SHOPPING PATTERNS AND CENTRAL PLACE THEORY IN RANGITIKEI COUNTY

A Thesis presented in partial fulfilment of the requirements for the degree of Master of Arts in Geography at Massey University

by

WARWICK ARTHUR BUCKMAN

1972

ACKNOWLEDGEMENTS

My thanks go to all those members of the public who answered questionnaires and to all the private individuals and public servants who supplied information on trade areas or contacts with the sample.

Thanks also to Malcolm Bell, Stuart Thom, Steve Britten and Richard LeHeron for help with the interviewing, and Professor Thomson for allowing them to do so; to Mrs. Anne Stewart for her help in coding questionnaire information; to Richard Sharpe for the computer programming; to Tony Clay and Peter Crawford for reading drafts; to Mr. B.G.R. Saunders for his comments on Cartography; to Miss Yvonne Pearson for her cartographic skills and assistance; to Mrs. Helen Horsfall for her typing, and to Mr. Geoff Thomas for his supervisory comments.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

AN INTRODUCTION TO SHOPPING

This thesis is a study of aspects of shopping. The term shopping has been deliberately used. It is academically nondescript, an advantage over terms such as retailing or marketing which have definite and consequently limiting connotations. In contrast an academically unrestricted idea of shopping is possible. But it is necessary to assume that there is a general body of content envisaged in the term. One elaboration of shopping could be "people buying goods from other people, usually at a shop in a town". From this elaboration can be constructed several postulates inherent in shopping: centres at which goods are sold, or central places, people selling goods, or retailers, and people buying goods, or consumers. Before delimiting the particular aspects of shopping to be studied, it is worthwhile to look more closely at the three postulates.

(a) Central Places

Three major abstractions have defined the role of central places in studies which have dealt with shopping. The first is the tacit acceptance that all shopping occurs in formally ordained and advertised institutions. In most studies the occurrence of such institutions has constituted a central place.

Scott (1970, 12) in his examination of the geography of retailing accepts as co-existent central places and retail establishments. Thus the multitude of small transactions such as the sale of eggs to friends or home hair styling are not formally incorporated into geographic models. Even Berry (1967) in his elaborate introduction of the place of market centres does not positively recognise such informal transactions.

The second abstraction is of greater moment. Geographers have followed Hagen's dictum : "For use in analysis, a system must be closed. ... For analysis ... it is necessary in the intellectual construct to assume that contact with the environment is cut off so that the operation of the system is affected only by given conditions previously established by the environment and not changing at the time of the analysis, plus the relationships among the elements of the system." (Quoted in Harvey, 1969, 447). In shopping studies the construction of a central place has involved the assumption that towns function primarily as centres for supplying goods and/or services to a hinterland. The central place nature of the town has been measured by the abstraction of two conditions : the occurrence of both functions and functional units (See Appendix A).

The numerical occurrence of functions and functional units has been used to undertake the third abstraction : that of ordering the central places into an hierarchy, each level of the hierarchy being assumed to reflect different consumer demands placed on the central place.

The initial abstraction is one which reflects the difficulties

associated with the identification of an event. It is generally assumed that the isolation of informal shopping and its incorporation within formal theory is not worth the effort required and as such is operationally ignored.

In the second case various methods of defining a central place indicate disagreement over the selection and measurement of elements to compose the system. A similar dissension surrounds the concept of hierarchy. These latter two problems will be taken further in later chapters.

(b) Retailers

Allied with the abstraction of central places are assumptions related to both the buying and selling of goods. In studies which have concentrated on the central places, little power to influence the pattern has been given to the retailers. In studies by Berry and Garrison (1958a,b), Brush (1953) and Bracey (1953), for instance, the terms function and functional unit were used to describe retail facilities. This reduced the power of the retailers to a common level as no attempt was made to weight the different functions or functional units.

Assumptions about retailers have varied. One condition has been the absence of excess profits (Losch, 1954). The retail of a single line of goods is nowhere specifically stated in the concept of threshold used by Berry and Garrison (1958b), but the entrance of a good is dependent on the demand for it and is not sustained by scale or association economies. A further condition is a high degree of retailer mobility to allow retail

outlets to reflect hypothetical markets. This problem is highlighted by the nature of such studies as those of Bracey (1953), Brush (1953) and Berry and Garrison (1958a,b) in which measurements are given for a single instance in time and not over a time span which could be taken to represent the period of retailer perception of markets.

In other studies, however, researchers have concentrated on the forms of retail outlets. Thus Scott (1970) draws attention to studies (Schultz, 1961; Duncan and Phillips, 1959; Jeffreys, 1954) in which researchers have outlined operations of multiples (multi-unit businesses), co-operatives and independents (single-unit businesses), and variations in both the behaviour of consumers and the formation of centres, given varying forms of retail outlets.

(c) Consumers

Several conceptions of consumers have been used. Homo economicus is the classical conception of man as an agent of economic activity. Homo economicus acts in a rational manner, that is, he bases his decisions (in this case his choice of good, shop, shopping centre or town) on achieving his desired purchase at least cost, this cost being measurable according to deduced economic principles. It is interesting to note Clarkson's (1963, 3) opinion that such economic theories are notably lacking in predictive qualities.

A second being, homo stochasticus, (Olsson and Gale, 1968) has a more flexible shopping pattern, this individual having a range of choice within the economic system and a degree of chance, or

disequilibrium, enters his ultimate pattern. Other researchers, in the field of market analysis, have investigated consumer decision processes, including such influences on buying as price, quality, availability, service, style, option and image (Kotler, 1967; Nicosia, 1966; Massy et al, 1970). Their studies seek to explain consumer preferences for specific goods and brands rather than the spatial buying patterns, although spatial interactions must affect such influences as availability and service.

The interchange of concepts between researchers using models based on the different postulates of shopping has been limited. The behavioural stochastic approach of Massy et al ignores conceptions of the spatial patterns which are central to the uses made of homo economicus to explain shopping patterns (Christaller, 1933). No formal hypothesis exists which seeks to explain retailer patterns in terms of buying behaviour or spatial location, although studies by such people as Carruthers (1962; 1967) mention both.

Concept interchange, or the lack of it, can affect explanation. If there is little interchange of notions the degree of explanation of shopping can be limited, any one approach explaining only a part of the total shopping system. However, it must be remembered that the work in different fields is not necessarily aimed at producing such an explanation. The use of concepts from these different fields of enquiry, however, is not without danger. In some cases there has been a tendency to assume, as rigid, conditions which, within a different research field, are themselves the subject

of enquiry. A leading example of this would be the use of the economically suspect homo economicus in Central Place Theory. This difference can be likened to a cleavage of disciplinary concepts. Harvey (1969, 112) considered that: "crossing inter-disciplinary boundaries in the search for new concepts on which to base geographic theory imposes certain responsibilities. It involves a precise understanding of the concepts and postulates developed in another discipline and an understanding of the derived conclusions... . It follows from this, however, that we should be fully aware of the empirical status of the law." Thus in conceptualising central place systems, assumptions made about consumer behaviour or retailers activities need to acknowledge the degree and form of knowledge about these other postulates that can be obtained from studies in their specific subject.

A means of ascertaining the validity of these adopted concepts is by means of empirical testing to find out if empirical regularity exists to support an hypothesis developed from the concept. Empirical exploration of some concepts common to the three postulates of shopping is the aim of this thesis. In particular, consumer behaviour will be investigated within a framework based on the theories which have been presented to explain the spatial pattern of shopping and settlement.

CHAPTER TWO

STUDIES OF ASPECTS OF SHOPPING AND SETTLEMENT

Hypotheses of spatial patterns of shopping centres have been formulated in what is known as Central Place Theory. The theory, initially based on economic concepts, has been recently developed with the use of complex geometric and probabilistic models. Concurrently researchers of consumer behaviour have examined empirically the bases of the Central Place Theory hypotheses.

Classical Central Place Theory

Christaller's 1933 study "Die zentralen Orte in Suddeutschland" has proved a foundation for studies of settlement and shopping. Curry (1964) saw Christaller as a location theorist within an economic framework. This view corresponds with that of Christaller himself who outlined a branch of geography termed "the geography of settlements". This branch would contain "laws of the geography of settlements, economic laws of a special character which we shall call special economic-geographic laws" (quoted in Harvey, 1969, 118). Since 1933, students of the various aspects of shopping have used Christaller's ideas as a framework around which to describe and explain consumer behaviour and the occurrence of retail units and central places.

Christaller described the pattern of consumer behaviour by

using assumptions derived from the economic theory of demand. He assumed demand to be a reflection of both the price of a good and the distance to the good, increasing distance effectively increasing the total cost of a unit of the good. Thus with a constant price but increasing distance an area of zero demand would be found where the total cost of acquiring the good becomes greater than the consumer is prepared to pay. For necessity items such as bread and butter, the unit prices of which are low, the increase in total cost for acquiring a good is considerably affected by increases in distance. The total cost of luxury or higher priced goods, in contrast, is relatively less affected by increased distance costs. Thus the consumer is willing to travel greater distances for luxuries than for necessities. A corollary to the tendency to elasticity of luxury items is the consumer's willingness to postpone purchase. Purchase will be undertaken when the distance cost per unit is able to be reduced, perhaps by multiple purchases. Considerations of cost also apply to the retailer. Their provision of retail outlets is a response to the profitability of any particular outlet. Outlets are established wherever the market area population/ distance potential is great enough to support an outlet.

Postulates were necessary to provide a system in which the assumed consumer behaviour could operate without distortion. These emphasised the location nature of the theory and included the existence of settlements primarily as places for retail activity, equal accessibility in all directions for all consumers and an evenly distributed purchasing power per unit

area. Thus each consumer could be plotted on a map with concentric isolines, each isoline showing the cost of purchasing a good from a centre. The consumer would use the centre forming the isoline of least cost. In such an economic landscape the optimal spatial organisation of an hierarchy of settlements would develop within an hexagonal lattice of market areas. The hierarchy of settlements would result from the aggregation of outlets for goods which had a larger minimum market and greater distance competitiveness. Each of these postulates have been studied, questioned and remodelled since.

Derivations from Christaller

In 1954 Losch reconsidered Christaller's postulates. While maintaining the hexagonal lattice, Losch introduced a new arrangement of the settlement hierarchy. Loschian central places still occurred in an hierarchy but goods were not necessarily common to all members of the hierarchy. For instance, in an area where the lowest central place function occurred in settlements of 100 people, a function with a minimum market of 300 people would occur in every third settlement, while another function with a minimum market of 400 people would occur in every fourth settlement, an irregular coincidence. This postulate allowed no excess profits to the retailer, a condition which was less stringent under the conditions used by Christaller. But while the grouping of higher order goods in the Christaller system allowed travel cost minimisation, the Loschian model entailed greater consumer travel for a group of purchases.

Exploration of the location pattern of settlements entered a further stage when Dacey used probability techniques to vary the central place landscape. Dacey translated Central Place Theory into geometric language (Dacey, 1965), and then randomly varied the location of each central place using the hexagonal lattice as an equilibrium point measure (Dacey, 1966). This was in response to a belief that it was inconceivable that any observed pattern of places conforms precisely to the lattice structure (Dacey, 1966, 551). By using such a probabilistic interpretation of the location of each central place Dacey was allowing for "noise" in the formerly algebraic and consequently precise nature of the theory. Dacey concluded that correspondence between the perceived location of settlements in his study area and that predicted by his hypothesis was affected by what he termed "a strong state of disequilibrium" (Dacey, 1966, 568).

Curry combined probability and Christaller's economic rationale to describe a pattern of consumer behaviour. He presented a stochastic pattern of consumer behaviour and also of retail outlet policy (Curry, 1962). This was a response to what Harvey (1969, 120) termed "the unwarrantable assumptions of human behaviour implicit in homo economicus". In other studies these assumptions of consumer behaviour were investigated at an empirical level. Golledge et al, in a study of an Iowa farm population, found that people did not always purchase goods and services at the closest occurrence of the function. They also found some indication that the degree of non-conformity varied with the level of good (Golledge et al, 1966; Rushton et al, 1967).

A similar study in New Zealand by Clark (1968) contained similar conclusions.

In some studies consumer behaviour was examined as a series of individual trip sequences. Marble and Nystuen (1963) proposed consumer behaviour was related to the mean information field, an expression of an individual's short term contacts. In a later article which revised the framework for consumer measurement Marble and Bowlby (1968, 45) identified two main areas of enquiry: the opportunity-set, or location of all establishments that could be visited, and the repetition of travel to each location. Nystuen (1967) added a further complication: the terminal cost, which is a measure of the cost of entering a shopping centre. This terminal cost comprised the various social and economic costs of leaving the home or work place and travelling to a shopping centre, but is also affected by the scale of the centre. The number of different goods able to be purchased at each centre and the ability of each centre to provide choice within each good together establish the scale of the centre.

The presence of the hierarchy asserted by Christaller has also been empirically investigated, first by Brush (1953) and Bracey (1953) and then at some length by Berry and Garrison (1958a,b). In the latter study the central place hierarchy was developed solely from two economic concepts. The first was the range of a good, the distance consumers would willingly travel to buy a good. The second was that of threshold, the minimum population needed to support a retail outlet. Proof of the

functional differentiation implicit in the hierarchy was obtained by testing for any significant difference between expected and observed reflexive relationships on a ranking of the occurrence of retail outlets within each central place (Berry and Garrison, 1959). This hierarchy would function in any area, not being dependent on a uniform purchasing surface and also independent of the spatial patterns of settlements. This flexibility of the hierarchy is an important consideration as Johnston (1966), in a study in Australia, found that the spatial arrangement of the hierarchy varied according to residential density, socio-economic status and age of the development of the hinterland. This non-spatial derivation of the hierarchy did not necessarily exhibit the nesting pattern of centres proposed in Christaller's theory of settlement, although Preston (1971) arranged a system of nesting for centres in the Pacific North West of United States. Berry (1967) also participated in studies of consumer behaviour, reaching a conclusion in conflict with those of Rushton et al (1967), although their respective measures of a satisfactory explanation could explain the difference.

The constitution of the parameters of measurement of the hierarchy has been the subject of some debate. Some measurements have used only retail outlets (Tarrant, 1968), others have included service and social functions (Berry and Garrison, 1958a), highlighting the problem of the multi-functional town. Further problems have been whether to weight according to size and/or use of the various functional units and the effects of different systems of retail outlet

ownership (Lichfield, 1967). To incorporate such consumer behaviour patterns as proposed by Nystuen (1967) would expose inadequacies in the measurement of central places. Scott (1970, 16) suggests a major weakness of Central Place Theory is its inability to predict a product mix, or the variety of goods that may be sold at a store. This could affect the occurrence of goods at central places. Whether this is related to the retail organisation is unknown.

At this stage in the development of Central Place Theory and other research encompassing shopping, then, many of the initial assumptions have been modified. It is apparent that the role of the consumer in contributing to an hierarchial and spatial arrangement of central places is not completely understood. While homo economicus can be used as a measure against which variance of consumer behaviour can be gauged, the concept seems no longer tenable as a rigorous explanation. Economists, from whose work this assumption was developed, recognise that their laws of demand, from which consumer behaviour was initially derived, are not empirically substantiated (Clarkson, 1963). Harvey, because of this maintains that: "it is surely evident that Central Place Theory will not and can not yield empirically testable hypotheses since it is founded on a theory of demand which is itself inherently untestable except by introspection" (Harvey, 1969, 139). Perhaps in response to this Rushton et al (1967) have proposed a redefinition of a central place by introducing a measure of consumer attractiveness beyond that supplied solely

by economic criteria. This is, in effect, building into the set of the location process elements non-economic conditions, or what Harvey (1969, 139) calls error term. This thinking would seem to be asking whether it is possible to develop a body of theory which can explain consumer movement without relying solely on economic criteria. It would entail redefining central places so that they fit the assumptions of the theory of demand. Other studies by such people as Huff (1961), Marble and Bowlby (1968), Morrill (1967) and Nystuen (1967) would appear to be seeking laws of consumer behaviour which would encompass both economic and geographic elements in the consumer's decision process. This can be compared with a new theory of demand suggested by Clarkson (1963) which includes such postulates as a limited search by the consumer for goods meeting certain minimum criteria, an event presumably partly conditioned by geographic location. Indeed, if the assumptions of the original laws of demand are denied it is possible to conceive that different geographic locations greatly affect consumer behaviour through both disparity in the price of a good (this being contrary to one of the assumed conditions of Central Place Theory) and the non-economic attractiveness of a central place. This problem hinges on the initial abstraction of postulates for it is difficult to visualise the application of a theory which would require knowledge of price variations from centre to centre for even the most elementary application. It is also possible that shopping is undertaken as a recreational pursuit and therefore any prediction of behaviour would initially have to

measure recreation attractiveness, the final decision providing maximum value on an 'indifference curve' of shopping and recreation. It can be concluded that studies of individual consumer behaviour have yet to produce an acceptable theory with which to evaluate further empirical evidence.

