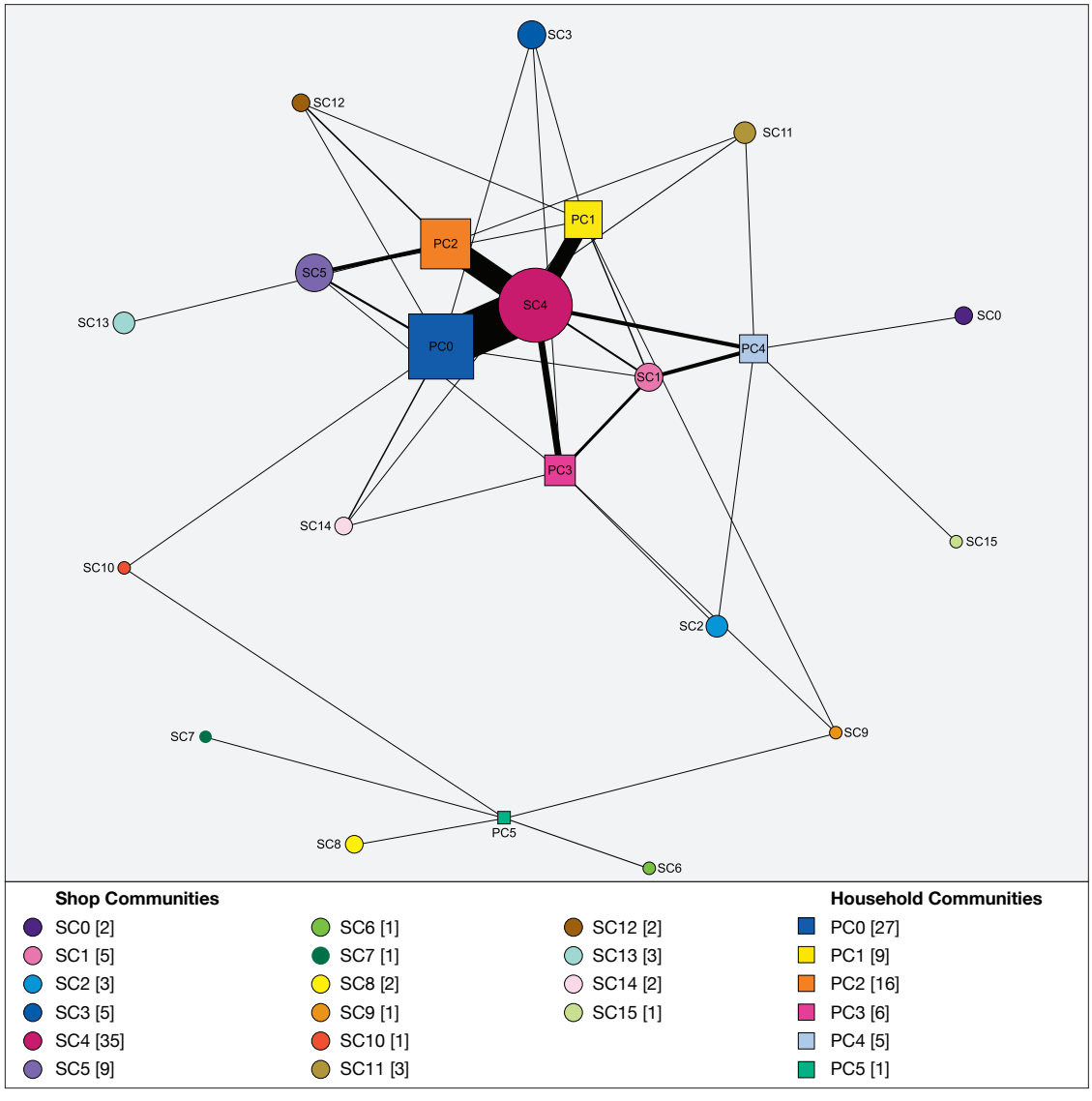


Figure 7.2.16 Simplified Graph of Case Area C.
Graph representing shopping behaviour of Case Area C using the Fruchterman–Reingold algorithm. actors in the same community are represented as a single node. The size of the node represents number of actors in the community. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

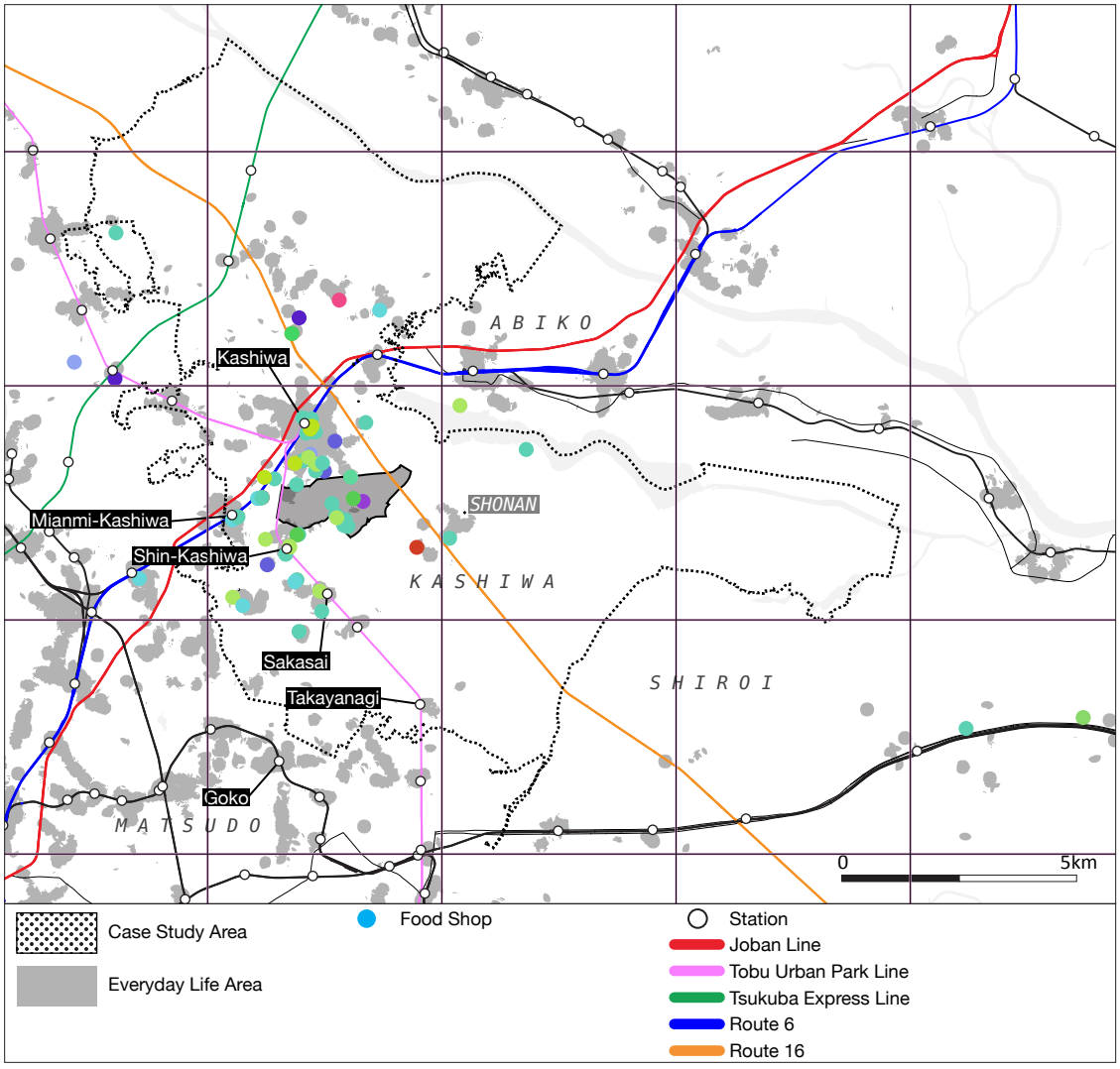


Figure 7.2.17 Location of Food Shops by Community - Case Area C.

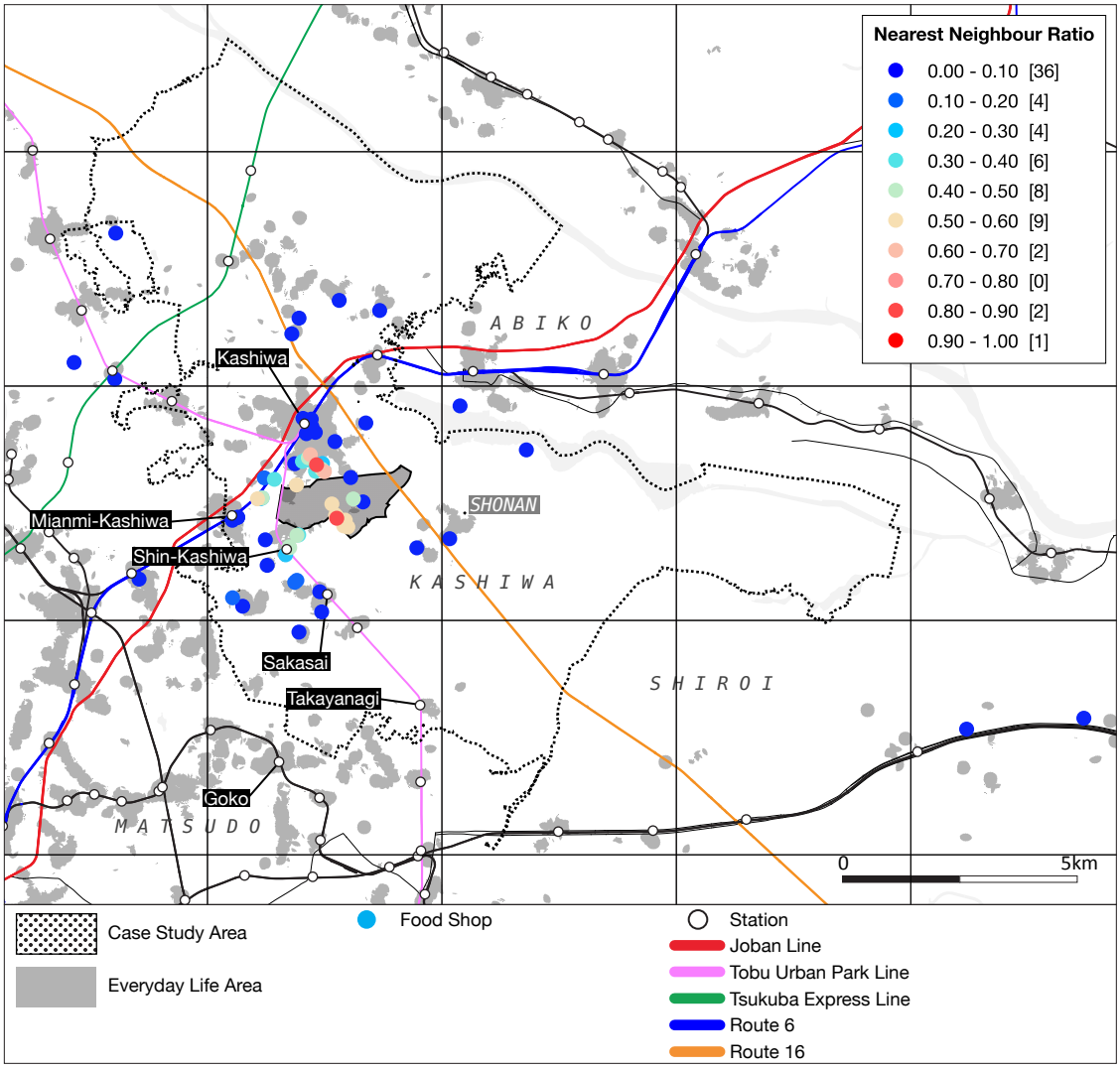


Figure 7.2.18 Location of Food Shops by Nearest Neighbour Ratio - Case Area C.

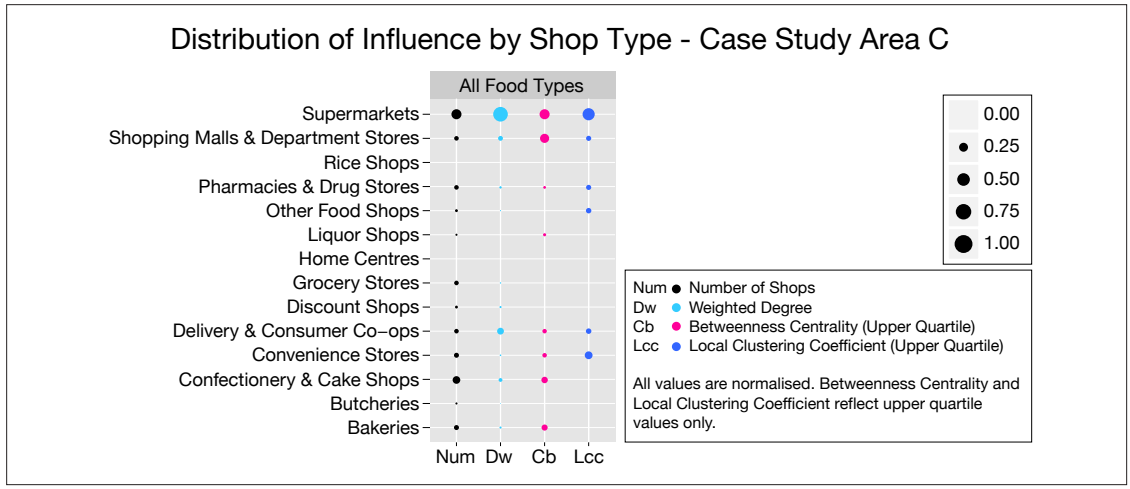


Figure 7.2.19 Distribution of Influence by Shop Type - Case Area C.

Figure 7.2.20 Distribution of Influence of Shop Type by Food Type - Case Area C.

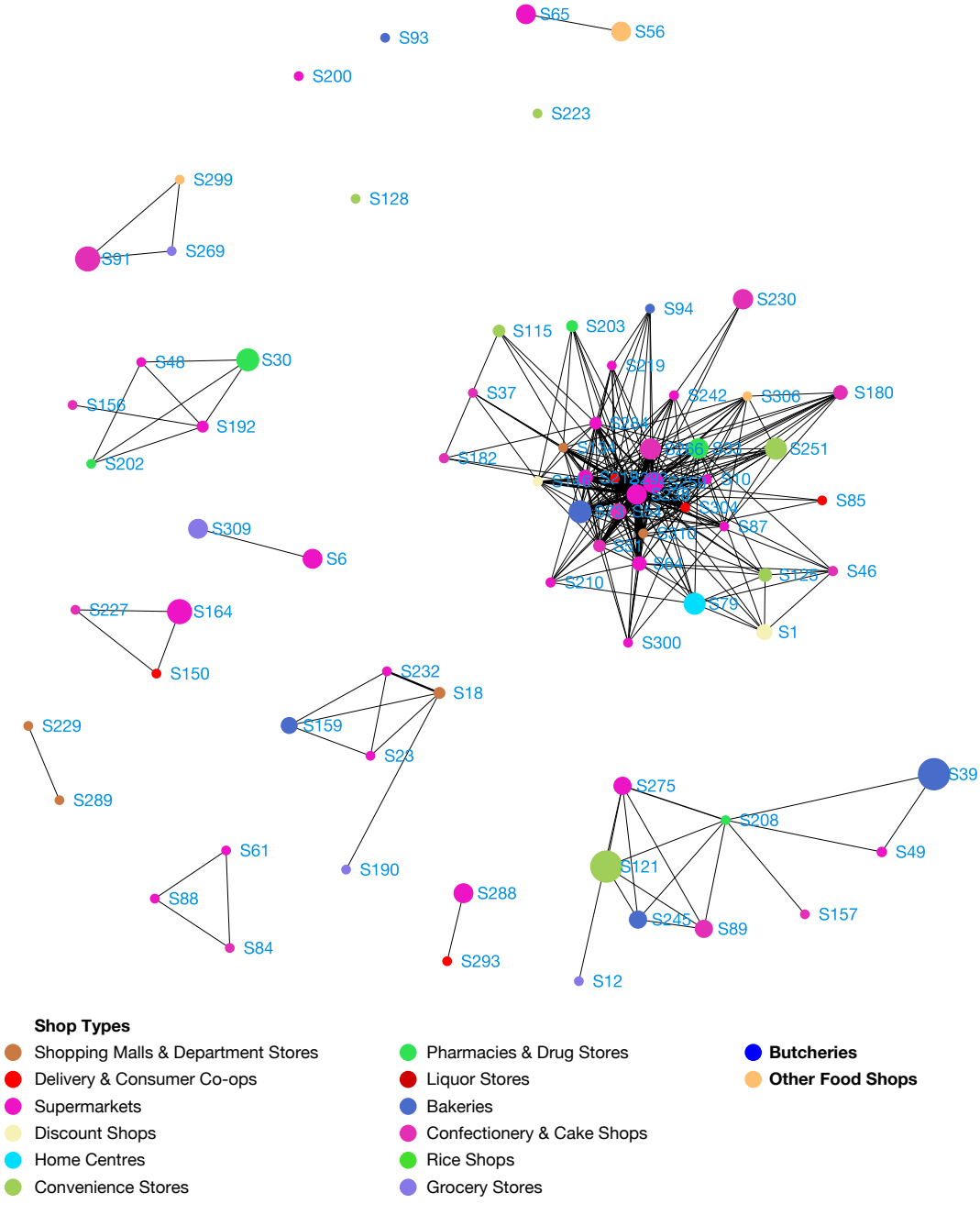


Figure 7.2.21 Composition of Shop Communities - Case Area C.

Community	SC0	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
Size	2	5	3	5	35	9			2
Total Weighted Degree	0.07	1.34	0.16	0.22	11.67	0.88	0.13	0	0.06
Total Betweeness Centrality	278	3503	417	775	16244	3497	139	139	278
Average Local Clustering Coefficient		0.58	0.35	0.65	0.71	0.68			
Average Nearest Neighbour Ratio	0	0.12	0	0.16	0.24	0.36		0	0.5
Supermarkets		2	2	2		2			
Shopping Malls & Department Stores	2				2				
Rice Shops									
Pharmacies & Drug Stores				2	2				
Other Food Shops									
Liquor Shops									
Home Centres									
Grocery Stores									
Discount Shops					2				
Delivery & Consumer Co-ops					3				
Convenience Stores					3				
Confectionery & Cake Shops					8	2			
Butchers									
Bakeries					2	2			

Community	SC9	SC10	SC11	SC12	SC13	SC14	SC15
Size			3	2	3	2	
Total Weighted Degree	0.03	0.02	0.22	0.3	0.07	0.24	0.04
Total Betweeness Centrality	244	817	417	378	417	283	139
Average Local Clustering Coefficient	0.33	0.34	0.67	0.51		0.53	
Average Nearest Neighbour Ratio	0	0	0.33	0.5	0.22	0.25	0
Supermarkets							
Shopping Malls & Department Stores							
Rice Shops							
Pharmacies & Drug Stores							
Other Food Shops							
Liquor Shops							
Home Centres							
Grocery Stores					2		
Discount Shops							
Delivery & Consumer Co-ops							
Convenience Stores							
Confectionery & Cake Shops							
Butchers							
Bakeries							

Table 7.2.4 Composition of Shop Communities - Case Area C.

7.2.4 Case Area D

The bipartite graph for Hikarigaoka JHS, Case Area D, reveals eight distinct shop communities and four household communities. The household communities are tightly knit and shop numbers range from 13 to 45. Of the eight shop communities, four can be considered large, ranging in size from 19 to 37 shops. The simplified graph shows a strong connection between shop community SC2 and household community PC0. However, in contrast to Case Area C, SC2 is not 'shared' to the same extent among other household communities. While PC1 also has a strong connection to SC2, household community PC2 is affiliated with SC0 and PC3 with SC3. This creates a polymodal network where distinct shop communities of significant size and at least to some extent exclusive household communities create independent shopping patterns within the wider network.

Figure 7.2.24 shows the physical location of shop communities and Figure 7.2.25 the spatial distribution of Nearest Neighbour Ratio scores. This map shows high values around Shin-Kashiwa Station to the east of the case study areas well as Naka-Shinjuku to the west and a group of supermarkets closer to Kashiwa Station that also scored highly in Area C; Yaoko, Mami-Mart and Food-Off.

The overall distribution of influence or power across nodes show that Supermarkets and Delivery & Consumer Co-ops dominate in terms of weighted degree, but Confectionery & Cake Shops and Bakeries have significantly high betweenness centrality values. Pharmacy & Drug Stores and Confectionery & Cake Shops have the most significant local clustering coefficient values.

Figure 7.2.27 shows the relationship between food types and shop types for Area D. Rice, through Delivery & Consumer Co-ops, and Wagashi & Cakes, through Confectionery & Cake Shops are the highest non-Supermarket scores. Of all of the case study areas, Area D has the highest proportional scores for butcheries through not only meat but also souzai.

Figure 7.2.28 shows the composition of shop communities for Area D. As with the other areas Supermarkets are dominant, however the role of other shop types, especially in SC2, can also bee seen.

