ANALYSIS OF THE SPATIAL DISTRIBUTION OF PUBLIC SECONDARY GIRLS' AND BOYS' SCHOOLS IN RIYADH, SAUDI ARABIA

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By

Nasser Marshad Al-Zeer

Department of Geography

University of Leicester

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NASSER MARSHAD AL-ZEER

Abstract

This thesis examines the spatial distribution of secondary schools in Riyadh. It considers both public girls and boys sector provision and assesses the efficiency of the spatial distribution of secondary schools. Since the establishment of the Ministry of Education (MOE) in 1953 and General Presidency for Female Education, (GPFE) in 1960, there has been a great expansion of education services in Saudi Arabia, particularly during the 1980s. However, recent years have seen much slower rates of increase in the public education sector but the population continues to grow rapidly.

This thesis investigates the spatial distribution of schools through the use of questionnaire surveys and applied GIS. Overall, the results indicate a shortage of public secondary schools, especially in the north of the city. It is clear that there is overcrowding in the majority of secondary schools. The establishment of new schools has been suggested to solve the problem of overcrowding. A number of socio-economic and demographic factors are associated with differences in the utilization of the public secondary schools.

A GIS was applied in this study in order to assess the spatial distribution of secondary schools including the modification of existing catchment area boundaries and locating new schools. This modification could also reduce the pupil pressure on certain schools and further benefits could probably be gained.

Acknowledgements

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I would like to express my sincere gratitude to my supervisor, Professor Michael Bradshaw, for his generous investment of time, encouragement, suggestions and insightful counselling thus making this study possible. His intensive and creative comments have helped me step by step through the many complexities of the researcher process. Professor Bradshaw has had a profound effect on my approach to this research and I will never forget his supervision and support. Of course, my thanks also go to the other supervisory members in the Department of Geography, especially Ms. Kate More, since their valuable comments helped shape the directions taken in this study.

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List of Abbreviations

KSA: Kingdom of Saudi Arabia

MOE: Ministry of Education

GNI: Gross National Income

GDP: Gross Domestic Product

LEAs: Local Education Authorities in England and Wales

HCRD: High Commission for Development of Riyadh

AEGRD: Administration of Education for Girls in Riyadh District

AEBRD Administration of Education for Boys in Riyadh District

GIS: Geographic Information System

RS: Riyal Saudi

EDISC: Educational Development and Information Statistical Centre

DCSS: Data centre and Statistics Section

PEB: Program on Educational Building

OECD: Organization for Economic Co- operation and Development

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CHAPTER ONE

Introduction

1.1 The study background

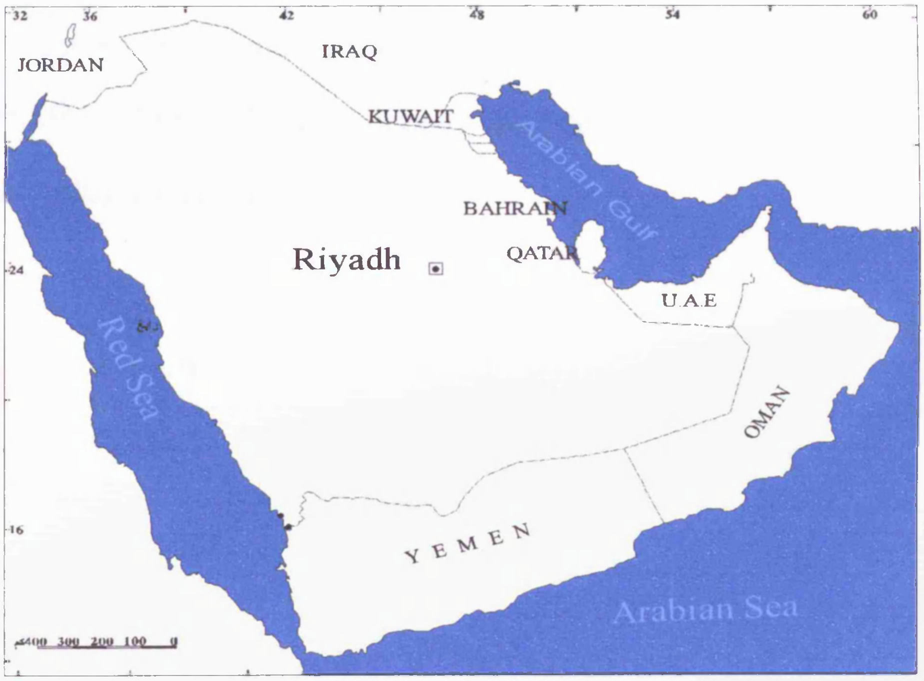
The adequate distribution of schools is very important to facilitate a good educational environment. The minimum distance between pupils' residences and their school saves both time and cost. This thesis is about the provision of educational facilities and particularly the provision of schools in the Kingdom of Saudi Arabia (KSA). National-level development planning in the KSA has sought to build a strong infrastructure of basic social services in order to develop the Kingdom's human resources, and to improve the quality of them (Ministry of Planning 1976). Sometimes, the building of schools takes place rather haphazardly; at other times and places building is undertaken according to need. The aim of this thesis is to assess the efficiency of the spatial distribution of secondary (high) schools in Riyadh, Saudi Arabia and to suggest more effective ways of taking into account the real needs of the population. In order to develop a spatial model for allocating schools, this thesis relies on the construction of geographical information systems (GIS).

Efficiency in the development of human capital in KSA in terms of economic progress is manifold. It is now well known, for example, that students who have far to travel to a school are more likely to give up before graduation, while a quarter of students in the Kingdom drop out before the 6th grade, this rate appears to be higher in rural areas (Presley and Westaway 1989,151).

1.2 The Geographical Location

Saudi Arabia lies at the furthermost part of southwest Asia and occupies about four-fifths of the Arabian Peninsula, with a total area of over 2,250,000 Km^2. Lying between 16' and 32' S and 35' and 55'N, the country (Figure 1.1) is bordered by Kuwait, Iraq and Jordan in the North, Yemen in the South, Oman, the United Arab Emirates, Qatar and the Arabian Gulf to the East and the Red Sea to the West (Mishkhes 2000,1-18).

Figure 1.1 Map of the Kingdom of Saudi Arabia



Source: Ministry of Defence 2001.

The climate in KSA varies from place to place, according to its various topographical features. It generally has a desert climate characterized by extreme heat during the day, an abrupt drop in temperature at night and slight, erratic, rainfall. There is significant variation in temperature and humidity. Temperatures go above 38° C, but the humidity is usually more than 85 percent and is frequently 100 percent for extended periods in coastal areas This mixture produces a hot mist during the day and a warm fog at night. Both the central region and the great desert have a uniform climate. For example, the average temperature in July in Riyadh is 28° C, but readings of up to 54° C are common. In October and April, the average temperatures are 20°C and 21°C respectively (Ministry of Planning 2000, 31). This range of temperatures, however, causes many problems to pupils' journeys and overcrowding in the schools.

1.3 The Population

In 1974 the population of KSA was 7,012,642 (Ministry of Finance and National Economics 1974). In 1993, the government of Saudi Arabia conducted a formal population census. The results revealed a population of 16,929,294 (Ministry of Information 1997). Table 1.1 below displays the population structure at that time in terms of nationality and gender.

Table 1.1 Population structure of Saudi Arabia by nationality and gender 1992.

Nationality	Male	Female	Total
Saudi	6,215,793	6,094,260	12,310,053
Non-Saudi	3,264,180	1,374,155	4,638,335
Total	9,479,973	7,468,415	16,948,388

Source: calculated by author depending on Ministry of Planning 1992, 5.

The Saudi population was 12,310,053 million, 6,215,793 males and 6,094,260 females while the non-Saudi population was 4,638,335 million, 3,264,180 males and 1,374,155 million female. By 2000 the population had increased to 20,846,884 (Al-Khraif 2003). The World Health Organization Report (2000:160) indicated that the total population of Saudi Arabia had reached 20,899,000 and that the annual population growth was 3 percent. According to the 2004 census, the population had grown to 22,673,538 million (Table1.2). The 2004 Saudi census indicated an indigenous population of 16,529,302 million (72 percent of population), 8,285,662 of them were male and 8,243,640 were female. In addition to the population holding Saudi citizenship, there were large numbers of foreign residents in the kingdom, the number of foreigners was 6,144,236,million, 4,271,598 of them male and 1,872,638 female (AL-Jajzirah Newspaper 2005,3).

Table 1.2 Population structure of Saudi Arabia by nationality and gender-2004.

Nationality	Male	Female	Total
Saudi	8,285,662	8,243,640	16,529,302
Non-Saudi	4,271,598	1,872,638	6,144,236
Total	12,557,260	10,116,278	22,673,538

Source: calculated by author depending on AL-Jajzirah Newspaper 2005,3.

This rise is not only due to high birth rates but also to the increasing immigration of highly skilled workers for industrial purposes (Mishkhes 2000,61). All of these factors have had significant impact on the education system.

1.4 Study area

Riyadh Administrative Area is one of the most important districts in the KSA. It comprises nineteen provinces and covers an area of 341,404 km^2 (15 percent of the whole country). It also ranks second in population size after the Makkah Administrative Area in both the 1974 and 1993 censuses (Ministry of Higher Education 1999,76)

Riyadh is the capital of Saudi Arabia. It consists of seventeen municipalities. They are as follows: Manfuha, Irgah, Otaygah, Al-Nnaseem, Al-Malaz, Al- Mather, Al-Ulayah, Al-Oraija, Al-Shimal, Al-Silay, Arrowdah, Al-Deerah, Al-Dariah, Al-Janoob, Al-Batha, Al-Ssafarat and Al-Hair (see Figure 1.2). All of these municipalities, except Al-Hair and the south of the Al-Janoob municipality, are covered by the current research.

As shown in Figure 1.2, these municipalities are divided into areas traditionally known as Hara (an informal expression for small area, especially in the oldest part of the city) and officially referred to as Hay (ward). Riyadh consists of 146 wards, which will be referred to by name in this research (see Figure 1.2 and list of names in provided in Appendix A).

The city of Riyadh was chosen as the location for this research for several reasons.

- A response to the desire by the Ministry of Education to encourage researchers to study the distribution of schools because of the lack of such study in Riyadh.
- The viability of data based on the existence of several research centres in the city including the High Commission for Riyadh Development (HCRD), the Riyadh Research Centre at King Saud University, King Abdul Aziz City for Science and Technology, and finally the King Abdul Aziz Library.
- Recent years have seen significant immigration to Riyadh. In some parts of the city there are heavy demands on schools. This increases pressure on the current schools. As a result, the issue of the location of schools in relation to population has become a priority.

Figure 1.2 Riyadh City: Municipalities and Wards boundaries

1.5 Revenue and Developments

During the last two decades Saudi Arabia has been one of the richest countries in the Middle East. However, after being involved indirectly in the wars in the region, namely the Iran- Iraq conflict and the Kuwait war of liberation, its economy has declined. The Saudi government bore a very large burden of the financing of the two Gulf Wars (Rashid *et al.* 1992, 230). As a result of these two events, the Saudi government moved from an era of over spending to an era of thrift because the main source of revenue for the Saudi Arabian government is from sales of oil. Official reports indicate that oil exports account for more than 77 percent of the Saudi government's revenue, whilst the rest comes from port services, customs duties, telephone services and gold sales (Ministry of Planning 1996). Thus, fluctuations in oil prices clearly have a direct impact on developments in Saudi Arabia (e.g., on education, health and economic developments).

The strength of the relationship between oil revenue and development in Saudi Arabia demonstrated itself in the 1970s and early 1980s. In this period, Saudi Arabia witnessed unprecedented financial wealth as a result of a very large increase in oil revenues. Thus, public organizations, including the education sector, were able to obtain virtually unlimited resources. In the second half of the 1980s the economic climate changed. The continuous fluctuations in oil revenue forced the country to make adjustments to its five-year development plans (Findlay 1994). This has restricted the government's prospects in policy-making (Statistisk sentralby 2000, 7). In sum, oil has become, as such, the main source of revenue in past and recent years. Furthermore, this main source of revenue has a strong effect on the Saudis' budget as well as being the main provider for public expenditure.