Studies of retail organisations within centres have been predominantly empirical. Scott (1970) mentions studies in the United Kingdom which suggest that the occurrence of different types of organisation varies with changes in the socio-economic status of the population. Another possible variable is the effect of different retail organisations on the total number of units per centre. Intuitive assessments of New Zealand systems could be made, recounting the effects such organisations as Woolworths and McKenzies, 'wholesale' grocers and discount houses have on the retail pattern. From what is known, no empirically verifiable hypotheses explaining the advent of a good or function to a level of the central place hierarchy can therefore be made. While central place hierarchy exists, or at least a system of nesting which equates to an hierarchy within a smaller area before giving way to a continuum over a larger area, the workings of the hierarchy have not been fully confirmed. Even with Berry and Garrison's (1958b) version of the establishment of a functional unit which reflects both threshold and the range of a good, the occurrence of retail outlets is still obscure. The argument that:

i) there is a functional unit retailing good A

ii) there is a population, X, in the theoretical trade area, M, of the functional unit retailing good A

iii) therefore the threshold of good A is population X and the range of the good A is the radius of the theoretical trade area M, is incomplete. It is still incomplete even if, by making allowance for the occurrence of excess profits, tolerances in the measurement of the various parameters were allowed. Not all studies have shown the operations of the consumers within the trade areas to follow the argument (see discussion of consumer behaviour above) and the unknown effects of retail organisation have not been accounted for. Thus it is just as possible to conclude:

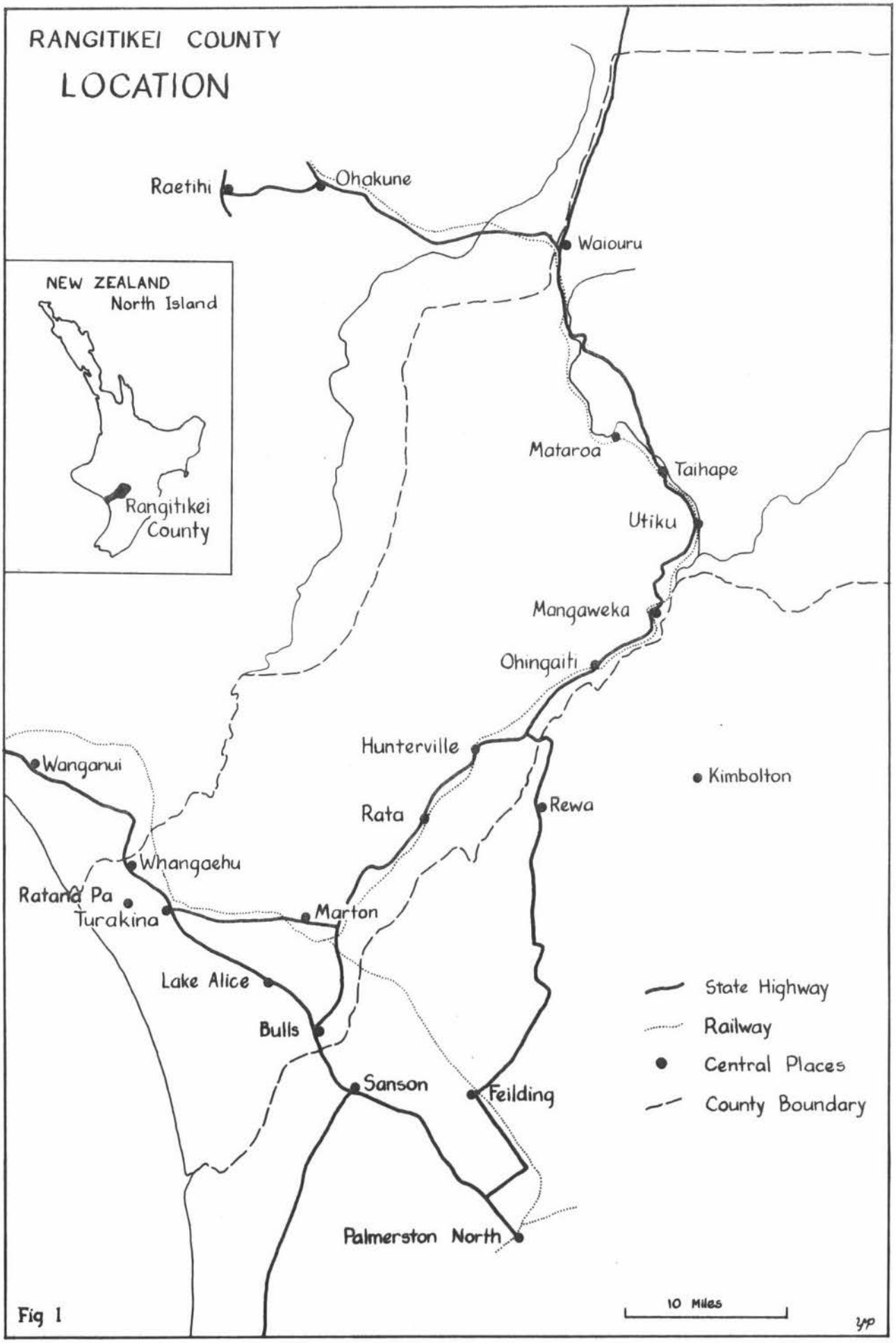
iv) therefore 50% of the consumers of good A come from the theoretical trade areas N, O, P, and Q, and 50% from the theoretical trade area M. A hierarchy can therefore be assumed to exist but no hypotheses of its relationships with the surrounding hinterland have been substantiated.

CHAPTER THREE

AN INVESTIGATION OF SOME SHOPPING PATTERNS :

THE AREA

An investigation of some shopping patterns was undertaken in Rangitikei County (see Figs 1 and 2), an administrative region of 1,732 square miles and 15,132 people (1966 Census). Within the geographic county are two boroughs and other smaller centres which bring the total county population to 23,321. The physical pattern of the county is dominated by the Rangitikei River valley. In the south broad river terraces form fertile flats used for fat lambing, stud farming and arable agriculture. In this area roads are frequent, often tarsealed and, by New Zealand standards, there is a reasonable density of population. Marton is a railway junction and the main market town with half of the labour force engaged in service industries, although more than one third is employed in manufacturing (Department of Labour, 1970). To the north, the downcutting of streams and rivers into sedimentary rocks and mudstones has created an area of hill country. Settlement is mostly in the valleys, concentrating along the Rangitikei River as far as Mangaweka and thence following State Highway One and the Main Trunk Railway up the Hautapu River valley.


RANGITIKEI COUNTY
LOCATION
NEW ZEALAND
North Island
Rangitikei County
Raetihi
Ohakune
Waiouru
Mataroa
Taihape
Utiku
Mangaweka
Ohingaiti
Hunterville
Kimbolton
Wanganui
Rata
Rewa
Whangaehu
Ratana Pa
Turakina
Marton
Lake Alice
Bulls
Sanson
Feilding
Palmerston North
State Highway
Railway
Central Places
County Boundary
10 Miles
Fig 1
YP

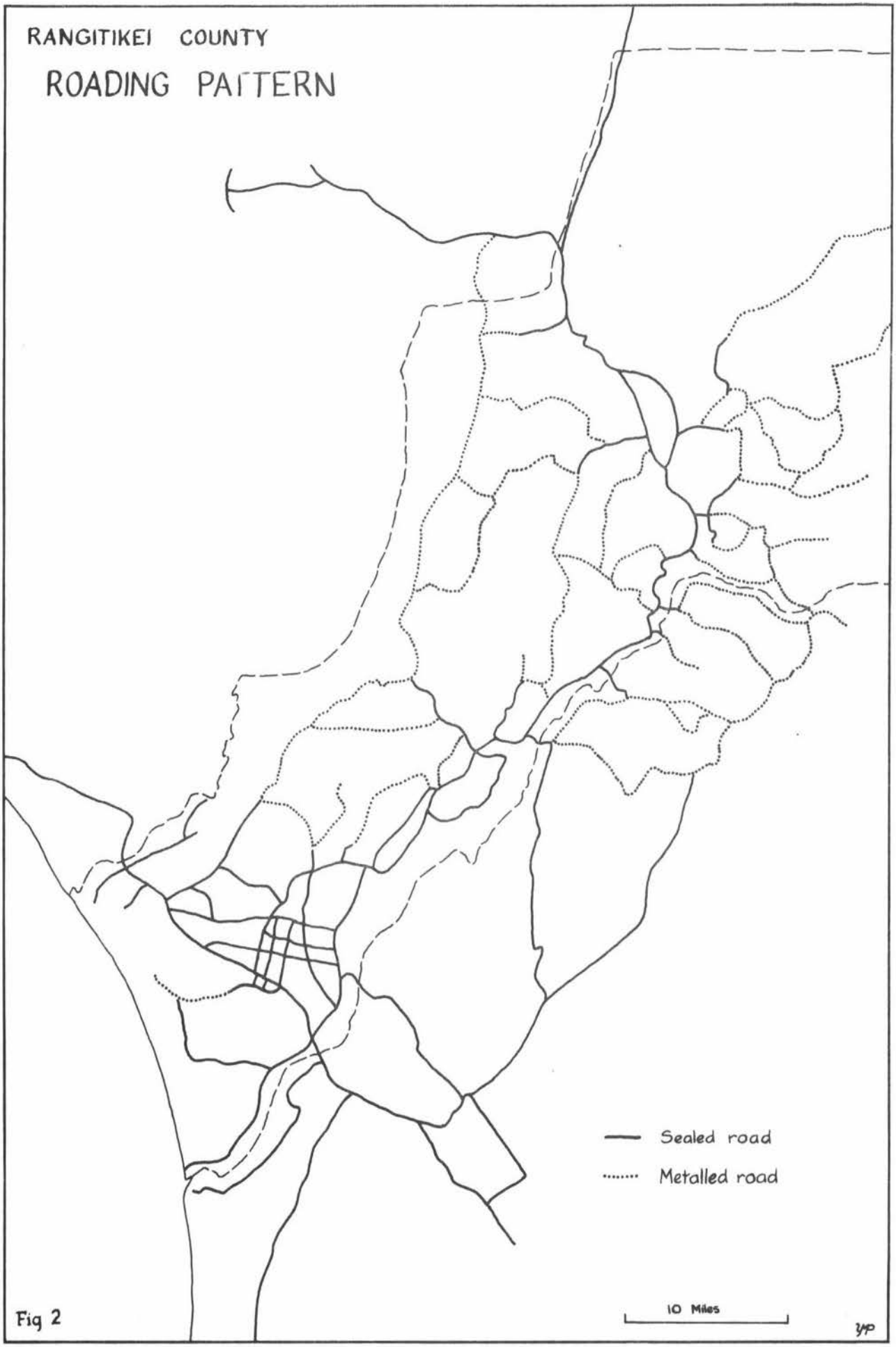

RANGITIKEI COUNTY
ROADING PATTERN
Sealed road
Metalled road
10 Miles

Fig 2

Fat lamb and store sheep farming are the bases of agriculture, settlements being more scattered than in the south, with roads often metalled, winding and narrow. Taihape is a regional railway centre and also market town with over 75% of its labour force engaged in service and maintenance industries.

Trade Areas and Hierarchy

The initial activity was to delineate the trade areas of the centres of the county. No attempt was made to base these on the hexagonal lattice of Christaller as the relief of the county imposed considerable constraints on the settlement pattern. The term trade area, while it can be measured for area and population, is not meant to infer that all the trade from the particular area is undertaken in the corresponding central place. Rather, it refers to an area which, to correspond with the postulates of Central Place Theory and also fulfil requirements of the consumer sample, is serviced by a particular central place. Maps of services such as grocery deliveries (Fig. 3), telephone exchange coverage, local paper deliveries (Fig. 4), stock and station firm and police districts were used to delineate mutually exclusive trade areas for each central place. Areas of competition between central places were included in the trade area of the smaller centre. Thus the Mataroa trade area was also serviced for the same goods by Taihape firms which used either their own transport or rural delivery. The Mataroa store closed after the survey was formulated but before all

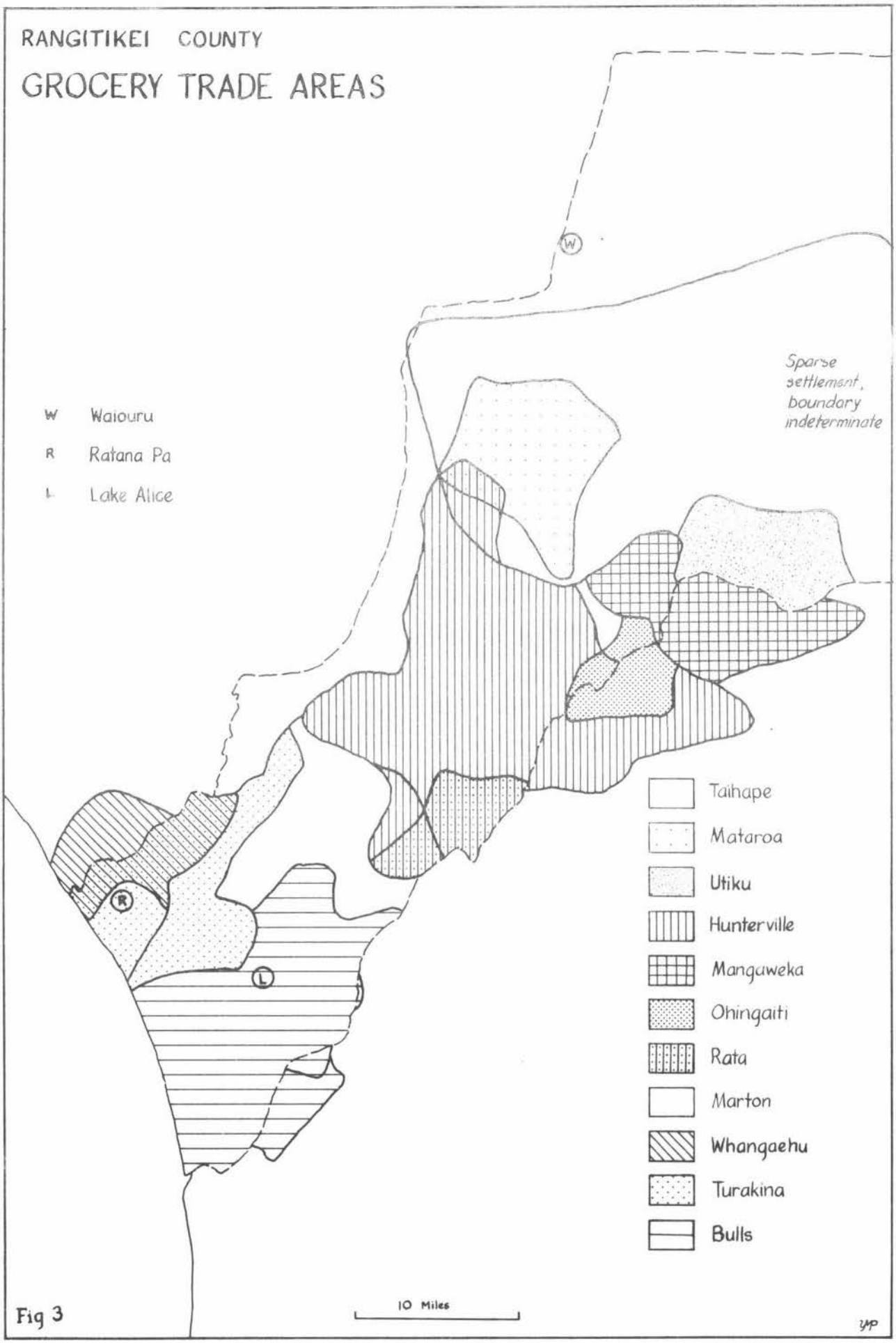
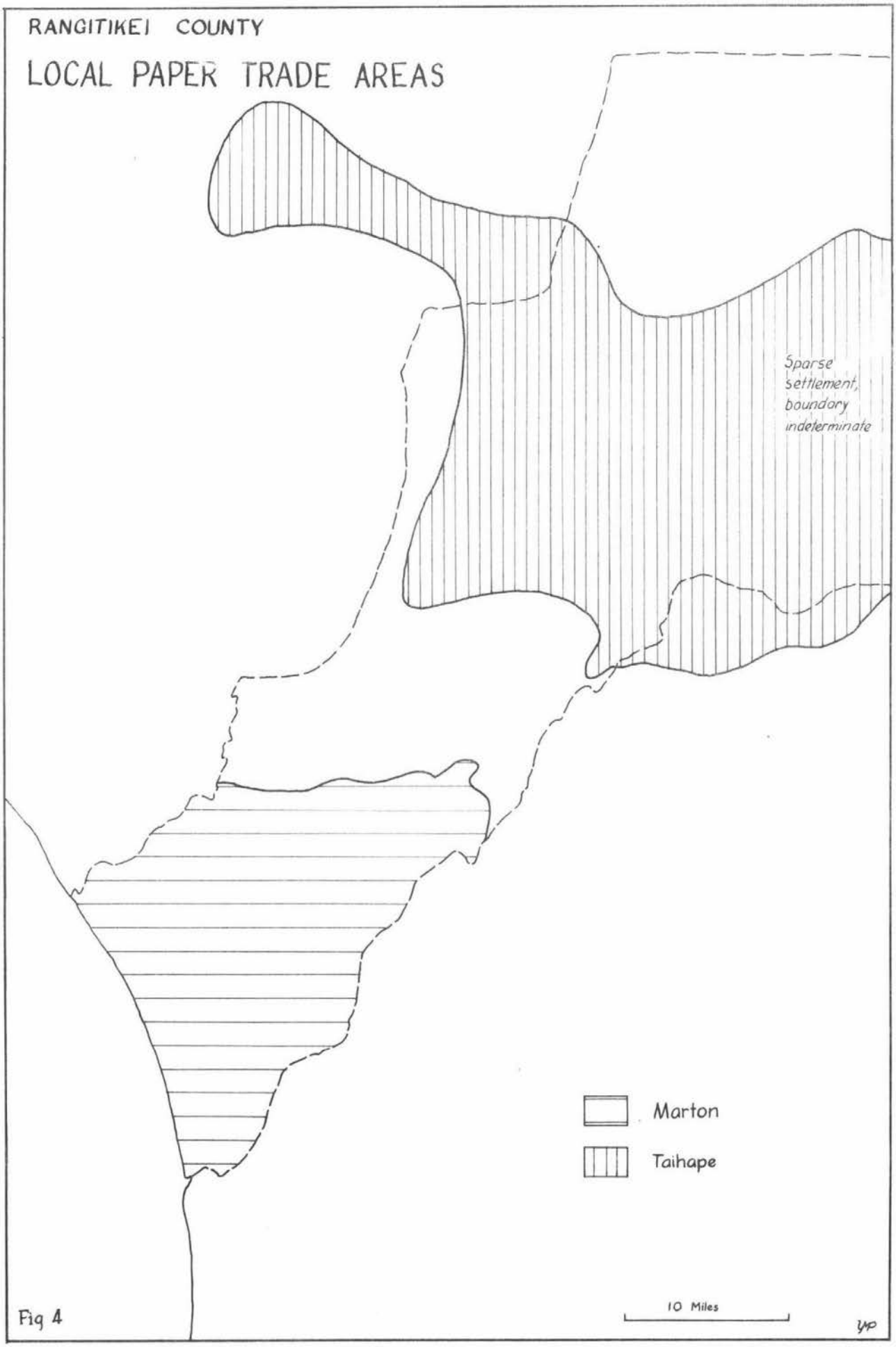