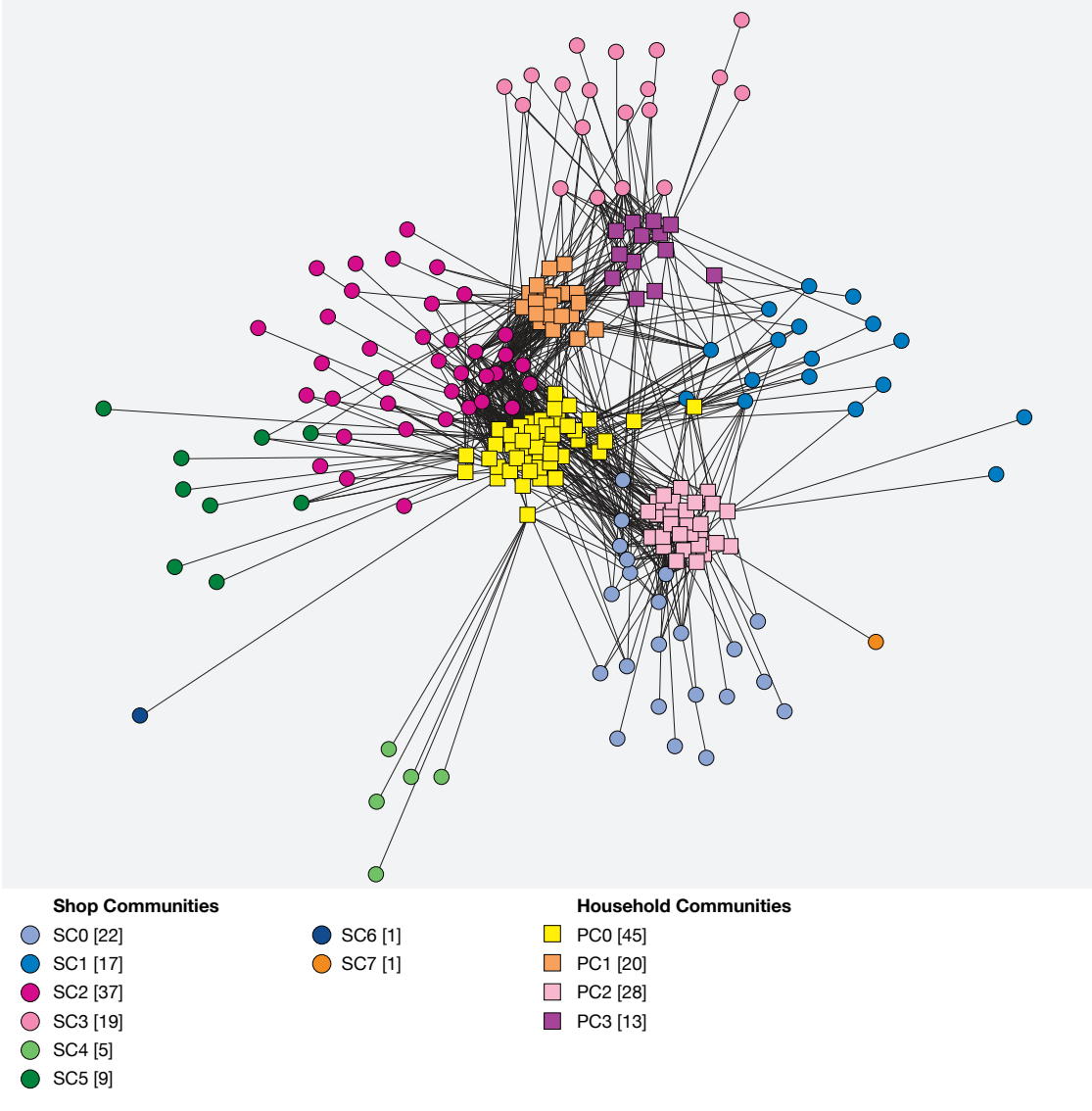


Figure 7.2.22 Network Visualisation of Case Area D.
Graph representing shopping behaviour of Case Area D using the Fruchterman–Reingold algorithm. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

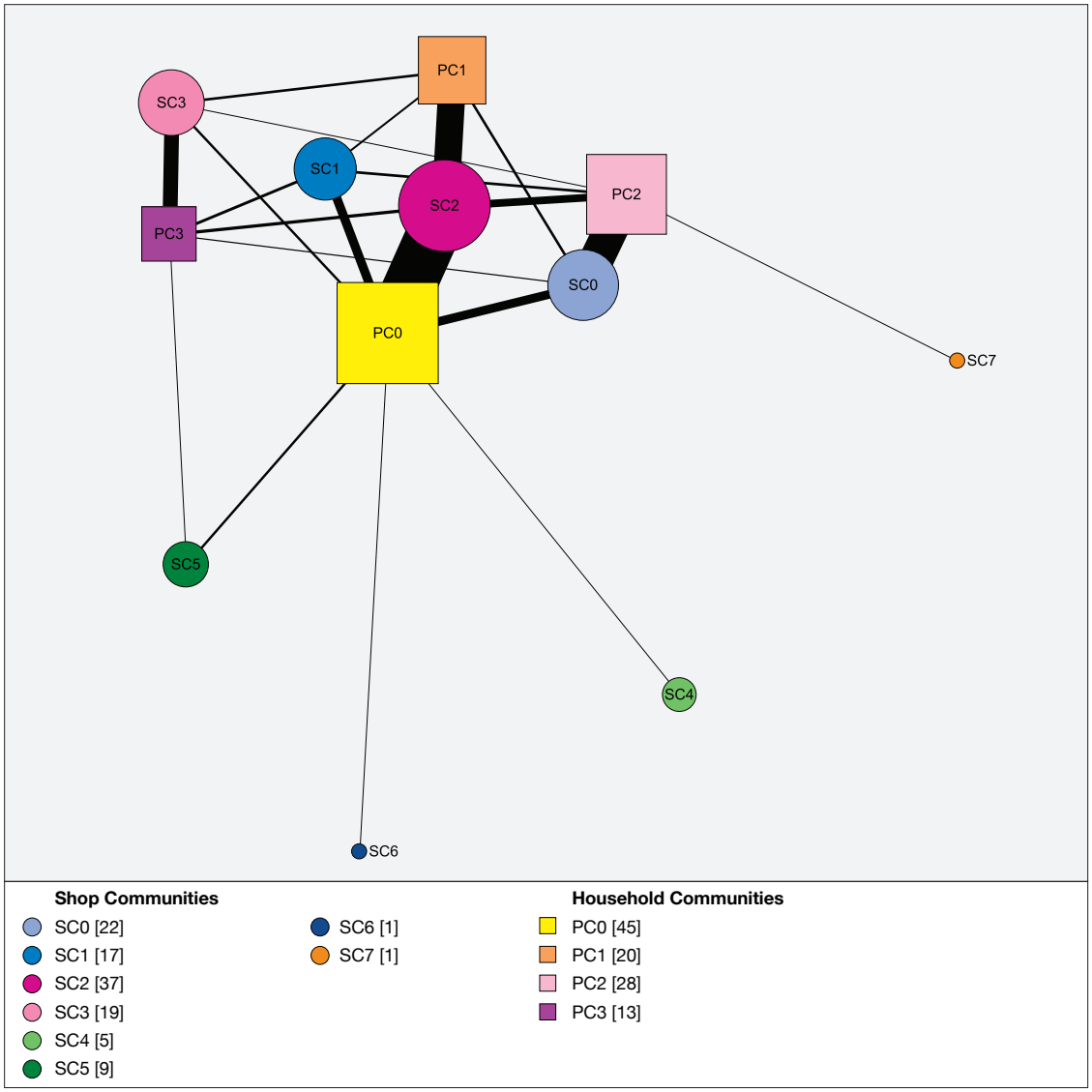


Figure 7.2.23 Simplified Graph of Case Area D.
Graph representing shopping behaviour of Case Area D using the Fruchterman–Reingold algorithm. actors in the same community are represented as a single node. The size of the node represents number of actors in the community. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

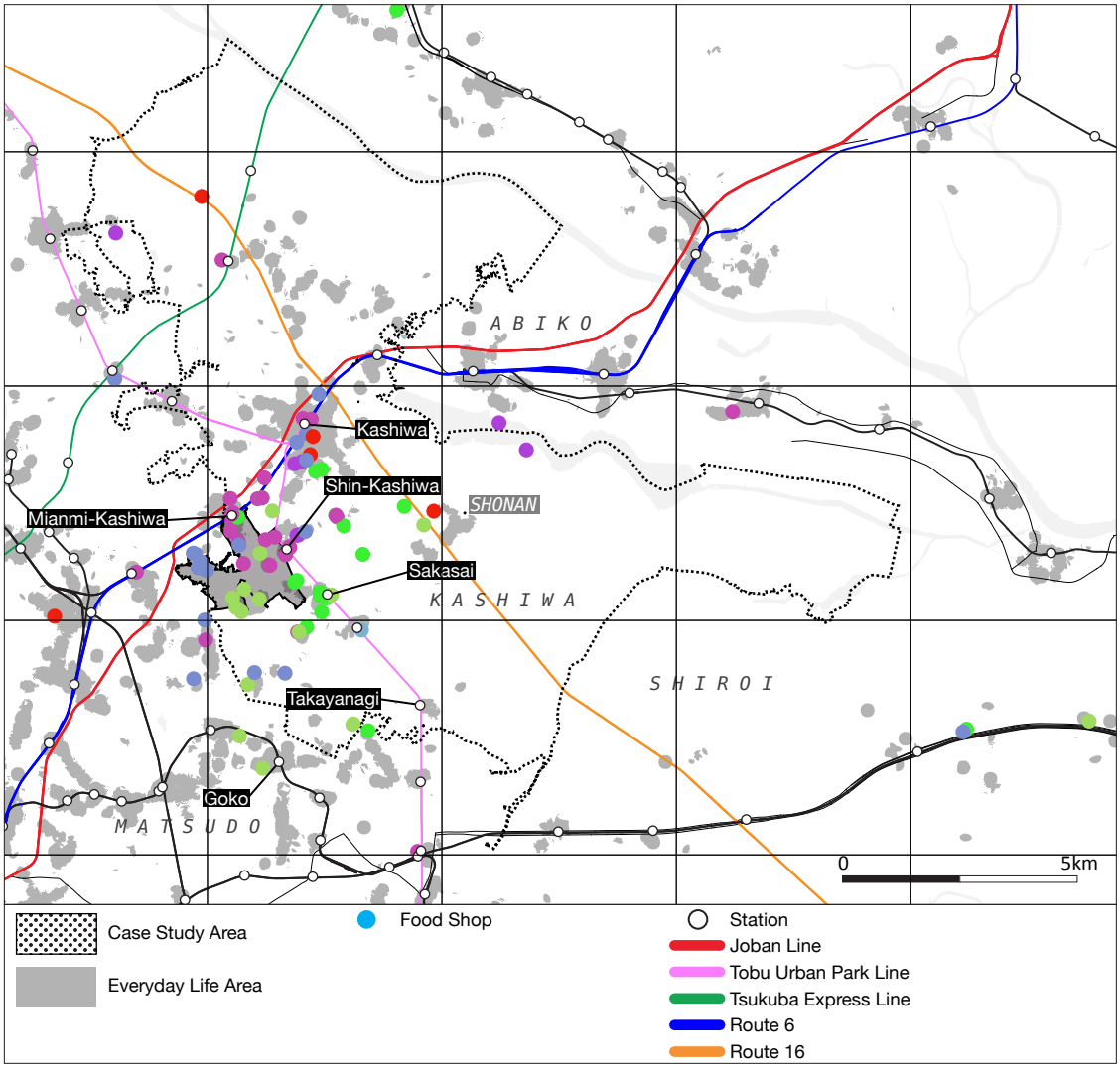


Figure 7.2.24 Location of Food Shops by Community - Case Area D.

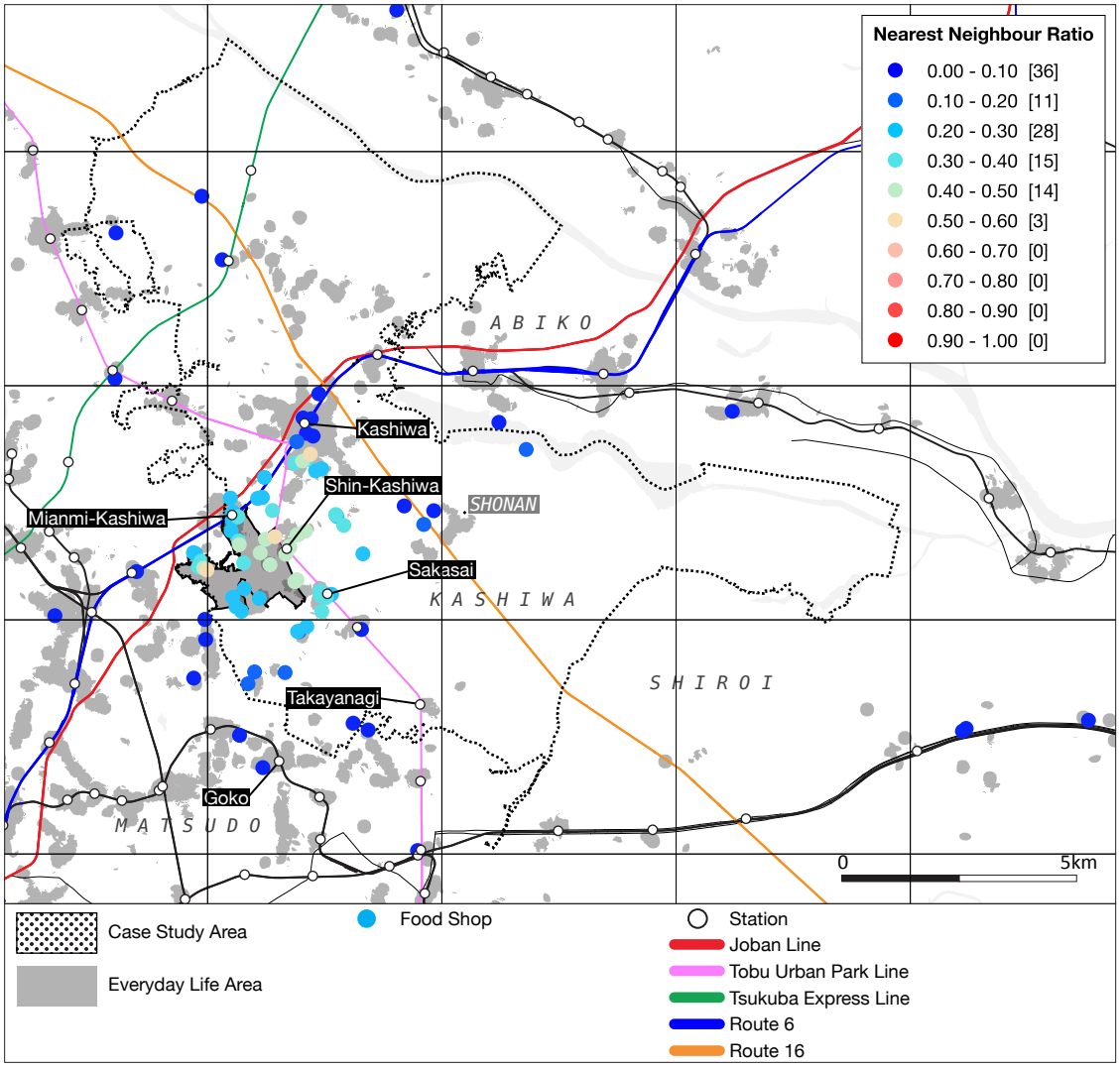


Figure 7.2.25 Location of Food Shops by Nearest Neighbour Ratio - Case Area D.

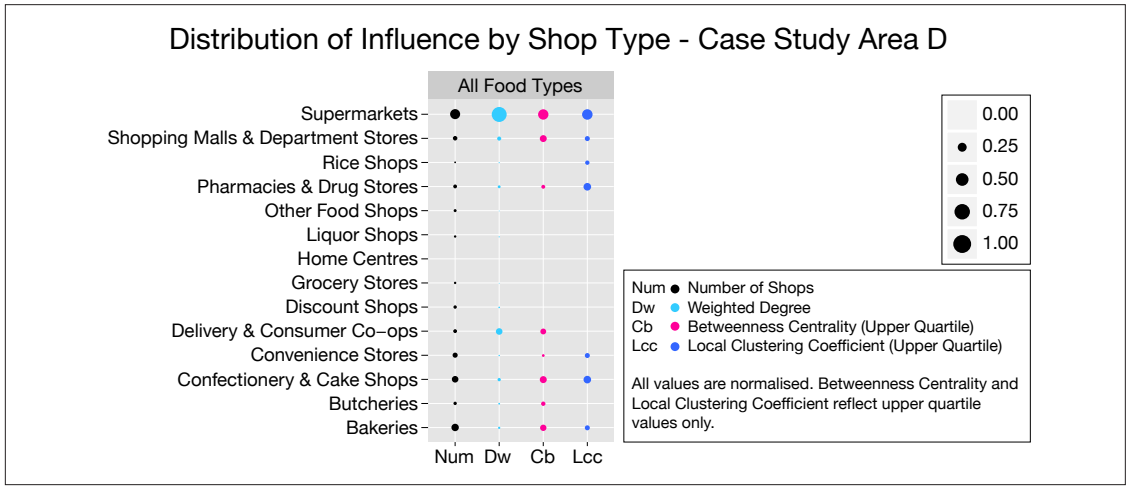


Figure 7.2.26 Distribution of Influence by Shop Type - Case Area D.

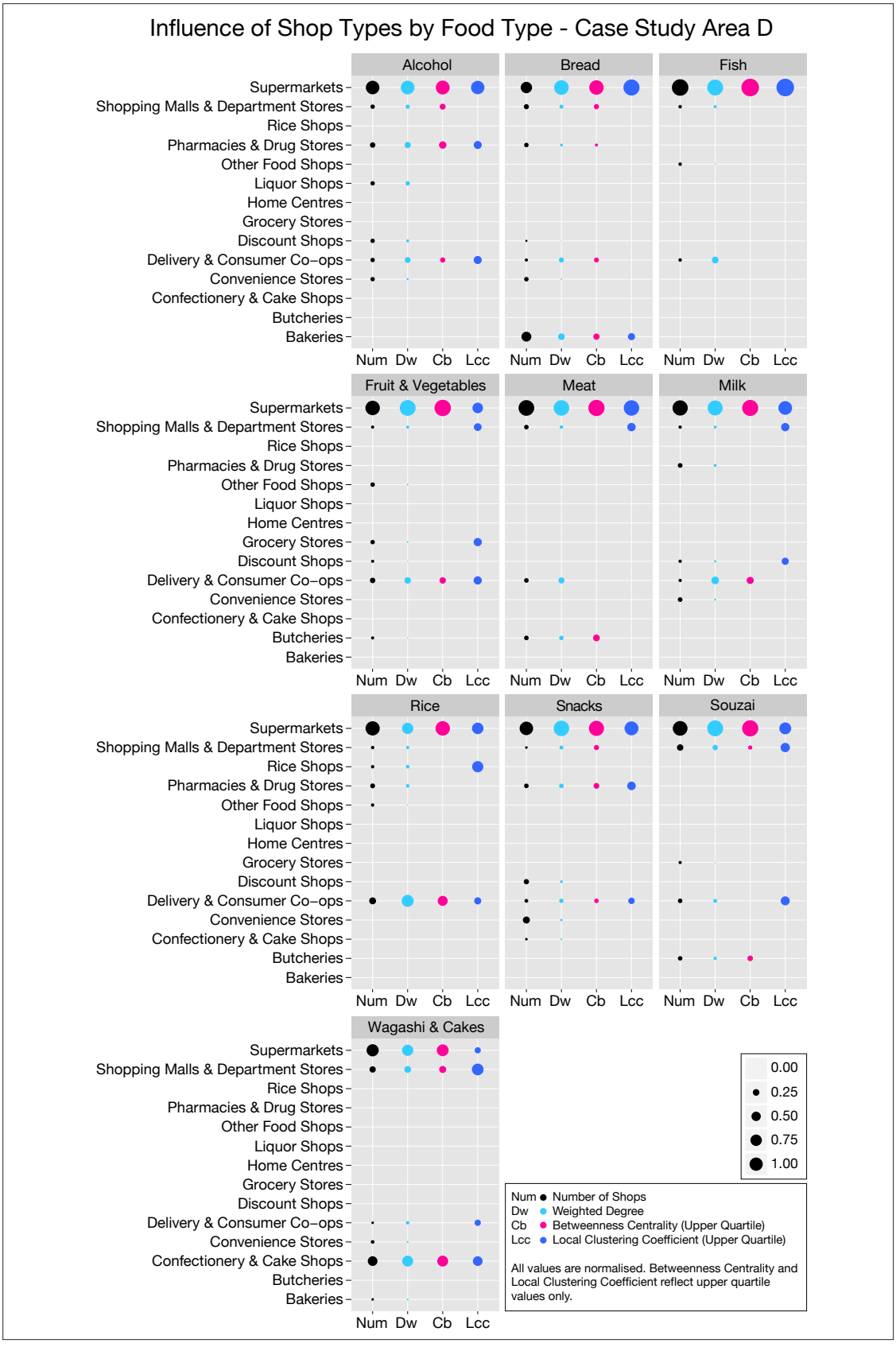


Figure 7.2.27 Distribution of Influence of Shop Type by Food Type - Case Area D.

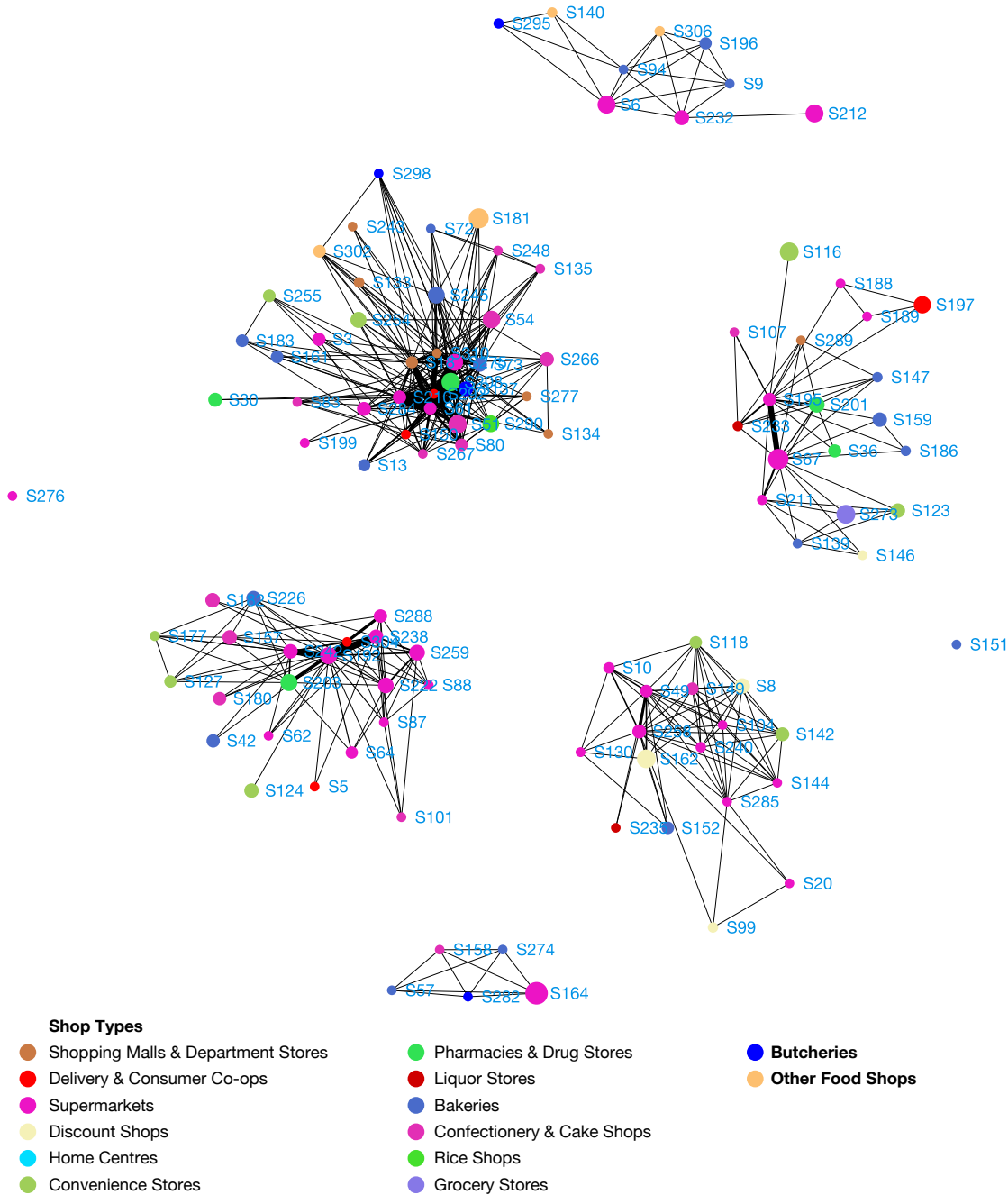


Figure 7.2.28 Composition of Shop Communities - Case Area D.

Community	SC0	SC1	SC2	SC3	SC4	SC5	SC6	SC7
Size	22	17	37	19	5		1	1
Total Weighted Degree	6.98	2.46	13.59	3.01	0.09	0.4	0	0.07
Total Betweeness Centrality	9978	7975	38459	7464	1080	2379	216	216
Average Local Clustering Coefficient	0.64	0.43	0.7	0.61		0.39		
Average Nearest Neighbour Ratio	0.25	0.17	0.22	0.21	0.12	0.2	0	0
Supermarkets	10		6	5	1	3		1
Shopping Malls & Department Stores			6	1				
Rice Shops			1					
Pharmacies & Drug Stores	1		2	2				
Other Food Shops			1			2		
Liquor Shops		1		1				
Home Centres								
Grocery Stores			1	1				
Discount Shops		3		1				
Delivery & Consumer Co-ops	2		2	1				
Convenience Stores	3	2	2	2				
Confectionery & Cake Shops	4	1	8	1	1			
Butchers			2		1	1		
Bakeries	2	1	6	4	2	3	1	

Table 7.2.5 Composition of Shop Communities - Case Area D.