"The kingdom of Saudi Arabia faces a grim economic future. Contrary to predictions in the late 1970s and early 1980s of rising prices for Middle Eastern oil, world oil demand and prices have followed a downward trend since 1981-1982, resulting in a reduction in Saudi oil revenues. Since 1983 Saudi Arabia has stopped accumulating financial surpluses, forcing it to draw down its financial reserves and, since 1987, to resort to large-scale borrowing" (Eliyahu 1994).[1]

Before 1985/1986 domestic demand was kept afloat by government budgets; since then the government budget and the current account have been in deficit (Statistisk sentralby 2000, 7). Table 1.3 shows the total value of oil revenue and its share of total revenue through the period 1981 to 2002. It is clear from the table that the main source of the total revenue is oil. Oil revenue accounts for an average of 71.58 percent of the total revenue. The highest percentage was in 1981, and the lowest was in 1999 and 2000. Figure 1.3 illustrates the reliance of the Saudi Arabia on oil revenue. As a result of the changing of scale situation, the ability of the public education sector to obtain resources, particularly fixed capital resources (e.g. school facilities), was much reduced. Table 1.3 and Figure 1.3 show the increase in government support for the Education Sector, starting from 1991. This increase of support stems from the increasing of number of teachers, and about 80 percent of this support goes toward salaries.

1.6 Statement of the Problem

Academics, as well as practitioners, have been interested in studying the spatial distribution of school institutions (Yeates 1963; Mishan 1969). The roots of this field of research emerged in the 1960s. A number of studies revealed many problems associated with the location of schools. For example, Yeates (1963) who conducted one of the

[1] See: http://www.washingtoninstitute.org/pubs/exec/eliexec.htm) Accessed 21 May 2004

Figure 1.3 Total revenues and oil revenues

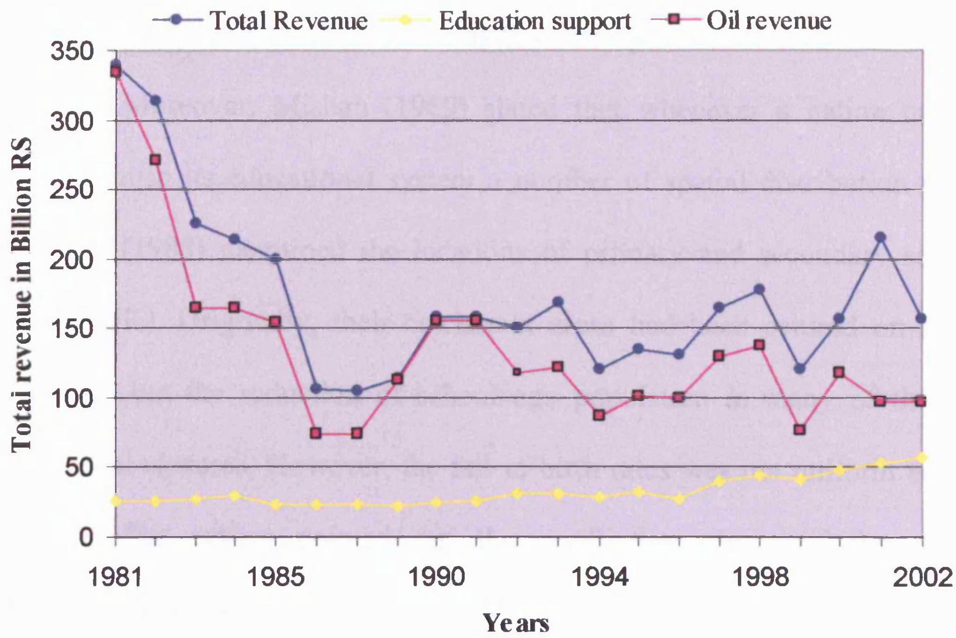


Table 1.3 Total revenue and oil revenue (Billion RS)

Year	Total Revenue billion RS	Oil revenue billion RS	Oil revenue as % of the total revenue	Education support billion RS
1981	340.0	334.0	98	25.8
1982	313.4	270.6	86	25.4
1983	225.0	164.5	73	26.7
1984	214.1	164.5	77	29.9
1985	200.0	154.3	77	23.5
1987	106.9	74.2	69	23.2
1988	105.3	73.5	70	22.9
1989	*	*	*	22.6
1990	*	*	*	24.2
1991	*	*	*	25.5
1992	151.0	117.7	78	30.8
1993	169.2	121.7	72	31.6
1994	120.0	86.9	72	28.8
1995	135.0	101.5	75	31.9
1996	131.5	99.6	76	27.5
1997	164.0	129.4	79	40.1
1998	178.0	136.8	77	43.9
1999	121.0	75.9	63	41.3
2000	157.0	117.9	75	47.6
2001	215.0	97.0	79	52.6
2002	157.0	97.0	62	57.5

Sources: Monetary Agency (1993); Alhaqil (1999, 254); Ministry of Education (1994, 111) and Ministry of Planning (2000).
* Data not available.

earliest studies relevant to the spatial distribution of schools, emphasised the importance of redesigning the school boundaries in a way that would lead to a minimisation of pupil transport costs. Moreover, Mishan (1969) stated that whenever a nation undertakes radical expansion in its educational system a number of spatial distribution problems arise. Molinero (1988) examined the locations of primary and secondary schools in Southampton (UK). Originally, their catchment areas had been centred on attractive residential areas but the reduction of school age population in many of these areas resulted in school closures. However, the fall in birth rates was not uniform across the social classes. The author pointed out the conflicting views of the education administration, which focused respectively on costs and the communities that worry about the quality of the service. London (1990 1992) demonstrated that the application of a location allocation model is a useful approach in the study of schools locations in Trinidad and Tobago. He illustrated the importance of spatial planning, especially when it involved public facilities such as secondary schools with the overall objective of distance minimization. Jahan and Oda (1999) conducted a study focused on the identification of spatial concentration and disparity in the distribution of public facilities as well as the identification of gaps or deficiencies in different wards of the city. The study found that certain wards are more developed in terms of a particular facility, while others lag far behind the mean level of development in the city in terms of that same facility.

In a Saudi Arabian context Al-Meteer (1999) studied school locations and traffic safety, and presented a model for improving safety standards in the main cities of Saudi Arabia, particularly in Riyadh. The study showed that 42 percent of all-male schools and 38 percent of all-female schools were located on unsafe roads that have a poor road surface, are too narrowly laid out, have poor lighting or have poor traffic lighting; one problem is the excessive speed of vehicles and concern for the personal safety for girl students, etc. Moreover, 19 percent of these schools were located alongside routes suffering from major traffic congestion. The study also showed that in 55 percent of Riyadh schools there was a lack of basic safety measures. Nelil; Fabrico and Luiz (2004) studied school location methodology in urban areas of developing countries, which was concerned with the location of primary schools, and the main objective was to evaluate the existing network and the relocation proposals. They concluded that the capacitated model was the most effective in this regard.

The KSA has witnessed radical educational changes in the last three decades. The implementation of five-year development plans, which started in the first half of the 1970s have been the cornerstone of these changes. A number of issues have arisen as a result of these changes. One of these issues is the way in which the sites of schools are chosen. There is no systematic approach (e.g., Geographical Information Systems (GIS) and location-allocation) used to select school locations. For example, residents of a specific ward or village may have been able to convince the policy makers to establish a new school in their ward / village, even though their request might not be justifiable. The problem arises not only from a lack of secondary schools in Riyadh, but also from the poor spatial distribution of those that do exist.

1.7 Aims and Objectives

The main aim of the current research is to assess the efficiency of the spatial distribution of secondary (high) schools in Riyadh, Saudi Arabia. To achieve this aim, the following objectives are pursued:

- An examination of the spatial evolution of the current system of secondary schools, in terms of the number of schools, pupils in each school, number of classes and teachers;

- An evaluation of the relationship between demand for school places and current level of provision by municipality;
- An evaluation of the factors that influence individual choice of schools, differentiated and compared on the basis of gender;
- A mapping of the journey to school for both male and female students attending state high schools in Riyadh, including accessibility in terms of travel times;
- An investigation of the current catchment areas of individual schools using a GIS; and,
- An assessment of the efficiency of current catchments using location-allocation to identify optimum catchments areas for individual schools.

1.8 The Significance of the study

This study derives its importance from the fact that it may be considered the first study in Saudi Arabia to address the spatial distribution of secondary schools. The limited number of studies in this field provides a sufficient reason to study this phenomenon in the capital city. Riyadh has the largest number of schools of any city in the country including about 161 of the nation's 2964 secondary schools (5.43 percent) to date (Administration of Education for Girls in Riyadh District 2002; Administration of Education for Boys in Riyadh District 2002). Moreover, the results should shed light on a number of essential issues related to the locations of these schools. To recap, this includes the distance between the homes and schools, and the transportation times. Furthermore, it can serve as a benchmark for studies of the spatial distribution of schools in the whole of Saudi Arabia. Finally, the results of this study may be of value to others, both academics and practitioners who, are interested in this area of research.

1.9 Structure of the Thesis

The current study is comprised of nine chapters. A concise summary reflecting the contents of each chapter is presented below. Chapter one gives a brief introduction covering areas of interest in the study and providing a background to Saudi Arabia. Moreover, it contains a statement of the research problem, the study's aim, its objectives and the significance of the study. Chapter two reviews existing related literature on some issues such as: the education system, spatial distributions, school catchment areas, and the choice of schools, location-allocation and the role of geographical information systems (GIS).

Chapter Three describes the data sources and methodology used. This includes consideration of both secondary data and questionnaires surveys. Chapter four provides an overview of the education system in Saudi Arabia in general. Chapter five is divided into four parts: part one aims to provide information about Saudi Arabia's population. Part two is concerned with the stages of construction and population growth in Riyadh. Part three is related to the factors behind the growth of the population in Riyadh. Part four is concerned with the density of the population in Riyadh and its distribution. Chapter Six gives details and concerns the development of education in Riyadh. In Chapters Seven and Eight attention switches to the questionnaire survey and analysis considers respondent characteristics as well as the transportation issue, journey times, the status of the mode of transportation, the choice of school, the evaluation of the present location for schools and location of proposed school. Chapter nine identifies the major contributions made by this study, presents its main contributions and makes policy recommendations

CHAPTER TWO

Literature Review

2.1 Introduction

This chapter reviews the literature on the relationship between education and geography. At the outset it is necessary to provide a definition of education and, following this, a brief explanation as to why it is important to study the geographical configuration of this sphere of activity. Having defined education and stated the rationale for examining the geographical aspects of education, attention then turns towards presenting a review of the literature so far produced on the geography of education in general, and on catchment areas in particular. This chapter concludes by identifying the gaps in the literature that this thesis intends to fill.

2. 2 Definition of education

The literature offers a numbers of definitions of education. For example, the Oxford Concise Dictionary defines education as "the act or process of educating or being educated" Fowler, and Fowler (1995, 431). Bryson defines education as a mechanism by which positive social changes can be realized (Bryson 2002, 175). In addition, Peters (1966, 144) suggests that education means that something worthwhile is being, or has been, intentionally transmitted in a morally acceptable manner

Today, attitudes and options have changed. A worthwhile endeavour would now include, for example, knowing a foreign language, and science. Thus, the definition of 'worthwhile' will change in reflection of society's changing values. In Muslim cultures a close study of the Quran is considered the bedrock of education, whereas in Britain at least a token recognition of a Christian past enters the notion of education. Similarly, what “morally acceptable” means will also change as society’s values change. For example, the state legislature of Wisconsin defined education as that which is:

- Conducted in and meets the needs of a community;
- Co-ordinated by an elementary school, secondary school, institution of higher education, or community service program, and with the community; and
- Helps foster civic reliability (The National Community Service Trust 1993).

Here, therefore, the emphasis is upon articulating the relationship between education and the wider community of which it is a part. The purpose of education is further explained as "to develop the knowledge, skill, or character of the learner" (Yero 2002, 1). One can deduce from these definitions that those who need to acquire greater knowledge and/or skills have to go through systematic and formal processes. Such processes, however, normally need to take place in formal settings or environments such as schools.