RANGITIKEI COUNTY
GROCERY TRADE AREAS
W Waiouru
R Ratana Pa
L Lake Alice
Sparse settlement, boundary indeterminate
Taihape
Mataroa
Utiku
Hunterville
Mangaweka
Ohingaiti
Rata
Marton
Whangaehu
Turakina
Bulls
10 Miles
YP

Fig 3


RANGITIKEI COUNTY
LOCAL PAPER TRADE AREAS
Sparse settlement, boundary indeterminate
Marton
Taihape
10 Miles
Fig 4

the questionnaires were completed. In all further questionnaire work interviewees were asked for their patterns prior to the closure of the store which has meant the virtual disappearance of Mataroa as a central place. A similar procedure was followed when the Ohingaiti store also closed, although in Ohingaiti several other functions continue to operate.

The trade areas which are outlined in Fig. 5, then, are those for each central place at the lowest level of service. Where centres of the same hierarchy level (see below) are contiguous, however, the individual trade areas are not distinguished. As goods with a greater range and threshold are included the trade areas of the larger central places, such as Taihape and Marton, expand; an example is the area of paper deliveries (Fig. 4). From the maps the nesting pattern of the central places in the county can be detected. For instance the trade area of the Taihape paper includes the grocery trade areas of Waiouru, Mataroa, Utiku, Mangaweka and Ohingaiti, as well as Raetihi, Ohakune and Rangataua from outside the area of the county.

This nesting pattern and the occurrence of functions and functional units have been used to delineate groups for an hierarchy of the central places. The occurrence of retail and service functions was used as a measure of the size of each of the central places, notwithstanding the limitations of the method previously noted. Other methods such as the size of the labour force employed in retailing, the floor area or retail turnover were rejected. Figures for the occupations

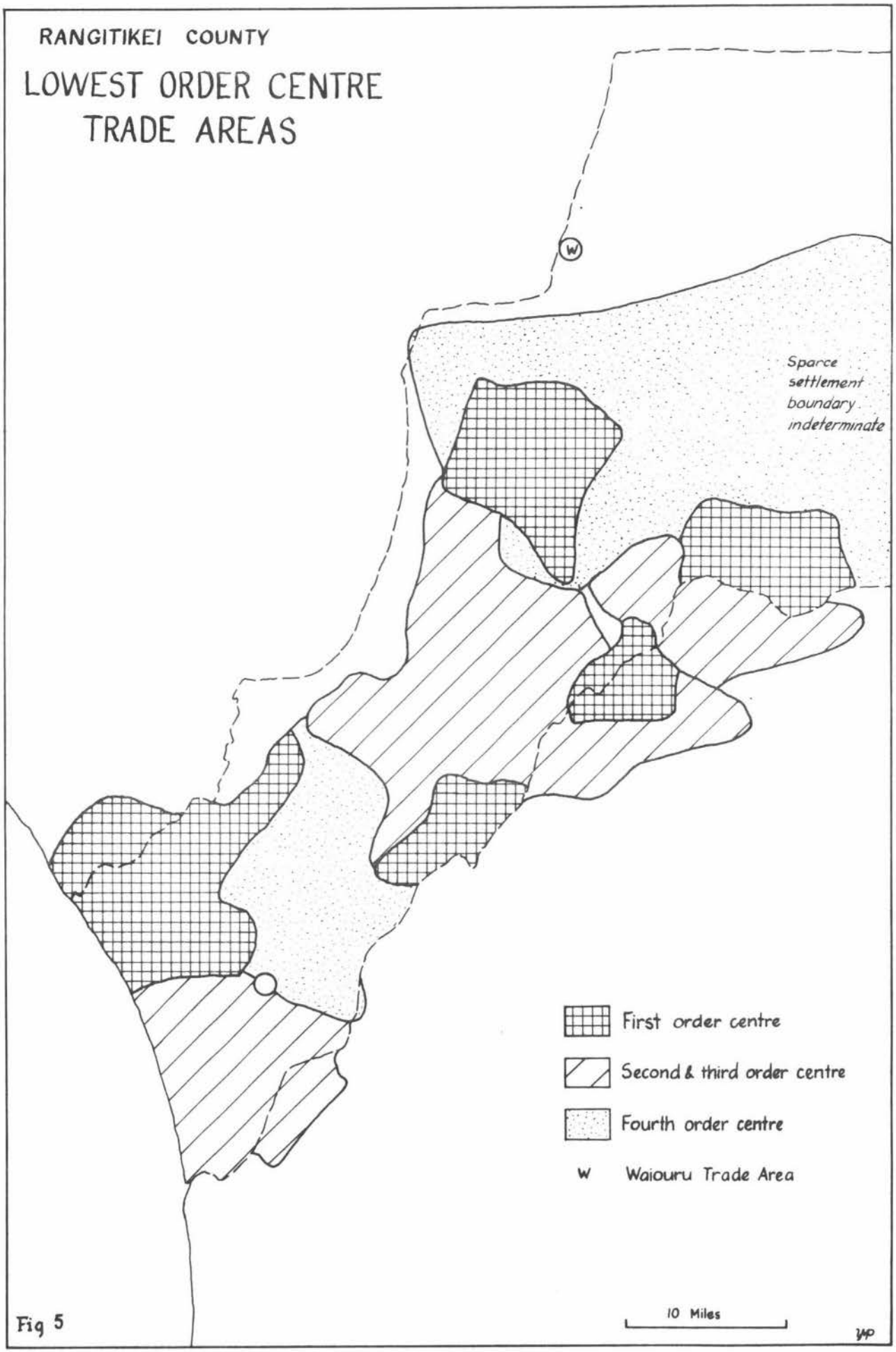

RANGITIKEI COUNTY
LOWEST ORDER CENTRE
TRADE AREAS
W
Sparce settlement boundary indeterminate
First order centre
Second & third order centre
Fourth order centre
W Waiouru Trade Area
10 Miles
YAP

Fig 5

of the population were obtained from the Department of Statistics for Ratana Pa, Bulls, Mangaweka, Hunterville, Marton, Taihape and the remainder of the administrative county, but as these figures were for residential populations they could not be taken to represent the labour force operating the various functions at each of the central places. Figures of floor area and retail turnover are not readily available and it was considered impolitic to attempt to find out such information by questionnaires. Appendix A gives a full listing of the occurrence of functions and functional units and the method used to derive these. The results are summarised in Tables I and II. From the information obtained from these sources and the trade area patterns (e.g. Figs. 3 and 4), the hierarchy listed in Table III was nominated to exist.

Having selected the several attributes which in Central Place Theory are the basis of the hierarchy of central places, the central places so defined were searched for their degree of affinity. Clark and Evans (1954) used as criterion for grouping the departure from the random expectation of the values of the members. Associated with this is the closeness of each member to one another and to any non-member. The level of closeness used would be an arbitrary value. The totals of functions and functional units for 1968 in Table I show that for the groupings listed in Table III each member of a group is closer to the other member(s) of the group than to any non-member. Thus Mangaweka is closer to Waiouru than it is

TABLE I

The Occurrence of Functions and Functional Units in Rangitikei County in 1938 and 1968

	1938		1968	
Centre	Units	Functions	Units	Functions
Marton	233	71	324	86
Taihape	216	67	248	80
Bulls	78	37	117	50
Hunterville	79	42	83	41
Waiouru	1	1	32	29
Mangaweka	60	37	25	20
Turakina	15	10	10	7
Ohingaiti	14	10	8	7
Utiku	9	6	7	5
Rata	3	2	5	5
Whangaehu	1	1	4	4
Mataroa	6	6	3	3
Lake Alice			3	3
Ratana Pa			2	1
Mount View			1	1
Silverhope			1	1
Moawhango	6	6		
Hihitahi	3	2		
Ruanui	2	2		
Crofton	1	1		

Source: Appendix A gives a full listing of the functions and functional units as well as a definition of terms and the sources used for gathering the information.

TABLE II

The Occurrence of Services and Community Facilities in Rangitikei County in 1938 and 1968

Centre	1938 Services	1968 Services	1968 Facilities
Marton	19	24	19
Taihape	22	24	14
Bulls	8	10	6
Hunterville	11	12	6
Waiouru		10	3
Mangaweka	6	9	5
Turakina	4	4	4
Ohingaiti	4	4	4
Utiku	3	3	1
Rata	2	2	1
Whangaehu	1	1	2
Mataroa	2	2	3
Ratana Pa		2	3
Lake Alice			
Moawhango	2		3
Hihitahi	2		
Ohotu	1		

Source: Appendix A gives a full listing of the service and community facilities as well as a definition of terms and the sources used for gathering information. It should be noted that the list of community facilities is not meant to represent all those in the County - numerous country localities have a hall, church or school, but nothing else, e.g. Moawhango in 1968.

TABLE III

An Hierarchy of Central Places in Rangitikei County in 1960

First Order:	Hataroa
	Lake Alice
	Ratana Pa
	Whangaehu
	Rata
	Utiku
	Ohingaiti
	Turakina
Second Order:	Mangaweka
	Waiouru
Third Order:	Hunterville
	Bulls
Fourth Order:	Taihape
	Marton

Source: The basis of the hierarchy is outlined in the text. The hierarchy applies to the situation in 1960. Both Silverhope and Mount View have been deleted. At Silverhope the functional unit is a tea rooms catering for travellers on State Highway One, while Mount View has a service station which is probably dependent on the same custom.

to Turakina in totals of both functions and functional units and also services (Table II). The degree of difference used to distinguish between one group and another is an arbitrary one, made in the light of what is known of their trade area services. No attempt to measure the significance of the accepted groupings was made.

On this basis the four groups of Table III were derived. Mangaweka and Waiouru were classified as a separate group or hierarchy for while their list of services compared to those of the next highest group their numbers of functional units fell far short of those of the next group and neither town had a trade area outside their immediate settlement which compared in size to those of Bulls and Hunterville (see Table IV).

Threshold

The concept of threshold is also worthy of a brief examination. Approximate populations, based on the 1966 Census, were calculated for each of the trade areas delimited in Fig. 5. These are summarised in Table IV.

Several trends, implicit in the idea of threshold and the appearance of further functions, can be found in Table IV. The populations of Bulls, Hunterville, Mangaweka, Taihape and Marton follow a similar pattern to the respective numbers of functions and functional units. Of the first order centres Turakina is the largest in numbers of both people and functions. However, there are also discrepancies. While there are two grocery stores at both Lake Alice and Ratana Pa, the stores

TABLE IV

Trade Area Populations in Rangitikei County in 1968

	Order			
Centre	First	Second	Third	Fourth
Waiouru	..	3,681		
Mataroa	534			
Taihape	..	..	..	9,941
Utiku	450			
Mangaweka	..	693		
Ohingaiti	335			
Hunterville	..	..	1,997	
Rata	407			
Marton	..	..	..	13,645
Bulls	..	..	3,148	
Lake Alice	577			
Turakina	833			
Ratana Pa	470			
Whangaehu	264			

Source: The figures were derived from those published in the New Zealand Census of Population and Dwellings, 1966, Vol. 1. Locality populations were attributed to those trade areas in which the locality appeared to fall - in some cases the certainty of the allocation is questionable. The figures for the third and fourth order centres include populations of all those lower order centres which come within the higher order centres for goods with high thresholds. The populations of the high order centres themselves are: Marton 4,731, Taihape 2,861, Waiouru 3,681, Bulls 1,803, Hunterville 590 and Mangaweka 280.

at both Mataroa and Ohingaiti have closed. The population of the trade area of Mangaweka is smaller than that of Turakina in contrast to the greater number of functions. It would seem that many other conditions could combine to account for the final pattern; conditions such as the degree of patronage from within each trade area, the amount of patronage from travellers, social bonds and capital investment combining to produce inertia, changes in travelling conditions, social conditions and the skill of individual entrepreneurs. Each one of these conditions could be discussed at some length, but the consideration would involve supposition and value judgement. An example could be made of Moawhango which was the original focus of settlement in the northern area. In 1938 Moawhango still had six functional units, but by 1968 none remained although the population in the immediate area was over 350 and totalled over 530 in a possible trade area. Hypotheses, each with a degree of factual basis, that could be put forward to explain the change in threshold characteristics include the improved means of travel enabling faster communication with Taihape, the ability of the high country populations to the east and north of Moawhango to also travel relatively quickly to Taihape, the break-up of the original Maori community as some of them shifted into Taihape seeking jobs, the approaching need to replace capital investment, the negligible amount of through traffic to contribute to sales, and probably several others.

CHAPTER FOUR

CENTRAL PLACE PATTERNS

Trade areas and hierarchy established in the previous chapter defined the sample used in an empirical investigation of consumer behaviour. This questionnaire survey measured each consumer's use of his closest centre, other towns he visited and his motivation. In this chapter the effects of central places and goods will be analysed - in the following chapter the effects of consumer variables.

Sample Area Stratification

Division of the sample served two purposes. It enabled a predetermined number of samples to be collected from the basic settlement classifications - urban and rural areas. This stratification was further arranged according to the hierarchy idealised in Central Place Theory.

Sample one was taken from first order central place trade areas (area One - see Fig. 5). Samples two and three were generated from consumers of third order trade areas, a division being made between rural (area Two) and urban (area Three) populations. Fourth order trade area rural populations constituted sample four (area Four). Two samples were generated from fourth order trade area urban populations.

This enabled separate results for Taihape (area Five) and Marton (area Six) to be calculated.

While the six sample areas above have followed the pattern of hierarchy previously established, there has been no inclusion of the second order centres, Waiouru and Mangaweka. A seventh sample was taken in Waiouru (area Seven). The town has no rural trade area. It was developed as a military camp during and after World War Two and while functions have been established in Waiouru township to serve travellers and residents, most shops are in Waiouru Military Camp. Waiouru township is an area on State Highway One under the administration of Rangitikei County Council, while Waiouru Military Camp is an area under the control of the Ministry of Works and New Zealand Army. In the Military Camp a shopping centre was planned and constructed, shops being allocated to various functions. As the population is a collection of people from all parts of the country and the township has few links with surrounding areas, it was decided to sample Waiouru independently of the hierarchy of which it is partly independent.