7.2.5 Case Area E

Area E, Kashiwa JHS, has by far the highest number of shop choices of the case study areas. Figure 7.2.29 shows the bipartite graph for Area E. The households are made up of two major communities containing 56 and 38 households each and one single household. 13 shop communities were detected. Of these two are of significant size; SC0 contains 57 shops and SC2 contains 21 shops. The simplified graph, Figure 7.2.30, shows that the foodscape for Area E is generally monomodal. While the strongest tie lies between SC0 and PC0, household community PC1 shows some level of independence by also utilising SC2.

Figure 7.2.30 shows the location of food shops by community. It shows that SC0, the dominant shop community is distributed in all directions in and around the case study area. The Nearest Neighbour Ratio analysis reveals that the most strongly correlated areas are located not at Kashiwa station but in the areas 500m to 1.5km immediately around the station.

Figure 7.2.33 shows the distribution of power and influence between shop nodes. In contrast to the other areas, Area E shows similar scores between Supermarket and Shopping Malls & Department Stores for weighted degree as well as Delivery & Consumer Co-ops. This is translated into high betweenness centrality scores for Shopping Malls & Department Stores followed by Supermarkets and Confectionery & Cake Shops. Supermarkets and Convenience Stores are the most embedded as reflected in the local clustering coefficient scores.

The breakdown of the distribution of influence by food type, shown in Figure 7.2.34, shows that Shopping Malls & Department Stores score highly for weighted degree in fresh foods such as Fish, Bread, Fruit & Vegetables and Bread while Rice, Souzai and Wagashi & Cakes have high scores for non-supermarket shop types. Betweenness scores are shared between Supermarkets and Shopping Malls & Department Stores for all food types except for Rice and Milk where Delivery & Consumer Co-ops also feature.

Figure 7.2.35 shows the composition of shop communities. Where the largest community, SC0 is dominated by Supermarkets and Delivery & Consumer Co-ops, the other prominent shop community, SC2, has Takashimaya, the major Department Store at Kashiwa Station, at it’s

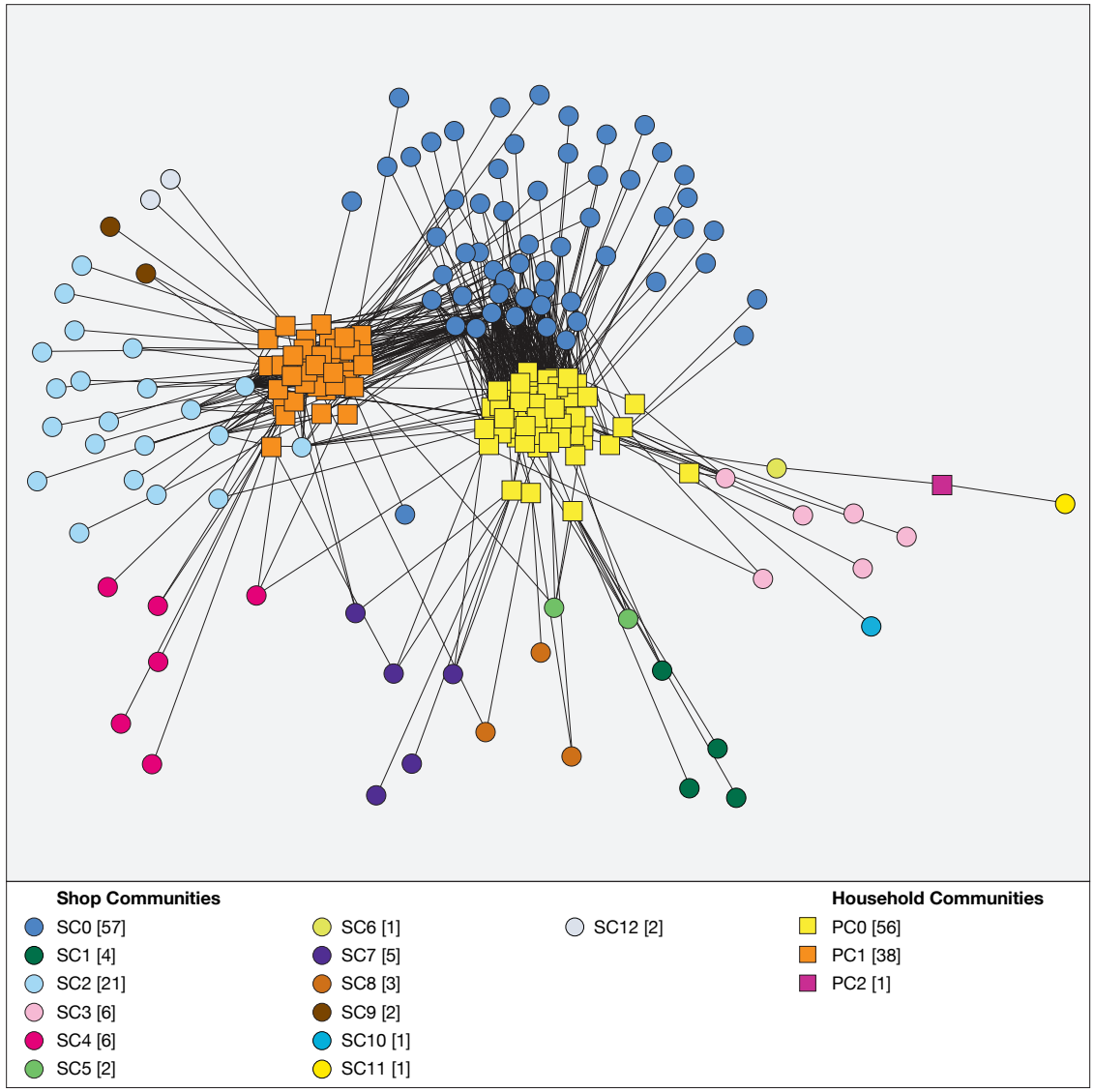


Figure 7.2.29 Network Visualisation of Case Area E.
Graph representing shopping behaviour of Case Area E using the Fruchterman–Reingold algorithm. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

core. SC0 has the highest average local clustering coefficient score of all of the communities suggesting that at it's core lies a number of key shops.

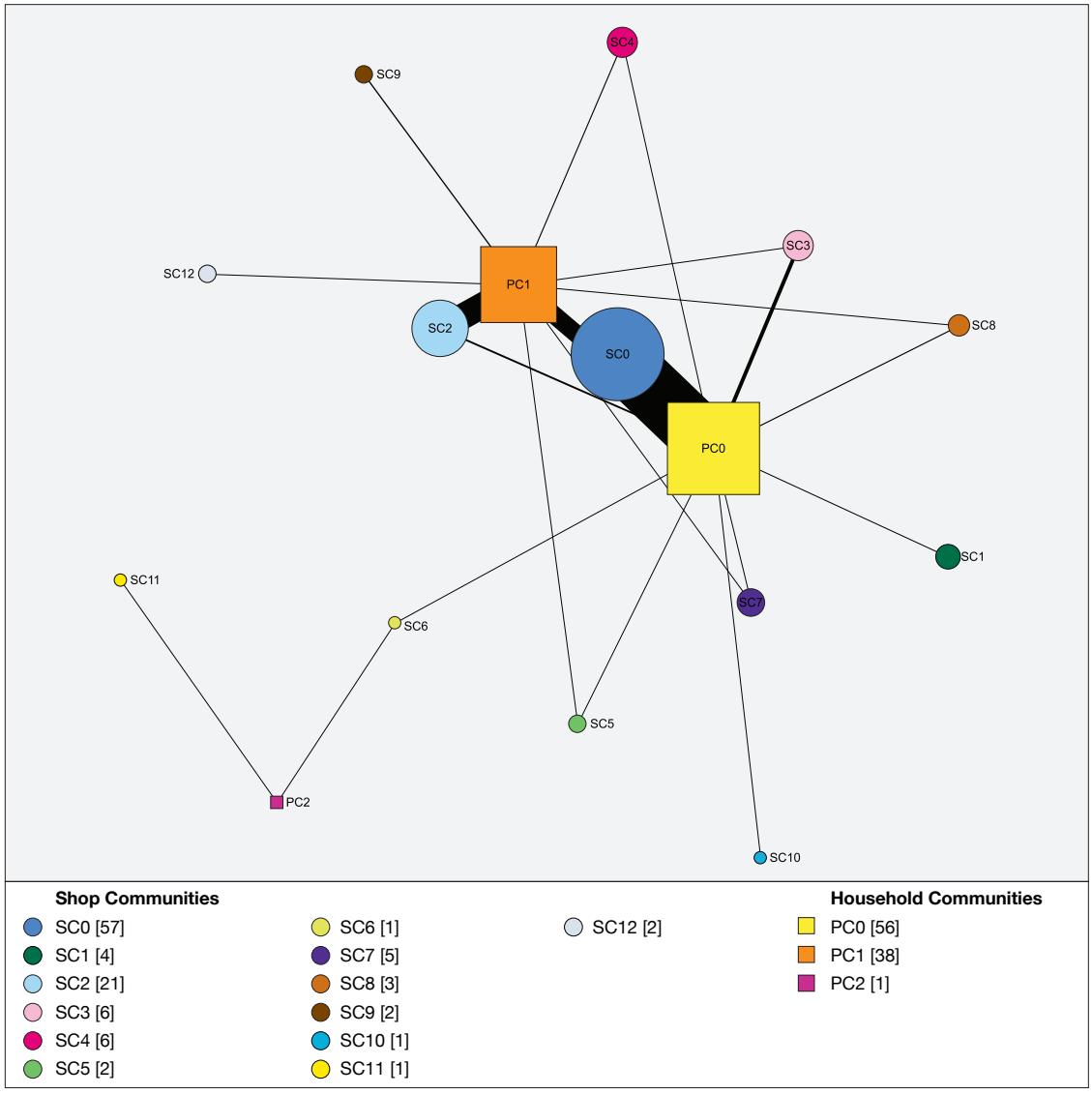


Figure 7.2.30 Simplified Graph of Case Area E.
Graph representing shopping behaviour of Case Area E using the Fruchterman–Reingold algorithm. actors in the same community are represented as a single node. The size of the node represents number of actors in the community. Circular nodes represent shops, square nodes represent households. Colour of nodes represent community.

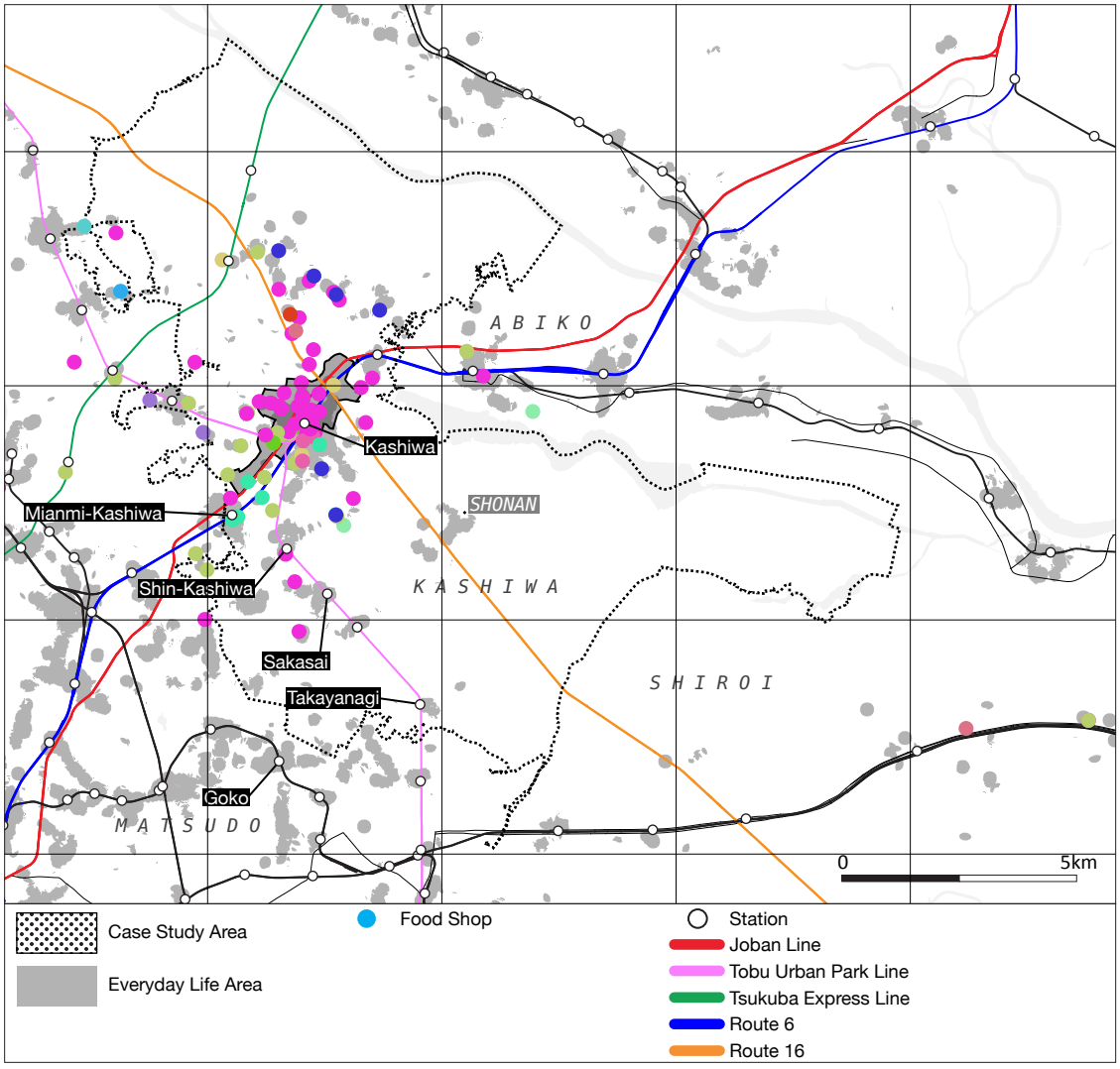


Figure 7.2.31 Location of Food Shops by Community - Case Area E.

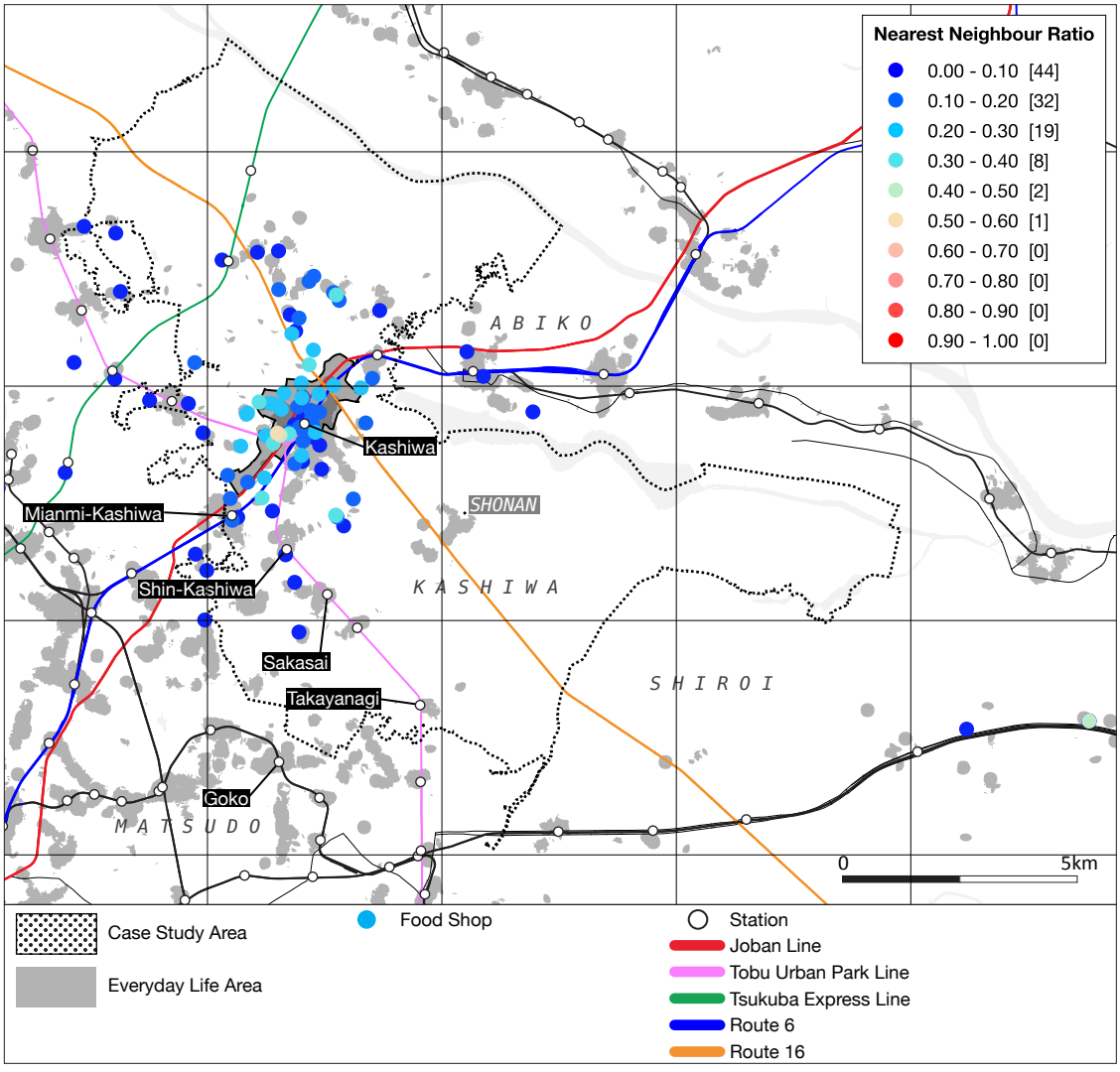


Figure 7.2.32 Location of Food Shops by Nearest Neighbour Ratio - Case Area E.

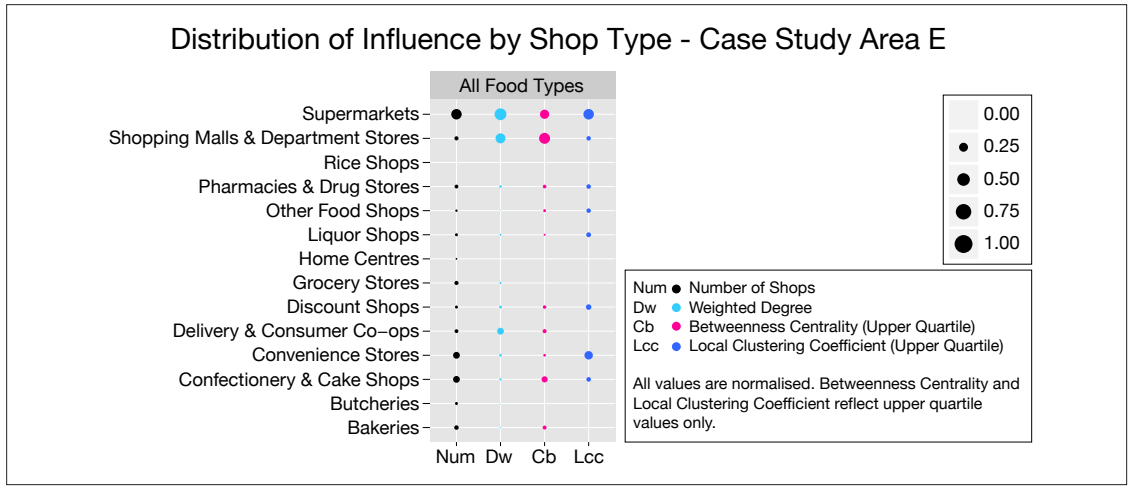


Figure 7.2.33 Distribution of Influence by Shop Type - Case Area E.