2.3 Rationale for developing educational provision

Educational achievement is obtained through educational investment, a major portion of which has to come from public sources, considering the high direct and opportunity cost on the part of the individual. Without proper government action to facilitate the diffusion of knowledge through the provision of, at least, the basic level of education, the newly created knowledge cannot add enough value to generate the required incentive. Investment in education is thus a critical decision that helps all nations in the long term. International comparisons of expenditure for education show considerable variation across countries in terms of the share of national resources devoted to education. The following table, drawn from the World Development Indicators (2001) database, clearly shows the high priority status of education in the developed economies. The non-OECD (Organization for Economic Co-operation and Development) high-income group, with its low percentage expenditure on education, contains some of the oil-rich Middle-Eastern economies, including the United Arab Emirates (1.79 percent).

Table 2.1 Public spending on education as a percentage of Gross National Income 1995.

Group of Countries 1995	%
Low income	3.2
Lower middle income	4.1
Middle income	4.6
Upper middle income	5.0
High income	5.4
High income non OECD	2.98
High income OECD	5.43

Source: World Development Indicators 2001, 80.

In nearly every country, educational provision is a prominent aspect of social policy, whether measured in terms of expenditure, employment, public concern or so on. Table 2.2 provides information about public expenditure on public institutions in U.S.A. in year 1999, when about 3.8 percent of the total expenditure is spent on primary and secondary education. As a matter of fact, the total expenses on education for each pupil was 6,852 US$ in primary school and 8,157 US$ in secondary school. Among the G-7[1] countries, France spends the highest percentage of education, as a percentage of GDP 4.4 percent and 31 percent on secondary education per student relative to GDP per capita. Italy and Japan spent a larger percentage on primary education: 22 and 21 percent respectively, per student and relative to GDP per capita. In 1999, expenditure per student at the primary-secondary level ranged from $3,818 in Germany to $6,582 in the USA. The USA spent more on secondary education students than any other G-7 country, and nearly than twice the amount spent in Germany, Italy and the UK.

[1] The G7 are: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

Table 2.2 Public expenditure on educational institutions by level of education and country 1999

G-7 countries	as a % of GDP	per student US dollars		% of spent per student relative to GDP per capita	
	Primary/Secondary Education	Primary Educatio n	Secondary Education	Primary Education	Secondary Education
Canada	3.8	*	5,981	*	23
Germany	3.7	3,818	6,603	16	27
France	4.4	4,139	7,152	18	31
Italy	3.2	5,354	6,518	22	27
Japan	3.0	5,240	6,039	21	24
United Kingdom	3.7	3,627	5,608	16	24
United States	3.8	6,582	8,157	20	24

Source: UNESCO Institute for Statistics 1999.
* Data not available.

In most developed countries there has also been a remarkable increase in the importance attached to the 'knowledge economy'. "For countries in the vanguard of the world economy, the balance between knowledge and resources has shifted so far towards the former that knowledge has become perhaps the most important factor determining the standard of living - more than land, tools, or labour. Today's most technologically advanced economies are truly knowledge-based" (The World Bank 1999, 16).

What is a knowledge economy? According to The UK Department of Industry, a knowledge-driven economy is one in which the generation and exploitation of knowledge play the predominant part in the creation of wealth. In the industrial era wealth was created by using machines to replace human labour. Many people associate the knowledge economy with high-technology industries such as the telecommunication and financial industries. Knowledge workers are defined as 'symbolic analysts', workers, teachers and policy analysts. In advanced economies such as the USA, more than 60 per cent of workers are knowledge workers (The Information Technology Advisory Group 1999). Clarke (2001) also pointes out that the determinant of the success of enterprises, and of national economies as a whole, is ever more a reliance upon their effectiveness in gathering and utilizing knowledge. Clarke (2001, 189) distinguishes between different types of knowledge-based economy, including know-what, know-why, know-how and know-who. Know-what represents an accumulation of facts, and is closest to information in that it can be broken down into bits while know-why refers to scientific knowledge of the principles and laws that underlie technological development and product and process advances.

On the other hand, know-how suggests the skills of capability to do something typical of the knowledge developed and kept within a company, and the reason for the formation of industrial networks to enable firms to share and combine elements of knowledge. Finally, Clark explained that know-who involves information about who knows what, and who knows how to do what, and implies the formation of special social relations in order to secure access to experts, which is particularly necessary in response to acceleration in the rate of change. The basic reason for increased spending on education is the need to promote a knowledge-based economy.

According to Kiker 1998; McMahon 1987 and Varcoe *et al.* 2001, education occupies a major part of everybody's life. It has a strong impact on their success in terms of employment, social class and consumption patterns. Parents display a universal concern about education, not merely in the same way as they might about other social services, but because it affects the quality of their children's lives not only while they are at school but also in later life. This sometimes depends on the nature of the parents' education. For example, parents who have received a higher education are more likely to place their children in schools that have high performance levels. Moreover, they are more adaptable to changes, both in their environment and in their work. If it is necessary to change servicing organisations, or even to change occupations, education can exert a positive effect on workers' self-confidence and efficacy in the face of change (Cheng *et al.* 2002).

Thus education is important for two basic reasons. The first is that the training of a human mind is not complete without education. It helps us to arrive at a conclusion and make a decision. The second reason for the importance of education is that only through attainment in education is an individual enabled to receive information from the external world, to become acquainted with past history and receive necessary information regarding the present. Without education, life is as if in a closed room. With education it is as if in a room with all the windows open to the outside world.

2.4 Educational provision: Geography matters

What unites geographers is a belief that geography matters. This is nowhere more clearly seen than in the provision of educational services. The fact that geography matters in relation to educational provision applies in a number of different ways. For example, it is unequally distributed across space.

Whether one examines such provision on a cross-national, regional or local level, it quickly becomes apparent that the nature of educational provision is inherently uneven. For example, there were clear disparities in enrolments in Saudi Arabia in 1985 between the three core regions and the fringe regions to the north and south. In order to tackle the lower rate of enrolments in the fringing region, and greater distance to schools, those regions gained rather more schools than their population numbers, such the Southern Regions 21.1 percent of the Kingdom's population were served by 27 per cent of all the primary schools for boys, and 24.5 percent of all the primary schools for girls. By contrast, the more urban eastern and western Regions appeared relatively under-provided with schools at that level, in relation to their population (Al-Hathloul; Nararyanan 1995, 222).

One of the major objectives of national development planning in the KSA has been to build a strong infrastructure of basic social services in order to develop the Kingdom's human resources, and to improve the quality of life (Ministry of Planning 1976). The Fifth Development Plan aimed to achieve balanced growth throughout all regions.

Outside of the urban areas, however, it is not yet possible to ensure that all children get a full education. This is either because schools do not exist in many of the rural communities, or because there has been a slower uptake of the available places than in the towns. Nevertheless, as the number of schools has grown, this problem is increasingly confined to the smallest and most scattered rural and Bedouin communities. The universal provision of schooling has been most difficult to achieve in these areas because of the small size of many of the communities and the large distances between them, which mean that pupil numbers are too small for viable school catchment areas. If the distances are too great to get the children to school, opening a school in one village to serve several others around it may still only tap part of that designated catchment area. This can be a particular problem for the provision of secondary schooling in areas of small, scattered communities because secondary schools generally need a greater member of students than elementary schools in order to provide a sufficient range of specialisations (Al-Hathloul; Nararyanan 1995, 219).

Here, however, the focus is on the way in which geography relates to educational provision in relation to catchment areas. Indeed, this issue has been the focus of much enquiry. Until now, the study of the geography of education has focused upon different issues. Here, a brief review provides an overview of the nature of contemporary educational geography. This is followed by an in-depth examination of the particular aspect of educational geography that is the focus of this research.

According to Bradford (1990), the geography of education has been a relatively under-developed area of research. However, the issue of spatial variation in the provision of education is clearly important. For example, he has illustrated the place that the geography of education has within geography by bringing together key components of economic geography, social geography and political geography. A number of geographers have written on the matter of education. Bondi (1989) took as her starting point the fact that school rolls in the UK had been declining for a decade and that there was, and still is, pressure on Local Education Authorities in England and Wales (LEAs) to reduce the number of surplus places in their areas. Her argument centred on the fact that, although LEAs may produce 'rational' plans for reducing places based on sound economic and demographic criteria, intense local loyalty to particular schools means that these plans could not always proceed as authorities wished. This resulted in reorganisation scenarios comprised largely of compromise. The study also highlights the fact that it is desirable, but extremely problematic, to utilise reorganisations (which inevitably involve a high level of closure and amalgamation) in order to maximise the quality of the remaining building stock. In other words, planners should aim not only to consider the population of areas when removing schools from a network, but should also aim to leave those buildings that are more suited to a modern educational environment. The conclusion is that although the situation was already complex for planners it is likely to become more so, with open enrolment and the like.

Following on from the possibilities outlined by Clarke and Langley (1995 1996), other researchers in geography have taken up the theme of using GIS to examine aspects of the education system. They reiterate that GIS can be extremely useful in several areas for showing:

- the variation in catchment characteristics across an area (in terms of socio-economic indicators);
- the variation in school 'performance' in terms of published indicators;
- the relative accessibility of residential areas to facilities such as schools;
- the differences between traditional fixed catchments and those actually existing under parental preference legislation; and
- improvement in school transport networks' settling of disputes regarding the allocation of free transport.

Bradford dealt with the issue of school performance. He noted a link between residential environments and schools (Bradford 1991). In 1994 he took a more demographic approach to the problems facing planners due to changing population structures and discussed the ways in which this might be combined with changes in planning legislation in the future. In particular he highlighted trends in the numbers of school-age children and explained how the planning response to such trends must adopt a different framework from that used prior to the1988 Education Reform Act.

Matthews *et al.* (1988) also examined the varying influences on children's educational performance. However, in this case they concentrated on the in-school factors that may have had an impact on pupil attainment. Building on a number of US studies which have found that schools in inner cities or deprived areas had less-qualified teachers than those in more affluent suburban schools, and from evidence from the UK which emphasises a higher teacher turnover in inner cities, the authors concluded that, in fact, the same differences do not appear to exist in the UK as in the USA. This is partly because of the differing administrative system under which schools operate and the fact that in the UK the state schools in any one area (or city) all operate under the aegis of a single body, the LEAs. There is little room for the same kind of funding or prestige variation that exists in the USA. This means that teachers have the same level of employment conditions and pay scale whether they teach in inner city or suburban schools. It may also be important to mention in this respect that the KSA system is more or less like the system in the UK. However, it is an interesting footnote to their work that the legislative background to their study has now changed, perhaps beyond all recognition. Schools in the UK are now more independent of their LEA and each other and may, therefore, be in a position to offer the kind of differential environments that have traditionally affected teachers in the US. This may mean that the concerns they raised about variations in terms of teacher experience and turnover have become more significant as market reforms take root in the UK.

2.5 School catchment areas and choice

A school catchment area is the administratively defined geographical area served by a school; it is the area from which the school recruits its pupils (Forojalla 1993, 246). The catchment area is defined partly by assumptions about the maximum acceptable distance a pupil can travel between home and school, the density of school-age population per km^2, and the size of the school (Forojalla 1993). Combes and Raybould (1997) examine how the neighbourhood conditions in which a child lives influences his/her school performance 'over and above the individual's characteristics and those of the school' with reference to 16 year olds' examination results in Newcastle-upon-Tyne. They argued that it is important to use the postcodes of pupils' home addresses to make the link with census data information about them and their families. The level of deprivation in a school's catchment area can only be represented when sufficient information on the neighbourhood and on the pupils' backgrounds is known. In other words, many parents consider living close to a school as a basic requirement for a safe, disciplined environment and acceptable academic standards (Thomas; Denison 1991).

The vast majority of catchment area studies in Western countries focus on the issue of socio-spatial inequalities such as in examination performance. As will be argued below, this is because there is already in place a system of school allocation for the students from particular areas. The contentious issue is whether such 'localisation' processes reinforce, rather than reduce, educational attainment due to the fact that people live in socio-economically differentiated communities.