As the constitution of Waiouru as a separate sample left Mangaweka the sole second order centre, it was incorporated in the third order samples. The pre-World War Two size of Mangaweka, continuance of several functions such as an electrician, T.A.B. and stock and station firms and the relatively large number of services, made it inappropriate to group Mangaweka with first order centres.

Organisation of the areal stratification on the basis of

central place hierarchy effectively ranks the different samples. Bulls, Mangaweka and Hunterville, the central places of areas Two and Three, have more functions and functional units than Utiku and the other centres combining in area One. Thus theoretically areas Two and Three have greater goods supply potential than area One. Similarly, areas Four, Five and Six, as the trade areas of the two largest towns, Marton and Taihape, have a greater goods supply potential than the first three areas.

As shown in Fig. 5, people living outside Rangitikei County but in the trade areas of the study centres, were sampled. Within each sample area a total of 40 interviews were completed. Selection procedures for the stratified random sample are outlined in Appendix B. Appendix C contains a copy of the questionnaire.

The Use of the Closest Centre

The focus of Central Place Theory, whether interpreted by Christaller's hierarchy formation or by Berry and Garrison's threshold, is use of the closest centre. Measurement of this pattern of use was therefore paramount in the study. The basic function of the questionnaire was to collect data to enable this to be done. The distances of each sample member to the different central places were measured. For grocery items availability of a rural delivery service was used to indicate the nearest centre. With prior investigation of hierarchy in the county, availability of different goods was already established.

To organise measurement of nearest centre use an hypothesis that

"all consumers will purchase their goods and services at the closest centre supplying the particular good or service"

was set up. In view of the nature of the material being tested it was unrealistic to expect all consumers to use the closest centre. The hypothesis was therefore modified, "all" being replaced by "most" and "the majority". When testing the hypothesis, "most" of the consumers was taken to be 90% or more of the population. This figure indicated that, unless strong forces of disequilibrium existed, consumers could use their closest centre. These strong forces could include a member of the household working in a shop in another centre, or a weekly business trip to Palmerston North. The "majority" was defined as greater than 50% of the population. This meant that prediction based on the hypothesis would, at the least, be right as often as wrong. It would also indicate that the closest centre is the single most important centre for supplying the particular good.

Weighted totals for the seven sample areas were combined to assess conformity between theory and actual level of closest centre use. The hypothesis was not confirmed for any good for most consumers (see Table V). For ten of the thirteen goods surveyed the hypothesis was confirmed for the majority of consumers at the 95% confidence level. This confirmation of the hypothesis is applicable only to those members of the population who

TABLE V

Use of the Closest Centre : Rangitikei County

	Sample	Total Population		
Good	No. 'yes' over all users	No. 'yes' as % of total population	No. 'yes' as % of total users	(users) S.E.
Electrician	188/205	72.5	93.5	2.97
Plumber	177/203	68.1	90.4	3.64
Carpenter	178/200	68.8	91.2	3.72
Dentist (Head)	138/206	55.0	70.5	6.72
Dentist (Wife)	132/216	50.1	68.6	7.75
Lawyer	156/235	60.4	70.6	6.80
Groceries	235/262	86.0	91.2	2.97
Hardware	171/254	65.1	72.7	6.46
Home Appliances	172/250	64.9	72.2	6.47
Clothing A	191/279	72.4	72.6	5.96
Clothing B	113/275	43.4	44.8	7.05
Furniture	136/237	52.0	60.4	7.44
Car Servicing	180/234	64.5	78.3	6.72

Note: Total population measurements are weighted estimates based on figures for each of the seven areas. Area figures can be found in Appendix D, the formula used for calculation in Appendix E. The weighting value for each area was taken from Appendix B. Total number of possible consumers for each good was 280.

bought the good. In some cases the actual number of consumers who bought the good was low. The hypothesis was therefore applied to data expressing consumers as a proportion of the total sample. For some eight goods the hypothesis, with data expressed as a percentage of the total population, is again confirmed for the majority of consumers at the 95% confidence level.

Armed Services Personnel as a Sub-population

Variation in the pattern of use between different areas appeared to be quite marked. Only 35% of area One and 12.5% of area Two samples used the closest centre for expensive clothing (Clothing B). This compares to 67.5% of the sample of area Five and 60% of area Six. Area Seven, the Waiouru sample, had a particularly low use of local shops for most goods. As this sample consisted only of Armed Services personnel, a check was made on Armed Services personnel in sample areas Two and Three. It appeared that Armed Services personnel there also had a wide ranging shopping pattern.

Provision of some services for Armed Services personnel has already been noted. To see whether their shopping patterns for the remaining goods were significantly different from those of the local population (Non-Service personnel), a chi square test was applied. The total Armed Services population was distinguished and a null hypothesis (H_o) that

> "there is no difference between Armed Services personnel and Non-Services personnel in their use of the closest centre"

formulated. The chi square test was applied to the total sample data for each good. Results of the test, given in Table VI, showed that for seven of the eight goods H_o was rejected at the 5% significance level (the actual probability, p, being less than .02 for each of the seven goods). In view of the variations between areas which have been noted above the difference could possibly be explained by area variances. A second set of chi square tests were therefore undertaken for difference between Armed Services and Non-Services personnel in areas Two and Three combined. Any difference between the two sets of data could no longer be explained by their respective positions on the central place hierarchy. Results for this second test (Table VII) were less conclusive than those for the total sample. With four goods, however, H_o was rejected at the 5% significance level ($p = .02$).

Rejection of the null hypothesis and a conclusion that there is a significant difference between Armed Services and Non-Services personnel posed a problem for assessment of further results. It was decided to distinguish between the two groups in all further tests. This would enable patterns which are inherent in either or both samples to be distinguished. It would also enable results which are not biased by the presence of a distinct sub-group to be obtained for what could be termed the resident population or county community.

TABLE VI

Use of the Closest Centre : Armed Services and Non-Services Personnel in Rangitikei County

	Services		Non-Services			
	Sample numbers for the centre used:					
Good	closest	other	closest	other	Chi	p
Lawyer	11	20	145	59	16.9	.001
Groceries	39	0	196	19	3.0	.02
Hardware	8	37	163	46	63.8	.001
Home Appliances	10	30	162	40	45.0	.001
Clothing A	22	37	169	51	35.5	.001
Clothing B	2	55	102	116	37.9	.001
Furniture	12	26	124	75	13.6	.001
Car Servicing	39	11	141	43	0.0	.98

Note: The chi square test used is given in Appendix E.

TABLE VII

Use of the Closest Centre : Armed Services and Non-Services Personnel in Areas Two and Three

	Services		Non-Services			
	Sample numbers for the centre used:					
Good	closest	other	closest	other	Chi	p
Lawyer	4	5	31	23	1.2	.30
Groceries	12	0	52	3		
Hardware	4	8	41	16	8.3	.01
Home Appliances	2	9	38	19	11.1	.001
Clothing A	3	16	35	25	12.2	.001
Clothing B	0	19	20	29		
Furniture	1	9	26	26	7.2	.01
Car Servicing	13	6	35	16	0.1	.70

Note: The chi square test used is given in Appendix E.

Differences between Sample Areas

The presence of Armed Services personnel in areas Two and Three would have contributed to differences in patterns between and amongst areas. Some variations still remained, however, once the Armed Services population was removed. A chi square test was conducted to find whether these variations were purely random or a reflection of distinct populations. The results (Table VIII) of this test led to the rejection of the null hypothesis that:

"the proportion of Non-Services personnel using the closest centre is the same in areas One, Two, Three, Four, and Five and Six."

From the cells of tables used to calculate the chi square tests (see Table VIII for an example) it appeared that the assumed greater goods potential in higher order sample areas was reflected in the results. There was a trend to proportionately greater use of the closest centre as the size of the closest centre became greater. As a refinement of the previous hypothesis, a further chi square test was carried out with the following null hypothesis:

"the proportion of Non-Services personnel using the closest centre is the same in areas One, Two and Three combined as in areas Four, Five and Six combined."

The combinations of the null hypothesis grouped samples of first, second and third order centres against consumers in trade areas of fourth order centres. Table IX shows results of the test which led to rejection of H_o. The alternative

TABLE VIII

Use of the Closest Centre : Results of Chi Square Tests of Difference Among Areas One, Two, Three, Four and Five and Six

Good	χ^2
Dentist (head)	41.0
Dentist (wife)	36.0
Lawyer	34.0
Hardware	24.2
Home Appliances	22.0
Clothing A	34.1
Clothing B	22.0
Furniture	22.6
Car Servicing	17.0

In all cases the critical values of chi square were:

$\chi^2 = 9.49 = .05$ probability

$\chi^2 = 18.46 = .001$ probability

Note: The chi square test (given in Appendix E) was undertaken on a 5 x 2 contingency table, shown below. The frequencies associated with cells in the tables for electrician, plumber, carpenter and groceries were too small to allow the test to be conducted without distortion.

Contingency Table : Lawyer

The increasing use of the closest centre between areas One and areas Five and Six can be seen.

		Area				
		1	2	3	4	5&6
Used	Closest:	19	10	21	31	64
	Non-closest:	20	14	9	8	8

TABLE IX

Use of the Closest Centre : Results of Chi Square Tests of Difference Between Various Groupings of the Six Areas

	Chi square results of the area groupings			
Good	4 v 56	2 v 3	123 v 456	124 v 356
Lawyer	2.65	5.61	24.8	17.2
Clothing A	0.61	4.05	30.9	5.7
Clothing B	6.21	7.56	12.2	16.6
Car Servicing	2.30	3.94	12.6	10.2

In all cases the critical values of chi square were:

$\chi^2 = 3.84 = .05$ probability

$\chi^2 = 10.83 = .001$ probability

Note: The tests were undertaken on a 2 x 2 contingency table, shown below. The chi square formula is given in Appendix E.

Contingency Table : Lawyer

	Area		Area	
	123	456	2	3
Closest Centre	50	95	10	21
Non-closest Centre	43	16	14	9

hypothesis, that there is a difference between smaller and larger order centre trade populations in the use of the closest centre, is accepted.

The possibility that variability amongst areas indicated in Table VIII is related to some other pattern cannot be discounted. Other groupings of areas were made and tested by chi square for differences. The sample was tested for differences between rural and urban populations of the same central place order. For second and third order centres the null hypothesis

> "there is no difference in the use of the closest centre between rural and urban populations of the same order centres"

was rejected at the 5% significance level ($p = .05$) for all four goods tested. Amongst fourth order consumers, however, there was a significant ($p = .05$) difference for only one good.

A second grouping of urban and rural populations was made by combining all urban areas of the sample and all rural areas. Differences associated with this grouping could also be explained by the difference between small and large centres. In the chi square tests of the null hypothesis

> "there is no difference in the use of the closest centre between the urban and rural populations"

chi square values were lower for three of the four goods than those for the earlier test for difference between lower and higher order areas. While the results led to acceptance of the alternative hypothesis that there is a difference in use

between rural and urban areas, they also suggested that the strongest factor is difference in size of the closest centre.

Sample areas are too few in number to permit a test for correlation to be made on a ranking of areas One to Six and an associated increase in use of the closest centre. But results of the chi square tests suggest that there is a difference in use of the closest centre between lower and higher order trade areas, with a lesser trend within this to greater use by urban populations.

The Use of Non-Closest Centres

One aspect of central place hierarchy that has not yet been tested is nesting. It follows from theory that consumers use the next step of the hierarchy to buy goods not bought at the closest centre. In fact buying decisions for most of the sample appear to be between using the closest centre or the provincial centres, Wanganui and Palmerston North. There is little use of another centre of the same hierarchy or, for third order centre members, of either of the fourth order centres. Table X shows the centres used by sample members in the Hunterville, Bulls, Taihape and Marton trade areas. The valley pattern of transportation (see Fig. 2) channels nearly all Taihape and Hunterville consumers to within a few miles of Marton on any trips outside the trade areas. For Taihape consumers there is a single tar-sealed road to just north of Hunterville and most travellers still keep to the flatter State Highway One. Thus people from

TABLE X

Use of Centres Other Than the Closest :

Rangitikei County

Clothing B Totals

	Centre Used : Sample No.				
Trade Area	Closest	Marton	P.Nth.	Wanganui	Other
Taihape	45		17	14	6
Marton	37		12	21	2
Hunterville	5	4	11	13	2
Bulls	12	2	10	2	

Lawyer Totals

Taihape	61	6	4	2	4
Marton	53			13	2
Hunterville	19	6	2	1	2
Bulls	8	8	6	2	2

Note: The trade areas as used in this table are representative of the service area of each of the towns at that level of good. Thus Taihape includes the grocery trade areas of Mataroa, Utiku and Mangaweka; Hunterville includes Rata and Ohingaiti; Bulls includes Lake Alice and Marton includes Ratana Pa and Turakina. Whangaehu residents are actually closer to Wanganui than they are to Marton.

the northern area of the county consciously or unconsciously determine to pass through or by Marton to Wanganui or Palmerston North. For the Bulls sample Marton is closer than the more used Palmerston North, albeit in a different direction. In general there appears to be only minor evidence of the pattern of nesting of different hierarchies which is suggested in Central Place Theory.

The arrangement of data in Table X emphasises the earlier conclusion that there is a difference in use of the closest centre between lower and higher order centres. The earlier conclusion was based on data from the lowest trade areas delimited. Data in Table X is of all consumers who live within trade areas of third and fourth order centres for higher order functions. The proportions of the samples using Taihape and Marton as the closest centres are higher than the same proportions for Bulls and Hunterville.

There is apparently no marked difference in the use of Wanganui and Palmerston North in the county. People in the west, around Whangaehu, Ratana Pa and Turakina look towards Wanganui for many goods and similarly people in the east who do not shop in Bulls use Palmerston North more often than Wanganui. But, as Fig. 6 shows, neither city dominates as a shopping centre for populations in the northern part of the county or around Marton.

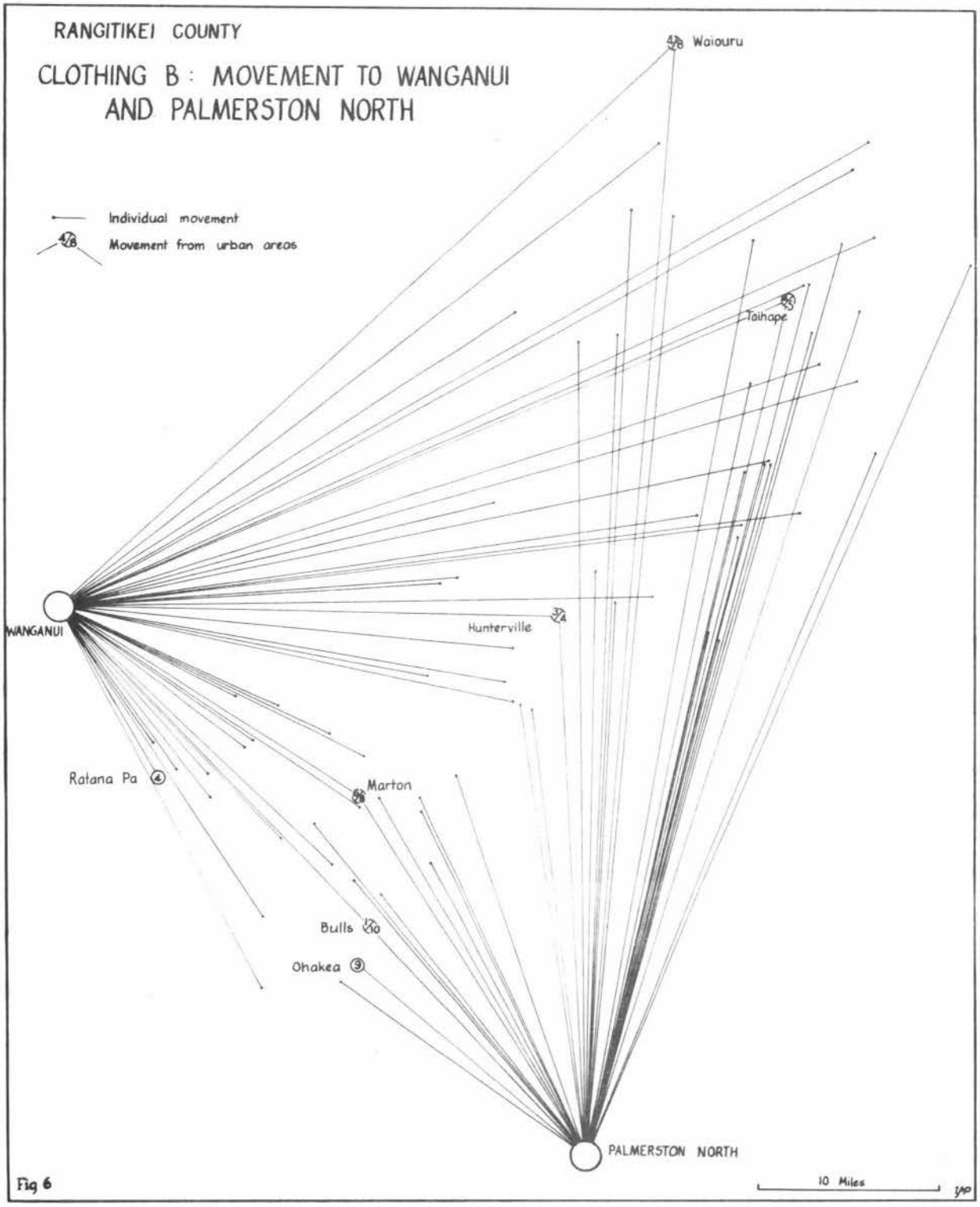

RANGITIKEI COUNTY
CLOTHING B : MOVEMENT TO WANGANUI AND PALMERSTON NORTH
Individual movement
Movement from urban areas
Waiouru
Taihape
WANGANUI
Hunterville
Ratana Pa
Marton
Bulls
Ohakea
PALMERSTON NORTH
10 Miles

Fig 6

The Level of Good and Use of the Closest Centre

It has already been stated that the degree of closest centre use varied from good to good. This could reflect variance in use of the particular good or the already indicated difference for all goods between areas. To find if the first premise was likely, a correlation test (the Kendall Coefficient of Concordance) was applied to rankings of thirteen goods for each of the six areas. Ranking was based on the proportion of the area sample using the closest centre, the good with the highest proportion being ranked one. This test indicated a significant degree of correlation among areas between use of the closest centre and type of good (see Table XI). Therefore it can be assumed that variance is mainly a reflection of overall differences between areas.