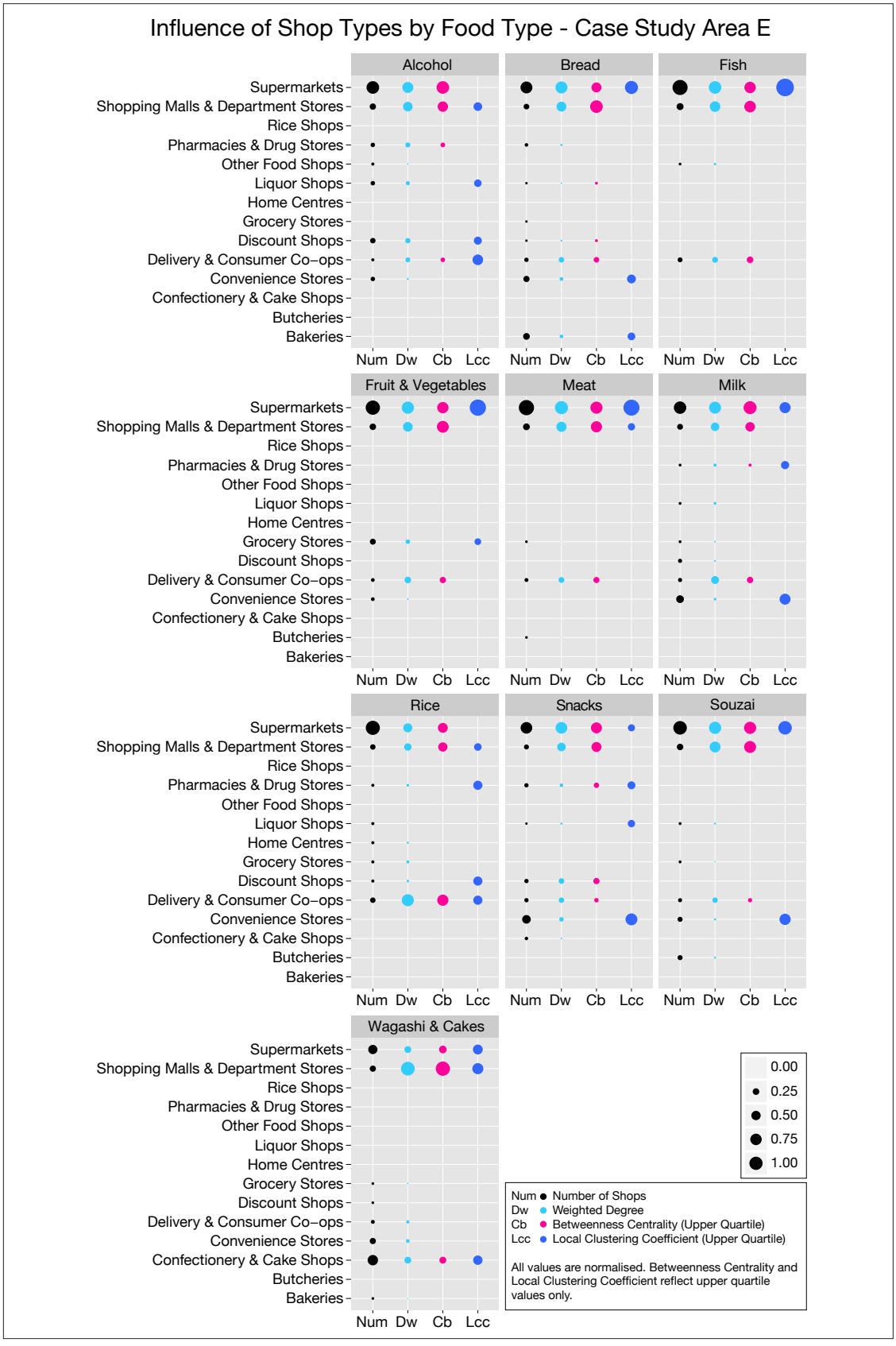
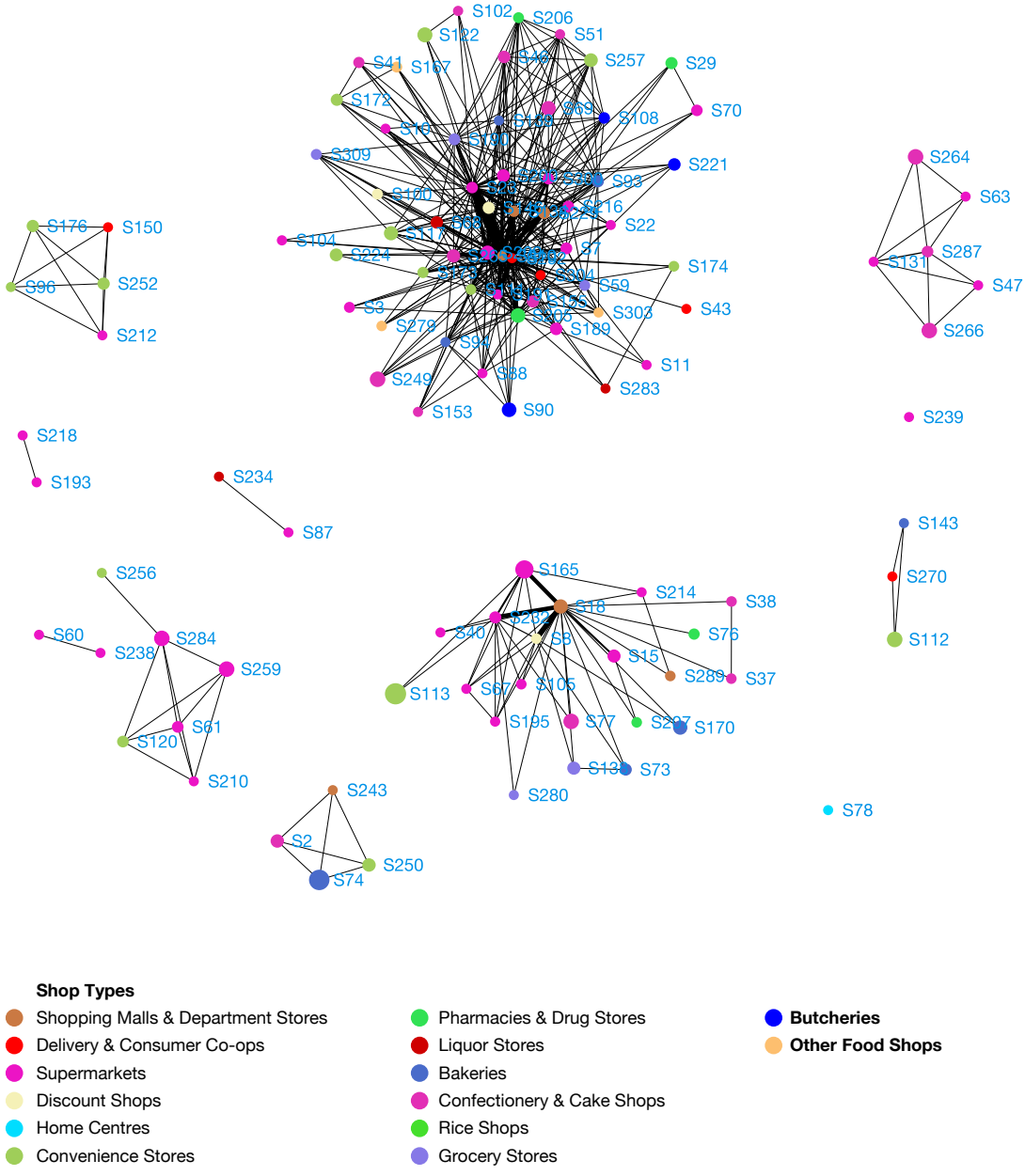


Figure 7.2.34 Distribution of Influence of Shop Type by Food Type - Case Area E.



Shop Types

- Shopping Malls & Department Stores
- Delivery & Consumer Co-ops
- Supermarkets
- Discount Shops
- Home Centres
- Convenience Stores
- Pharmacies & Drug Stores
- Liquor Stores
- Bakeries
- Confectionery & Cake Shops
- Rice Shops
- Grocery Stores
- **Butcheries**
- **Other Food Shops**

Figure 7.2.35 Composition of Shop Communities - Case Area E.

Community	SC0	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
Size	57	4	21	6	6	2		5	3
Total Weighted Degree	15.06	0.19	5.29	0.74	0.26	0.18	0.24	0.25	0.22
Total Betweeness Centrality	46038	820	10595	1768	2038	605	611	1357	1030
Average Local Clustering Coefficient	0.65	0.46	0.57	0.45	0.33	0.51	0	0.38	0.3
Average Nearest Neighbour Ratio	0.15	0.25	0.17	0.14	0.17	0	0	0.1	0.17
Supermarkets	15		8	3	4				
Shopping Malls & Department Stores	3		2						
Rice Shops									
Pharmacies & Drug Stores	3		2						
Other Food Shops	2								
Liquor Shops	2								
Home Centres									
Grocery Stores	4		2						
Discount Shops	2								
Delivery & Consumer Co-ops	3								
Convenience Stores	8				2			3	
Confectionery & Cake Shops	9		3	3					
Butchers	3								
Bakeries	3		2						

Community	SC9	SC10	SC11	SC12
Size	2			2
Total Weighted Degree	0.25	0.04	0.05	0.18
Total Betweeness Centrality	410	205	205	410
Average Local Clustering Coefficient	0.4			
Average Nearest Neighbour Ratio	0	0	0	0
Supermarkets	2			2
Shopping Malls & Department Stores				
Rice Shops				
Pharmacies & Drug Stores				
Other Food Shops				
Liquor Shops				
Home Centres				
Grocery Stores				
Discount Shops				
Delivery & Consumer Co-ops				
Convenience Stores				
Confectionery & Cake Shops				
Butchers				
Bakeries				

Table 7.2.6 Composition of Shop Communities - Case Area E.

7.2.6 Comparison and Summary

The visualisation of bipartite graphs for each of the case study areas reveals three types of networks; monomodal, bimodal and polymodal. Monomodal networks have one major shop community. The inference of this type of network is that defined shopping patterns cannot be found within the this major community, that household patterns are disproportionately diverse. Polymodal networks, in contrast, infer discernible shopping patterns that divide the network into distinct groups. Bimodal networks, as the name suggests have two major groups, infer that only general types of shopping patterns can be discerned.

Table 7.2.7 compares the case study areas. Monomodal, bimodal and polymodal networks can be further categorised as either ‘shared’ networks or ‘exclusive’ networks. Exclusive networks tend to have one major tie from a shop community to a household community. Case Area A shows this relationship where SC0 ties to PC1, SC1 to PC0, SC2 to PC2 and SC3.

The analysis found that Case Areas A and D are polymodal, Case Areas C and E are monomodal and Case Area B is bimodal. Of all of the areas Case Areas B and C have ‘shared’ ties.

The location of shops within the same community reveals information about the nature of the shopping patterns. The Nearest Neighbour Ratio (NNR) allows the strength of the relationship between shop communities and their local environment to be quantified. In general Areas A and B have low NNR values suggesting that neighbouring shops tend not to be used together, that they are in competition. Case Area C has the highest NNR scores. Over all of the areas, high NNR values tend to be local. Further shop communities with high NNR values do not necessarily have a core supermarket supported by smaller specially shops. Case Area C, for example, shows three supermarkets in close proximity working together complimentarily.

Food shops around Kashiwa Station are used by all areas, however the NNR values for the immediate station area are low suggesting that households use one or a few shops only in this area. Area E too, despite encompassing Kashiwa Station, shows low values at the station but increase at greater distances surrounding the station.

	Case Area A Island Roadside	Case Area B Isolated Suburban	Case Area C Peripheral Suburban	Case Area D Central Suburban	Case Area E Major Urban
Network Type	**Polymodal**	**Bimodal**	**Monomodal**	**Polymodal**	**Monomodal**
Network Definition	Exclusive	Shared	Shared	Exclusive	Exclusive
Density	High	Low	High	High	High
Weighted Degree Distribution	No Dominant Shop	One Dominant Shop	One Dominant Shop	A Few Dominant Shops	A Few Dominant Shops
Clustering	Low	Medium	High	High	Medium
Spatial Correlation (NNR)	Low	Low	High	Medium	Medium
Shop Types					
Weighted Degree	•**Supermarkets** •**Delivery**	•**Supermarkets**	•**Supermarkets** •Shopping Malls •**Delivery**	•**Supermarkets** •**Delivery**	•**Supermarkets** •Shopping Malls •**Delivery**
Betweenness Centrality	•**Supermarkets** •Shopping Malls •Drug Stores •Liquor Stores •Discount Shops •**Cake Shops** •**Bakeries**	•**Supermarkets** •Drug Stores •**Cake Shops** •**Bakeries**	•**Supermarkets** •Shopping Malls •Delivery •Convenience Stores •**Cake Shops** •**Bakeries**	•**Supermarkets** •Shopping Malls •Delivery •**Cake Shops** •**Bakeries**	•**Supermarkets** •Shopping Malls •**Cake Shops**
Local Clustering Coefficient	•**Supermarkets** •Delivery	•**Supermarkets** •Shopping Malls •**Drug Stores** •Discount Shops •Delivery •Convenience Stores •Cake Shops	•**Supermarkets** •Shopping Malls •**Drug Stores** •Other •Delivery •Convenience Stores	•**Supermarkets** •**Drug Stores** •Cake Shops	•**Supermarkets** •Shopping Malls •**Drug Stores** •Other Food Shops •Liquor Shops •Discount Shops •Convenience Stores •Cake Shops
Food Types					
Weighted Degree	•**Alcohol** •**Rice** •**Wagashi & Cakes**	•**Alcohol** •**Rice** •**Wagashi & Cakes**	•**Alcohol** •Bread •Milk •**Rice** •**Wagashi & Cakes**	•**Alcohol** •Bread •**Rice** •**Wagashi & Cakes**	•**Alcohol** •Bread •Fish •Fruit & Veges •Meat •Milk •**Rice** •Snacks •Souzai •**Wagashi & Cakes**
Betweenness Centrality	•**Alcohol** •**Bread** •**Rice** •**Snacks** •**Wagashi & Cakes**	•**Alcohol** •**Milk** •**Rice** •**Snacks** •**Wagashi & Cakes**	•**Bread** •**Fruit & Veges** •**Meat** •**Milk** •**Rice** •**Snacks** •**Souzai** •**Wagashi & Cakes**	•**Alcohol** •**Bread** •**Rice** •**Wagashi & Cakes**	•**Alcohol** •**Bread** •Fish •Fruit & Veges •Meat •**Milk** •**Rice** •**Snacks** •Souzai •**Wagashi & Cakes**
Local Clustering Coefficient	•**Snacks**	•**Alcohol** •**Milk** •**Rice** •**Snacks** •**Souzai**	•**Alcohol** •Bread •Fruit & Veges •**Milk** •**Rice** •**Snacks** •**Souzai** •Wagashi & Cakes	•**Alcohol** •Fruit & Vegetables •Meat •**Milk** •**Rice** •**Snacks** •**Souzai** •Wagashi & Cakes	•**Alcohol** •Bread •**Milk** •**Rice** •**Snacks** •**Souzai** •Wagashi & Cakes

Table 7.2.7 Summary of Foodscape Structures.

The supermarket form dominates all areas studied. They are widely used across all food types, and except for Case Area E which also features Shopping Malls & Department Stores prominently, are typically the most widely used shop type. The food types that are most resistant to the supermarket form are common across all of the areas. Alcohol, Wagashi & Cakes and Rice all show high weighted degree values.

Areas C and D have the easiest access to Shopping Malls & Department Stores being close to Aeon Mall and Route 6. Betweenness values are present in all areas for Confectionery & Cake Shops an Bakeries and Shopping Malls and Department Stores for four of the areas. Local clustering coefficient values are spread across a high number of shop types in Areas B, C and D.

In terms of food, the foods most resistant to the supermarket format by weighted degree centre on Alcohol, Rice, Wagashi & Cakes and to a lesser extent Bread. Alcohol, Bread, Snacks, Wagashi & Cakes and Rice are the most represented betweenness centrality shops. Shopping for Snacks are highly embedded in non-supermarket food shops in all of the areas. In Areas other than Area A Alcohol, Milk, Rice and Snacks feature in local clustering coefficient scores. Area E has the widest variation of values across food types. It is important to note is how areas differ rather than correlate.

7.3 Comparison of Foodscapes

This section compares the structural qualities if each of the case study areas. By comparing these areas variations the role of urban structures on shopping behaviour can be unveiled. Particularly this section is interested in understanding how the role various food shop types vary across urban environments, the influence of individual food types on foodscapes and the roles that specific shops play in the various networks.

Firstly, the overall network measures for each area are compared and contrasted to understand the varying roles of food shop types across urban landscapes.

Secondly, the role of individual food types are analysed by constructing individual graphs for each of the 10 surveyed food types in each area and general structural characteristics extracted.

Thirdly, graphs constructed for each food type in each area are analysed to extract the varying forms of influence that food type provides.

Finally, specific food shops are selected as examples of how shopping behaviour endows food shops with varying levels of influence in different communities.

7.3.1 The Structure Foodscapes by Food Type.

The overall structure of each foodscape can be further analysed by food type. Separate graphs were constructed for each food type and their structural qualities compared.

Density reflects the spreading of shopping activity across a number of shops. Low values suggest the restriction of shop choices either as a result of loyalty or alternatively a lack of choice, whereas high values suggest a complimentary relationship between shops.

Figure 7.3.1 shows the variation of density of graphs for each food type in each area. Values are compared by normalising density values against the mean density score for each area. Density scores above 1 therefore show a relatively high spread of shopping habits while scores below 1 suggest more restrictive shopping patterns. In general Area A tends to show more exaggerated values to the other areas; where Fruit & Vegetables and Milk values are relatively high for all areas, it is very high for Area A, and where bread is low it is very low for Area A. Apart from Area A scores for each food type follow similar trends; Rice, Fish, Meat, Fruit & Vegetables and Milk have high density values while Bread, Snacks, Wagashi & Cakes and Alcohol have lower values. Souzai is neutral.

Of all of the food types, Bread and Wagashi & Cakes show the greatest variation amongst the four Areas B, C, D and E. In these areas there are a number of shops accessible for these food items suggesting that loyalty, or the exercising of personal preference, is a more likely driver of low density than a lack of choice.

The distribution of ties in a network gives insight into the relationships between shops. Where a group of ties accumulate in a network ideas of cooperation and complementarity can be established. The global clustering coefficient is a value between 0 and 1 gives an indication of the level of clustering over a network. Values approaching 1 have greater levels of clustering. High global clustering coefficient scores suggest that defined number of shops within a network are more closely interconnected than other shops, or that the distance between shops varies significantly. A cluster of nodes suggests a level of interaction greater than that of nodes outside of the group.

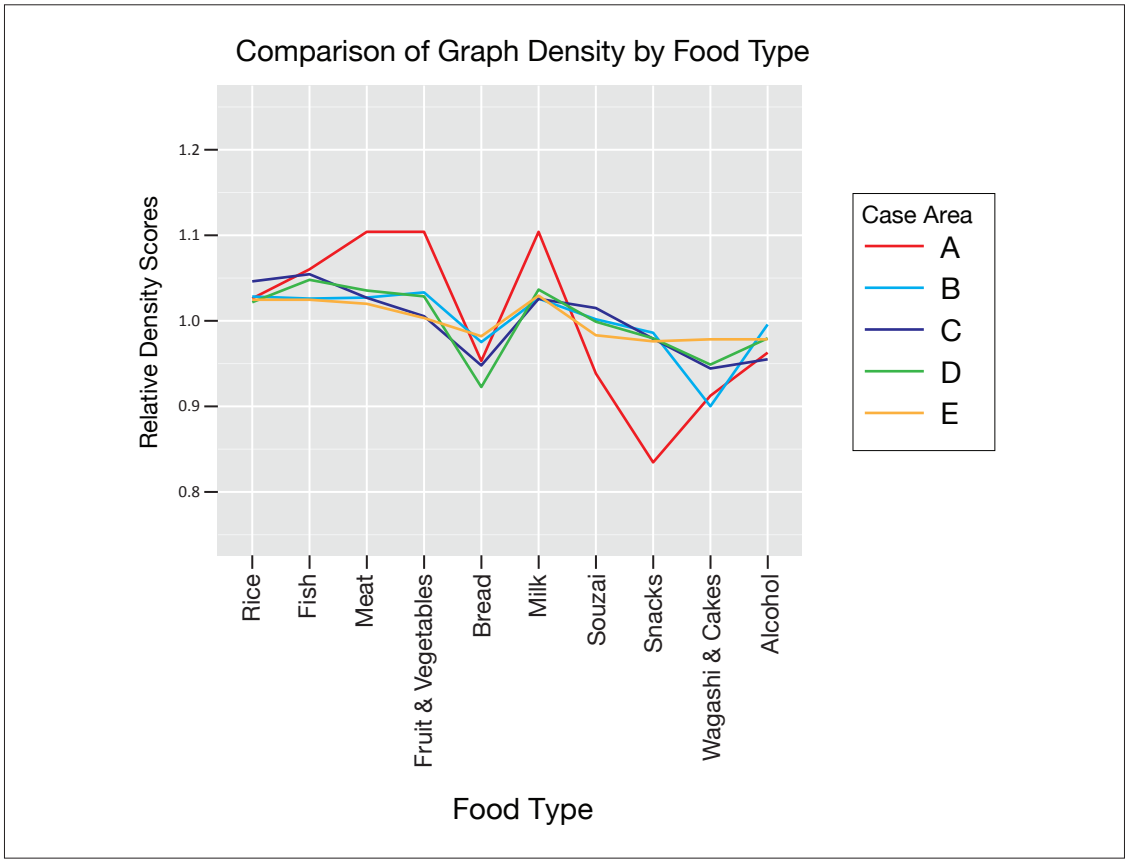


Figure 7.3.1 Comparison of Graph Density by Food Type.

Figure 7.3.2 shows the variation of global clustering coefficient values for each food type in each area. Global coefficient values for each food type on each area were calculated and their relative difference graphed. Generally, scores for Area A differ from global clustering coefficient scores for Areas B, C, D and E which show similar trends; Fish, Meat and Fruit & Vegetables have high levels of clustering than average, Rice, Bread, Souzai and Alcohol have clustering coefficient scores lower than average and Milk and Snacks have average clustering coefficient scores. Global clustering values for Wagashi & Cakes varies the most by area with scores ranging between 1.07 in Area C and 0 in Area B.

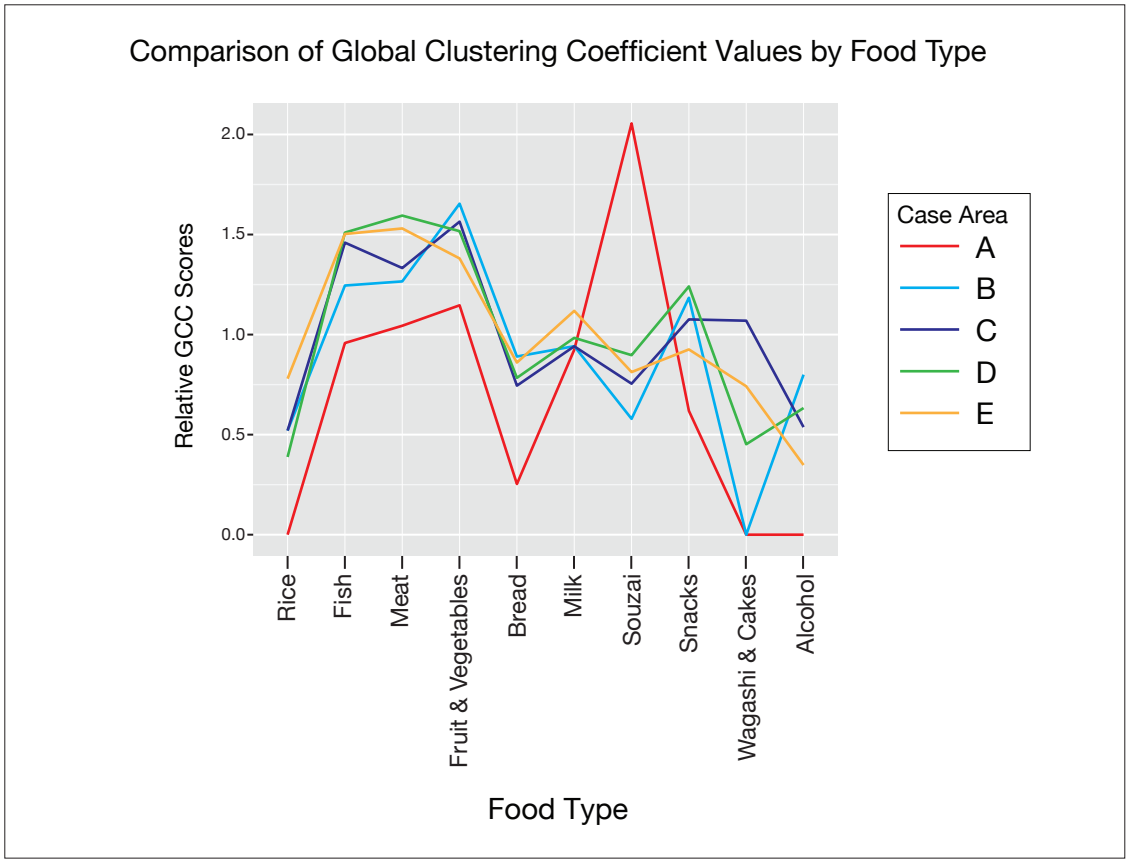


Figure 7.3.2 Comparison of Global Clustering Coefficient Values by Food Type.

7.3.2 The Role of Food Shop Types Across Urban Environments.

The supermarket format dominates each of the five communities in terms of amount of use and measures of flow such as betweenness centrality and clustering coefficients. Figure 7.3.3 shows the distribution of influence across each of the case study areas for all food types. As outlined in the previous chapter, concepts of influence or power are contextual in that influence can be understood from various points of view. It is through this variation that the nature of foodscapes can be understood in different communities. Four network measures were extracted and compared. Values for the number of shops used, weighted degree, betweenness centrality and local clustering coefficient are normalised to allow comparison. Upper quartile values only are used to show the distribution of betweenness centrality and local clustering.

By reading the graph horizontally the varying roles of influence across each case study area can be understood. In terms of the number of shops used, there is little variation across the areas except for Bakeries which has a higher value in Area D and the non-use of shop types such as Home Centres in Areas C and D, and Rice Shops in Areas B, C and E.