An early study by Hallk and McCabe (1973) analysed the geographical distribution of schools, transport services, staffing conditions and costs, and showed the planning of the locations of schools in County Sligo, Ireland. Recently, Brunsdon (2001) has demonstrated a relationship in the North of England between a school's catchment area and its examination results. Furthermore, Martin and Atkinson (2001) have examined the spatial linkage between primary school performance and catchment characteristics. In Scotland research has shown that, in addition to school and social-compositional effects, there is also a neighbourhood effect (Williams 1986; Garner and Raudenbush 1991). For example, children in areas that are socially and environmentally poor do worse than their counterparts elsewhere.

However, urban areas in North America, where most children attend neighbourhood schools, generally speaking, are segregated and defined by social class. Thus, family background, the schools they attend, and the culture of their peers disadvantage the children of poor parents. According to Clark and Ware (1997), the children of rich and middle class parents enjoy better-funded schools and benefit from more academically oriented peers. Goldring and Hausmam (1999), and Bruno (1996), studied the reasons for parental choice of urban schools in the USA where GIS is used in mapping methods to sustain education policy and school site management. Moody and Edgell (2000) noted that over the past 25 years $18 billion has been spent on the planning and location of new public schools in the USA. Of that money 45 percent was spent on new schools, 20 percent on refurbishing or modernizing old schools, and 35 percent on additions to existing buildings.

In the UK people are concerned about education, but not in the same way as they might be about other social services, because it affects the quality of their children's lives both while they are at secondary school and subsequently. The LEAs, who are responsible for organizing state school provision, publish details of school pupils' performance in externally assessed tests. Many parents regard such information as important. In 1992 the Centre for Educational Research reported two studies examining the issue of choosing schools in Islington, the aim of these studies was to provide qualitative information, gathered by means of interview, on the reasons why parents considered private schooling or schooling in another local education authority for their children. The result of this study indicated a variety of reasons why parents considered schools outside Islington for their child. The most important factor for parents in both studies was the quality of education, academic excellence (West 1992). This finding differs from the study by West and Varlaam (1991) who found that good discipline was the most important factor. Hunter (1991) also mentioned good discipline as a factor.

In much of the developing world the earliest schools were established by Christian Missions, particularly in the tropical and western parts of Africa. In addition to the religious factor, they hold certain political implications. These schools, for example, did not necessarily provide equal educational opportunities. A disproportionately large number of their pupils, drawn from particular ethnic groups, achieved leading government positions. This often resulted in ethnic enmity. Gould (1970), in his article on Tanzania from 1920-63, produced an early study entitled "The spatial impress of the modernization process". It highlighted the importance of the distribution of educational facilities in tropical African countries and its significance for modern urban development.

Similarly, Soja (1968) showed that there is some relationship between regional inequity in terms of educational opportunity and spatial imbalances in the distribution of other indices of development. Onokerhoaye (1980) presented a theoretical framework for planning the location of primary and secondary educational institutions in Nigeria and along with Okoh (1980) emphasised education as a means for growth and development. In particular, he emphasised the problems of physical distance in tropical Africa and, especially, in Nigeria. Furthermore, London (1992) examined the importance of spatial planning in Trinidad and Tobago in the West Indies. The study showed that public facilities such as secondary schools were located with the overall objective of distance minimization. Additionally, Bacchus (1988) argued that the speed with which most of these developing countries can develop their educational services is associated with problems related to the physical accessibility of schools. Urwick (1983) also observed that, with respect to the provision of educational services in general, there is a bias in favour of the provision of educational facilities to urban communities. Obviously, this reduces access for rural students. However, parental choice is the guiding principle for school allocation. This choice is based on the distance between the home and school. Hunter (1991) and West (1993) showed parents as rational consumers making choices on the basis of simple criteria. Echols *et al.* (1990) and Woods (1992), on the other hand, identified the relationship between choice-making and social class. They took account of the extent to which pupils moved to schools outside of their home catchments and the main patterns of pupil flow.

Bastow (1991) summarised the factors influencing parental choice as school accessibility, safety of journey, discipline, variety of subjects, examination results, able caring teachers and the quality of the facilities. Furthermore, Bagley (1996) studied gender because single-sex school issues are much more prominent in the literature than ethnicity, despite the latter being more important in the context of parental choice. Goldring and Hausmam (1999) also examined the role of parents in the choice of school for their wards (neighbourhoods) in St Louis City, USA. The study explored interrelationships among race, social class and participation in the city system of school choice. The results of the study indicated that parental background characteristics, parents' reasons for choosing a particular school, satisfaction with public schools and distance between the home and school differentiate between parents who choose magnet schools, parents who choose non-magnet school and non-choosers. Talen (2001) examined school accessibility in three counties in West Virginia (USA). The study utilized an extensive dataset of distances between students and eighty-four elementary school locations. The study examined whether or not the distribution of travel costs between resident locations (blocks) and schools was equitable on the basis of the density of resident populations and the socio-economic status (SES) of resident populations. The article also carried the analysis one step further by investigating the effect of access on student achievement. The study concluded that spatial inequities in access to schools were substantial and varied by county and school zone and that pupil achievement was influenced by the distance they lived from their schools.

However, in the UK the government interpretation of school performance derives solely from exam results, regardless of the type of area and its location. Other related factors are levels of parental education, household income and parental pressure to succeed academically, which pupils are likely to do better in school than those from homes where there is little encouragement (Cuttance 1988). Pearce (2000) found that school performance tables, as used in the UK, can provide a false impression of school performance. He argued that performance indicators cannot be measured in isolation from the social characteristics of schools' localities. In other words, school performance measurements are not only a result of the success of the school, but are also dependent on the background of the children.

Moreover, the relationship between test scores and socio-economic variables cannot be measured because of uncertainties in the linkage between school and catchment area. Further, Flowerdew and James (2001) examined the relationship between academic achievement, school effectiveness and social background. Their study showed a significant relationship between school performance and the school's catchment area, and social deprivation. Parsons *et al.* (2000) examined parental choice in relation to catchment areas and pupil movement using GIS. Furthermore, Martin and Atkinson (2001) examined the spatial linkage of primary school performance and the characteristics of catchment area in northern England.

Fotheringham *et al.* (2001) examined the role of various attributes in determining differences in school performance in mathematics using the data for 3,687 schools in northern England. The study showed a relationship between school performance and the socio-economic characteristics of school catchment areas and the spatial variations in these relationships. Similarly, Cuttance (1988) used multilevel modelling to analyse pupil achievement in fourth year ordinary grade English, mathematics and overall attainment across subjects in the Scottish Certificate of Education (SCE) examinations. He compared variation in the social composition of schools, variation in the process and teaching characteristics of schools and variation in the social background of pupils. Moreover, he took into consideration the selective nature of schools in Scotland. The selectivity of schools derives from two sources: variation in the residential pattern of socio-economic groups and the voluntary choice of school. Variation among schools in cities, large burghs and towns, small towns, new towns and rural areas were examined. The differences in attainment between schools in different types of community were found be related to the selectivity of schools, and the social class composition.

In the same way, Martin and Atkinson (2001) investigated the nature of the relationship between school performance and catchments' characteristics. They explored the sensitivity of such relationships to their geographical framework and compared a range of alternative approaches. They found that the relationship between pupils and schools is similar to that between adults and health care institutions, and other users of group facilities. Brunsdon (2001) claimed that catchment areas are generally linked to school performance. Moreover, Mayston and Jesson (1988) attempted to separate out the contribution of primary pupil achievement from the subsequent choice of secondary school, using statistical methods such as reading age at the time of secondary school entry.

Bete (1998) claimed that good architectural design includes climate control, an inviting lunchroom atmosphere, a centralized administration area, good acoustics, easy access to information technology, common areas for informal contact and a generous circulation pattern that will minimize congestion. In turn, aggression and destructive behaviour increase as the number of children in a room increases, according to Rivlin and Wolf (1972). Some of the consequences of high-density conditions that involve either too many children or too little space are: excess levels of stimulation, stress and arousal, a reduction in levels of desired privacy and loss of control. Similarly, Wohlwill and Vliet (1985) added that high density and crowding detract from the quality and functionality of the school. Finn (1998) reported that the size of a class influences academic performance because larger number of students in classes can discourage a sense of meaningful participation.

It is realised by geographers within education research that the role of space in schools is considered an important factor for improving pupils performance and pedagogic practice (Holloway and valentine 2000, 242). Also, the mobility of pupils between schools is another important factor for educational performance. Dobson (2000, 96) stated that "pattern of residential migration and school transportation make it likely that some schools will be adversely affected by pupils' gain and loss much more than others". In fact, the Saudis consider the architecture of school as a critical issue as a result of the cultural and religious influences. For example, based on the Saudi culture, the girls' schools are closed from outside with high brick walls surrounding the schools, whereas that of the boys' schools are normally clear with big playground and other facilities.

2.6 Location-allocation

Location-allocation is a type of spatial interaction analysis. Spatial interaction methods deal with at least pairs of points or areas in space between which there is posited to be some sort of flow of people, goods or information (Bailey 1994), although the precise nature of that interaction need not be specified. The most commonly used general spatial interaction analyses are the family of gravity models (Haynes and Fotheringham 1984). These were widely used in geography and archaeology on an intuitive, "even metaphysical" (Tobler and Wineburg 1971, 40) basis, before being theoretically justified as the general solution to an entropy maximisation problem (Bailey 1994, 34-35). In the gravity model, interaction between pairs of points or places is proportional to both their relative sizes and their relative distance apart. It is important to realise that size and distance do not necessarily have to be physical mass linear distance, but can refer to population, capital, goods, cognitive (perceived) distance, distance expressed as travel time, or even frequency of place names on tablets (Tobler and Wineburg 1971).

Location-allocation modelling was developed to help solve site selection problems in the public and private economic sectors for facilities such as schools, fire stations and medical facilities; namely, in situations in which an organisation needs to obtain the most efficient distribution of a system of facilities according to various criteria. For example, rules can be applied, such as the following: no pupil should live more than one kilometre from a school; no house should be more than five minutes travel from schools or a fire-hall. The unique aspect of location-allocation is the ability to solve the problem for all facilities in the system at the same time (despite using pair-wise comparisons), thus incorporating the interdependence of central places on each other into the solution. For example, the location of one school or one fire-hall necessarily affects the potential location of all others. Take the example of the school. To optimally site a school in relation to pupils, one might set the criterion that the collective distance travelled by all children should be minimized. In these terms, the most central place in the city is that place to which, if all the children went to a school sited there, their total summed travel distances from home to school would be the smallest possible number. Where location-allocation differs from conventional notions of centrality is where the decision is made to build two or more schools. Logically, the second most central place in the city is right across the street from the most central place. However, only a very foolish school administrator would build both schools on the same intersection. Rather, they would seek to place the schools optimally in relation to both the pupils and to each other. If two schools were to be built, neither would be in the single most central location relative to the pupils, but they would be in complementary places. If they were both built in the same place there would be no benefit to pupils living close to the central place, nor would there be any benefit to those living far away. An interdependent placing of the schools imposes an additional cost on centrally located pupils, but more than balances this out with a benefit to those who are peripheral. Equally, three schools, four schools, etc., should be placed so that if all pupils travel to one or another school, the schools are located and pupils are assigned to them such that the total travel distance is minimized. This is the essence of interdependent versus independent centrality. While it is clearly not always possible to meet this ideal, location-allocation is a widely used tool for such complex problems of supply, demand and the location of public facilities.

The location-allocation method offers an approach to analysing the options in location decisions, and effectiveness in human spatial activities. Consumers' search for accessibility to services and facilities is an essential part of any geographical investigation. The problem of location involves knowing the target population and who will have access to the various facilities. Moreover, Teitz (1968) and Goodchild and

Noronha (1983) determined that location-allocation is very useful in determining where to best place facilities for a scattered population.