The relationship between level of centre and use of the closest centre suggests that there could also be a similar pattern between level of good and the use of centres. The level of good had to be more precisely ranked than to one of the hierarchy levels to allow any tests of relationship. Thus the number of centres in which the good could be obtained and also the total number of functional units within the county were used to rank the functions. These were obtained from Table I of Appendix A. This ranking was tested for correlation with a ranking of the good by use of the closest centre. This second ranking was based on what Kendall suggests is the "best estimate of the true ranking" of objects (quoted in Siegel, 1956, 238). Kendall's estimate is the various sums

TABLE XI

Correlation of the Use of the Closest Centre and the Type of Good, by Area

	Area						Kendall's	
Good	1	2	3	4	5	6	r_j	ranking
Electrician	1	1=	2	3=	2	2	12.5	2
Groceries	4	1=	1	1=	1	1	10.0	1
Carpenter	2	3	4	3=	4=	3=	21.0	3
Plumber	3	4	6	3=	4=	3=	25.0	4
Car Servicing	7	6	5	9	3	9	39.0	6
Hardware	5=	7	3	7	11	8	41.5	7
Clothing A	5=	8	9	6	9	5	42.5	8
Home Appliances	8	5	7	1=	10	7	38.5	5
Lawyer	9	9	8	11=	7	6	50.5	9
Dentist (Head)	10	10	11	8	6	10	55.0	10
Dentist (Wife)	11	12	13	10	8	12	66.0	11
Furniture	12	11	10	11=	12	11	67.5	12
Clothing B	13	13	12	13	13	13	77.0	13

The Kendall Coefficient of Concordance, W, was used to test the correlation.

W = .815 at the 95% confidence level (p = .001)

The formulae used can be found in Appendix E.

of ranks obtained in the Kendall Coefficient of Concordance given in Table XI. A Kendall Rank Correlation Coefficient of r = .527 was obtained for the correlation between the two different rankings, at a probability of occurrence of .0062. Thus we can conclude that consumers are more likely to use the closest centre for common goods (those with lowest thresholds) and less likely to use it for luxury items.

Intuitively this association between type of good or service and consumers' use of the closest centre can be emphasised. Using the rankings based on Kendall's Coefficient of Concordance, the good most regularly sought at the closest centre is the group of necessity items, Groceries. The next three ranks are all services to property, travelling by tradesmen being a major consideration in the availability of different functional units. All three can be considered necessities. Home Appliances and Car Servicing are the next two rankings. It could be hypothesised that consumers' decisions here are a compromise between the need for service, which is central to the first ranked items, and the expression of individual choice which can be seen in the luzury items. For both Car Servicing and Home Appliances it would appear that pressures of maintenance have led to greater use of the closest centre than for other items of similar cost. The last seven items are all services to the individual or retail items. It can be hypothesised that use of the closest centre declines as items become more expensive and personal. Thus while hardware is relatively cheap and mass produced, services of

a dentist or buying suits of clothing are expensive and personal, the consumer being more inclined to search in a larger market for the required items.

CHAPTER FIVE

CONSUMER VARIABLES

While consumer shopping patterns have been shown to reflect Central Place Theory postulates, past research suggests consumer variables will also affect patterns. Hypotheses have been established, tested and, where applicable, extended to find the impact different consumer variables have on the hierarchical patterns of the Non-Services personnel. To represent the range of consumer movement, Clothing B (as the most mobile), Home Appliances (average) and Groceries (the least mobile), patterns were used for hypothesis testing.

Age

Previous studies (Huff, 1961; Bannister, 1969) have found consumer response to shopping possibilities varied with age. The initial task was to find if use of the closest centre in Rangitikei County was affected by age. A null hypothesis defining this was stated:

"there is no difference amongst consumers of different ages in their use of the closest centre".

Sample members were divided into three broad age groups (up to 29, 30 to 49, over 49 years) based on that of the head of the household. A chi square test was applied to total data

for each good. Results of the tests (Table XII) showed that for the two higher goods there was a significant difference with age ($p = .001$). The grocery pattern was less likely to be a reflection of different patterns ($p = .30$). The alternative hypothesis, that there is a difference in use of the closest centre between people of different ages, was accepted.

The same null hypothesis, when applied to Armed Services personnel, was retained. The possibility that the Armed Services personnel pattern could be attributed to age appeared slight in view of figures in Table XII. Contrary to the local populations, Armed Services personnel of the middle age group were more mobile than people under 30. Chi square tests of the null hypothesis

> "there is no difference in use of the closest centre between Armed Services and Non-Services populations of the same age group"

showed differences significant at the 5% level for all but two tests (see Table XII). It is concluded that age is not a major contributor to Armed Services personnel mobility.

Age group-area cell analysis undertaken to extend the perception of both age effects and areal variations was limited by cell size. Hierarchy levels were used to group areas to test for areal difference in age patterns. The age/closest centre null hypothesis was tested, using Clothing B. It was found that there was a significant difference ($p = .001$) amongst the high order sample (fourth order centres), with

TABLE XII

Age and Use of the Closest Centre : All Areas

	% of Age Group using the closest centre			
Good	0 - 29	30 - 49	50 +	Chi square
Groceries	84.2	91.5	93.9	2.98
Home Appliances	62.2	71.7	90.1	13.97
Clothing B	37.5	36.2	63.1	14.62

In the above cases critical values of chi square were:

$\chi^2 = 3.22$ = .20 probability

$\chi^2 = 13.82$ = .001 probability

Armed Services Population

Groceries	89.5	78.6	-	-
Home Appliances	33.3	20.0	-	0.32
Clothing B	27.6	10.7	-	0.03

Chi Square Tests : Difference between Armed Services and Non-Services

Groceries	0 - 29	:	0.02	30 - 49	:	4.93
Home Appliances	0 - 29	:	4.82	30 - 49	:	24.28
Clothing B	0 - 29	:	1.26	30 - 49	:	7.88

In the above cases critical values of chi square were:

$\chi^2 = 3.84$ = .05 probability

$\chi^2 = 6.64$ = .01 probability

significance less ($p = .20$) for lower order areas (see Table XIII). While age groups were changed for Home Appliances to allow mathematical analysis, results were similar.

To emphasise the effect of contrasting patterns between consumers of the same age grouping, the area totals were tested for difference. Chi square tests of the null hypothesis

> "there is no difference in use of the closest centre by consumers of the same age groups between lower order trade area populations (areas One, Two and Three) and high order trade area populations (areas Four, Five and Six)"

showed that the greatest disparity was in greater movement by older people of the lower order trade areas (see Table XIII).

When a second areal grouping was made, combining separately urban and rural areas, the difference in age patterns became less (Table XIII). This would appear to follow a similar pattern to use of the closest centre where the difference between lower and high order centres was more marked than that between rural and urban areas.

Ages of consumers using Palmerston North and Wanganui were examined. Both groups of consumers were checked against the total number of the sample shopping outside their closest centre, but for neither city was there a significant age grouping of consumers. There were slightly more young and less old people using Palmerston North than Wanganui.

TABLE XIII

Age and Use of the Closest Centre : Areal Pattern

Differences Within Areas : Chi Square Values

Good	Areas	1,2,3	4,5,6	1,2,4	3,5,6
Clothing B		3.83	13.55	7.42	6.25
Home Appliances		3.45	7.03	0.78	11.03

Clothing B was divided 0 - 29, 30 - 49 and 50 + .
For Clothing B critical values of chi square were:

$\chi^2 = 4.60$ = .10 probability

$\chi^2 = 13.82$ = .001 probability

Home Appliances was divided 0 - 44 and 45 + .
Chi square values for this and all following sections of the Table were:

$\chi^2 = 3.84$ = .05 probability

$\chi^2 = 10.83$ = .001 probability

Differences Between Lower and High Order Areas

Clothing B	0 - 30	:	0.06	30 - 49	:	6.04	50+	: 10.87
Home Appliances	0 - 44	:	9.97	45+	:	12.47		

Differences Between Rural and Urban Areas

Clothing B	0 - 29	:	1.32	30 - 49	:	10.65	50+	: 5.68
Home Appliances	0 - 44	:	0.08	45+	:	5.21		

A chi square test of the difference showed that it was not significant ($p = .30$).

Residence

The longer people live in an area the more ties they form with surrounding people, businesses and organisations. Ipso facto, they will be more likely to use the local centre. To test the logic of this the following null hypothesis was chi square tested:

"there is no difference in use of the closest centre between people of different lengths of residence".

Results for both Home Appliances and Clothing B led to the rejection of H_o at the 5% significance level ($p = .02$). The areal data used for constructing the test cells showed some startling variations and so a further null hypothesis was formed:

"there is no difference in use of the closest centre between people of the same length of residence in rural and urban areas".

Following chi square tests (see Table XIV), the null hypothesis was retained for both goods for people resident less than 16 years in their district. However, there was a significant difference ($p = .05$) in the patterns of the two groups of longer residents. To see what caused this difference the first null hypothesis used,

"there is no difference in the use of the closest centre between people of different lengths of residence",

was applied separately to the urban and rural samples. H_o was rejected at the 5% significance level for all but the buying of Clothing B by the rural population. The rural sample maintained

TABLE XIV

Length of Residence and Use of the Closest Centre :

Rangitikei County

Total Sample	Years : % using closest centre			
Good	0 - 5	6 - 15	16 +	Chi Square
Home Appliances	56.3	78.8	84.3	15.46
Clothing B	30.8	59.4	49.6	8.16
Rural Areas - (One, Two, Four)				
Home Appliances	47.1	77.8	79.5	7.72
Clothing B	36.8	33.3	32.5	0.14
Urban Areas - (Three, Five, Six)				
Home Appliances	61.3	79.2	91.8	10.99
Clothing B	27.4	67.9	77.6	21.74
Difference - Rural/Urban Areas - Chi Square Values				
Home Appliances	1.57	-	4.45	
Clothing B	0.17	2.09	26.51	

Difference - Armed Services Zero to Five Year Residents

Home Appliances (Armed Services) 25.0% (Local) 56.3%

= 10.07

Clothing B (Armed Services) 3.6% (Local) 30.8%

= 16.70

Critical values of chi square were (2 x 2)

$\chi^2 = 3.84$ = .05 probability $^2 = 10.83$ = .001 probability

(3 x 2)

$\chi^2 = 5.99$ = .05 probability $^2 = 13.82$ = .001 probability

a high level of movement irrespective of length of residence. To summarise, it would appear that use of the closest centre increases with length of residence, although this is less marked with rural populations.

The mobility of Armed Services personnel does not appear to equate with length of residence. Armed Services personnel are still significantly different ($p = .01$) to the most mobile local residents.

A second set of data on residence was collected by asking where members had previously lived. This data was used in several ways. The first was to see if having always lived in the same district resulted in less shopping movement. The data was arranged for a chi square test (Table XV) of the null hypothesis

> "there is no difference in use of the closest centre between people who have lived in the one district all their lives and people who have shifted into the district".

There was no significant difference and therefore H_o is retained.

A second classification of previous residence was on the basis of size of previous central places people had used. All those people who had shifted into their present trade area from larger towns were compared with those people who had either not shifted or formerly lived in small centres of

TABLE XV

Previous Residence and Use of the Closest Centre :

Rangitikei County

Total Sample

Good	% Use of the closest centre: Shift	No shift	Chi Square
Home Appliances	72.7	84.1	3.12
Clothing B	43.7	45.1	0.00
Rural Areas - (One, Two, Four)			
Home Appliances	66.0	82.1	2.83
Clothing B	32.1	25.0	0.37
Urban Areas - (Three, Five, Six)			
Home Appliances	76.9	88.5	0.97
Clothing B	55.4	73.7	1.88
Shift From Largers Centre - Total Sample			
Home Appliances	68.2	81.3	3.67
Clothing B	42.3	45.2	0.07

In all cases the critical values of Chi square were

$\chi^2 = 3.84 = .05$ probability

$\chi^2 = 10.83 = .001$ probability

comparable or lesser size to their present situation. As Table XV shows there was no significant difference between the two groups. Further division, into rural and urban groups, still showed no significant difference. It would appear therefore that length of residence is more important than previous residence. This conclusion is based on results for only two goods. One of these, Home Appliances, had chi square values for previous residence which were almost significant at .05 probability. It is possible that for such goods as Lawyer and Car Servicing, people who have lived in the local area or similar places of the hierarchy are less mobile.

Occupation

The amount of time available for shopping and the need to buy goods are possible determinants of consumer habits. Huff (Marble, 1967) found some connectivity between occupation and shopping pattern, while Berry (1965) saw income as a major component of social structure. Three sets of data have been used to study effects of consumer's occupations.

Work load has been used to measure the amount of time available to consumers for shopping. Initially, one member households were removed and divided into people working full-time, part-time or retired. For Clothing B purchasing there was no difference in their respective patterns. With multi-member households the position changed. Seventy of 163 households with working heads used the closest centre and nine of thirteen with retired heads. The chi square value

of this difference is 4.51, significant at the 5% level. A similar division was made on the basis of the work load of wives but figures for workers and non-workers were little different. When areal totals for housewives were grouped into urban and rural totals the pattern remained comparable. The influence of work load would appear to be weak, for it is likely that the one significant result is a reflection of the age group of the retired heads of households.

Congalton and Havighurst's scale of the status rating of occupations (see Appendix C) was used to determine the ability and desire of consumers to buy goods. The Congalton-Havighurst status rating of occupation has two rankings: one the actual rating scale, the second the grouping of similar occupations. Both indices were used to classify the sample, in preference to data on income. This was a consideration of the possibly high refusal rate for a question on incomes, and also recognition that shopping is a social activity and as such consumers habits reflect social pressures. The Congalton-Havighurst scale included response to this second problem which would have been lacking in straight economics.

Several occupational groups were combined: proprietors-managers were totalled with office and sales workers, and skilled manual workers, semi-skilled and unskilled repetitive workers were also combined. Professionals and farmers were retained as separate groups. Members of the sample were

allocated to a ranking and their use of the closest centre for four goods tabulated. In Table XVI figures for the chi square test of the null hypothesis

"there is no difference in use of the closest centre between members of different occupational groups"

are given. H_o was rejected for only one good (Clothing B, $p = .001$). When the sample was divided into rural and urban members little difference was found between the groups in rural areas. Clothing B remained the only good which was significantly different ($p = .02$) for urban members. To gain some ideas of relative values the percentage use of the closest centre by each grouping was calculated and ranked. This gave retired people as the least mobile group, followed by manual workers, the proprietor/office group, farmers and, last and most mobile, the professional group (Table XVI). When similar rankings were applied to the other goods and the totals for each group counted, the position was different to that for Clothing B. The varied results preclude any positive conclusion although it does appear that there is some difference in use of the closest centre between occupational groups, with farmers and professional people being more mobile.