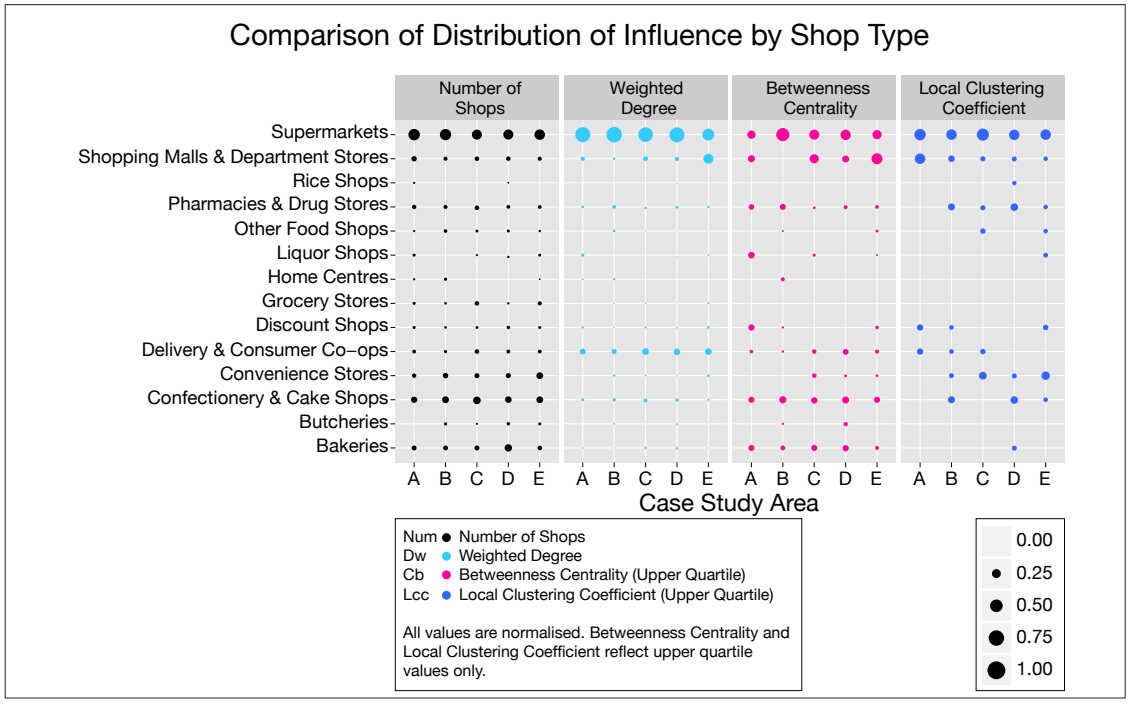


Figure 7.3.3 Comparison of Distribution of Influence by Shop Type.

Weighted degree values are dominated by Supermarkets and Delivery and Consumer Co-ops. However, in Area E Shopping Malls & Department Stores have strong ties.

In contrast to weighted degree and shop number values, betweenness centrality and local clustering coefficient values are influenced directly by ties between shops. In these two values a wider variation of influence can be seen. While Confectionery & Cake Shops and Bakeries have a high proportion of betweenness centrality values, the value for Bakeries is lower in Area E. Pharmacies & Drug Stores, Liquor Shops and Discount Shops have a higher proportion of betweenness in Area A than other areas.

The local clustering coefficient reflects a level of embeddedness of an actor in a network. Values for Supermarkets are consistent across all areas. Values for Shopping Malls & Department Stores is stronger in Area A. Pharmacies & Drug Stores have high values in Areas B and D, while Convenience Stores have high values in Areas C and E. Confectionery & Cake Shops have a high proportion of betweenness values in all areas but only shops Areas B & D show strong qualities of embeddedness.

7.3.3 Comparison of the Mapping of Food Types onto Food Shop Types

This section looks at the relationship between food types and food shop types across all of the case study areas. By analysing the graphs of each food type we can see which food shop types dominate food types and how this varies across areas. Based on the characteristics of the ten food types they were categorised into 3 general groups, 'Staples', 'Personal Preference' and 'Generic', and compared.

Staples: Rice, Fish, Meat and Fruit & Vegetables

Household food staples are made up of Rice, Fish, Meat and Fruit & Vegetables. All food types are widely available across many food shop formats and possess and vary in price and quality. Fish, Meat and Fruit & Vegetables are perishable items and so shopping frequency is high and fall under major shopping trip and fill-in shopping trip categories. Rice is categorised by it's weight and difficultly in transportation. Typically rice comes in 5, 10 or 20 kg sizes.

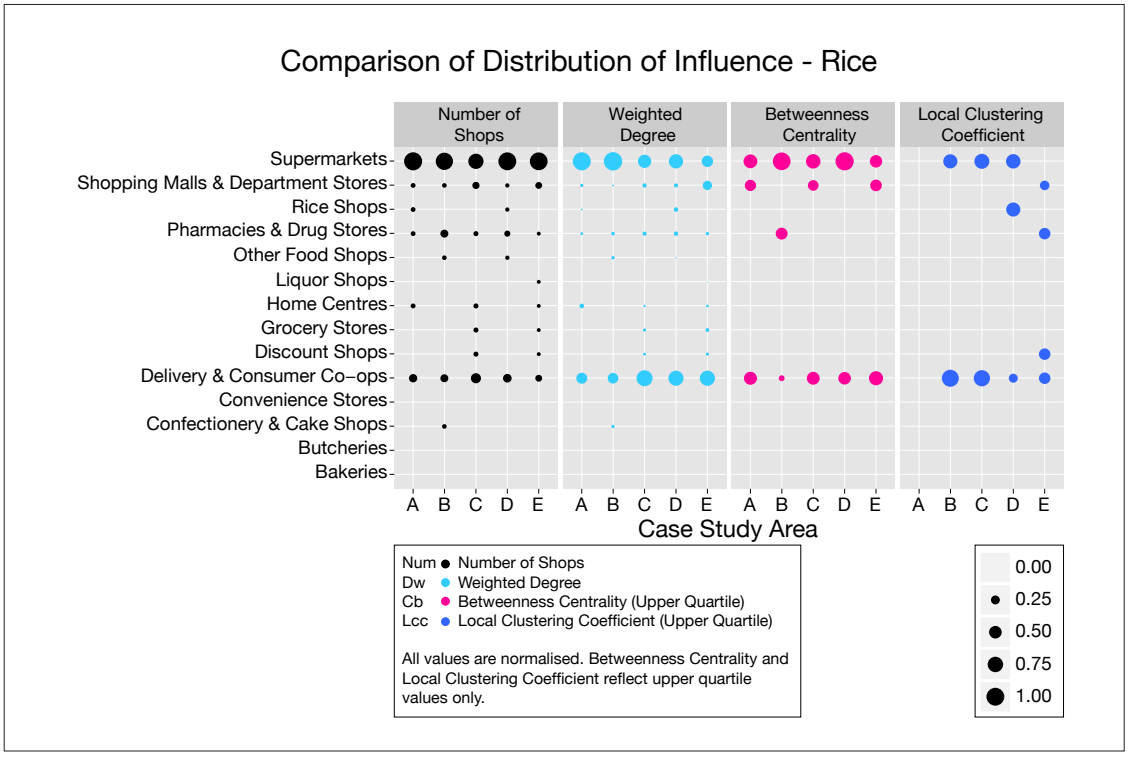


Figure 7.3.4 Comparison of Distribution of Influence - Rice.

Shopping for Rice is dominated by Supermarkets and Delivery & Consumer Co-ops but is also purchased at a variety of shops ranging from traditional Rice Shops to more generic shop types such as Home Centres and Drug Stores. Apart from Supermarkets and Delivery and consumer Co-ops, significant betweenness centrality is found in Shopping Malls & Department Stores in Areas A, C, and D and in Pharmacies & Drug Stores in Area B. Rice shops are highly embedded into shopping practices in Area D and evenly distributed amongst Shopping Malls & Department Stores, Pharmacies & Drug Stores, Discount Shops and Delivery & Consumer Co-ops in Area E.

Shopping for Fish takes place almost exclusively at Supermarkets with minor use of Shopping Malls & Department Stores and Delivery & Consumer Co-ops. Betweenness Centrality varies significantly across each area for Shopping Malls & Department Stores where it is high in Areas A, C and E as well as Delivery & Consumer Co-ops where it is high in Areas A and E only. All local clustering coefficient values in the upper Quartile occur in Supermarkets.

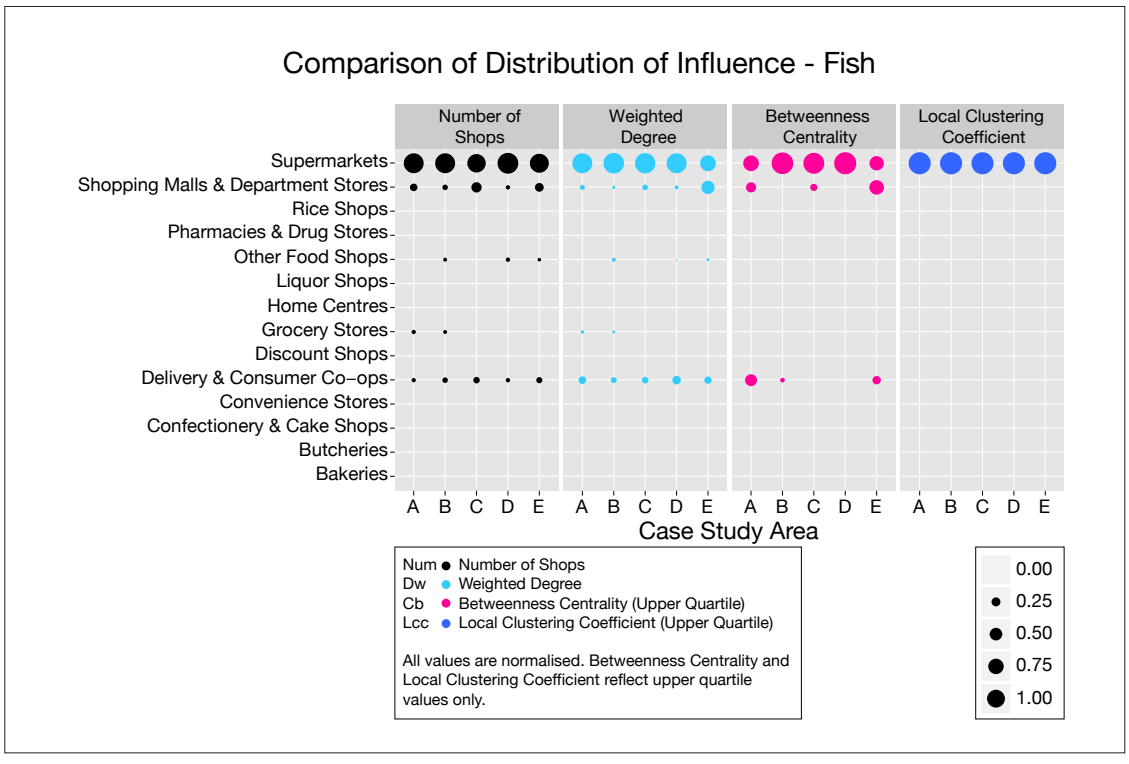


Figure 7.3.5 Comparison of Distribution of Influence - Fish.

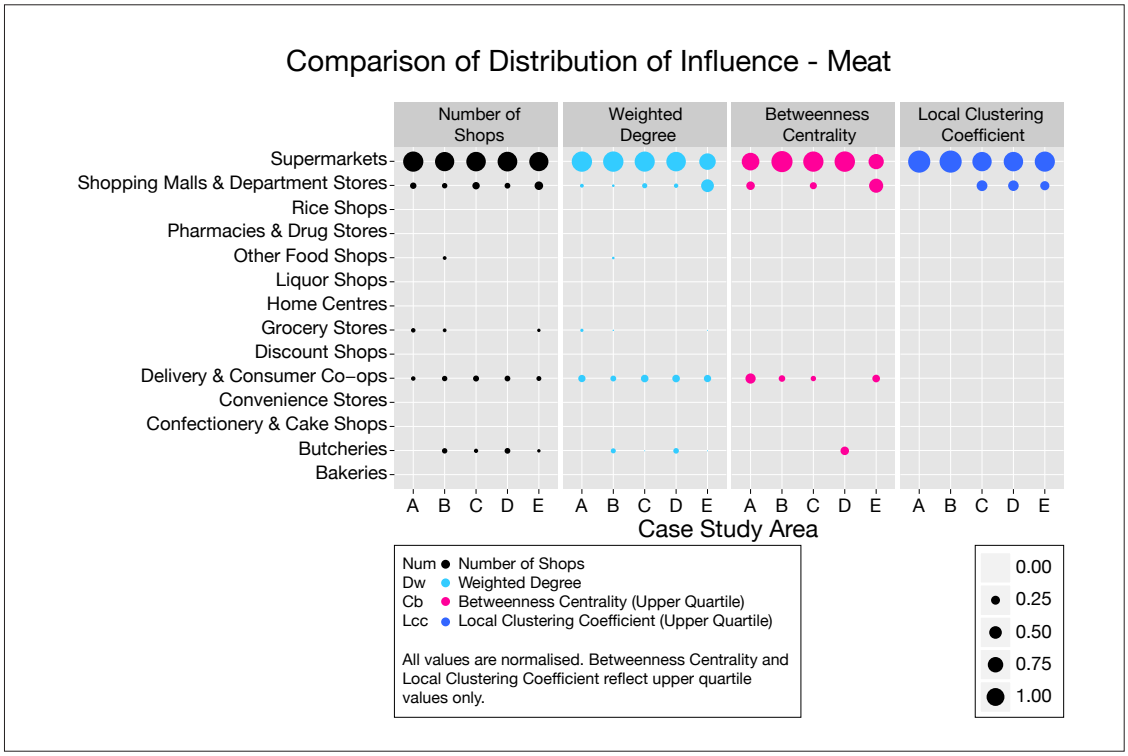


Figure 7.3.6 Comparison of Distribution of Influence - Meat.

Meat exhibits similar qualities to Fish in that Supermarkets and Delivery and Consumer Co-ops dominate. In addition, Butcheries are used in Areas B and D and scores for Shopping Malls & Department Stores is significantly higher in Area E. Supermarkets are the most embedded while Shopping Malls & Department Stores also have high scores in Areas C, D and E.

Fruit & Vegetables are dominated by Supermarkets but Grocery Stores, Delivery & Consumer Co-ops and Shopping Malls & Department Stores are represented. Betweenness centrality scores for Shopping Malls & Department Stores are unevenly distributed with Areas A, C and E exhibiting higher values. While weighted Degree values are relatively low for Grocery Stores high values for local clustering coefficients suggest they play a significant role in Areas C, D and E as local shops.

In general the purchase of staples is uniform across all case areas. While Rice is purchased at a number of different shop types, when weighted by association shows that Supermarkets and Delivery & Co-ops are the dominant food shop types. The exception to this trend in Area E where Shopping Malls & Department Stores also feature. While the distribution of degree values is uniform the transference of betweenness centrality values and local clustering coefficient

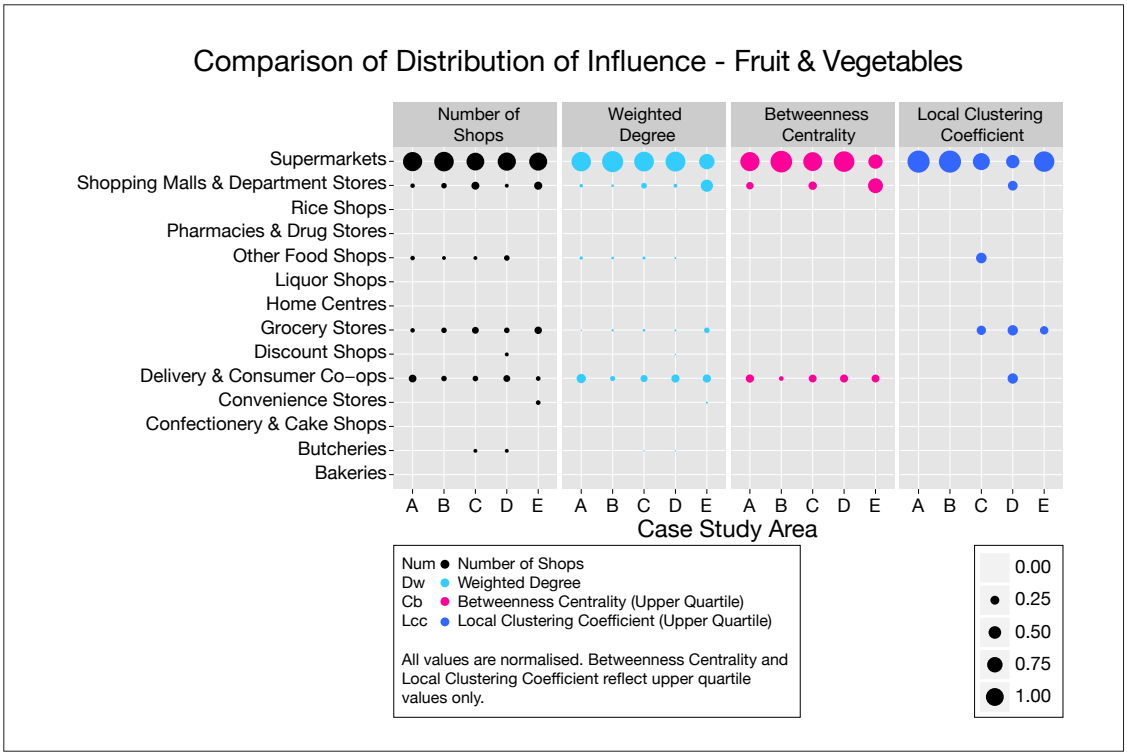


Figure 7.3.7 Comparison of Distribution of Influence - Fruit & Vegetables.

values varies in some cases. For example, Delivery & Consumer Co-ops have high betweenness values in Areas A and E but not in the other areas. This means that although each area uses the same shops types to the same degree, the influence or power that they are endowed with vary by area.

Personal Preference Items: Bread, Souzai and Wagashi & Cakes

The food items that are categorised as Personal Preference are characterised by their variation across food shops. Bread, Souzai and Wagashi & Cakes vary significantly in price, quality and style. Routines established around these foods are largely seen as based on personal preference.

Shopping for Bread takes place across a wide variety of shop types. As well as Supermarkets, Shopping Malls & Department Stores, Pharmacies & Drug Stores, Delivery & Consumer Co-ops, Convenience Stores and Bakeries are also represented. As a result Bakeries have significant value as a 'bridge' with high betweenness centrality scores in Areas A, B, C and D as well as high embeddedness with high local clustering coefficient scores in Areas C, D and E.

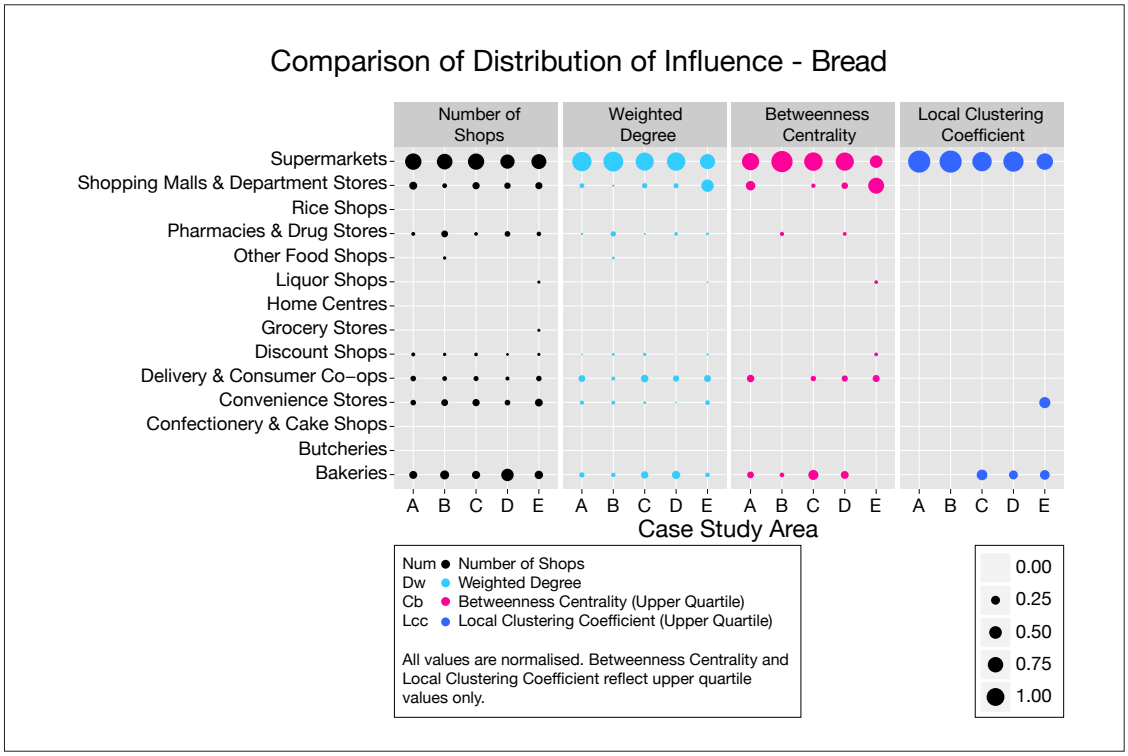


Figure 7.3.8 Comparison of Distribution of Influence - Bread.

Shopping for Souzai occurs mainly in Supermarkets except for Area E where Shopping Malls & Department Stores are also predominant. While Butcheries have minor influence in terms of weighted degree in Areas B, D and E, they have high betweenness scores in Area D. Convenience Stores have high local clustering values in Area E while Areas B and D have high values for Delivery & Consumer Co-ops.

Wagashi & Cakes present the most significantly varied weighted degree values for all of the food types surveyed. While specific values vary slightly, generally shopping for Wagashi & Cakes is spread across Supermarkets, Shopping Malls & Department Stores and Confectionery & Cake Shops. In particular Areas A, C and E have a lesser reliance on supermarkets than other shop types. In the most extreme cases, Shopping Malls & Department Stores dominate Area E and Confectionery & Cake Shops dominate Area C. In terms of betweenness centrality, Values vary the most across the case study areas for Shopping Malls & Department Stores and Confectionery & Cake Shops. Areas A and B show no local clustering for Areas A and B reflecting a diverse range of shopping patterns in these communities. In Area C Convenience Stores are highly embedded.

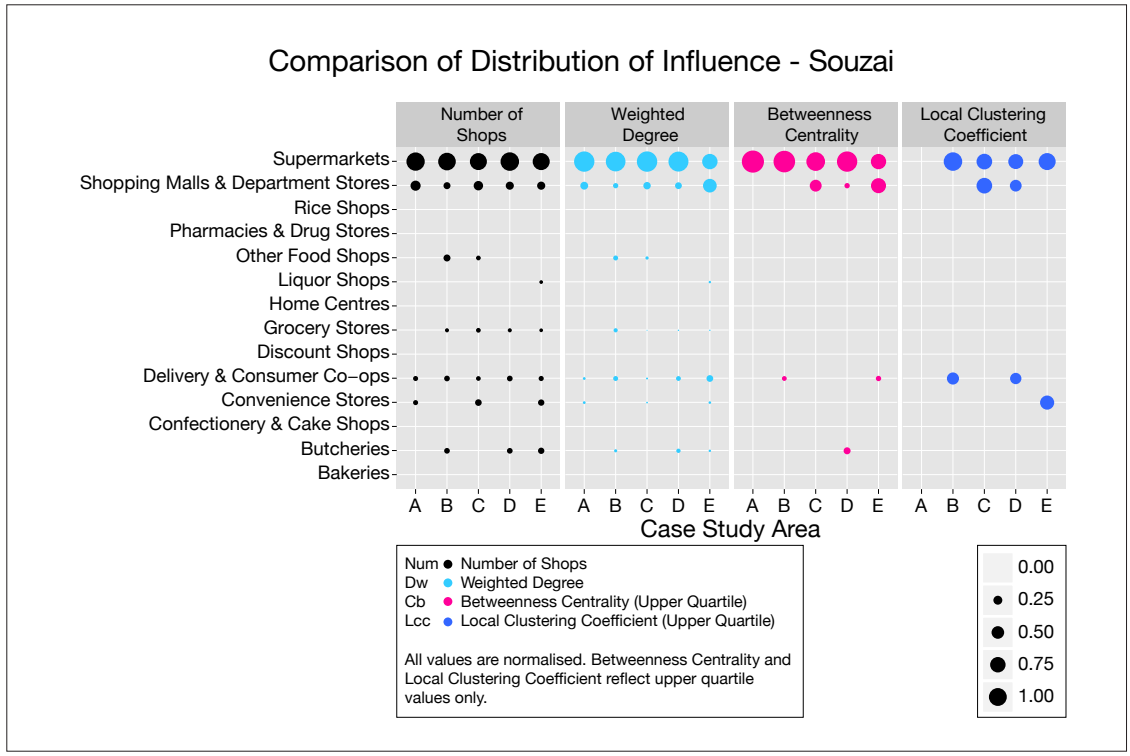


Figure 7.3.9 Comparison of Distribution of Influence - Souzai.