Yeates (1963) conducted one of the earliest studies that examined the location of schools. He showed the location of schools and existing school district boundaries for a sample quadrat in Grant County Wisconsin. He redrew school boundaries to arrive at the optimum boundaries, where he divided the area of interest into sections of one square mile around the various schools' boundaries. If the greater part were inside that section, it would be added to that school's catchment area. Mishan (1969) said that problems like these are common whenever a nation undertakes systemic expansion for the overall benefit and welfare of its citizens. He identified two problems, namely externality effects and natural problems. Externality effects are those unwanted by-products of system expansion, which affect the welfare and academic achievement of pupils negatively. Secondly, natural problems are those persistent problems in any system of education which should be excused and eradicated whenever possible. As a result, in 1985, the Ministry of Education in Trinidad and Tobago drew up a five-year education plan (1985-1990). The main goal was to add eight secondary schools to the existing ones to eliminate or minimize the problem of the lengthy home-to-school journeys encountered by the pupils. In addition, the problem of physical access to schools would be addressed (Ministry of Education 1985). Similarly, London (1990 1992) demonstrated the application of the location-allocation modelling approach in the study of school location in Trinidad and Tobago. He illustrated the importance of spatial planning, especially when it involved public facilities such as secondary schools, with the overall objective of distance minimization.

Molinero (1988) examined the locations of primary and secondary schools in Southampton (UK) that had originally been placed in the center of areas of attraction or catchment areas. Reductions in birth rates now pose the problem of closing schools. However, the fall in birth rates has not been uniform across social classes. The author points out the conflicting views of the education administration, which focuses on costs, and the community that worries about the quality of the service. Tewari and Jena (1987) considered the location of high schools in rural India. They proposed the use of the P-median model and proposed locations that would maximize the population covered within a maximum service distance of 8 km. Pizzolato and Silva (1997) examined large portions of the metropolitan area of Rio de Janeiro in which, over the past 50 years nearly five million people have disorderly settled down, and modeled the problem as a p-median model. They suggested separating the study into two phases: an evaluation of the present location and a relocation proposal. Viegas (1987) used a network flow algorithm to select the most economical sites on which to construct or expand a school, in order to keep the maximum access distance to a school at a predetermined value; reduction of such a value requires more facilities and costs more. Tewari (1992) examined the access to services and facilities in rural areas. This study contrasted the use of operations research models with the concepts of rural development proposed by United States Agency for International Development (USAID) in the late 1970s. Armstrong *et al.* (1990) developed a system for providing decision-support to people who make decisions regarding location. Related studies can also be found in Rahman and Smith (1991); Stock (1983); Revelle and Swain (1970).

The issue of accessibility is also important in urban studies. One definition by Ingram (1971) points out that accessibility is an inherent characteristic or advantage of a place with respect to overcoming some form of friction. He added that there are two related notions; places or things are connected, which measures the degree of interconnectedness of points or things in the system. The quest of consumers for accessibility to services and facilities is crucial within the city as it is in any geographical investigation. In other words, the crucial thing about accessibility, generally speaking, is that it relates to the location of educational facilities. These should be located more closely to where the largest possible number of people can be served. The measurement of accessibility can be based on terms of physical distance, time and monetary and/or inconvenience costs.

A simple definition of accessibility is provided by Moseley (1979, 57), who described it as "the capacity to overcome space". Accessibility refers to the characteristics of selected destinations, the aims of a trip, and to the type of interaction involved in such a trip (Naud *et al.* 1999). Accessibility is determined by the spatial distribution of destinations, the level of ease of reaching each destination, the magnitude, quality and the character of the activities found there, and the attractiveness of a place, which makes people prefer it to others. Distinctions are sometimes made between potential and realized accessibility (Aday and Andersen 1974; Joseph and Philips 1984; Love and Lindquist 1995). The point has been made that practical definitions of accessibility should come from the service users rather than researchers (Handy and Niemeier 1997). From a broader perspective, three types of accessibility are often distinguished (Jones 1996). The first is geographical (or physical) accessibility, which emphasizes the relationship between the location of centers of service provision and those of prospective users. A second category is socio-economic accessibility which includes such factors as the ability to pay for the service, sufficient understanding of any provision to obtain maximum benefits from it, and the influence of culture on determining patterns of use. The third dimension is organizational accessibility, which is associated with the internal structure of service system and the availability of resources. With regard to the typical distances traveled, this obviously varies between countries and urban or rural contexts. In urban locations in the UK distances of three miles have been defined as maximum journey distance to schools. All pupils whose address falls outside this bands receive free travel if they attend their nearest appropriate school.

Pooley *et al.* (2005) studied the school journey in Britain since the 1940s: regarding continuity and change, they focused on the urban areas of Manchester and Lancaster, UK. The aim of this study was to collect detailed information on everyday mobility for people of different ages and at different times from the 1940s to 2004. It focused on three main keys. The first examined the factors which affect the choice of a particular school and how this choice has changed over time, Secondly, it assessed changes in the mode of transport used for journey to school, and examined the reasons why pupils (or their parents) chose to use a particular transport mode. Thirdly, it investigated changes in the extent to which pupils travelled to school alone, with other pupils or with an adult, and the reasons for such changes. The study confirmed that there have been increases in the proportion of children travelling to school by car with an adult, and a consequent decrease in the proportion walking alone. In other respects most children lived relatively close to their schools and the reasons for choosing a particular school remained quite stable over time.

Travel to and from school is a common practice for children. The more children go to school by private car, the greater the increase in traffic congestion. Such practice also reduces the independence of children and denies them the physical exercise that would be obtained from walking to school. Many studies express concern about students walking to school especially for safety reasons (traffic, strangers and time constraints).

The likelihood of children walking to school is reduced when safety measurements are taken into account. Within the broader context of children's geographies, this issue was explored extensively by number of studies, such as: Pooley 2005; Valentine and McKendrick 1997; Holloway and Valentine 2000; and Aitken 2001.

In Saudi Arabia (SA), pupils and their parents are generally unwilling to travel long distances as the climate makes walking long distances impractical. Admittedly, having a car has become a matter of habit; even if a person is not rich, he needs to adapt to social customs. Nevertheless, during the hot season, which in some parts of the country lasts for more than eight months, even driving to schools can be very uncomfortable.

The ability of a school to add value is strongly related to its geographical access for enrolment (Conduit *et al.* 1996). Socio-economic issues such as the proportion of pupils receiving free school meals, the type of neighbourhood, parental occupation and other influences on the school such as teacher retention and income for the teacher can have positive or negative effects on a school's examination results. Gould (1985) argued that the ability to settle into a school is related to the distance pupils must travel each day. The longer their journey time the more anxiety pupils tend to feel and the more difficult it is for them to settle down.

Mabogunje (1974) remarked that the extent to which urban populations could service thresholds for the location of urban facilities, and their supply and demand functions, emphasises the structure of accessibility and location. Furthermore, the problem of the home-to-school journey can be viewed as a problem of accessibility to a public service (Mabogunje, 1981).

Bacchus (1988) and Urwick (1983) argued that urban development, particularly with respect to the provision of education services and the problem of physical accessibility to school, is the most common problem in developing nations. Likewise, Mabogunje (1981, 11) indicated that in the developing countries, development planning has created conditions for a substantial proportion of population which are far from satisfactory or dignifying. It is desirable that the spatial perspective of education is brought into the wider developmental process: the way we adjust geographic space, that is to say, the way we locate features (for example schools); the way we locate subdivided physical space to promote social well-being and minimise the difficulties of physical access (for example to schools), represent some of the challenges that still confront educational planners in developing countries. Briefly, school location-allocation methods provide an approach for analysing optimality in location decisions as well as efficiency in human spatial performance. Modelling location will be discussed in chapter three, which is concerned with method.

2.7 The role of GIS

A Geographical Information System (GIS) might well be defined as a special purpose digital database in which an ordinary spatial coordinating system is the primary reference. The use of GIS requires:

- data from maps, aerial photos, satellite images or field data;
- storage, retrieval, and search of data;
- transformation of data, analysis and modelling, including spatial statistics; and
- data communication through maps, reports, and plans.

Today, GIS systems are extensively used by government agencies, in business and in research within a vast range of applications which includes the evaluation of environmental resources, land-use planning, location analysis, tax evaluation, infrastructural planning, real estate analysis, marketing and demographic analysis, habitation analysis and archaeology. Therefore, a GIS may be applied to any project that manipulates data or information referring to a specific place, which may be represented on a map, such as houses, schools, hospitals and so on. Therefore, the range of applications of a GIS is increasing while the systems are getting more efficient and less costly. One of the main objectives for using GIS technology is to enable policy makers to view the movement of pupils to schools outside their home catchments and to demonstrate statistical information and attach them to the related mapping locations. A GIS application can be used to improve the provision of educational and instructional support services to pupils at the location of their address (Maziarz 1974) and (Sawicki 1993).

Furthermore, a GIS can be applied to a wide range of geographically distributed data, which can be maintained and retrieved at greater speed and find value in a spatial perspective. In the UK LEAs have implemented a GIS system to filter applications for school places according to geographical criteria and to calculate home-to-school distances for more than 95,000 primary and secondary schools (Ireland 1995). A model GIS was developed in Scottish LEAs to illustrate its potential contribution to educational management. Clarke and Langley (1996) appraised the potential of GIS and spatial modelling for educational planning and found that there was evidence of a rather gradual growth in the use of GIS in educational applications. Parsons et al. (2000) also used GIS to assess the extent to which parents select out-of-catchment schools as well as the pattern of pupil flow across LEA catchment boundaries.

A number of different methods associated with school locations and census information have been identified by Combes and Raybould (1997), though they did not consider the distribution of pupils. A second method employed is to allocate each school to a census area where a GIS can be used to provide a conceptually simple association between schools and census data. A third method used by Conduit *et al.* (1996) attempted to define a catchment area around each school and then to average the census data across all areas falling within the catchments in order to average the census data across all areas falling within it. The approach was used to find a 2 km radius for each school. A fourth approach attempted to divide the entire region into school catchment areas (Boots 1986).

Bruno (1996) demonstrated the importance of GIS applications to the sitting, planning and administration of schools in the USA. Mapping with GIS procedures is a powerful and inexpensive mechanism for presenting visual images of a region, county, city or school site. Moreover, the location of pupils and teachers can be determined and precisely noted on such maps. GIS is indeed a powerful mechanism for visualizing the impact of school policies and for evaluating the effectiveness of various types of information. However, although paper maps have been much used in educational research they are limited in the types of information they can show. More crucially, they cannot be used to illustrate client population changes. Furthermore, they are tricky and costly to update.

While Flowerdew and James (2001) attempted linking point and area data to model primary school performance, Fotheringham *et al.* (2001) illustrated the spatial variations in school performance in Northern England. Moreover, Bruno (1996) examined parental choice of secondary schools; there has been relatively little research on the extent to which options damage the role of geographically defined school catchments. He used a GIS in mapping procedures to support education policy and school site management in the United States of America. Okoh (1980) studied education from the viewpoint of national growth and development, whilst Onokerhoaye (1980) analysed the spatial theory of location for education institutions in tropical Africa with special reference to Nigeria.

Generally speaking, in developing countries, geographic space as a resource in the provision of educational services has been underutilized. Bacchus (1988) stated that the spatial component of development did not come into play in models of educational planning and development. Moreover, this neglect of the spatial distribution of modernization in the Third World is a result of the growth process. It is important that the spatial perspective is brought into the development process for planning educational development (Mabogunje 1981).

In a rare example, Ahmed (1998) examined the government education system in Khartoum City, Sudan. He tried to match population distribution against neighbourhood location to see if the distribution of schools fulfilled the needs of the people. The study showed that in almost half of the city there were no government secondary schools. Moreover, El-Shafey and Nasimudheen (1997) examined the transportation arrangements for two preliminary schools in Qatar, which had been selected as prototypes for a vehicle routing application. Buses of various types and capacities were used for transporting students to and from school. The problem of constraints, for example on routes, vehicle capacity and journey time, is by no means uncommon. The study used a GIS to produce optimum routes for the buses used by the schools in order to maximize their use, and Global Positioning System (GPS) to generate the coordinates of every pick up and drop off point on the existing school bus routes on the street map. This was an attempt to provide a quick way of creating alternative routes for the remaining buses in the event of a bus breaking down or driver absence and, most importantly, to ensure student pickup and drop-off points that would be convenient and safe.