Similar procedures were undertaken with the occupational status material. The null hypothesis

"there is no difference in use of the closest centre between people of different occupational status"

was tested by chi square (Table XVII). Clothing B was again

TABLE XVI

Use of the Closest Centre by Different Occupational Groups : Rangitikei County

Good		Occupational Groups				
		0	567	24	3	1
Dentist (Wife)	(1)	7 - 8	37 - 19	11 - 5	39 - 37	9 - 5
	(2)	47	66	69	51	64
	(3)	5	2	1	4	3
Dentist (Head)	(1)	10 - 11	41 - 19	14 - 4	46 - 36	8 - 9
	(2)	62	68	78	56	47
	(3)	3	2	1	4	5
Lawyer	(1)	23 - 7	44 - 14	14 - 3	45 - 30	11 - 5
	(2)	77	76	82	60	69
	(3)	2	3	1	5	4
Clothing B	(1)	20 - 11	40 - 26	10 - 9	28 - 56	4 - 12
	(2)	64	61	53	33	25
	(3)	1	2	3	4	5

(1) = Number using closest centre/number not using closest centre

(2) = Number using closest centre as a percentage

(3) = Ranking according to percentage

Chi Square Values	All Areas	Urban	Rural
Dentist (Wife)	4.65	2.12	0.02
Dentist (Head)	7.36	7.51	0.11
Lawyer	7.41	0.61	0.14
Clothing B	18.48	11.09	0.63

Note: For "all areas" $\chi^2 = 7.78$ = .10 probability

$\chi^2 = 18.46$ = .001 probability

For "urban" and "rural" areas $\chi^2 = 9.84$ = .02 probability

TABLE XVII

Use of the Closest Centre by Different Occupational Status Ranks : Rangitikei County

Good		Occupational Rating			
		123	45	67	0
Dentist (Wife)	(1)	39 - 37	19 - 13	36 - 16	7 - 5
	(2)	51	59	69	58
	(3)	4	2	1	3
Dentist (Head)	(1)	48 - 35	22 - 16	39 - 17	19 - 10
	(2)	58	58	70	65
	(3)	4	3	1	2
Lawyer	(1)	51 - 31	26 - 10	41 - 14	23 - 7
	(2)	62	72	74	77
	(3)	4	3	2	1
Clothing B	(1)	26 - 57	19 - 20	37 - 27	20 - 11
	(2)	31	49	58	64
	(3)	4	3	2	1

(1) = Number using closest centre/number not using closest centre

(2) = Number using closest centre as a percentage

(3) = Ranking according to percentage

Chi Square Values

	All Areas	Urban	Rural
Dentist (Wife)	4.10	2.13	0.65
Dentist (Head)	2.44	2.59	0.27
Lawyer	3.64	-	0.17
Clothing B	14.98	7.57	0.77

Note: For "all areas" $\chi^2 = 4.64$ = .20 probability

$\chi^2 = 11.34$ = .01 probability

For "urban" and "rural" areas $\chi^2 = 6.25$ = .10 probability

the only good for which H_o was rejected ($p = .01$). Within both the urban and rural samples there was no difference between status ratings. When the percentage use of the closest centre was totalled the three top status ratings combined were lowest for all four goods. This corresponds to the previous table as farmers and professional people comprise the highest ratings. Members of ratings four and five combined were also lower and more mobile than members of ratings six and seven for all four goods. These figures have not been statistically tested, however, and it must be remembered that the chi square test showed there was no significant difference between the rating divisions for each group individually. The results reinforce the conclusion that farmers and professional people are more mobile, however, and that this is most apparent for the buying of expensive clothing.

The possibility that Wanganui and Palmerston North were selectively used was also examined, using consumer behaviour for the buying of expensive clothing. It appeared that people of a higher occupational rating are more likely to use Palmerston North and conversely people with a lower rating to use Wanganui. Data for both occupational groups and status rating was chi square tested, using the null hypothesis

"there is no difference in the occupational status/ grouping of people using Palmerston North and Wanganui".

For occupational status the difference was significant at the 5% level ($p = .001$). Farmers as a group balanced the pattern

for occupational groupings, but if they are removed the remainder were also significantly different ($p = .02$; see Table XVIII).

Consumers Distance to Travel

Distance has little effect on the shopping patterns of the sample. Consumers in Taihape, although they are over forty miles further from Palmerston North and Wanganui, have a similar pattern of use of the centres to consumers in Marton. Within their rural hinterlands there was little difference in the use of Taihape or Marton. In area Four, 15 of the sample living within seven miles of the two centres used those centres, 11 did not, and of those living more than six miles from the centres seven used them and six did not.

Educational Commitments

Sixty-two children of the members of the sample were at secondary school, including those at the local colleges. Of their parents only 35 for basic clothing and 36 for expensive clothing used the centre in which their children were at school. These figures include usual and occasional use of the centre. It would appear that parents do not necessarily use the centre in which their children are at school.

Trip Type and Motivation

Two questions (one on trip type and the other on motivation), required consumers to verbally rationalise their patterns. The first, the range of activities undertaken during a shopping

TABLE XVIII

Use of Wanganui and Palmerston North by Consumers of Different Occupational Status and Groups : Rangitikei County

Total Area : Occupational Status

Status	Numbers: Wanganui	Numbers: Palmerston North	
0, 8	3	6	
5,6,7	22	7	$\chi^2 = 10.8$ (= .001 p)
1,2,3,4	27	30	

Total Area : Occupational Grouping

Group	Numbers: Wanganui	Numbers: Palmerston North	
0,8	4	5	
5,6,7	15	9	$\chi^2 = 4.50$ (= .20 p)
1,2,4	5	12	
3	20	25	

Note: The chi square value for the difference between the totals for 5,6 and 7 and 1,2 and 4 is

$$\chi^2 = 5.79 = .02 \text{ probability}$$

trip placed shopping patterns within the wider context of the consumers social contacts. The second was an open-ended question, the consumer stating a single dominant attitude in his selection of a town for shopping for a good. Both questions were intended to give some insight into the individual attitude to central place use.

Consumers made relatively few trips outside their immediate centre solely for shopping. Of the 128 trips during which expensive clothing was bought, only three were made to buy only that good, although a further 32 trips were for a variety of shopping needs. Thirty-eight consumers included both shopping and visiting in their trips and 33 both shopping and business (stock sales, local body meetings). The remaining 23 members included a full range of social activities in the single trip. Thus shopping for most people was closely associated with many other pursuits. This is reflected in the conventions of the towns. In Taihape, for instance, a second picture theatre operated only on Friday and Saturday nights, catering for the town and country folk who combined late night shopping with family entertainment. Saturday night catered for many people who were in town for sport.

Trip type was not consistent for all goods. For the necessity items more single purpose trips were made but where purchase could be delayed the number of activities undertaken was greater. Thus single purpose trips were more common for grocery items then for any other good. Associated with these

trips was the use of country store deliveries, housewives obtaining day to day groceries from the local store and occasionally buying items when in a larger centre.

The trip type pattern of Armed Services personnel also showed an extensive range of multi-purpose trips. The dominant feature of their trips for expensive clothing was that half (19 out of 38) of the Waiouru sample also visited friends or relatives during the trip.

The second question asked consumers why they used particular centres. Reasons varied from good to good. Distance and consequent ease and cheapness of access were major factors in the use of the closest centre (70 used the closest centre for Clothing B for this reason). Some 18 people said they used the closest centre for expensive clothing because it was "their town", they considered themselves part of the community and therefore bound to support it. Of reasons given for passing the closest centre, desire for a better selection of goods was the most common (51 out of 115). Many others, however, reflected the multi-purpose nature of trips. Thus visits to friends or parents (16), business commitments (8), visits to children at school (6), medical needs (4) and similar attractions induced longer travel.

Interestingly there was some difference between the reasons for going to Palmerston North and Wanganui. Twenty-nine out of 50 of those going to Palmerston North were motivated by better selection, but only 17 out of the 51 Wanganui users.

Thirteen Wanganui users were attracted by the presence of friends or parents, but only four to Palmerston North.

Motivation for passing the closest centre was more pronounced among the Waiouru sample. Of the 27 people who visited centres other than Taihape and Waiouru for expensive clothing, shopping was associated with regular excursions for seven, visits to parents and friends for six, while eight sought a better selection.

None of these results are incompatible with earlier conclusions. The range of trip types and reasons could account for the random distance pattern, while age and residence patterns could be covariate with specific attitudes. One point the two questions do show is that in terms of cost-benefit maximisation the consumers outwardly operate at a high level. The multi-purpose nature of trips, attested by both trip type and motivation, shows that shopping costs are born at least partly by expenditure related to other budgets.

CHAPTER SIX

CONCLUSION

The central aim of this thesis has been to determine the use shoppers make of their closest central place. Following a study of previous research on shopping it had been decided that the closest centre hypothesis, the basis of Central Place Theory, could be used as a standard in evaluating existing patterns. Results would thus have immediate applicability to Central Place Theory interpretation, and also be in a conceptual framework which would allow analysis of patterns, the definition of any secondary patterns and the identification of causal factors.

A survey organised according to Central Place Theory postulates was therefore undertaken to investigate this central aim. Results from the survey area, Rangitikei County, showed that a substantial percentage of the population usually bought goods at their closest centre. The figures showed support of the closest centre was greater than anticipated in the light of results of previous research in New Zealand (e.g. Bannister, 1969; Clark, 1968).

Two broad trends dominated the survey results. One was the decreasing reliance on the closest centre for expensive or luxury goods. For necessities the hypothesis successfully predicted the response of a high percentage of consumers. Prediction levels dropped as costs of items rose, until, for expensive clothing, the hypothesis was less than 50% accurate. The second trend was a changing areal response to the hypothesis. Consumers in higher order trade areas diverged less from the closest centre than did people in low order areas. Both these trends demonstrate the importance of consumer choice. Where selection or opportunity is greatest (high order centres for low order goods) substantiation of the hypothesis is highest. The corollary, high order goods, low order centres and lowest substantiation, also applies.

As the survey results were arranged to identify people who did not follow the majority pattern several sub-populations were identified. Foremost of these sub-populations were Armed Services personnel who maintained a highly mobile shopping pattern over a wide spatial framework. Attempts to relate this pattern of the Armed Services personnel to particular universal attributes of consumers failed. Shopping patterns amongst the Armed Services personnel were consistent, irrespective of difference in consumer variables. At the same time the sub-population showed no association with the most divergent of the remaining consumer groups.

A second set of sub-populations proved to be associated with certain of the consumer variables. It has been noted that consumers in trade areas of smaller centres had a more mobile

shopping pattern than consumers in the two largest centre trade areas. Tests of patterns associated with consumer attributes showed this difference extended to movement of age groups. Division of the total sample into rural and urban populations also produced distinctive sub-populations. This latter sub-population distinctiveness also extended to differences between age groups. Results of consumer occupational attributes showed these differences were particularly associated with one occupational group, the farmers.

The results have demonstrated consumer responses to shopping alternatives are not uniform. They also showed that, while statistically the survey supported the logic of using the closest centre, centre selection decisions were not based solely on postulates contained in theory. Answers on trip type and motivation showed that shopping patterns are part of total social movement. Decisions to use centres reflected more conditions than those postulated in Central Place Theory. The importance of social contacts, especially with friends and relatives, was demonstrated by the high number of multi-purpose trips entailing visits.

The association of the mobility of young people (who would still be establishing ties), new residents and the trip type and motivation answers showed that consumer's shopping patterns are very much conditioned by their range of social linkages. To consumers, central places are identified with a set of personal associations. The ideas of a Mean Information Field and

Opportunity-Set would thus appear to have some value. Central Place Theory, however, is an attempt to predict general patterns without recourse to knowledge of individual conditions such as are required for the Mean Information Field concept. Thus any replacement theory would need to predict the reaction of a whole town or rural district. The range of linkages involved in some trips suggests that any attempt to ascertain all factors determining an individual's shopping pattern would be futile. One possibility is whether the deviation from use of the closest centre could be statistically predicted by a general weighting of centres, as suggested by Rushton et al (1967). Results from the Rangitikei suggest that use of the closest centre is distorted by size of surrounding towns and degree of contact with these towns. Contact would cover both historical and personal links, these being dependent on the size of town and channels of communication. Theory would thus be phrased in terms of centre to centre relationships and not in an individual context.

APPENDIX A

FUNCTIONS AND FUNCTIONAL UNITS IN RANGITIKEI COUNTY

In this thesis the term functional unit has been used to define a shop, place or means of supplying a line of goods in an institutionalised manner. Thus it includes such places as a lawyer's office, a department store or a painter's workshop/office. A function refers not to the actual workplace but to the type of work undertaken. Thus it is possible to have several firms or functional units undertaking the one activity or function.

The retail and service functions of each of the centres were calculated from Universal Business Directories. The 1968 figures were checked randomly in the centres, only one discrepancy being noted apart from changes of ownership.

The basis for divisions of functions has tended to follow the U.B.D. format. Some control over repetition was attempted; dairies/cake shops, restaurants/tea rooms and grocers are mutually exclusive, department stores do not appear under drapers/mercers or women's clothing, and service stations are those places other than motor garages which sell petrol. Motor garages do not have to sell petrol. Visiting agencies have been included in totals; an optician visits Taihape regularly and this has been included, but collection agencies are not, thus the fact that Turakina stores collect dry cleaning for Wanganui firms is not recorded.

Four brackets of functions have been used, each bracket corresponding roughly to occurrence among centres - this is for convenience of reference. Tables for two years (Table I - 1968, Table II - 1938) have been included to give some historical perspective. From the tables can be seen the decline and disappearance of some of the central places. This is still occurring as witnessed by the closing of the Mataroa and Ohingaiti stores. The general store in Mangaweka suffered a similar fate but was then taken over and operated in co-ordination with a Hunterville concern.

In Table I the two functional units which cater for travellers on State Highway One have been omitted - the service station at Mount View and a tea rooms at Silverhope.

TABLE I

1968

Central Place / Function	General store	Motor garage	Service station	Insurance agent	Cartage contractor	Agricultural contractor	Hotel	Butcher	Bank	Builder	Coal merchant	Electrical contractor	Fruiterer	Grocer	Mens hairdresser	Home appliances	Restaurant	Stock and station	Cake shop/dairy	General engineer	Chemist	Accountant	Agricultural machinery	Barrister/solicitor	Beauty salon	Stationer
Marton		14	1	35	6	7	4	4	4	16	1	7	2	8	3	7	5	3	6	7	2	5	9	2	3	5
Taihape		6	1	31	9	7	2	3	4	11	2	2	4	8	2	8	10	4	4	2	3	4	7	2	2	2
Bulls		4	1	11	2		2	2	3	4	1	2	3	6	2	6	7	2	1	3	1	2		1	3	3
Hunterville		3	1	12	3	2	2	1	2	4	2	2	1	3	1	3	2	4	1		1	2		2		1
Waiouru	1	3		1	1	1	1	1	1		1		1	1	1	1	3		1		1				1	1
Mangaweka	1	1	1	4	1		1	1	1	1	1	1	1	1		1	1	3								
Turakina	2	1	1	2		1	2													1						
Ohingaiti	1	1	1	1	1	2	1																			
Utiku	1	2		2	1																					
Rata	1	1	1			1														1						
Whangaehu	1	1		1			1																			
Mataroa	1		1	1																						
Lake Alice	2		1																							
Ratana Pa	2																									

TABLE I Cont'd.

1968

Central Place / Function	Cycle etc. dealer	Draper/mercer	Dry cleaner	Fish shop	Footwear	Furnisher	Grain/seed/produce	Hardware	Library	Doctor	Car painter/panelbeater	Plumber	Painter/paperhanger	Veterinary agency	Taxi	Wines, spirits	T.A.B.	Building Society	Womens clothes	Bus company	Photographer	Travel agency	Auctioneer	Insurance Co.
Marton	2	4	3	3	4	7	6	7	2	5	3	6	7	1	1	2	1	7	3	1	1	5	2	2
Taihape	1	2	1	3	5	2	4	7	1	3	2	2	5	1	1	1	1	3	4	1	1	2	3	1
Bulls	2	5	1	1	4	1		3	1	2	1	2	3	1	1	1	1	1		2				
Hunterville	1	1		1	1	1	3	4	1	1	1	2	2	1	1	1	1						2	
Waiouru		1	1	1	1			1		1							1							
Mangaweka									1							1	1							
Turakina																								
Ohingaiti																								
Utiku																								
Rata																								
Whangaehu																								
Mataroa																								
Lake Alice																								
Ratana Pa																								

TABLE I Cont'd.