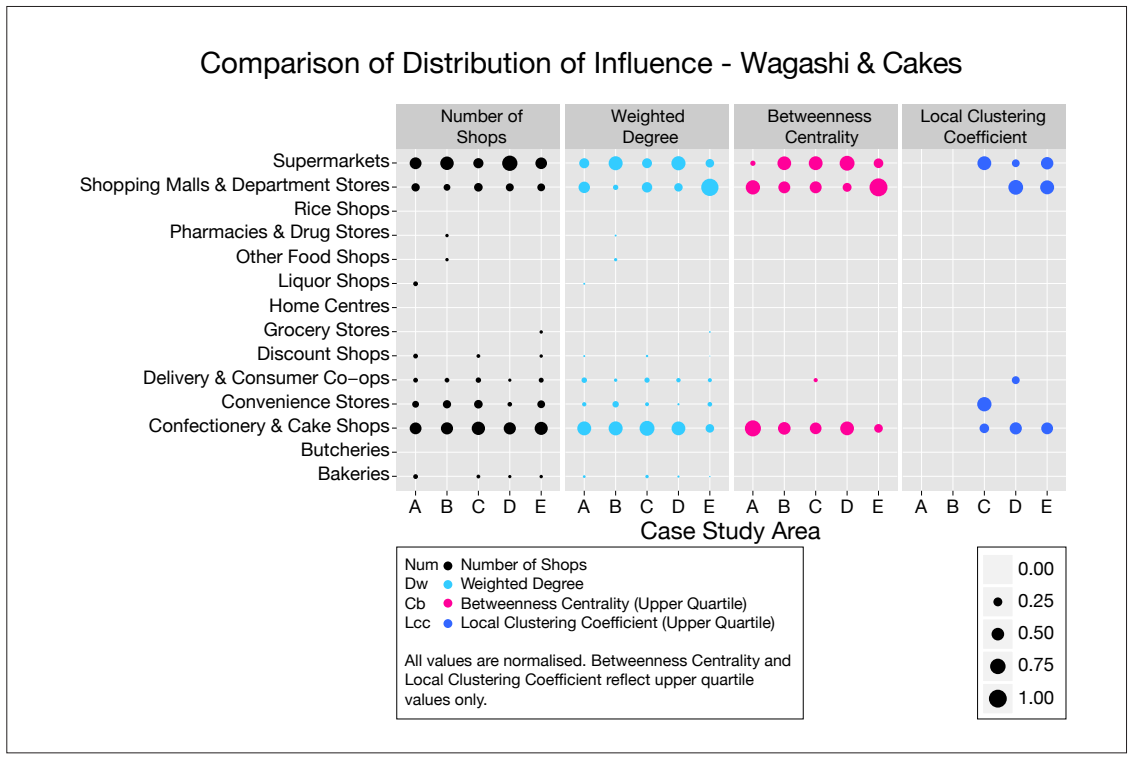


Figure 7.3.10 Comparison of Distribution of Influence - Wagashi & Cakes.

The distribution of influence of this group of food items vary significantly across each area. Apart from Souzai, Wagashi & Cakes and Bread are present in non-supermarket formats. In terms of Wagashi & Cakes all areas have significant betweenness centrality values for Confectionery & Cake Shops but the distribution varies. For Wagashi & Cakes and Bread, local clustering coefficient values are present in non-supermarket formats in Case Areas C, D and E but not Case Areas A and B. This suggests that in Areas C, D and E Confectionery & Cake Shops are deeply embedded in daily life. While Case Areas A and B do not have high local clustering coefficient values they do have high betweenness centrality values suggesting that these non-supermarket formats play a role in bridging between shopping patterns.

Generic Items: Milk, Snacks and Alcohol

Generic foods are defined as food types that are undifferentiated in terms of brand and quality and can found across many food shop formats. Of the food items surveyed, Milk, Snacks and Alcohol can be considered generic. Alcohol is a typical example of a generic product that can be found throughout Kashiwa in shops ranging from Department Stores to Convenience Stores to Liquor Shops. While price variations do occur across these types they do not vary within each shop type and generally shoppers can expect to find the same major brands on sale.

Shopping for Milk occurs mainly in Supermarkets and to a lesser extent Delivery & Consumer Co-ops and Pharmacies & Drug Stores. In Areas B and E Pharmacies & Drug Stores provide a key link between shopping patterns and Shopping Malls & Department Stores perform a similar role in Areas C and E. In terms of embeddedness, local clustering coefficient values are spread across Supermarkets, Pharmacies & Drug Stores and Convenience Stores in Area E, but Shopping Malls & Department Stores and Discount Shops in Area D.

While Supermarkets dominate shopping for Snacks, a number of other food shop types are also prevalent and uniform across each of the case study areas. Shopping Malls & Department Stores, Pharmacies & Drug Stores, Discount Shops, Delivery & Consumer Co-ops, Convenience Stores and Confectionery & Cake Shops all feature with Confectionery & Cake Shops significantly higher than other ares in Area C. Betweenness Centrality values are consistent across all areas for Delivery & Consumer Co-ops but only present in Convenience Stores in Area C. Pharmacies

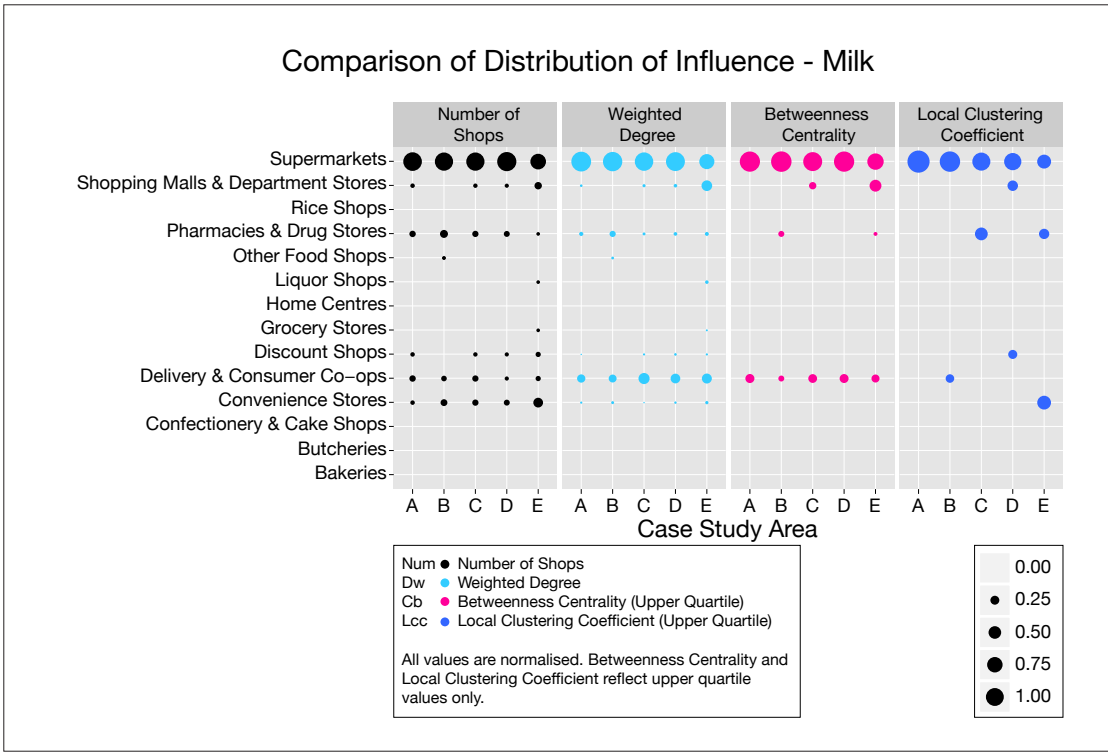


Figure 7.3.11 Comparison of Distribution of Influence - Milk.

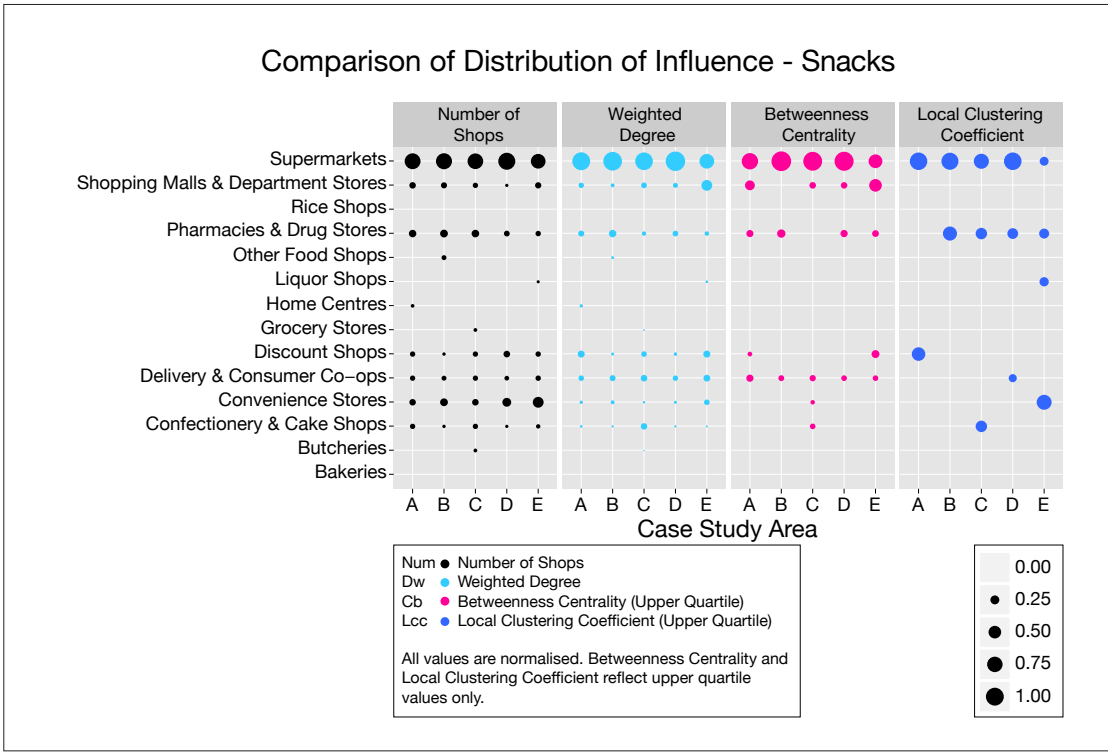


Figure 7.3.12 Comparison of Distribution of Influence - Snacks.

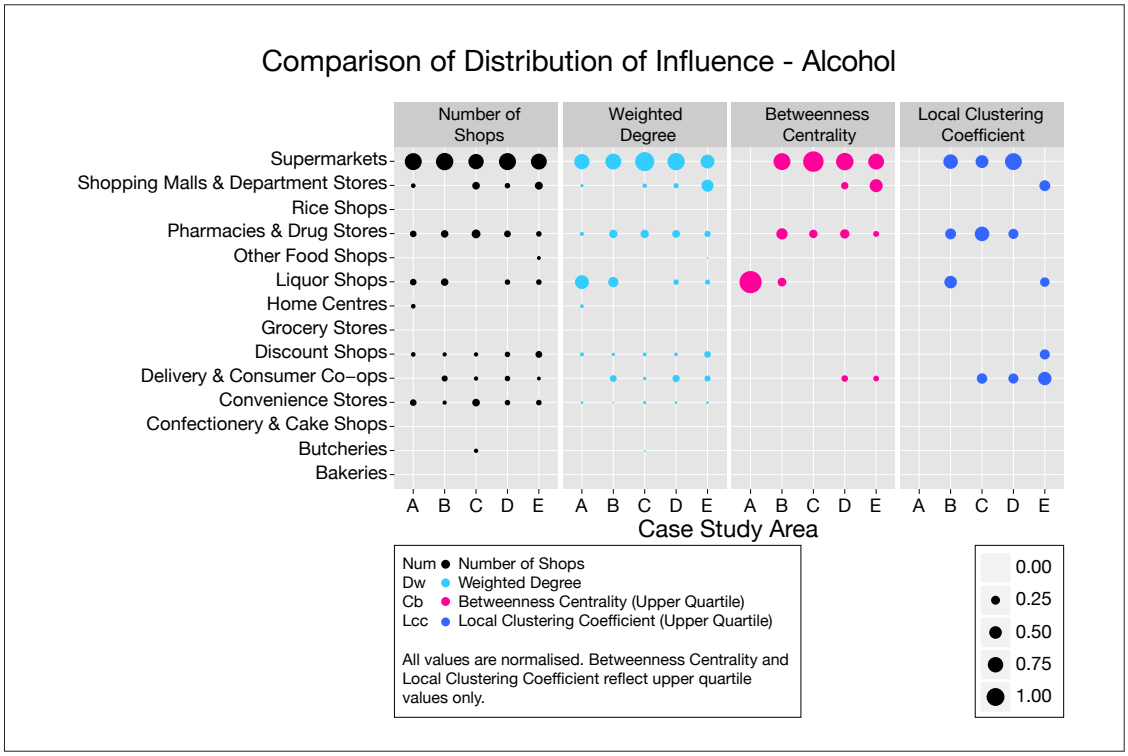


Figure 7.3.13 Comparison of Distribution of Influence - Alcohol.

& Drug Stores are significantly embedded in Areas B, C, D and E but vary for Liquor Shops, Discount Shops, Delivery & Consumer Co-ops, Convenience Stores and Confectionery & Cake Shops. Discount Shops have a high proportion of betweenness centrality in Area E, but high embeddedness in Area A.

Alcohol is available in a wide range of shops in Kashiwa. In terms of weighted degree, Supermarkets are dominant. However the use of other shop types varies considerably across other areas. Shopping Malls & Department Stores have a high value in Area E, while whereas the other four areas have high values for Pharmacies & Drug Stores, Area A is significantly lower. Area A has a significantly higher value for Liquor Shops. This is also reflected in betweenness centrality values where Area A has significantly higher values for Liquor Shops. Values for Pharmacies & Drug Stores also vary across each area. Clustering values vary by presence and absence. Pharmacies & Drug Stores are represented in Areas B, D and D while Liquor Shops only appear in Areas B and E. Delivery & Consumer Co-ops appear in Areas C, D and E.

Shopping for generic goods takes place over a wide variety of shops types, especially Snacks and Alcohol. The weighted degree values are uniform across all areas for Milk but vary for

Alcohol and Snacks. For example, Alcohol is often purchased at Liquor Shops in Areas A and B and Pharmacies & Drug Stores in other areas. The distribution of influence is also inconsistent; Discount Shops have embeddedness for Snacks in Area A, but in Area E Convenience Stores have higher scores.

7.3.4 Comparison of Shops & Areas

This section considers how shopping behaviour affects specific shops or areas in the case study areas. Across the case study areas 21 shops, including shops categorised in Delivery Services & Consumer Co-ops, were used by households in four or more of the areas. to varying degrees. Of interest is how the same shops or areas take on different roles in different communities. Three shops, a department store, a shopping mall and a cake shop were selected for analysis as well as a cluster of shops in Nadogaya, a suburb in the catchment area of Kashiwa No.4 JHS, Area D.

Takashimaya

Takashimaya is a major Department Store located at Kashiwa Station. It is made up of three separate buildings that accommodate a number of fashion and entertainment shops and social infrastructures such as banks and a post office. As well as a number of restaurants and cafes, it also has a number of food shops including bakeries, wagashi and cake shops. The basement levels, as is typical of Japanese department stores house a small supermarket as well as small delicatessen-like shops that sell souzai and other pre-cooked dishes. Department Stores are characterised by their high quality goods and high levels of customer service.

Takashimaya is located in the catchment area of Area E, Kashiwa JHS, and is widely known through out the city. It is surrounded by a number of other food shops ranging from supermarkets to greengrocers. Figure 7.3.14 shows the location of Takashimaya next to Kashiwa Station. Table 7.3.8 shows the network measures for each of the case areas. Takashimaya has the highest betweenness value for Area E and significantly high values for Areas C and D. It has relatively high local clustering coefficient scores, but significantly scores 0 for every area for Nearest Neighbour Ratio. This suggests that Takashimaya is treated as a specific destination. Shoppers use Takashimaya exclusively in this area. The food shops that were also recorded in the questionnaire and within 300m of Takashimaya were analysed.

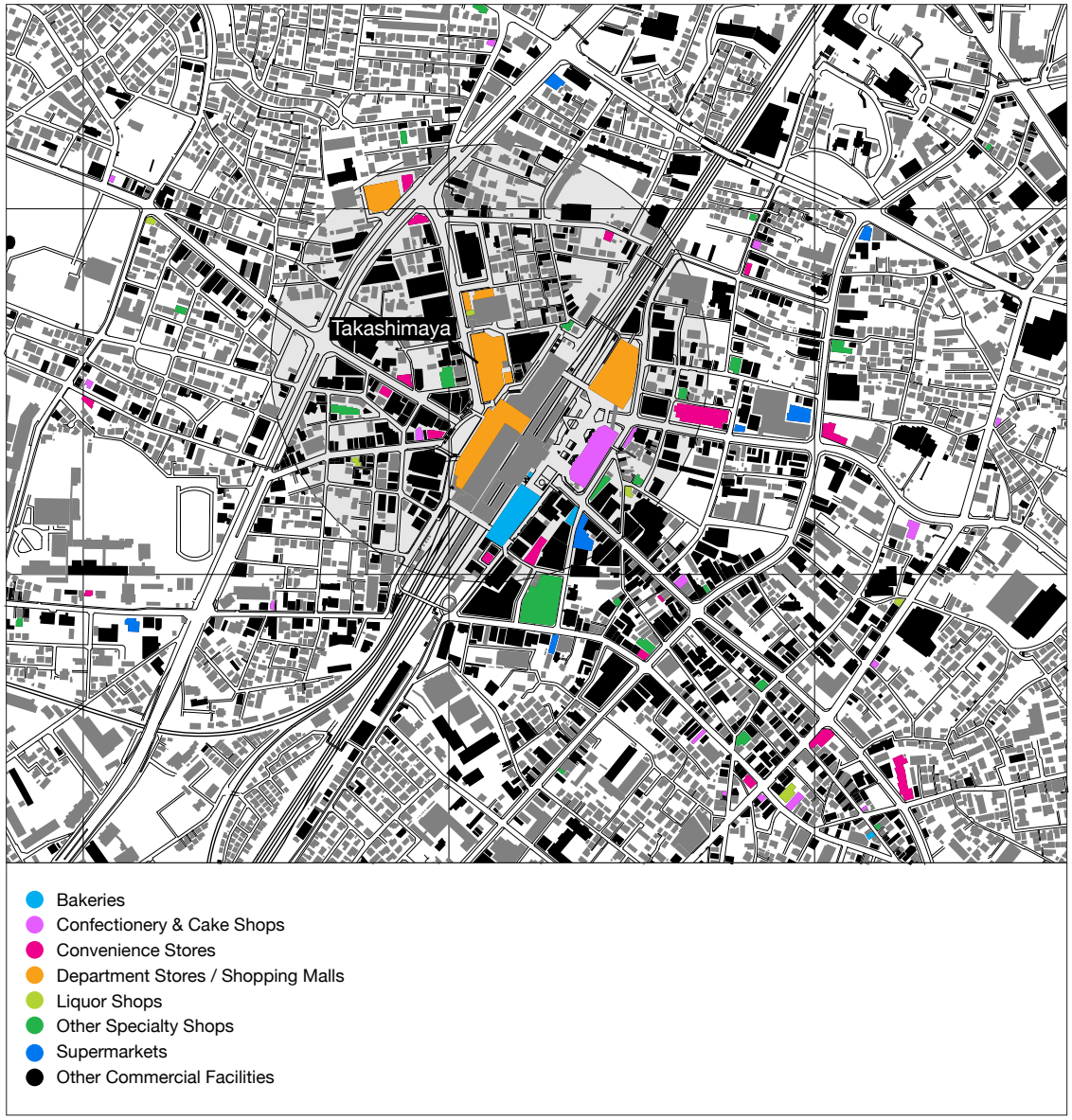


Figure 7.3.14 Takashimaya Department Store

Takashimaya										
	Case Area A		Case Area B		Case Area C		Case Area D		Case Area E	
Weighted Degree	0.098	0.634	0.146	3.770	0.216	4.147	0.358	3.921	1.753	3.738
Betweenness Centrality	90	1272	167	5214	2029	2174	2917	4346	11984	11984
Local Clustering Coefficient	0.243	0.404	0.548	0.938	0.629	0.918	0.592	1.000	0.553	1.000
Nearest Neighbour Ratio	0.000	0.500	0.000	0.464	0.000	0.889	0.000	0.600	0.000	0.524
Community	SC0		SC1		SC4		SC2		SC0	
Neighbours	SC0	Other	SC1	Other	SC4	Other	SC2	Other	SC0	Other
Supermarkets						1			2	
Shopping Malls & Department Stores	1		1		1		1		1	
Rice Shops										
Pharmacies & Drug Stores									1	
Other Food Shops						1			1	
Liquor Shops									1	
Home Centres										
Grocery Stores									1	
Discount Shops										
Convenience Stores									2	1
Confectionery & Cake Shops									1	
Butcheries			1						1	
Bakeries		1								1

Table 7.3.8 Structural Position of Takashimaya Department Store

Operaza

Operaza is a local cake shop that specialises in high-end cakes and sweets. It is located in a residential area a short walking distance from Shin-Kashiwa Station. It is largely isolated from other food shops.