In Saudi Arabia few studies regarding educational spatial distribution have been conducted. One of these was by Abd-Elwassie (1983), and this study dealt with the history of education in Saudi Arabia. It discovered that the main aim of education was to provide the child with self-confidence as an individual and to provide schools with an environment conducive to healthy growth. Al-Khraif *et al.* (1994) studied the factors affecting school journey, including the monthly income of the household, the number of drivers in the household, nationality, the distance from bus routes and the number of brothers and sisters who study in other schools. The study comprised a sample of 4,500 pupils from public education schools. It showed that the bus route and availability of transportation were the main factors affecting the choice of school. In addition, Al-Meteer (1999) studied school location and traffic safety and presented a model for improving safety standards in the main cities of Saudi Arabia and, particularly, in Riyadh. The study showed that 42 percent of male schools and 38 percent of female schools were located on unsafe roads (poor road surface, too narrowly laid out poor lighting, poor traffic lighting,) and other factors are the excessive speed of vehicles and concern for the safety of female pupils, and the molestation of young men, young ladies, etc. Moreover, 19 percent of these schools were located alongside routes of major traffic congestion. The study also showed that in 55 percent of Riyadh schools there was a lack of such basic safety measures as speed limit signs and pedestrian crossings. Al-Gabbani (1999) studied the spatial distribution of population and development in Saudi Arabia between 1974 and 1992. This study showed a strong relationship between population and socio-economic factors, particularly the labour force and excluded other forces such as students. The study found that most people in Saudi Arabia, about 64 percent, live in the main cities.

The few education studies that have been done in Arab countries have been limited to location, transportation and pupils travel hazards. There are, however, other factors affecting the journey of schools, such as household incomes and the distance from home to the nearest bus routes. Moreover, Saudi Arabia, like the other countries of the Arab World, shows little concern for school location. The location of educational facilities is haphazard. As a result, pupils travelling to and from school face road hazards from the increasing density of traffic and a lack of such as basic road safety provisions as speed limit signs and pedestrian crossings. These studies, however, focused either on the city area as a whole or on specific locations or functions. None of these studies paid any attention to the spatial variation in the availability of public facilities within the city area. This study is an attempt to fill the gap in our knowledge. Using data from different sources, it presents a picture of the long term evolution of spatial distribution in education.

CHAPTER THREE

Research Methods

3.1 Introduction:

The main goal of this chapter is to present a clear vision of the methods that are used in this research. Basically, this study intends to provide policymakers with specific recommendations regarding the spatial distribution of the higher secondary schools in Riyadh. Nisbet (1997, 212), in an attempt to define a useful view to policy-making orientation suggested that "researchers undertake systematic procedures, such as surveys, to enable policymakers to base their decisions on evidence rather than on prejudice or guesswork". The educational revolution in Saudi Arabia, particularly in secondary education, reflects a huge investment in developing human capital and therefore analysing the location of schools in Riyadh is significant. There are many methods which can be used to measure the efficiency of a school's location, but convenient methods need to be developed to determine the reliability and validity of school locations.

Consequently, this research utilises a number of processes to collect and analyse the relevant data. This chapter starts by providing a definition of the variables of the research study and the need for data, then presenting the two main research methodologies. The second stage is concerned with population selection and the provision of a clear view of the population sample frame, including the type of sample that should be selected to obtain the target data. The next three sections are related to designing the questionnaire and the interviews, followed by the pilot study and the management of the main survey. As a follow up to this chapter, the preparation data for statistical and survey analysis is also discussed. The last section is concerned with analysing the quantitative data. This has mainly been achieved by using GIS and is based on using the case-study strategy.

3.2 Variables of the research study and the need for data

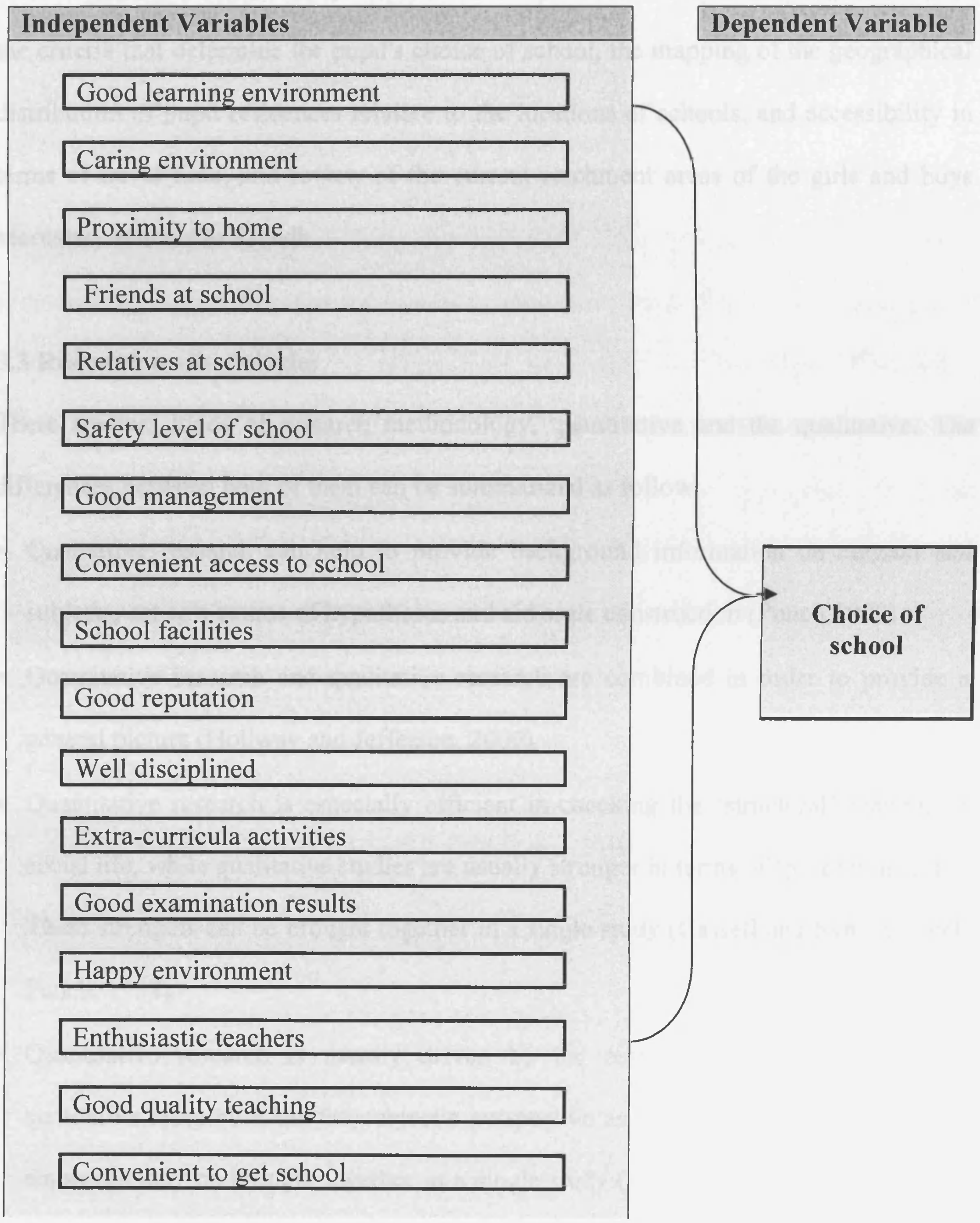
Seventeen independent variables have been selected for the current research. These variables, which are defined below, are proposed as the factors that impact on the choice of school (i.e. by pupils). They are presented through the conceptual model below (Figure 3.1).

To determine the factors that have an impact on choice of schools, the respondents' characteristics are explained and presented: the pupil's current academic year, age, nationality, number of people (including respondents) living in the home, father's and mother's highest educational qualification, the number of people living in the current house who can drive cars, the number of cars that the family has, and total monthly incomes are examined before testing the above model. Moreover, modes of transportation are investigated, whether by foot, private transportation, hire car (taxi car), or public transportation. Travelling times to/from school should also be included. Those who are using the government transportation should be asked to indicate their perception regarding the various types of transportation. This investigation relies on the following criteria: crowding, comfort, air-conditioning, safety of driving, and punctuality. Furthermore, the following points should be examined:

- Respondents should be invited to determine who the decision maker in the selection of a school is: the student, the father, the mother, a brother or the family.
- Addresses of respondents should also be known, as this will be a major consideration in selecting a catchment area.

- The final grades of respondents in the last academic year for the academic year 2002 (1423-1424 H[1]) are required as well.

Figure 3.1 Conceptual model of the research variables



[1] A Hijra year is of 12 months but using the lunar month which are based on the rise of the moon and the calculation of the crescent appearance in each month

Data needs: as mentioned in Chapter One, this study aims to assess the efficiency of the spatial distribution of secondary (high) schools in Riyadh, Saudi Arabia. This can be achieved by using many sources of data; documents, questionnaires. These data are also used to examine the current system of secondary schools in Saudi Arabia, to evaluate the criteria that determine the pupil's choice of school, the mapping of the geographical distribution of pupil residences relative to the locations of schools, and accessibility in terms of travel time, and review of the current catchment areas of the girls and boys secondary schools in Riyadh.

3.3 Research methodologies

There are two kinds of research methodology, quantitative and the qualitative. The differences between both of them can be summarized as follow:

- Qualitative research can help to provide background information on context and subjects, act as a source of hypotheses and aid scale construction (Punch 1998).
- Quantitative research and qualitative research are combined in order to provide a general picture (Hollway and Jefferson, 2000).
- Quantitative research is especially efficient in checking the 'structural' features of social life, while qualitative studies are usually stronger in terms of 'process aspects'. These strengths can be brought together in a single study (Cassell and Symon, 1994; Punch, 1998).
- Quantitative research is usually driven by the researcher's concerns, whereas qualitative research takes the subject's perspective as the point of departure. These emphases may be brought together in a single study (Warwick and Osherson. 1973; Punch, 1998).
- A qualitative study can be used to help explain the factors underlying the broad relationships that are established, whereas quantitative research readily allows the

researcher to establish relationships among variables, but is often weak when exploring the reasons for those relationships (Punch, 1998; May 2002).

- Many researchers have used a triangulation technique and utilised it effectively in investigating organisational studies (for more information see: Hofstede *et al.* 1990; Adebanjo and Kehoe 1999; Maull and Brown 2001; Harris and Crane, 2002; Marshall and Sheaff, 2002; Payne et al. 2002; Rob and Zemsky 2002).

The bulk of the primary research conducted for this study generated quantitative data. Documentary analysis and questionnaires were used to obtain the required data. Marsh (1979) insists that a survey is not synonymous with a particular technique of collecting information; questionnaires is widely used but other techniques such as structured and in-depth interviews, observation, content analysis etc. are also appropriate. De Vaus (1993, 3) stated that a survey is characterized by a structured or systematic set of data, which can be called a variable or case data matrix. Because questionnaires are the easiest way of ensuring this structured data matrix it is the most common technique used in survey research, therefore questionnaires were used in this study.

3.4 Selection of the population and sample

This research, in common with other social research, has many limitations such as time, capacity, and cost. Because it is impossible to pursue the entire population, a selected sample is considered sufficient and representative. First, the population frame is clarified and then a sample frame selected.

The population frame covers pupils attending secondary girls and boys schools in Riyadh. The total population was estimated at 14468 pupils for girls and 11113 pupils for boys, giving a population total of 25581 pupils in the third phase of secondary schooling in Riyadh (AEBRD; AEGRD, 2002). Before selecting and choosing a sample frame, it is important to explain the main types of sample in order that we can choose a suitable one to be used in the methodology. Sampling can be divided into two types: a probability sample and a non-probability sample.