1968

Central Place	Timber merchant	Drainage contractor	Second hand dealer	Specialists goods	Wool/skin/hides	Rental car	Real estate	Theatre	Optician	Printer	Newspaper	Newspaper agency	Music teacher	Motel	Jeweller	Heating contractor	Metal contractor	Funeral director	Florist	Fertiliser supplies	Department store	Dentist	Motor cycles	Concrete supplies	Concrete manufacturer	Caterer	Leather/canvas goods
Marton	3	2	2	4	1	1	8	1	1	1	1	2	1		2	2	5	1	3	5	2	3	1	2	1	1	1
Taihape	3	2	1	3	2	1	4	1	1	1	1	2	3	2	2	1	3	1	2	2	2	1	1		1	1	1
Bulls	1	1		1			1										2		1	1		3				1	
Hunterville												2			1												
Waiouru								1						1										1			
Mangaweka																											
Turakina																											
Ohingaiti																											
Utiku					1																						
Rata																											
Whangaehu																											
Mataroa																											
Lake Alice																											
Ratana Pa																											

TABLE I Cont'd.

1968

Central Place	Bricklayer	Automotive electrician	Commercial art	Aerial topdressing	Driving school	Glass specialist	Surveyor	Tyre specialist	Chiropractor	Bottle merchant	TOTAL: FUNCTIONAL UNITS	CENTRAL PLACE FUNCTIONS
Marton	2	1	1		1	2	1	1	3	2	322	84
Taihape	1	1	1	1							246	79
Bulls											117	50
Hunterville											83	41
Waiouru											32	28
Mangaweka											24	19
Turakina											10	7
Ohingaiti											8	7
Utiku											7	5
Rata											5	5
Whangaehu											4	4
Mataroa											3	3
Lake Alice											3	2
Ratana Pa											2	1

TABLE II

1938

Central Place	General store	Garage	Service station	Insurance agent	Cartage contractor	Agricultural contractor	Hotel	Butcher	Bank	Builder	Coal merchant	Electrical contractor	Fruiterer	Grocer	Hens hairdresser	Home appliances	Restaurant	Stock and station	Dairy/confectioner	General engineer	Chemist	Accountant	Agricultural machinery
Marton		9		18	3		4	3	4	4	3	2	4	9	4	3	4	3	7	5	2	4	2
Taihape		4		21	4		2	3	3	4	4	2	5	6	4	4	8	5	1	1	3	3	1
Bulls		5	1	8	3		2	3	2	3	3	1	2	6	3	1	2	1		1	1		
Hunterville		2	1	11	2		2	1	2	3	2	1	2	4	2	1	4	3	1	1	1		
Waiouru																							
Mangaweka		2	1	8	5		1	2	1	3	2	1	1	1	2		1	1		1			
Turakina	2	1		4	1	1	2	1												1			
Ohingaiti	2	1		3	2		1	1											1				
Utiku	2		1	3	1														1	1			
Rata	2	1																					
Whangaehu							1																
Mataroa	1		1	1	1															1			
Lake Alice																							
Ratana Pa																							
Moawhango	1		1	1		1											1						
Hihitahi	1				2																		
Ruanui		1									1												
Ohotu	1																						
Crofton	1																						

Function

TABLE II Cont'd.

1938

Function	Marton	Taihape	Bulls	Hunterville	Waiouru	Mangaweka	Turakina	Ohingaiti	Utiku	Rata	Whangaehu	Mataroa	Lake Alice	Ratana Pa	Moawhango	Hihitahi	Ruanui	Ohotu	Crofton
Barrister/solicitor	4	4	1	2		1													
Beauty salon	4	4																	
Stationer	3	4	1	1		1													
Cycle shop	2	1	1	1															
Draper/mercer	10	10	4	4		3													
Dry cleaner	1	2				1													
Fish shop	2	3																	
Footwear	8	5	5	2		1		1											
Furnisher	4	3		1															
Grain/seed/produce	7	6	1	1		1													
Hardware	2	6	2	2		1													
Library	2	2	2	1		2	1												
Doctor	3	3	1	2															
Car painter	1	2																	
Plumber	4	3	1	2		3													
Painter/paperhanger	4	3	1	3		1													
Taxi	3	3				1													
Wine and spirits	1	1		1		1													
Building society	3	1																	
Womens clothing	2	4		1								1			1				
Private hotel	1	5			1														
Bus company	1	1																	

TABLE II Cont'd.

1938

Function	Marton	Taihape	Bulls	Hunterville	Waiouru	Mangaweka	Turakina	Ohingaiti	Utiku	Rata	Whangaehu	Mataroa	Lake Alice	Ratana Pa	Moawhango	Hihitahi	Ruanui	Ohotu	Crofton
Commercial photographer	2																		
Travel agency	2	3																	
Auctioneer	4	4																	
Second hand dealer		1																	
Specialist goods	2	3																	
Wool/skin/hides		1																	
Rental car	1																		
Real estate	3	4	1																
Theatre	1	2		1		1													
Optician	1																		
Printer	2	1		1															
Newspaper	1	1		1															
Newspaper agency	1																		
Music teacher	2	4		1		1													
Jeweller	2	2		1		1													
Metal contractor						1													
Funeral director	2	1																	
Florist	3	1	1																
Fertiliser supplier	2																		
Department store		1																	
Dentist	3	3	1	1															
Motor cycle garage	1																		
Timber merchant	3	3	3			1													
Caterer				1															
Leather and canvas	4	2	1					1											
Bricklayer	1																		

TABLE II Cont'd.

1938

Central Places	Auto electrician	Commercial artist	Surveyor	Tyre specialist	Baker	Billiard saloon	Architect	TOTAL:	FUNCTIONAL UNITS	CENTRAL PLACE FUNCTIONS
Marton		3	1		4	2	1		228	68
Taihape		1	1	1	2	2			218	64
Bulls		1			1	2			78	37
Hunterville					1	1			79	42
Waiouru									1	1
Mangaweka	1				1	2			59	36
Turakina					1				15	10
Ohingaiti						1			14	10
Utiku									9	6
Rata									3	2
Whangaehu									1	1
Mataroa									6	6
Lake Alice									-	-
Ratana Pa									-	-
Moawhango									6	6
Hihitahi									3	2
Ruanui									2	2
Ohotu									1	1
Crofton									1	1

APPENDIX B

THE SAMPLE

Two sources from which to extract a sample were available. The local body electoral rolls were rejected as inaccurate: in some ridings no election had been held for up to 15 years and as a consequence few residential voters were on the rolls. A further problem was the presence of non-residential ratepayers. The second source, parliamentary electoral rolls, while not fully satisfactory, gave a better coverage. The rolls could be assumed to be complete, the most important absence to the sample being householders under 20 years of age.

The rolls were used to select individuals who would represent the household in which they lived. The problem of changes in address was avoided by interviewing the new resident at the address selected, or, in the case of Army and Air Force personnel, the job replacements.

Three electoral rolls contained the names of people living in the area of study. A list of random numbers representing individuals was generated on a computer for each of the three rolls (Column 2 in Table I). These lists were checked for individuals who lived in the trade areas being researched (Column 3). The percentage of each list made up of such individuals was calculated (Column 4), and used to predict the total population in the research area. Once this total was ascertained, the

percentage of the population derived from each of the rolls was calculated (Column 6) and then the list of random numbers was reduced (by use of a table of random numbers) in number so that a total of 1440 individuals from the research area was achieved, each roll having contributed the percentage shown in Column 6.

Once this final list of random numbers was attained, it was stratified into the different sample areas used (see Chapter 4). Then the required number of individuals was taken from the list, using a table of random numbers.

The list of individuals which was used for the final random sampling was also used to calculate total populations for each of the sample areas. Numbers of individuals from each area were counted and then converted to a percentage of the final list. This percentage was then used to calculate numbers in each trade area, using the total population of the research area produced from Column 5 in Table I. Table II shows the figures for the individual trade areas.

TABLE I

Sample Generation from Three Electoral Rolls

		Roll		
		Western Maori	Rangitikei	Waimarino
(1)	Roll Total	14,486	18,134	18,114
(2)	Sample generated	2,000	2,450	3,940
(3)	No. of sample in research area	137	1,009	504
(4)	(3) as a % of (2)	6.85	41.18	14.24
	Standard Error	1.13	1.82	1.12
(5)	Total number from research area on roll	992	7,468	2,579
(6)	% of total population of research area (11,039) on roll	8.99	67.75	23.36

Source: 1969 Electoral Rolls for Rangitikei, Waimarino and Western Maori electorates.

TABLE II

Populations Within Each Sample Stratification Area

Area	Sample No.	% of 1440	S.E.	Total
1.	162	11.25	0.83	1,242
2.	174	12.09	0.74	1,335
3.	182	12.64	0.77	1,395
4.	174	12.09	0.74	1,335
5.	201	13.96	0.84	1,541
6.	390	27.09	1.38	2,990
7.	157	10.91	0.68	1,204

Note: Areas are numbered in the same sequence as in Fig. 4.

APPENDIX C

THE QUESTIONNAIRE

The following are the questions included in the questionnaire used. While some immediate coding was undertaken for such information as age and sex, much of the information from questions such as motivation and centres and schools used was unable to be pre-coded. In outlining the questions here, no attempt has been made to show the actual questionnaire layout.

Rangitikei County Retail and Service Survey

Questionnaire of Households

1. Demographic

Would you please outline the members of this household with their respective age

sex

marital status

relationship to the head of the household.

2. Residence

i) How long have the members of this household lived in this house?

ii) How long have members of this household lived in this district?

iii) Where have members of this household previously lived? (Specify the centre or centres.)

3. Occupation

What are the part-time and/or full-time occupations of the various members of the household, and where do they work?

4. Transportation

What transportation do the members of the household use for the following activities: going to work

shopping for groceries

shopping outside their immediate town or trade centre

going out for entertainment

going out for recreation

travelling on business for a firm or organisation?

5. Delivery of Goods

How and what goods deliveries do household members use? Deliveries specifically asked for were grocery, butchery, stock firm and N.D. Three categories were given for response; regularly, occasionally and not at all.

6. Buying of Goods

For the following goods and services, please indicate the centre/centres from which the household usually or occasionally acquires that particular good or service. Should a particular member of the household shop in a different manner, note his or her activities also. Groceries

Hardware e.g. saucepans

Home appliances e.g. fridge, electric stoves

Clothing A e.g. shirts, blouses, socks

Clothing B e.g. mens/womens suits

Furniture e.g. carpets, chairs

Car servicing - private vehicle

commercial including farm machinery

Electrician

Plumber

Carpenter

Dentist

Lawyer

Would you also please note the type of trip made when buying each of these goods: delivery to house

to buy a single good or line of goods

to buy various goods and services

multi-purpose; also visiting

multi-purpose; also entertainment

multi-purpose; also business.

7. Motivation for use of centres

Why do you use that particular centre for that good? The goods and centres are as for the above question.

8. Retrieval

Does the household use any centres you have not listed in Question 6, for any goods on a regular or occasional basis?

9. Trip Frequency

How many trips to each centre does the head of the household or the household as a unit make? Categorise any member who makes extra regular trips.

10. Education

Where do the children of members of the household at present receive their education - primary, secondary and tertiary?

11. Social

To what organisations or clubs do members of the household belong, and where are they located?

The questionnaire was tested prior to the final use, one question (on consumer ranking of the central places) being deleted and the order of the remainder being changed.

Application was predominantly by the compiler, but four geography students, who were briefed on terms and technique, helped cover the urban samples of Waiouru, Taihape and Marton. A mail questionnaire was not attempted as the anticipated response rate was low (the Rangitikei County Council Clerk reported responses of only 30% to Council documents).

Refusal rates were low; only six people refused to answer the questionnaire or were absent (following re-calls) and these people were replaced by further randomly selected individuals.

Occupations were classified according to the Congalton-Havighurst scale for status rating of occupations in New Zealand (Congalton, 1953, Vellekoop, 1969, 243-251).

APPENDIX D

USE OF THE CLOSEST CENTRE

TABLE I

The Use of the Closest Centre by Consumers:

By Sample Areas

Area 1

Good	No.	% Sample	% All Users	S.E. All Users
Electrician	30/38	75	79.0	6.6
Plumber	27/36	67.5	75.0	7.2
Carpenter	27/35	67.5	77.1	7.1
Dentist (head)	17/39	42.5	43.6	7.2
Dentist (wife)	14/36	35	38.9	8.1
Lawyer	19/39	47.5	46.2	8.0
Groceries	29/40	72.5	72.5	7.1
Hardware	25/40	62.5	62.5	7.7
Home Appliances	24/40	60	60	7.7
Clothing A	25/40	62.5	62.5	7.7
Clothing B	14/40	35	35	7.5
Furniture	15/40	37.5	37.5	7.7
Car Servicing	22/36	55	61.1	8.1

TABLE 1 cont'd.

Area 2

Good	No.	% Sample	% All Users	S.E. All Users
Electrician	20/26	50	76.9	8.3
Plumber	19/26	47.5	73.1	8.7
Carpenter	18/24	45	75.0	8.8
Dentist (head)	11/28	27.5	39.3	9.2
Dentist (wife)	7/27	17.5	25.9	8.4
Lawyer	12/30	30	40.0	8.9
Groceries	24/30	60	80.0	7.3
Hardware	15/29	37.5	51.7	9.3
Home Appliances	16/30	40	53.3	9.1
Clothing A	14/39	35	35.9	7.7
Clothing B	5/40	12.5	12.5	5.2
Furniture	9/28	22.5	32.1	6.6
Car Servicing	22/38	55	57.9	8.0

Area 2 : Non-Service Personnel

Electrician	20/26	71.4	76.9	8.3
Plumber	19/26	67.9	73.1	8.7
Carpenter	18/24	64.3	75.0	8.8
Dentist (head)	11/28	39.3	39.3	9.2
Dentist (wife)	7/23	25.0	30.4	9.6
Lawyer	10/24	35.7	41.7	10.1
Groceries	20/26	71.4	76.9	8.3
Hardware	13/25	46.4	52.0	10.0
Home Appliances	16/26	57.1	61.5	9.5
Clothing A	13/28	46.4	46.4	9.4
Clothing B	5/28	17.9	17.9	7.2
Furniture	9/24	32.1	37.5	9.9
Car Servicing	15/27	53.6	56.6	9.5

TABLE 1 cont'd.

Area 3

Good	No.	% Sample	% All Users	S.E. All Users
Electrician	30/31	75	96.8	3.2
Plumber	24/30	60	80.0	7.3
Carpenter	26/30	65	86.7	6.2
Dentist (head)	13/26	32.5	50.0	9.8
Dentist (wife)	13/30	32.5	43.3	9.1
Lawyer	23/33	57.5	69.7	8.0
Groceries	40/40	100.0	100.0	
Hardware	30/39	75	76.9	6.7
Home Appliances	24/38	60	63.2	7.8
Clothing A	24/40	60	60.0	7.7
Clothing B	15/38	37.5	39.5	7.9
Furniture	18/34	45	52.9	8.6
Car Servicing	26/32	65	81.3	6.9
Area 3 : Non-Service Personnel				
Electrician	30/31	93.8	96.8	3.2
Plumber	24/30	75.0	80.0	7.3
Carpenter	26/30	81.3	86.7	6.2
Dentist (head)	13/26	40.6	50.0	9.8
Dentist (wife)	10/23	31.3	43.5	10.3
Lawyer	21/30	65.6	70.0	8.4
Groceries	32/32	100.0	100.0	
Hardware	28/32	87.5	87.5	5.8
Home Appliances	22/31	68.8	71.0	8.1
Clothing A	22/32	68.8	68.8	8.2
Clothing B	15/31	46.9	48.4	9.0
Furniture	17/28	53.1	60.7	9.2
Car Servicing	20/24	62.5	83.3	7.6

TABLE 1 cont'd.

Area 4

Good	No.	% Sample	% All Users	S.E. All Users
Electrician	35/36	87.5	97.2	2.7
Plumber	35/36	87.5	97.2	2.7
Carpenter	35/36	87.5	97.2	2.7
Dentist (head)	33/39	82.5	84.6	5.8
Dentist (wife)	28/35	70.0	80.0	8.0
Lawyer	31/39	77.5	79.5	6.5
Groceries	39/40	97.5	97.5	2.5
Hardware	36/38	90.0	94.7	3.6
Home Appliances	39/40	97.5	97.5	2.5
Clothing A	38/40	95.0	95.0	3.4
Clothing B	17/40	42.5	42.5	7.8
Furniture	31/39	77.5	79.5	6.5
Car Servicing	31/37	77.5	83.8	6.1

Area 5

Electrician	35/36	87.5	97.2	2.7
Plumber	36/39	90.0	92.3	4.3
Carpenter	36/39	90.0	92.3	4.3
Dentist (head)	32/35	80.0	91.4	4.7
Dentist (wife)	26/30	65.0	86.7	6.2
Lawyer	31/35	77.5	88.6	5.4
Groceries	37/38	92.5	97.4	2.6
Hardware	28/35	70.0	80.0	6.8
Home Appliances	29/36	72.5	80.6	6.6
Clothing A	34/40	85.0	85.0	5.6
Clothing B	27/40	67.5	67.5	7.4
Furniture	25/34	62.5	73.5	7.6
Car Servicing	27/29	67.5	93.1	4.7

TABLE 1 cont'd.