Aeon Mall

Aeon is major nationwide shopping conglomerate involved in various retail formats from shopping malls to supermarkets and local retail shops. Aeon Kashiwa is a large hypermarket located approximately 1.5km from Kashiwa Station on National Route 6. It accommodates a

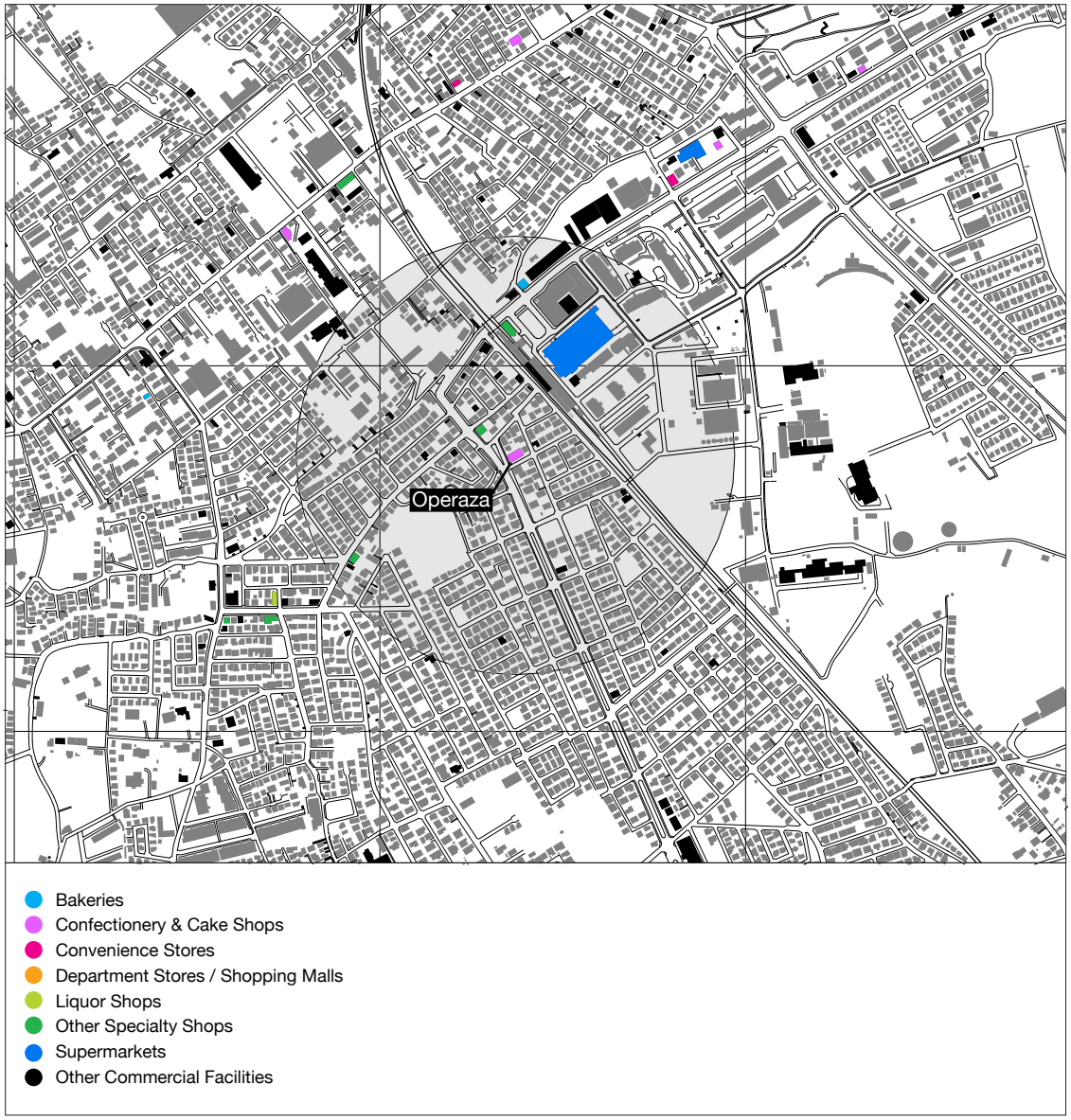


Figure 7.3.15 Operaza Cakes & Confectionery Shop

number of family-oriented restaurants, a food court, supermarket and a number of bakery/cafes and specialty food shops. It provides an abundance of free parking.

Nadogaya Area

Of the 21 shops that featured in at four areas, three of them were located within close proximity. Watanabe (Shin-Kashiwa) Supermarket, York-Mart (Shin-Kashiwa) Supermarket

Operaza										
	Case Area A		Case Area B		Case Area C		Case Area D		Case Area E	
Weighted Degree	0.003	0.634	0.137	3.770	0.187	4.147	0.331	3.921	0.003	3.738
Betweenness Centrality	90	1272	886	5214	768	2174	1548	4346	205	11984
Local Clustering Coefficient	-	0.404	0.546	0.938	0.715	0.918	0.673	1.000	-	1.000
Nearest Neighbour Ratio	0.000	0.500	0.065	0.464	0.229	0.889	0.459	0.600	0.035	0.524
Community	SC1		SC1		SC4		SC2		SC0	
Neighbours	SC1	Other	SC1	Other	SC4	Other	SC2	Other	SC0	Other
Supermarkets						1	1			
Shopping Malls & Department Stores										
Rice Shops										
Pharmacies & Drug Stores										
Other Food Shops										
Liquor Shops										
Home Centres										
Grocery Stores										
Discount Shops										
Convenience Stores										
Confectionery & Cake Shops										
Butcheries										
Bakeries						1	1			

Table 7.3.9 Structural Position of Operaza Cakes & Confectionery Shop.

and Couronne Bakery are located within 300m of each other on near an intersection of urban roads that connect various suburbs of Kashiwa to the Kashiwa City Centre or Route 16.

Watanabe is a local supermarket located in a residential area approximately 1km from Shin-Kashiwa Station. It is a price-oriented supermarket. The nearest rival is York-Mart located on the same road approximately 300m away.

York-Mart is a suburban chain supermarket with a number of shops across the Kashiwa area. It combines a supermarket with additional facilities such as fast-food restaurants in a quasi-shopping mall format.

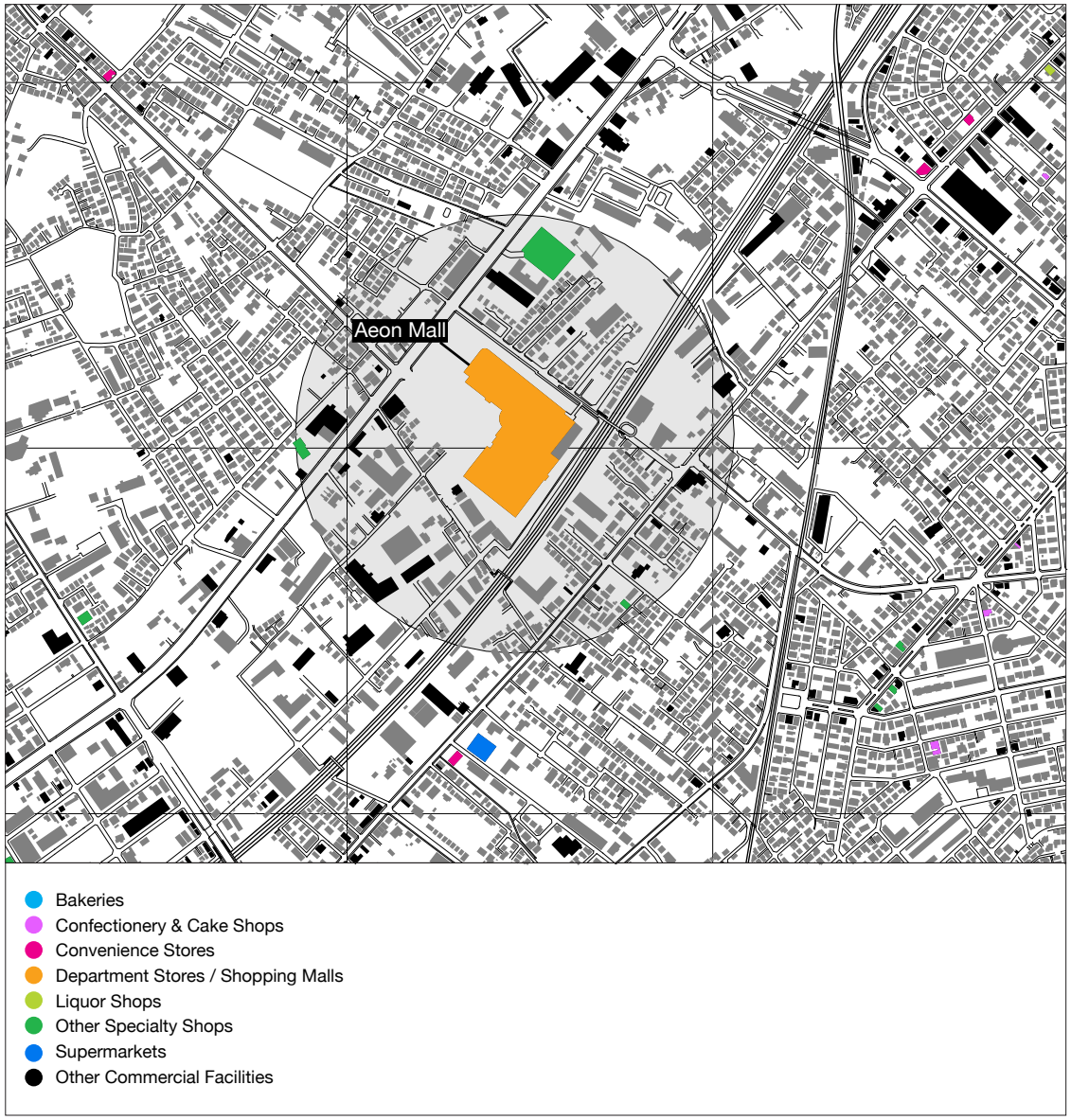


Figure 7.3.16 Aeon Mall

Couronne is a local bakery that is well-known in the Kashiwa area. It also has a satellite shop in the SOGO department store at Kashiwa Station. As well as providing bread and sandwiches it also has a small outdoor seating area for quick breaks.

Aeon Mall (Kashiwa)										
	Case Area A		Case Area B		Case Area C		Case Area D		Case Area E	
Weighted Degree	0.147	0.634	0.055	3.770	0.710	4.147	0.885	3.921	3.738	3.738
Betweenness Centrality	1272	1272	167	5214	2161	2174	4341	4346	1166	11984
Local Clustering Coefficient	0.331	0.404	0.516	0.938	0.587	0.918	0.591	1.000	0.419	1.000
Nearest Neighbour Ratio	0.045	0.500	0.000	0.464	0.200	0.889	0.216	0.600	0.286	0.524
Community	SC0		SC2		SC4		SC2		SC2	
Neighbours	SC0	Other	SC2	Other	SC4	Other	SC2	Other	SC0	Other
Supermarkets										
Shopping Malls & Department Stores										
Rice Shops										
Pharmacies & Drug Stores										
Other Food Shops										
Liquor Shops										
Home Centres										
Grocery Stores										
Discount Shops						1				
Convenience Stores										
Confectionery & Cake Shops										
Butcheries										
Bakeries										

Table 7.3.10 Structural Position of Aeon Mall (Kashiwa).

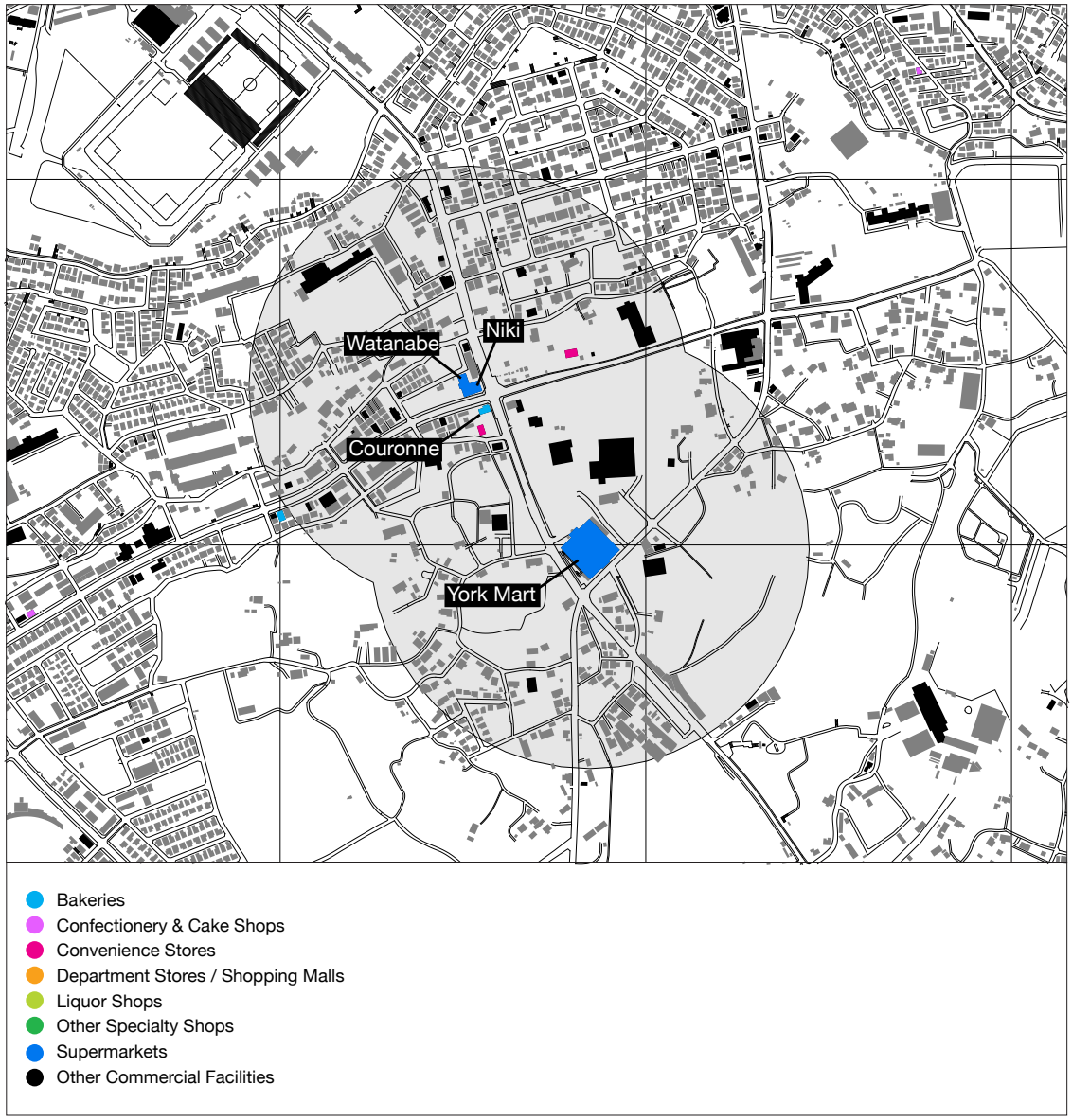


Figure 7.3.17 Nadogaya Area.

	Case Area A		Case Area B		Case Area C		Case Area D		Case Area E	
York-Mart										
Weighted Degree	0.608	0.634	0.028	3.770	4.147	4.147	1.256	3.921	0.165	3.738
Betweenness Centrality	90	1272	167	5214	1032	2174	1808	4346	205	11984
Local Clustering Coefficient	0.189	0.404	$	0.938	0.615	0.918	0.711	1.000	0.397	1.000
Nearest Neighbour Ratio	0.333	0.500	0.250	0.464	0.514	0.889	0.318	0.600	0.000	0.524
Community	SC2		SC6		SC4		SC0		SC9	
Watanabe										
Weighted Degree	0.134	0.634	0.094	3.770	1.749	4.147	0.817	3.921	0.122	3.738
Betweenness Centrality	90	1272	167	5214	335	2174	228	4346	261	11984
Local Clustering Coefficient	0.338	0.404	0.189	0.938	0.676	0.918	0.599	1.000	0.390	1.000
Nearest Neighbour Ratio	0.333	0.500	0.286	0.464	0.543	0.889	0.297	0.600	0.333	0.524
Community	SC3		SC5		SC4		SC0		SC4	
Couronne										
Weighted Degree	0.003	0.634			0.138	4.147	0.118	3.921	0.003	3.738
Betweenness Centrality	90	1272			2171	2174	2932	4346	205	11984
Local Clustering Coefficient	$	0.404			0.661	0.918	0.696	1.000	$	1.000
Nearest Neighbour Ratio	0.143	0.500			0.571	0.889	0.297	0.600	0.190	0.524
Community	SC1				SC4		SC2		SC2	
Niki										
Weighted Degree	0.003	0.634	0.021	3.770	0.127	4.147	0.029	3.921	0.013	3.738
Betweenness Centrality	90	1272	167	5214	867	2174	1070	4346	338	11984
Local Clustering Coefficient	$	0.404	$	0.938	0.674	0.918	0.699	1.000	0.603	1.000
Nearest Neighbour Ratio	0.143	0.500	0.286	0.464	0.543	0.889	0.297	0.600	0.333	0.524
Community	SC1		SC5		SC4		SC2		SC3	
Neighbours										
Supermarkets										
Shopping Malls & Department Stores										
Pharmacies & Drug Stores			1		1					
Liquor Shops										
Home Centres					1					
Convenience Stores					3					
Confectionery & Cake Shops										

Table 7.3.11 Structural Position of Nadagoya Area.

Part III

Potential for Foodscapes

Part III of this thesis discusses the findings of the analysis in Part II in the context of existing research outlined in Part I. It identifies how this research can contribute to the design of urban environments.

Secondly, Part III identifies the implications for this research which fall under the headings of ‘Understanding Place’, ‘Distance and Movement’, and ‘Resilience’. Where existing research tends to focus on single shops or specific kinds of shops, this research has been able to identify how shops of varying formats work together to meet shopping needs. This has important implications for ideas about place, where shoppers are able to move across traditional neighbourhood boundaries. There are also implications for resilience of shopping networks. In an age of increasing demographic and population change the impact of changes or closures of food shops on daily routines is becoming acute.

Finally this section identifies future work to extend this research. While this research focussed on the difference between urban environments, understanding how different social groups such as the elderly or young families utilise the same urban environment would provide valuable insight into the social role of food shops in local communities.

8

Discussion

This chapter locates the research findings in the wider context of urban design and architecture. Firstly the findings of Part II are compared to the existing research outlined in Part I.

Secondly the implications of this research are discussed in terms of their application to urban design, planning and architectural issues facing contemporary society including transportation and mobility, ideas of place and community resilience.

Finally recommendations are made for the extension and reinforcement of the methods developed in this research.

8.1 Foodscapes in Context

While the use of network analysis methods to understand urban structure through inhabitant behaviour is rare there is a wide range of research on the relationship between food and the city. The methodology and literature review found that existing research on food and the built environment can broadly be categorised into economic or commercial oriented research and health focussed research. Where these studies focus on food shops the tendency is to focus on a single type of shop format or group shop types broadly into categories such as 'supermarkets' or 'grocery stores'. By asking respondents of a questionnaire to name specific shops which could then be geocoded this research has been able to transcend these categories to reveal finer detail in shopping behaviour. This has shown that shoppers discriminate between shops within the same format type, for example, it is common for shoppers to use a number of supermarkets to meet their shopping needs. A typical approach to analyse the location of food shops is to calculate the distance to the nearest shop. This approach, while relevant for underprivileged areas, negates the fact that shoppers use a number of shops to meet their daily needs. In the responses to the questionnaire, all areas made shopping trips on average 4 times a week and used up to 6 different shops. Such a significant number of shops and time have a fundamental impact on daily routines. Existing research also showed that food shopping, while mundane and repetitive, is an essential part of daily life. The ability to choose is one way that people can participate in the construction of their environment.

Network analysis allows multiple shops and trips to be analysed together. By analysing the multiple trips for different food types it is possible to extract underlying structural information about how people view the city.

This research was interested in the relationship between food and the city. It focussed on shopping behaviour as a key link between these two entities. The key findings confirmed existing research in that the supermarket is the dominant format in Japan and that shoppers make multiple trips to a number of shops. This research extended this knowledge by extracting information about the influence of specific foods on shopping behaviour.

The construction of graphs visualised food shopping behaviour and revealed that each community has developed a unique foodscape. Although unique, these foodscapes can generally be categorised as monomodal, bimodal and polymodal where monomodal foodscapes have one dominant shopping pattern, bimodal have two distinct patterns, and polymodal networks have a number of distinct patterns. These networks could be further categorised as shared or exclusive reflecting how rigourously shop communities connected to household communities.

Further this research was able to analyse the role of specific food types. Across all areas general trends were found that showed that staple foods such as fish and vegetables tend to have higher density networks which suggests that shoppers use a number of shops interchangeably. On the other hand, food items such as bread had a low density score suggesting either a lack of choice or loyalty to a particular shop. In contrast Wagashi & Cakes varied by area. In area B and D the 'lack of choice/loyalty' factor was high whereas in Area E it was lower.

Furthermore, the role that foods play within a network vary. This research focussed on two qualities; the ability to 'bridge' between different shopping patterns, and 'embedded' shops that form the core of a shop community. While the supermarket was dominant in this measures the role of bakeries and cake shops were significant as 'bridging' actors while Pharmacies & Drug Stores had a significant 'embedding' role.

Network analysis also allowed these shops to be understood in more detail. It is possible to see trends and lifestyle changes reflected in shopping activity. Perhaps obviously bread and Wagashi & Cakes were responsible for empowering bakeries and cake shops. Rice was the main driver for drug stores empowerment. While traditionally and in the past by law, rice retail was regulated the evolution of drug stores as a source for rice purchase can be seen.

The research also revealed that while, for example, Wagashi & Cakes has high betweenness centrality in most areas, it is projected onto different shop forms. In Areas A and E Wagashi & Cakes was 'mapped onto' shopping malls and department stores as well as cake shops, where as in the other areas the supermarket format was dominant. So while some kinds of food have the same role across all areas the way that they are mapped onto urban environments varies. This can be most easily seen in Area A where roadside shops like discount stores are used to buy bread or liquor stores are used to buy cakes.

Visualising food shopping behaviour as networks allows this research to transcend typical boundaries in existing research based on analysing defined spatial areas. This research is able to transcend these physical constraints to make connections between shops that have until now seemed unrelated.

8.2 Implications of this Research

The findings of this research lead to a new understanding of food environments and urban structures. This section discusses potential implications and uses for these findings.

8.2.1 Understanding Place

One of the key issues under discussion is the role of place in urban theory. Discussions involving concepts such as place attachment involve the cognitive association of individual experience and physical environment. Food shopping, as a repeated, habitual activity is influential in the organisation of daily life. Where a person utilises a number of shops in the same area for food shopping a stronger association with the physical environment is made in comparison to a shopping trip to a single shop. In travelling to a single shop the attachment is made to the shop itself rather than it's place. The nearest neighbour ratio describes the relationship of shops connected by shopping behaviour to the physical environment. Where values are high shops in the same area are considered as complimentary, that is, that they are working together to meet the needs of the shopper. Where nearest neighbour ratios are low, shops in the same area are supplementary in that where a similar shop is located nearby it is replaceable and if not then it is detached from the place.

The Nearest Neighbour Ratio analysis showed that food shops have different levels of embeddeddness in their local environment. Different areas build up different spatial embeddedness. Where a shop has a low nearest neighbour ratio score we can say that shoppers are travelling to that location for that shop only. On the other hand, where the value is high we can say that shoppers are travelling to an place for shopping. We can therefore discuss how food shopping reinforces ideas of attachment to spatial community. In general we find that food shopping is not attached to local practices and so is contributing little to local community building. This implies that food shopping is an 'isolated' activity. But, on the other hand food shopping allows new ideas to be brought into an area as movement for shopping is much greater.

This think is reinforced by the value for travel distances. Despite Areas D and E having a number of shops the average travel distance was above 1 kilometre. Furthermore, shoppers in Area A, with no medium-range shopping choices, preferred to travel great distances than to make do with the few local choices available. Simply, people do not shop at the nearest available shop. We can reunderstand place as not attached to place but attached to social practices and activities.