First, the probability sampling is a sampling design in which elements of the population have some likelihood of being selected as participants (Cooper and Schindler 2003, 183). The literature on research methods suggests five kinds of probability sampling: 1) Simple random sampling (SRS), this kind of sample is actually used when a population frame is available, and every member of the population has an equal probability of selection. The selection sample frame is random selection. This stage is actually done after preparing a list of the population. It offers great scope for making generalisations from the findings because of each individual has the same chance of selection; 2) Cluster sampling, this is used when a sample frame is not available. Clusters may be by organizational level, or geographical area, etc. The costs of data collection from using this approach are low; 3) Stratified random sampling, this is based on a random selection, but differs from random and systematic as it is used when the population is non-homogeneous. For example, suppose a researcher wishes to work out the average home to school distance to each type of schools in his/her group which consists of primary, intermediate and secondary education. They could divide up his/her group into the three sub-groups and take samples from each; 4) Systematic sampling, this is a simple and a straightforward alternative to random sampling which gives good results. It requires a complete listing of individuals in the form of an exhaustive sampling frame (like the random sample) but, instead of using a table of random members, the sampling procedure involves drawing individuals at regular, predetermined intervals from the sampling frame. It is easy to use if a population frame is available, but systematic bias is possible. ; and 5) Area sampling, this is a cluster sampling within a particular area or locality. It is cost-effective as it is related to a local area or a target community, it takes time to collect the data (Dyer. (1995); Bryman and Bell (2003, 495-516) and Sekaran (2003)

Second, in non-probability sampling, the sample is selected in such a way that the chance of each unit within the population or universe being selected is unknown. Indeed, the selection of the subjects is arbitrary or subjective (Cooper and Schindler 2003, 184). According to Cavana et al. (2001, 262-265); Dyer. (1995); Bryman and Bell (2003); and Sekaran (2003) the non-probability sample has two types: 1) Convenience sampling, in this type of sampling the most easily accessible members are chosen as subjects and there is no generalisation involved. Its attractive features are that it is quick, convenient, and cheap (Sekaran 2003, 2) Purposive sampling, it has two kinds: the opportunity sample that consists of those who are willing to take part in the research at the time that sample is being put together, and the judgment sample in which the researcher judges and decides a target sample.

Regarding the above presentation of a population frame and the various kinds of sample frames, a satisfactory sample frame can be selected by using a probability sample: particularly by using a simple random sample of 33 percent from all pupils in each school. Borg *et al.* (1996, 289) stated "collecting data from participants in a sample about their characteristics, experiences, and opinions in order to generalize the findings to a population that the sample is intended to represent". Moreover, Moser and Kalton (1993, 3) indicated that the purpose of conducting surveys is to explain relationships between a numbers of variables. Then, a selected sample should be taken to satisfy the need for generalizing results, and be convenient for using GIS in drawing the catchment area. Table below (3.1) shows the confidence level of choosing a sample of each population.

Table 3.1 Framework of sample determination

Error		1%		3%		5%	
Confidence level		95%	99%	95%	99%	95%	99%
POPULATION	1000	More than 500	More than 500	More than 500	More than 500	278	400
	2000	More than 1000	More than 1000	696	959	322	498
	3000	More than 1500	More than 1500	787	1142	341	544
	5000	More than 2500	More than 2500	879	1347	357	586
	10000	4899	More than 5000	964	1556	370	622
	50000	8057	12456	1045	1778	381	655
	100000	8763	14229	1056	1810	383	659
	500000 Or more	9433	16056	1065	1836	384	663

Source: Al-Qahtani *et al.* 2000.

According to the above table, because the confidence level is 95 percent, the sample size is 384. This is sufficient to investigate the relationships and the differences. The error desired is 5 percent under the confidence level of 95 percent. This is the fewest number of cases that are required, but more then 384 cases is better.

Power and Sample Size (PS) is one of a number of computer programmes that can be used to investigate the sample size. It is an interactive programme, which performs the necessary power and sample size calculations. The programme runs on the Windows operating systems (Dupont and Plummer 2003) . Moreover, it is possible to use a web-based sample calculator, such as Pearson, which is both a web-based calculator and a survey-system calculator[1]. The latter was used to determine the sample size for this thesis. The calculation helped to answer two questions:

- How many completed surveys are required to take a reasonably accurate view of the entire population?
- How confident can we be that the collected information is representative?

  These steps were followed in order to determine how many completed surveys were necessary to:

- Determine the population of interest (all pupils in their third secondary academic year).
- Determine the confidence needed that the results are representative. A common rule of thumb is 95 percent confidence so that the results are accurate to within +/- 5%.

By entering the above two numbers in the calculator it is possible to estimate how many completed surveys are needed for this population. The "uncorrected" confidence interval is for data that is not a continuous, normal distribution. Please note that these suggested sample sizes simply indicate whether or not there are enough respondents to be representative of the chosen population. This is not the same as statistical power, which indicates if the sample is large enough to determine differences between groups or identify relationships through correlations. According to the Pearson calculator, in Figure 3.2, 378 pupils are enough as a sample size for this research. The GIS system requires a target number of completed surveys. The sample sizes above are suggested, and are sufficient to help in determining differences between groups or identify relationships through correlations.

1 See: (http://www.pearsonncs.com/research-notes/sample-calc.htm Accessed 1.2. 2003

Figure 3.2 Prototype of the web-based Pearson calculator

Sample size required if desired confidence interval and population size are known (p=.5)		
Please enter a number in the Error Desired and Population Size fields then tab out of those fields to calculate. Do not use commas or other formatting characters:		
Error Desired:	5%	
Population Size:	25581	
	Sample Needed	Uncorrected
@90% Confidence:	269	272
@95% Confidence:	378	384
@99% Confidence:	647	664

However, 384 or 378 instruments are not sufficient for use with GIS. Because information on where pupils were living was limited, and in view of the desirability to achieve optimum catchment areas for (each or a new) school, the number of returned questionnaires was vital. The sample of 1/3 of population (25581*0.33) was decided as sufficient for GIS data analysis.

The below table illustrates the population, sample, pilot study, distributed questionnaires, collected questionnaires, response rate, and the questionnaires entered to the SPSS programme, split between boys and girls. The total population was 25581 pupils, composed of 14468 girls and 11113 boys. Some 8441 pupils were randomly selected from this population (3667 boys and 4774 girls). The age range of the selected pupils in the sample is between 17-19 years old. Subsequently, 329 questionnaires were distributed in the pilot study (165 to boys and 143 to girls), 288 of them were returned and 8133 were distributed in the main survey (3502 to boys and 4631 to girls).

Table 3.2 Details of the target population and sample

		Girls	Boys	Total
Population and Sample	Population	14468	11113	25581
	Sample (0.33 of the population)	4774	3667	8441
Pilot study	Selected	143	165	329
	Distributed	143	165	329
	Collected	127	111	238
	Excluded	4	6	10
	Ready to be entered in SPSS	123	105	228
Main survey	Selected	4631	3502	8133
	Distributed	4631	3502	8133
	Collected	2351	2198	4549
	Excluded	23	12	35
	Response Rate	0.51	0.63	0.56
	Ready to be entered in SPSS	2328	2186	4514
SPSS data	From Pilot study	123	105	228
	From main survey	2328	2186	4514
	SPSS (total)	2451	2291	4742

In all, 4549 of them were returned (2198 from boys and 2351 from girls). The response rate for the whole sample is therefore 56 percent (51 percent of girls and 63 percent of boys), which is considered acceptable. Before entering the data to the SPSS, 35 instruments were excluded (12 from boys and 23 from girls). Then, data from 4514 instruments was entered to the SPSS program (2186 from boys and 2328 from girls). In the end, 4742 usable responses were inserted (4514 from the main survey; 228 from the pilot study). Tables 3.3 and 3.4 display the population, sample and the response for each school.

This main focus of this study does not require an in-depth comparison between nationalities, age groups and parental incomes for the following reasons. The nationality variable is not applicable since non-Saudis are not significant to this study as a result of their lower percentage in the public school population. Also, in some cases they enrol in the private schools. For the age variable, there are no such age groups presented in this study because only one year group is taken (secondary third grade). Finally, for the parental incomes variable, there are no clear big differences in incomes in the city, they are all considered middle class. So, no comparisons could be performed. Finally, an in-depth analysis of such variables is not the main scope of this research

Table 3.3 Distributions of respondents for each Secondary Girls School setting

School	Population	Sample	Response	School	Population	Sample	Response
1	67	22	19	47	309	102	53
2	224	74	38	48	111	37	16
3	177	58	32	49	171	56	24
4	122	40	21	50	185	61	43
5	129	43	23	51	106	35	19
6	186	61	33	52	135	45	24
7	224	74	19	53	274	90	48
8	98	32	17	54	145	48	26
9	259	85	35	55	212	70	35
10	216	71	31	56	159	52	27
11	111	37	19	57	39	13	15
12	86	28	18	58	128	42	19
13	89	29	15	59	325	107	45
14	279	92	40	60	199	66	33
15	85	28	16	61	154	51	49
16	132	44	25	62	94	31	18
17	294	97	25	63	152	50	25
18	135	45	27	65	97	32	21
19	120	40	20	66	63	21	15
20	54	18	15	67	182	60	26
21	225	74	33	68	174	57	27
22	107	35	17	69	112	37	17
23	192	63	35	70	158	52	27
24	160	53	31	71	131	43	22
25	155	51	22	73	150	50	25
26	75	25	16	74	150	50	21
27	259	85	46	75	223	74	41
28	225	74	33	76	276	91	42
29	128	42	20	77	88	29	19
30	195	64	34	78	185	61	28
31	95	31	31	79	68	22	21
32	225	74	35	81	96	32	16
33	365	120	36	82	122	40	26
34	77	25	20	83	73	24	16
35	122	40	23	84	210	69	38
36	60	20	15	85	155	51	26
37	155	51	20	86	259	85	38
38	217	72	40	87	209	69	41
39	180	59	25	88	82	27	13
40	282	93	51	89	103	34	15
41	176	58	32	90	83	27	19
42	205	68	27	94	80	26	14
43	202	67	32	137	175	58	27
44	127	42	22	146	35	12	15
45	116	38	22	118	102	34	22
46	291	96	33	337	26	9	15
Total					14468	4774	2451

Table 3.4 Distribution of respondents for each Secondary Boys School settings

School	Population	Sample	Response
Abd Al Aziz Bin Baz	209	69	41
Abd Alah Bin Saud	94	31	20
Abd Alrihmam Bin Mhdi	167	55	35
Abdalzeiz Bin Mohammed	98	32	18
Abd Alruohmam Alghafegy	190	63	35
Abi Bakar Al Arabi	179	59	39
Abi Bakar Al Makhzumi	185	61	22
Abi Tamam	172	57	40
Abn Abi Hatim	104	34	19
Abn Akeal	146	48	31
Abn Almunther	70	23	18
Al Adrece	125	41	24
Al Albani	276	91	35
Al Arid	189	62	34
Al Emam Al Losi	206	68	46
Al Gadisiah	189	62	19
Al Harawi	138	46	18
Al Jawhary	125	41	37
Al Jazeera	172	57	38
Al Jowini	253	83	61
Al Madain	183	60	37
Al Mawrdi	190	63	42
Al Muotamad Bin	130	43	27
Al Najashi	70	23	15
Al Riyadh	161	53	35
Al Ruodwan	281	93	48
Al Shawkani	252	83	58
Al Shuora	301	99	53
Al Sidiq	209	69	37
Albiruni	236	78	53
Aleiz Bin Abd Alsalam	179	59	40
Alhasan Bin Ali	119	39	22
Badar	194	64	56
Balat Alshuhada	275	91	53
Alfaisal	112	37	31
Al Faruq	189	62	37
Fisal Bin Fahad	96	32	22
Gasim Bin Salam	40	13	15
Gortubah	247	82	47
Hafid Hakami	14	5	15
Irgah	28	9	15
Jabal Tariq	132	44	21