Area 6

Good	No.	% Sample	% All Users	S.E. All Users
Electrician	38/38	95.0	100.0	
Plumber	36/36	90.0	100.0	
Carpenter	36/36	90.0	100.0	
Dentist (head)	32/39	80.0	92.1	6.1
Dentist (wife)	25/35	62.5	71.4	7.6
Lawyer	33/37	82.5	89.2	5.1
Groceries	39/39	97.5	100.0	
Hardware	33/39	82.5	84.6	5.8
Home Appliances	32/37	80.0	86.5	5.6
Clothing A	37/40	92.5	92.5	4.2
Clothing B	24/39	60.0	61.5	6.7
Furniture	27/36	67.5	75.0	7.2
Car Servicing	26/31	65.0	83.9	6.6

Area 7

Electrician)	All these items are supplied by the employer - the sample consisted of Army and Navy personnel.			
Plumber)				
Carpenter)				
Dentist (head))				
Dentist (wife)	20/23	50.0	87.0	7.0
Lawyer	7/22	17.5	31.8	9.9
Groceries	27/35	67.5	77.1	7.1
Hardware	4/26	10.0	15.4	7.1
Home Appliances	8/29	20.0	27.6	8.3
Clothing A	19/40	47.5	47.5	7.9
Clothing B	11/38	27.5	28.9	7.4
Furniture	11/28	27.5	39.3	9.2
Car Servicing	26/31	65.0	83.9	6.6

APPENDIX E

STATISTICAL FORMULAE

Population Weighting

The weighted estimate of the population percentage of people using the closest centre was calculated by using the formula:

$$T = \sum_{i=1}^{n} (p_i \, w_i) \qquad (1)$$

where T = the percentage of the total county population who use the closest centre for buying a particular good

n = the number of areas in the study - seven

p = the percentage of the total sample using the closest centre for each good for each area

w = the percentage of the county population in each area.

An identical formula was used to estimate the percentage of all those users of a good with:

T = the percentage of the total county population of users of the particular good who use the closest centre

n = the number of areas in the study - seven

p = the percentage of the users in each area using the closest centre

w = the percentage of the county population of users in each area.

Chi Square Tests

Two chi square formulae were used. For 2 x 2 contingency tables (as shown in Table IX) the formula used was:

$$\chi^2 = \frac{N \left(|AD - BC| - \frac{N}{2} \right)^2}{(A + B)(C + D)(A + C)(B + D)} \qquad (2)$$

Where the contingency tables contained more than two cells in any one direction the formula used was:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \qquad (3)$$

The degrees of freedom of these chi square values was calculated by:

$$df = (r - 1)(k - 1) \qquad (4)$$

Chapters 6 and 8 of Siegel (1956) were used for direction in the use of the formulae, and the terms are also his.

Correlation Techniques

The Kendall Coefficient of Concordance, W, was used according to Siegel's (1956, 229 - 239) directions.

$$W = \frac{S}{\frac{1}{12} k^2 (N^3 - N)} \qquad (5)$$

where S = sum of the squares of the observed deviations from the mean of R_j

k = number of sets of rankings

N = number of entities (goods) ranked.

The denominator is the maximum possible sum of the squared deviations of the sum S which would occur with perfect agreement among k rankings.

The probability associated with the occurrence under the null hypothesis of any value as large as the observed W was determined by using the formula

$$\chi^2 = k (N - 1) W \qquad (6)$$

and the

$$df = N - 1 \qquad (7)$$

The Kendall Rank Correlation Coefficient (Siegel, 1956, 213 - 223) used is:

$$r = \frac{S}{\frac{1}{2} N (N - 1)} \qquad (8)$$

where S = the sum of the scores of the pairs being tested

N = the number of objects (goods) ranked.

The denominator is the maximum possible score which can be attained.

BIBLIOGRAPHY

Books

Berry, B.J.L., 1967, Geography of Market Centres and Retail Distribution.

Berry, B.J.L., Pred, A., 1961, Central Place Studies : a Bibliography of Theory and Applications.

Blalock, H.M., 1970, An Introduction to Social Research.

Britt, S.H., 1966, Consumer Behaviour and the Behavioural Sciences.

Chorley, R.J., Haggett, P., 1967, Socio-Economic Models in Geography.

Christaller, W., 1933, Die zentralen Orte in Suddeutchsland (translated to English by Baskin, C.W., 1966, Central Places in Southern Germany).

Clarkson, G.P., 1963, The Theory of Consumer Demand : a Critical Appraisal.

Cochran, W.G., 1956 (2nd Ed.) Sampling Techniques.

Cox, K.K., (ed.), 1967, Readings in Market Research.

Duncan, D.J., Phillips, C.F., 1959 (5th Ed.) Retailing : Principles and Methods.

Duncan, O.D., et al., 1960, Metropolis and Region.

Forster, J., (ed.), 1969, Social Process in New Zealand.

Garrison, W.L., Marble, D.F., (eds.), 1967, Quantitative Geography : Part 1 : Economic and Cultural Topics.

Garrison, W.L., et al., 1959, Studies of Highway Development and Geographic Change.

Haggett, P., 1965, Locational Analysis in Human Geography.

Harvey, D., 1969, Explanation in Geography.

Horton, F., (ed.), 1968, Geographic Studies of Urban Transportation and Network Analysis.

Jeffreys, J.B., 1954, Retail Trading in Britain 1850 - 1950.

Kish, L., 1965, Survey Sampling.

Lichfield, N., et al., 1967 Report on Shopping : London Borough of Enfield.

Losch, A., 1941, Die raumliche Ordnung der Wirtschaft (translated to English by Woglom, W,H., Stolper, W.F., 1954, The Economics of Location).

McCaskill, M., (ed.), 1962, Land and Livelihood : Geographical Essays in Honour of George Jobberns.

Massey, W.F., et al., 1970, Stochastic Models of Buying Behaviour.

Nicosia, F.M., 1966, Consumer Decision Processes.

Norborg, K., (ed.), 1962, I.G.U. Symposium in Urban Geography (Lund).

Pitts, F.R. (ed.), 1962, Urban Systems and Economic Development.

Schultz, W.J., 1961, American Marketing.

Scott, P., 1970, Geography and Retailing.

Siegel, S., 1956, Non-parametric Statistics for the Behavioural Sciences.

Smith, R.H.T., et al., 1968, Readings in Economic Geography : The Location of Economic Activity.

Stouffer, S.A., 1962, Social Research to Test Ideas.

Articles

Badcock, B.A., 1970, Central Place Evolution and Network Development in South Auckland, 1840 - 1960 : A Systems Analytic Approach, N.Z. Geogr., 26, 109 - 135.

Berry, B.J.L., 1965, The Retail Component of the Urban Model, J. Am. Inst. Planners, 31, 150 - 155.

Berry, B.J.L., Garrison, W.L., 1958a, The Functional Bases of the Central Place Hierarchy, Econ. Geogr., 34, 145 - 154.

_____, 1958b, A Note on Central Place Theory and the Range of a Good, Econ. Geogr., 34, 304 - 311.

Berry, B.J.L., et al, 1962, Retail Location and Consumer Behaviour, Reg. Sci. Ass. Pap., 9, 65 - 106.

von Boventer, E., 1969, Walter Christaller's Central Places and Peripheral Areas : The Central Place Theory in Retrospect, J. reg. Sci., 9, 117 - 124.

Bracey, H.E., 1953, Towns as Rural Service Centres, Trans. Inst. Br. Geogr., 19, 95 - 105.

Brush, J.E., 1953, The Hierarchy of Central Places in Southwestern Wisconsin, Geogrl. Rev., 43, 380 - 402.

Carruthers, W.I., 1957, A Classification of Service Centres in England and Wales, Geogrl. J., 123, 371 - 385.

_____, 1962, Service Centres in Greater London, Tn. Plann. Rev., 33, 5 - 31.

_____, 1967, Major Shopping Centres in England and Wales, Reg. Stud., 1, 65 - 81.

Carter, H., et al., 1970, Functions of Welsh Towns : Implications for Central Place Notions, Econ. Geogr., 46, 25 - 38.

Clark, P.J., Evans, F.C., 1954, Distance to Nearest Neighbour as a Measure of Spatial Relations, Ecology, 35, 445 - 453.

Clark, W.A.V., 1968, Consumer Travel Patterns and the Concept of Range, Ann. Ass. Am. Geogr., 58, 386 - 396.

Clark, W.A.V., Rushton, G., 1970, Models of Intra-Urban Consumer Behaviour and their Implications for Central Place Theory, Econ. Geogr., 46, 486 - 497.

Cohen, S.B., Lewis, G.K., 1967, Form and Function in a Geography of Retailing, Econ. Geogr., 43, 1 - 42.

Curry, L., 1964, The Random Spatial Economy : An Exploration in Settlement Theory, Ann. Ass. Am. Geogr., 54, 138 - 146.

_____ , 1967, Central Places in the Random Spatial Economy, J. reg. Sci., 7, 217 - 238.

Dacey, M., 1965, The Geometry of Central Place Theory, Geogr. Annlr., 47B, 111 - 124.

_____ , 1966, A Probability Model for Central Place Locations, Ann. Ass. Am. Geogr., 56, 550 - 568.

Duncan, J.S., 1955, New Zealand Towns as Service Centres, N.Z. Geogr., 11, 119 - 138.

Fano, P.L., 1969, Organisation, City Size Distribution and Central Places, Reg. Sci. Ass. Pap., 22, 29 - 38.

Fuguitt, G.V., Deeley, N.A., 1966, Retail Service Patterns and Small Town Population Change : A Replication of Hassinger's Study, Rur. Sociol., 31, 53 - 63.

Golledge, R.G., et al., 1966, Some Spatial Characteristics of Iowa's Dispersed Farm Population and Their Implications for the Grouping of Central Place Functions, Econ. Geogr., 42, 261 - 272.

Green, F.H.W., 1958, Community of Interest Areas : Notes on the Hierarchy of Central Places and their Hinterlands, Econ. Geogr., 34, 210 - 226.

Haggett, P., Gunawardena, K.A., 1964, Determination of Population Thresholds for Settlement Functions by the Reed-Muench Method, Prof. Geogr., 16, 6 - 9.

Hodge, G., 1965, The Prediction of Trade Centre Viability in the Great Plains, Reg. Sci. Ass. Pap., 15, 87 - 115.

_____ , 1966, Do Villages Grow? - Some Perspectives and Predictions, Rur. Sociol., 31, 183 - 196.

Holton, R.H., 1958, The Distinction Between Convenience Goods, Shopping Goods and Specialty Goods, J. Mktg., 23, 53 - 58.

Horton, F.E., Reynolds, D.R., 1971, Effects of Urban Spatial Structure on Individual Behaviour, Econ. Geogr., 47, 36 - 48.

Huff, D.L., 1961, Ecological Characteristics of Consumer Behaviour, Reg. Sci. Ass. Pap., 7, 19 - 28.

_____ , 1963, A Probabilistic Analysis of Shopping Centre Trade Areas, Land. Econ., 39, 81 - 90.

Johnston, R.J., 1966, The Distribution of an Intra-Metropolitan Central Place Hierarchy, Aust. Geogrl. Stud., 4, 19 - 33.

Johnston, R.J., Rimmer, P.J., 1967, The Competitive Position of a Planned Shopping Centre, Aust. Geogr., 10, 160 - 168.

King, L.J., 1962a, The Functional Role of Small Towns in Canterbury, Proc. Third N.Z. Geogr. Conf., 139 - 149.

_____ , 1962b, Central Place Theory and the Spacing of Towns in the United States, in M. McCaskill (ed.) Land and Livelihood, Geographical Essays in Honour of George Jobberns, 238 - 254.

Kotler, P., 1967, Behavioural Models for Analyzing Buyers in K.K. Cox (ed.), Readings in Market Research, 315 - 331.

Macaulay, J.U., 1954, The Oamaru Tributary Region, N.Z. Geogr., 10, 121 - 133.

Marble, D.F., 1967, A Theoretical Explanation of Individual Travel Behaviour, in Northwestern University Studies in Geography, 15, 95 - 119.

Marble, D.F., Bowlby, S.R., 1968, Shopping Alternatives and Recurrent Travel Patterns, in Northwestern University Studies in Geography, 16, 42 - 75.

Marble, D.F., Nystuen, J.D., 1963, The Direct Measurement of Community Mean Information Fields, Reg. Sci. Ass. Pap., 11, 99 - 109.

Marshall, J.U., 1964, Model and Reality in Central Place Studies, Prof. Geogr., 16, 5 - 8.

Mayfield, R.C., 1967, A Central Place Hierarchy in Northern India, in Northwestern University Studies in Geography, 15, 120 - 166.

Morrill, R.L., 1967, The Movement of Persons and the Transportation Problem, in Northwestern University Studies in Geography, 15, 84 - 94.

Nystuen, J.D., 1967, A Theory and Simulation of Intra-Urban Travel, in Northwestern University Studies in Geography, 15, 54 - 83.

Olsson, G., Gale, S., 1968, Spatial Theory and Human Behaviour, Reg. Sci. Ass. Pap., 21, 229 - 242.

Pownall, L.L., 1953, Town and Region : A Comparison of Palmerston North, Wanganui and New Plymouth, N.Z. Geogr., 9, 1 - 16.

Preston, R.E., 1971, The Structure of Central Place Studies, Econ. Geogr., 47, 136 - 155.

Rushton, G., et al., 1967, Formulation and Test of a Normative Model for the Spatial Allocation of Grocery Expenditures by a Dispersed Population, Ann. Ass. Am. Geogr., 57, 389 - 400.

Scott, P., 1964, The Hierarchy of Central Places in Tasmania, Aust. Geogr., 9, 134 - 147.

Smailes, P.J., 1969, Some Aspects of the South Australian Urban System, Aust. Geogr., 11, 29 - 51.

Stafford, H.A., 1963, The Functional Bases of Small Towns, Econ. Geogr., 39, 163 - 175.

Swedner, H., 1962, Prediction of Differences in Habits and Attitudes toward Service Establishments in Rural and Urban Settings, Rur. Sociol., 27, 396 - 417.

Tarrant, J.R., 1968, A Note Concerning the Definition of Groups of Settlements for a Central Place Hierarchy, Econ. Geogr., 44, 144 - 151.

Thompson, D.J., 1966, Future Directions in Retail Area Research, Econ. Geogr., 42, 1 - 10.

Thorpe, D., 1968, The Main Shopping Centres of Great Britain in 1961 : Their Locational and Structural Characteristics, Urban Stud., 5, 165 - 206.

Vellekoop, C., 1969, Social Strata in New Zealand, in J. Forster (ed.), Social Process in New Zealand, 233 - 271.

Vining, R., 1955, A Description of Certain Spatial Aspects of an Economic System, Econ. Dev. Cult. Change., 3, 147 - 195.

Yuill, R.S., 1967, Spatial Behaviour of Retail Customers; Some Empirical Measurements, Geogr. Annlr., 49B, 105 - 115.

Government Publications

Department of Statistics, 1967, New Zealand Census of Population and Dwellings, 1966, Volume 1, Increase and Location of Population.

Ministry of Works, 1970, Industry in New Zealand : Distribution and Potential.

Theses

Bannister, G., 1969, Central Place Theory and the Distribution of Retail Centres within Dunedin, Unpublished M.A. Thesis, Otago University.

Barber, M.G., 1965, Some Geographical Aspects of Shoppers Travel Patterns, Unpublished M.A. Thesis, University of Canterbury, Christchurch.

Cant, R.G., 1960, The Rural Settlements of the Canterbury Plains in the area between the Rakaia and Waimakariri Rivers, Unpublished M.A. Thesis, University of Canterbury, Christchurch.

Carter, J.G., 1961, The Rural Settlements of the Central Waikato - a study in Settlement Geography, Unpublished M.A. Thesis, Auckland University.

Millar, J.P., 1958, Towns and Tributary Regions of the Central North Island, Unpublished M.A. Thesis, Auckland University.

Pownall, L.L., 1955, The Contemporary New Zealand Town - a study in Urban Geography, Unpublished Ph.D. Dissertation, University of Canterbury, Christchurch.

Stenhouse, L.J., 1958, Milton : a functional study of Town and Tributary Region in South-East Otago, Unpublished M.A. Thesis, Otago University, Dunedin.

Whitelaw, J.S., 1960, Four Towns of the Waikato - a problem in the Measurement of Urban Influence, Unpublished M.A. Thesis, University of Auckland.

Zachariassen, R., 1965, A functional analysis of Service Centres on the Canterbury Plains, Unpublished M.A. Thesis, University of Canterbury, Christchurch.