This has direct implications for planning. Where a single shop is a complete ‘magnet’, that is people only shop at that shop in that area, associations with place are low. Where two shops are working together, i.e. there is a high nearest neighbour score, there is a greater attachment to place.

Further, values for betweenness centrality and local clustering coefficient could be useful for understanding which kind of shop can easily embed in an existing environment. ‘Bridging’ shops have the ability to draw people from other shopping patterns, while ‘embedded’ shops can integrate easily into existing structures. As values for betweenness and local clustering coefficients vary by area, so does the shop format. In addition, new formats that can reestablish other social activities with food shopping can be developed.

8.2.2 Distance and Movement

We can see in this research that people travel great distances to buy food and so catchment areas are not useful for understanding foodscapes. By exercising choice varying foodscapes are constructed. Furthermore connections between distant shops exist and ‘pull’ those areas together.

Rather than focussing on commuter routes to organise cities, shopping patterns could reveal alternative spatial configurations.

One aspect of commercial activity analysis that is often overlooked is the individual shop. Existing research tends to focus on densities of shops. Network analysis allows to understand how individual shops relate to the wider food environment. This in turn suggest patterns of movement that vary from environment to environment. As lifestyles change and mobility with it, this information could be useful for understanding how daily routines are affected by change. One of the critical points of network analysis is the role of structure. Daily routines and habits are an important way of creating stability. Changes to routines can have a deep impact on daily life.

Further, from another point of view. Understanding the relationships between shops that are not necessarily physically close but share customers could cooperate to maintain these ties, and therefore the stability of the community.

8.2.2 Resilience

In terms of the network qualities of each foodscape, we can understand the resilience of a food environment, that is it's ability to tolerate change. The local clustering coefficient can be understood from two points of view. Firstly, as a highly embedded/connected node, it is influential in the transference of information to it's neighbours. Triadic closure creates strong ties between three nodes (shops). However, form another point of view, if a node in a triad was to disappear the remaining two node would still be connected so there is a kind of resilience in the network.

The research found, for example, that shops in Areas A and B showed no local clustering coefficient score for Wagashi & Cake shopping. This means that there are no triads and therefore the closure of a shop would cut a shopper from the network and they would be forced to find a completely different shop. In general Fish, Meat and Fruit & Vegetables had the highest clustering coefficient scores so they appear to be the most resistant.

Bearing this in mind, understanding the weaknesses in a food network could help to reinforce it with, for example, local deliveries or a new format of shopping.

In terms of betweenness centrality, nodes with high values have higher influence in the transference of information, which in this research is the transference of cultural practice and norms. However, as conduits of information flow, they are also open to influence of other shopping experiences. In reality, what this means is that as shoppers use different shop types with their different styles of service etc, that experience is carried by shoppers to other shops. For example, when a shopper uses a department store with it's high level of customer service, that experience is carried to a convenience store and influence the expectation of service. This also happens in the opposite direction. Traditionally betweenness values are seen as the ability of communities within networks to receive information from other parts of the network and are seen as ways to introduce new ideas.

We can see in this research that betweenness centrality and local clustering coefficients are not projected uniformly onto food shops or physical space and that different food types influence the distribution of these roles. This contrasts to existing research that tends to generalise shop types into uniform experiences with similar roles.

As lifestyles change through macro demographic change or simply lifestage progress, switching shops is not simply a matter of changing preferences. Routine behaviour is trusted and safe, so changing shops or shopping patterns also involves the change of fundamental practices. In a declining community where shops are closing down, this research could be used to maintain connections between shops by integrating new services or facilities within the network.

In general monomodal networks are dominant and perhaps difficult to influence or change. This kind of analysis is conducive to micro-planning where minor interventions could help sustain community life.

8.3 Future Work

The focus of this research is to understand how food shopping routines of households with similar space-time constraints and personal backgrounds manifest across varying urban environments. Further work could be to understand how different demographic groups within the same community develop routines in the same urban environment. It is important to note however that variations in routine could also be the result of personal preference, generational differences, differences in mobility and economic freedom. While it would be possible to ascribe differences in the value of individual shops using the same methods outline in this research, it would be problematic to attribute motivating factors for these differences to urban or built environment factors alone.

In terms of food, eating out in Japan has it's own rich history with specific architectural types such as *izakaya*, foodcourts and family restaurants. As a cultural event, dining out is ingrained in Japanese culture, even for young families. Understanding the role of restaurants in the wider food environment would be valuable.

The production of food is also worthy of consideration. Japan has a naturally occurring urban-agriculture culture in as far as rapid urban development meant that housing overtook farming leaving pockets of albeit sometimes commercial farms still operating throughout Kashiwa's residential areas.

In a wider context the study of everyday life is undervalued in architectural research. That is to say everyday life in 'low-risk' communities. A great amount of research has investigated the conditions of vulnerable groups such as low-income families or immigrants, or in high risk areas such as rural areas, however consideration of the daily lives of urban dwellers outside of unique urban environments such as Tokyo remain few.

The role of food shopping as a social infrastructure should not be undervalued and should also be considered in conjunction with other commercial public services such as banks, clinics, hair salons and postal services, all of which are subject to economic forces.

9

Conclusion

This section reviews the findings of Section 2 contextualises and reflects on the relevance of the results. Furthermore suggestions for future work are proposed. By understanding the routine shopping activities of urban inhabitants we can understand the underlying structure of their food environment and how it empowers or restricts their food choices. By considering food shops as a network of daily activity we can see how shops, even kilometres apart, can be linked by shopping activity. This connection should not be underestimated. Both shops are fulfilling needs by either being accessible in different space-time locations or supplying different products or functions.

The role of inhabitants in the construction of their own environment is often overlooked in architectural circles. That is to say, that actual use of the built environment is often outside of the intention of the designer, and how spaces will be appropriated is impossible to predict or control. This research has shown that multiple food environments, or foodscapes, have been constructed and reconstructed across Kashiwa's varying urban conditions.

Food has developed greatly in the modern era, not only in terms of diet but also technology and in the focus of this research, it's distribution to the consumer. Food shops have developed dramatically over the last 100 years and been rationalised into a number of specific architectural types.

While food and cities have been studied in detail in terms of distribution and food deserts, the impact of food shopping activities on everyday life have been overlooked.

This research attempts to understand food shopping as a network of activity that contributes to the construction of a communities image of food and as a result social practice.

Commercial activity is one direct way that the general public actively shape their environment, using a shop ensures it's survival while a lack of support will end in closure. Recognition of the inhabitant's role in shaping their own environment is critical for the development of sustainable, culturally relevant urban environments.

By understanding food shops as a network in this way we can analyse it's structure to understand how shops are interrelated, how specific shops might influence other shops in the network and it's vulnerability to change.

While the economic and health impacts of foodscapes have been well researched, this research is concerned with the role of food shops as a social infrastructure, that is spaces that support daily life. Japan is undergoing significant social and demographic change. A shrinking and ageing population will place pressure on urban infrastructure. Issue related to food safety and nutrition are also increasing as globalisation increases. Changes in the access to food as well as associated lifestyle changes not only have physical but also mental well-being implications.

Appendices

Appendix A - Questionnaire Sample

Bibliography

Akiyama, Y. et al. *Automatic Detection and Spatio-Temporal Analysis of Commercial Accumulations Using Digital Yellow Page Data*, pg 115-120 in World Academy of Science, Engineering and Technology vol. 4, June 2010.

Akiyama, Y. et al. *Development of Commercial Accumulation Statistics Throughout Japan and Utilization Environment of Them*, pg 11-20 in Theory and Application of GIS vol. 21, No. 2, 2013. (In Japanese)

Arai, Y. 日本の流通と都市空間 *(Nihon No Ryutsu To Toshi Keikaku),* Kokon-Shoin: Tokyo, 2004. (In Japanese)

Arata, M. 商店街はなぜ滅びるのか：社会政治経済史から探る再生の道 *(Shotengai Ha Naze Horobiru No Ka: Shakai Seiji Keizaishi Kara Saguru Saisei No Michi),* Kobunsha: Tokyo, 2012. (In Japanese)

Axhausen, K. et al. *Observing the Rhythms of Daily Life: A Six-Week Travel Diary*, pg 95–124 in Transportation 29, 2002.

Bailey, A. et al. *Consumer Behaviour and the Life Course: Shopper Reactions to Self-Service Grocery Shops and Supermarkets in England c. 1947 – 75*, pg 1496-1512 in Environment and Planning A 42(6), 2010.

Baudrillard, J. *Consumer Society* in Jean Baudrillard Selected Writings, ed. Poster, M. Polity Press: Cambridge, 1988.

Beck, U. *Risk Society : Towards a New Modernity*. Sage: London, 1992.

Berry, B. *Commercial Structure and Commericial Blight : Retail Patterns and Processes in the City of Chicago*. University of Chicago: Chicago, 1963.

Borchert, J. *Spatial Dynamics of Retail Structure and the Venerable Retail Hierarchy*, pg 327–336 in GeoJournal 45, 1998.

Borgatti, S. et al. *Network Analysis of 2-Mode Data*, pg 243-269 in Social Networks 19, 1997.

Borgatti, S. *Centrality and Network Flow*, pg 55-71 in Social Networks 27, 2005.

Borgatti, S. et al. *Analyzing Affiliation Networks*, pg 417-434 in The SAGE Handbook of Social Network Analysis, ed. Scott, J. & Carrington, P. SAGE: Los Angeles, 2011.

Bourdieu, P. *Distinction : A Social Critique of the Judgement of Taste.* Routledge & Kegan Paul: London, 1984.

Breiger, R. *The Duality of Persons and Groups*, pg 181-190 in Social Forces vol. 53, no. 2 Special Issues, December 1974.

Brown, S. *Retail Location: The Post Hierarchical Challenge*, pg 367-381 in The International Review of Retail, Distribution and Consumer Research 1(3), 1991.

Burgoine, T. et al. *Changing Foodscapes 1980–2000, Using the ASH30 Study*, pg 157–165 in Appetite 53, 2009.

Burgoine, T. *Collecting Accurate Secondary Foodscape Data. A Reflection on the Trials and Tribulations*, pg 522–527 in Appetite 55, 2010.

Cannuscio, C. et al. *Urban Food Environments and Residents' Shopping Behaviors*, pg 606-614 in American Journal of Preventive Medicine, vol. 45, no. 5, 2013.

Chen, X. et. al. *Interactive Three-Dimensional Geovisualization of Spacetime Access to Food*, pg 81-86 in Applied Geography 43, 2013.

Choi, Y. et al. *Food Deserts, Activity Patterns, & Social Exclusion: The Case of Tokyo, Japan*, pg 87-98 in Applied Geography 43, 2013.

Clammer, J. *Contemporary Urban Japan: A Sociology of Consumption.* Blackwell Publishers: Oxford, 1997.

Clarke, G. *Changing Methods of Location Planning For Retail Companies*, pg 289–298 in GeoJournal 45, 1998.

Clarke, I. et al. *Retail Restructuring and Consumer Choice 1. Long-Term Local Changes in Consumer Behaviour: Portsmouth, 1980 – 2002*, pg 25-46 in Environment and Planning A 38(1), 2006.

Clarke, I. et al. *The Economic and Social Role of Small Stores: A Review of UK Evidence*, pg 187-215 in The International Review of Retail, Distribution and Consumer Research vol. 20, no. 2, May 2010.

Craven, P. et al. *The Network City*, pg 57-88 in Sociological Inquiry vol. 43, Issue 3-4, July 1973.

Crewe, L. *Geographies of Retailing and Consumption: Markets in Motion*, pg 352-362 in Progress in Human Geography 27, 3, 2003.

Cummins, S. et al. *A Systematic Study of an Urban Foodscape: The Price and Availability of Food in Greater Glasgow*, pg 2115–2130 in Urban Studies Vol. 39, No. 11, 2002.

Cwiertka, Katarzyna J. 2006. *Modern Japanese Cuisine: Food, Power, and National Identity*. London: Reaktion Books.

du Gay, P. *Self-Service: Retail, Shopping and Personhood*, pg 149-163 in Consumption, Markets and Culture Vol. 7, No. 2, June 2004.

Everts, J. et al. *Modernisation and the Practices of Contemporary Food Shopping*, pg 917-935 in Environment and Planning D: Society and Space 27(5), 2009.

Faust, K. *Centrality in Affiliation Networks*, pg 157-191 in Social Networks 19, 1997.

Faust, K. et al. *Spatial Arrangement of Social and Economic Networks Among Villages in Nang Rong District, Thailand*, pg 311–337 in Social Networks 21, 1999.

Faust, K. et al. *Scaling and Statistical Models for Affiliation Networks: Patterns of Participation Among Soviet Politicians During the Brezhnev Era*, pg 231-259 in Social Networks 24, 2002.

Flath, D. et al. *Is Japan's retail sector truly distinctive?*, pg 181-191 in Journal of Comparative Economics, vol. 23, no. 2, 1996.

Freeman, L. *Finding Social Groups: A Meta-Analysis of the Southern Women Data*, pg 39-77 in Dynamic Social Network Modeling and Analysis: Workshop Summary and Papers, ed. Breiger, R. et al. National Academies Press, Washington, 2003.

Fujino, H. et al. *Store Choice Orientations and Intertype Shopping Behavior Toward Grocery Stores*, pg 459-464 in Japan Industrial Management Association, vol. 58, 2008. (In Japanese)

Giddens, A. *The Consequences of Modernity.* Stanford University Press: California, 1990.

Giddens, A. *The Constitution of Society: Outline of the Theory of Structuration.* University of California Press: Berkeley, 1984.

Glenn, P. *Consumption, Consumerism and Urban Form: Historical Perspectives. Urban Studies*, vol. 35, nos5-6, 1998

Goss, J. *The "Magic of the Mall": An Analysis of Form, Function, and Meaning in the Contemporary Retail Built Environment*, pg 18-47 in Annals of the Association of American Geographers Vol. 83, No. 1. , 1993.

Gottdiener, M. *The Social Production of Urban Space.* University of Texas Press: Austin, 1994.

Granovetter, M. *The Strength of Weak Ties*, pg 1360-1380 in American Journal of Sociology Vol. 78, Issue 6, 1973.

Granovetter, M. *Economic Action and Social Structure: The Problem of Embeddedness*, pg 481-510 in The American Journal of Sociology, vol.91, No.3 (Nov. 1985), University of Chicago Press: Chicago, 1985.

Gregson, N. et al. *Shopping, Space, and Practice*, pg 597-617 in Environment and Planning D: Society and Space 20(5), 2002.

Grier, J. *Japan's Regulation of Large Retail Stores: Political Demands Vs. Economic Interests*, pg 1-60 in University of Pennsylvania Journal of International Economic Law, 22:1, 2001.

Gronow, J. ed. *Ordinary Consumption*, Routledge; New York, 2013 (2001).

Haddock-Fraser, J. et al. *The Failure of Multinational Food Retailers in Japan: A Matter of Convenience?* pg 327-348 in British Food Journal vol. 111, no. 4, 2009.

Hagerstrand T. *What About People in Regional Science?*, pg 7-21 in Papers of the Regional Science Association 24, 1970.

Hanley, S. *Everyday Things in Premodern Japan: The Hidden Legacy of Material Culture*, University of California Press: London, 1997.

Hayashi, N. et al. *Spatial Patterns of the Distribution System in Japan and Their Recent Changes*, pg 120-140 in Geographical Review of Japan Series B 61(1), 1988.

Hino, H. *Antecedents of Supermarket Formats' Adoption and Usage: A Study in the Context of Non-Westerners*, pg 61-72 in Journal of Retailing and Consumer Services 17, 2010.

Ilmonen, K. *Sociology, Consumption and Routine*, pg 9-23 in Ordinary Consumption, Routledge; New York, 2013 (2001).

Jackson, P. et al. *Retail Restructuring and Consumer Choice 2. Understanding Consumer Choice at the Household Level*, pg 47-67 in Environment and Planning A 38(1), 2006.

Jacobs, J. *The Death and Life of Great American Cities*, Vintage Books: New York, 1992.

Jay Christian, W. Using Geospatial Technologies to Explore Activity-Based Retail Food Environments, pg 287–295 in Spatial and Spatio-temporal Epidemiology 3, 2012.

Kim, B. et al. *Studying Patterns of Consumer's Grocery Shopping Trip*, pg 501-517 in Journal of Retailing Vol. 73 No. 4, 1997.

Kitamura, R. et al. *How Routine is a Routine? An Analysis of The Day-to-Day Variability in Prism Vertex Location*, pg 259–279 in Transportation Research Part A: Policy and Practice Vol. 40 Issue 3, 2006.

Koch, S. *A Theory of Grocery Shopping: Food, Choice and Conflict*. Berg: London, 2012.

Kolodinsky, J. et al. *It is Not How Far You Go, It is Whether You Can Get There: Modeling the Effects of Mobility on Quality of Life in Rural New England*, pg 113-122 in Journal of Transport Geography, 31, 2013.

Krider, R. et al. *Which Birds of a Feather Flock Together? Clustering and Avoidance Patterns of Similar Retail Outlets*, pg 123-149 in Geographical Analysis 45, 2013.

Lamichhane, A. et al. *Spatial Patterning of Supermarkets and Fast Food Outlets with Respect to Neighborhood Characteristics*, pg 157-164 in Health & Place 23, 2013.

Langston, P. et al. *Retail Saturation, Retail Location, and Retail Competition: An Analysis of British Grocery Retailing*, pg 77-104 in Environment and Planning A vol. 29, 1997.

Langston, P. et al. *Retail Saturation: The Debate in the Mid-1990's*, pg 49-66 in Environment and Planning A 30(1), 1998.

LeDoux, T. et al. *Going Outside the Neighborhood: The Shopping Patterns and Adaptions of Disadvantaged Consumers Living in the Lower Eastside Neighborhoods of Detroit, Michigan*, pg 1-14 in Health & Place 19, 2013.

Leete, L. et al. *Congruence and Coverage: Alternative Approaches to Identifying Urban Food Deserts and Food Hinterlands*, pg 204-218 in Journal of Planning Education and Research 32(2), 2012.

Lefebvre, H. *The Production of Space*. Blackwell: Oxford, 1991.

Maruyama, M. et al. *Quantifying Barriers Impeding the Diffusion of Supermarkets in China: The Role of Shopping Habits*, pg 383-393 in Journal of Retailing and Consumer Services 21, 2014.

Mikkelsen, B. *Images of Foodscapes: Introduction to Foodscape Studies and Their Application in the Study of Healthy Eating Out-of-Home Environments*, pg 209-216 in Perspectives in Public Health Vol. 131, No. 5, 2011.

Miles, S. et. al. Urban Consumption: An Historiographical Note, pg 927-951 in Urban Studies, vol. 35, nos 5-6, 1998.

Miller, D. et al. *Shopping, Place, and Identity*. Routledge: London, 1998.

Moeran, B. *The Birth of the Japanese Department Store*, pg 141-176 in Asian Department Stores, ed. MacPherson, K. Curzon Press: Richmond, Surrey, 1998.

Morgan, K. et al. *The Urban Foodscape: World Cities and the New Food Equation to Geography and Health Studies*, pg 209-224 in Cambridge Journal of Regions Economy and Society, vol. 2 iss. 3, 2010.

Motoshige, I. *The Japanese Distribution System and Access to the Japanese Market, pg 175-190 in Trade with Japan: Has the Door Opened Wider*?, ed. Krugman, P. University of Chicago Press: Chicago, 1991.

Neutens, T. et al. *The Prism of Everyday Life: Towards a New Research Agenda for Time Geography*, pg 25-47 in Transport Reviews, vol. 31, no. 1, January 2011.

Nilsson, E. et al. *Who Shops Groceries Where and How? – The Relationship Between Choice of Store Format and Type of Grocery Shopping*, pg 1-19 in The International Review of Retail, Distribution and Consumer Research, vol. 25, Issue 1, 2015.

Netz, J. et al. *Maximum or Minimum Differentiation? Location Patterns of Retail Outlets*, pg 162-175 in The Review of Economics and Statistics 84(1), February 2002.

Opashl, T. et al. *Clustering in Weighted Networks*, pg 155-163 in Social Networks 31, 2009.

Opashl, T. *Triadic Closure in Two-Mode Networks: Redefining Global and Local Clustering Coefficients*, pg 159-167 in Social Networks 35, 2013.

Ritzer, G. *The McDonaldization of Society*. Pine Forge Press: Thousand Oaks, California, 2000.

Ryuutsuu Keizai Kenkyuujo コンビニエンス・ストア・マニュアル *(Konbiniensu Sutoa Manyuaru)*, Ryutsu Keizai Kenkyujo: Tokyo, 1972. (In Japanese)

Sadahiro, Y. *A PDF-based Analysis of the Spatial Structure of Retailing*, pg 237-252 in GeoJournal 52, 2001.

Saito, S. et al. *An International Comparison of Daily Shopping Behavior Among Shanghai, Taipei, And Fukuoka*, pg 223-239 in Studies In Regional Science Vol. 36 No. 1, 2006. (In Japanese)

Sengoku, H. et al. *Determining Spatial Extent of Shopping Areas Using Store Density: An Approach with Kernel Density Estimation*, pg 409-414 in Journal of the City Planning Institute of Japan, vol. 46, no. 3, October 2011. (In Japanese)

Simmel, G. *The Metropolis and Mental Life*, in *Rethinking Architecture: A Cultural Reader*, Leach, N. ed. Routledge: London, 1997.

Sobal, J. et al. *Kitchenscapes, Tablescapes, Platescapes, and Foodscapes: Influences of Microscale Built Environments on Food Intake,* pg 124-142 in Environment and Behavior Vol. 39, No. 1, January 2007.

Sparks, A. et al. *Comparative Approaches to Measuring Food Access In Urban Areas: The Case of Portland, Oregon*, pg 1715-1737 in Urban Studies 48(8), June 2011.

Takaoka, M. *Globalization of the Distribution System and the 1985 Shock in Japan*, pg 275-296 in Strategies Towards Globalization: European and Japanese Perspectives, ed. Park, S. Free University of Berlin: Berlin, 2002.

Takaoka, M. *Japan's 'Distribution Revolution' and Chain Store Supermarkets,* pg 75-101 in Japanese Yearbook on Business History 15, 1998. Tsuchiya, J. *Geographical Studies on Retail Chain Development and Restructuring of Retail Systems in Japan*, pg 111-119 in Geographical Review of Japan Series B 86(2), 2014.

Terasaka, A. *Development of New Store Types: The Role of Convenience Stores* in Japan, pg 317-325 in GeoJournal 45, 1998.

Timmermans, H. et al. *Spatial Context and the Complexity of Daily Travel Patterns: An International Comparison*, pg 37-46 in Journal of Transport Geography 11, 2003.

Tomko, M. et al. *Experiential Hierachies of Streets*, pg 41-52 in Computers, Environment and Urban Systems 32, 2008.

Tsuchiya, J. *Geographical Studies on Retail Chain Development and Restructuring of Retail Systems in Japan*, pg 111-119 in Geographical Review of Japan Series B (Review Article of the Special Issue on Geography in Japan after the 1980s (Part II)) 86(2), 2014.

Weber, M. *The Theory of Social and Economic Organisation*. Free Press: New York, 1964.

Wrigley, N. et al. *Urban Regeneration, Social Inclusion and Large Store Development: The Seacroft Development in Context*, pg 2101–2114 in Urban Studies vol. 39, no. 11, 2002.

Yakushiji, T. et al. *Accessibility to Grocery Stores in Japan: A Comparison Between Urban and Rural Areas By Measuring Distance to Stores*, pg 14-25 in Journal of Food System Research, vol. 20, No. 1, 2013. (In Japanese)