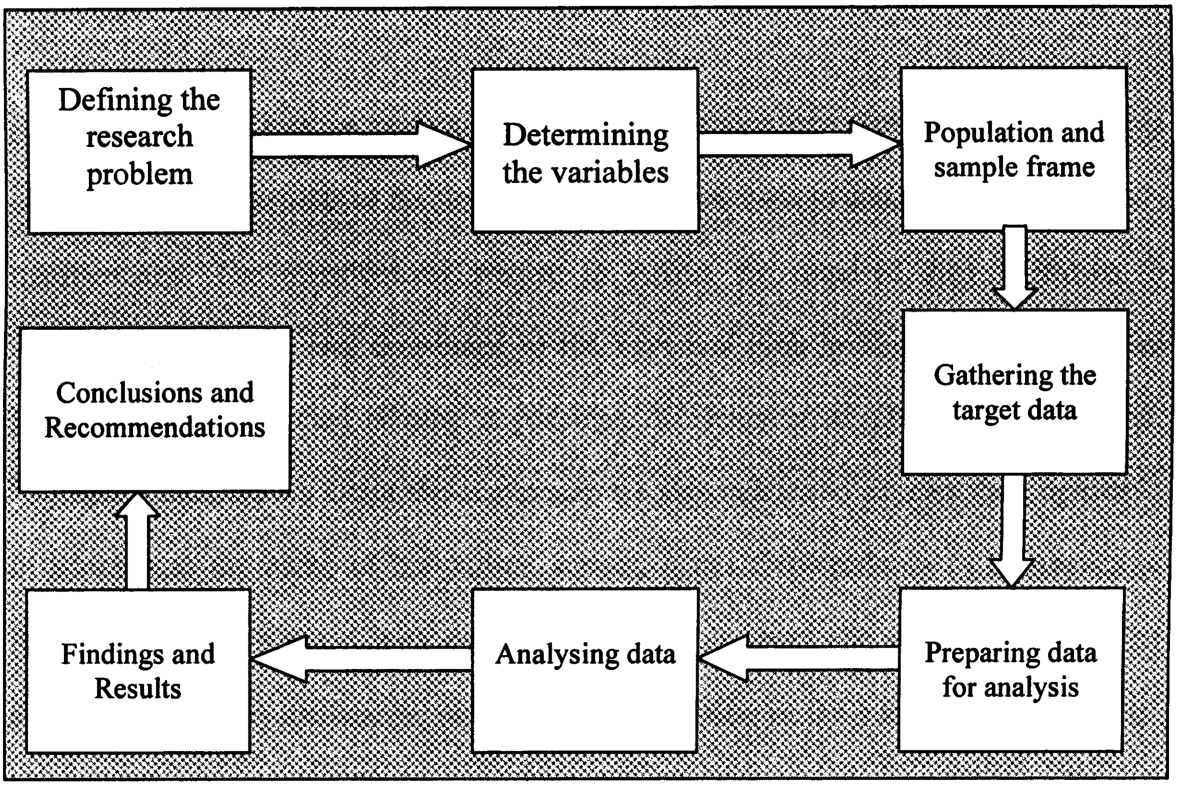
Table 3.4 Distribution of respondents for each Secondary Boys School settings

School	Population	Sample	Response
King Abd Al Aziz	135	45	43
King Fahad	135	45	30
Mahad Al Asemah	150	50	25
Mahmuod Alghaznay	196	65	23
Mohammed Alfateh	125	41	16
Mohammed Bin Saud	64	21	21
Mujama Prince Salman	147	49	42
Mujamaa Al Ulian	202	67	57
Mujamaa King Saud	178	59	43
Mujamaa Prince Sultan	217	72	38
Musa Bin Nusair	98	32	32
Nadheem	255	84	27
Nahawend	246	81	39
Najed	223	74	52
Prince Salman	165	54	38
Al Quds	140	46	34
Alsafrat	129	43	28
Seqleah	240	79	46
Al Shafa	140	46	46
Al Shatibi	235	78	19
Al Sulaimaniyah	94	31	22
Tuolitelah	66	22	17
Al Ulayah	85	28	28
Uthman Bin Ass	137	45	27
Yagut Hamawi	37	12	15
Al Yamamah	205	68	47
Al Yarmouk	144	48	27
Total	11113	3667	2291

3.5 Research Design

To gain sufficient data for the research to have validity, the design strategy chosen and adopted is the survey strategy. Information from hhe questionnaires and documents are combined to answer the research questions and achieve the research target.

Figure 3.3 Action Plan for solving the research problem



3.6 Questionnaire design

As mentioned above, the structured questionnaire was the method selected to help solve the research problem. Frazer and Lawley (2000, 3) and Bryman and Bell (2003,495-516) state that there are four possible types of questionnaire delivery. 1) The mail questionnaire, this is considered cheap in comparison with other kinds of questionnaire. The speed of data collection is considered high, there is no interview bias in using it, but it has a low response rate; 2) The personally administered questionnaire, the speed of data collection is immediate and the response rate is very high but it has high costs, the amount of data that can be generated is very low, and there is a high interview bias; 3) The telephone questionnaires, this is moderate in cost and immediate in collection speed, but has a medium interview bias and a moderate response rate; and 4) The internet questionnaire, its cost is very low, the speed of data collection is fast, the ability to reach geographically dispersed segments is very high, it has no interview bias, and a moderate response rate.

A review of the literature pertaining to school locations revealed a number of ideas covering different aspects of the field. These data were used to construct the main study questionnaire. The questionnaire chosen to collect the required data is shown in Appendix (B), which was distributed to the boys and girls in Riyadh. The five-point Likert scale was selected because it provides, as Henry *et al.* (1998, 96) suggested, "Sufficient alternatives along the continuum for respondents to express their opinion". In addition to the name of the current school, it has five sections: 1) Demographic factors, this is concerned with personal information about the respondents: current academic year, age, nationality, number of people living in the current house, parents' highest educational qualification, number of people living with respondents who can drive cars, the number of cars owned by the family and the total household monthly income; 2) The address, name of the neighbourhood, name of the street, and the house number; 3) Means of transportation, availability of transportation e.g. walking, private family car, hire car (taxi) public transport, travelling time and means of transportation from home to school, and travelling time and means of transportation from school to home. Those actually using school transportation were asked to indicate their perception

of the status accorded to the different modes. This investigation relies on the following criteria: crowding, comfort, air-conditioning, standard of drivers, and punctuality. A five-point Likert-scale shown below was used to acquire the information (crowding is used as an example in the below scale).

Not crowded at all	Crowded to some extent	Crowded	Very crowded	Extremely crowded

Those not actually using the school transportation were asked about their monthly budget estimate for their chosen mode of travel; 4) Choosing the school, this section is concerned with discovering who it is in the family who makes the choice of the secondary school for students. There are five options: students, father, mothers, brother and family. Respondents were also invited to indicate which factors they regarded as important in their choice of current school. The proposed factors were good learning environment, caring environment, proximity to home, respondent's friends, relatives (sisters at same the school), safety size of school, management, convenience of access, facilities, reputation, policy on discipline, extra-curricula activities, examination results, happy environment, enthusiasm of teachers, quality of teaching and local environment. The following five-point Likert-scale was used to find out these factors.

Not important	Limited mportance	Important	Very important	Extremely important

and 5) Grade, the final grades of respondents in the last academic term of the current academic year (1423-1424 H) were assessed in accordance with the following scale: excellent, very good, good, satisfactory and fail. This assessment is based on the schools grades.

3.7 Interviews

Interviews were used to collect information from Ministry of Education officials. There are three types of possible interview: 1) The fully structured interview, this method is concerned with a systematic approach for gaining data. It actually requires pre-

preparation of materials, planning and time as well, so the intervention of the interviewer is minimal. The use of mainly open-response questions is the only essential difference from an interview-based survey questionnaire (Robson 2002, 270). It is simple to analyse as tick-boxes can be used to record responses and interviewers do not need to be trained; 2) The semi- structured interview, this is not so closed and offers more scope for intervention by the interviewer. By using this kind of interview the researcher can present and provide his/her opinion better than in a structured interview. It may be considered as a conversation interview. Inappropriate questions can be changed or omitted (Robson 2002, 270). A semi-structured interview involves a series of open-ended questions based on the topic areas the researcher wants to cover. There is a great deal of flexibility, as the order/actual working of questions is not determined in advance; and 3) The unstructured interview, Robson (2002, 270) presented his concept of the unstructured interview. It has very little structure, is non-standardized, open-ended and in-depth. It is related to specific topics, has no clear structure, and can be completely informal when the interviewer has a general area of interest.

As stated in Chapter One, the semi-structured interview was used to collect the data needed and for generating data from different sources as suggested by Mason (2001). The degree of structure in an interview varies from study to study according to King (1994). He chooses the term "qualitative research interview" to give more flexibility to the interview. Five interviews with officials from The Ministry of Education were undertaken. The questions sought to elicit information on the spatial distribution of secondary schools in Riyadh, transportation issues, school capacities, ideal distances, procedures and enrolment regulations, the criteria to determine the location of school and the criteria for opening new schools. These were the main items of face-to-face interviews used to support analysing the data (see Appendix C).

3.8 Pilot study

The first step in developing the questionnaire is to undertake a pilot study, which tests the design of the questionnaire and clarifies the wording of the questions, the number of the questions, the instructions, and the presentation. The pilot study actually helps to determine if the respondents can understand the language in which the instrument has been written (Arabic Language see Appendix D). Moreover, the time needed to complete the questionnaire has to be assessed since the quality of responses may quickly decline if the questionnaire is too long and thus invalidate the resulting data (Kitchin and Tate, 2000:219).

Five schools were selected randomly. These schools numbers were (50, 31 and 61) for girls and (Balat Al Shuhada, Najed) for boys. Also included were 228 pupils out of the 8441 randomly selected (See Appendix E; F and G). Through their school principals and managers they were given copies of the instrument. Participants were asked in the covering letter to express their opinions on the level of importance which they attached to each of the items incorporated in the survey. These pilot study pupils were excluded from participating in the main study. Thus, 8441 pupils (8441-228 = 8213) subjects were included in the main study.

After three working weeks from the date on which the questionnaires were distributed (April 02, 2003), and as a result of a daily follow up, the researcher was able to collect all of the 228 instruments distributed to the members of the pilot study. The main results of this study are:

- completion time was roughly 12 minutes for the whole questionnaire;
- outlines were clear and acceptable;
- presentation was satisfactory;
- all items were answered;

- participants understood the wording of the instrument; and
- having ensured that the questionnaire was reliable, it was consequently distributed to the girls and boys.

3.9 Main survey management

The following measures were taken to maximize the response rate:

- The questionnaire was translated into Arabic because the respondents do not speak English with sufficient fluency.
- The researcher visited the boys schools more than once to attempt to contact their managers and the girls schools were visited by the researcher's wife.
- A sample frame list was prepared before visiting any school.
- Distribution proceeded according to the action plan.

As ascertained by Al-Ansri (1995, 122), "Postal services in Saudi Arabia are not reliable" so these 8213 questionnaires were distributed by the drop-off and pick-up method. In other words, the researcher had to hand in questionnaires to the AEGRD and AEBRD, and ask them to distribute them to the respective participants and pick up the returned instruments from the Administration on a daily basis. To ensure confidentiality, a covering letter was attached to the questionnaire (See Appendix A: the Secondary School spatial distribution survey) and distributed to each randomly selected

individual with instructions as follows:

- One copy of a questionnaire survey written in Arabic;
- Please respond to each of the questionnaire statements following the instructions given at the top of the questionnaire;

- Please try your best to complete the questionnaire and return it within two days; and
- If you have any questions you can ask the manager of the school or call me by phone.

By the end of two weeks, the percentage of returned instruments was not encouraging, so the researcher decided to send reminders to those schools had not returned their instruments. These reminders, sent in the third week of the data collection period, were meant to remind participants that the time allocated to the data collection phase was about to end. It seemed that such an intervention was helpful because there was an improvement in the number of returned instruments. By the end of the fourth week, the majority of school managers were absent from their schools or having a vacation during distribution the questionnaires. This was especially true for girls schools and therefore they were sent another reminder. Fortunately, the researcher assigned documents to each school so it was easy to identify which school needed further intervention. For example, some managers, particularly those at Safarat Secondary School for boys and the Forty Six Secondary School for girls, were totally uncooperative. They had not returned a single instrument by the end of the data collection period so the researcher met with the director at AEGBD and AEGRD and informed him about the situation. The director said that he would call them or send a message to persuade them to respond. A meeting was called which the researcher explained the purpose of conducting the study and the importance of their participation. At the end of the meeting the director promised he would require the schools to press people to respond. As Jackson and Furnham (2000, 78) suggested, "There is no universal acceptable response rate since it depends upon so many other factors". They also added, "A response rate of less than 35 percent might be considered unacceptable". Taking into consideration these responses with other studies, particularly those conducted in Saudi Arabia, indicates that the response rates of this study are very acceptable. At-Twaijri and Woodworth (1996), who conducted a study to evaluate corporate mentoring in Saudi Arabia, reported an overall response rate of 36 percent. At-Twaijri and Woodworth (1996, 26), stated that, "a response rate of 36 percent is considered excellent for surveys of this type in Saudi Arabia". So, 56 percent returned is very acceptable.

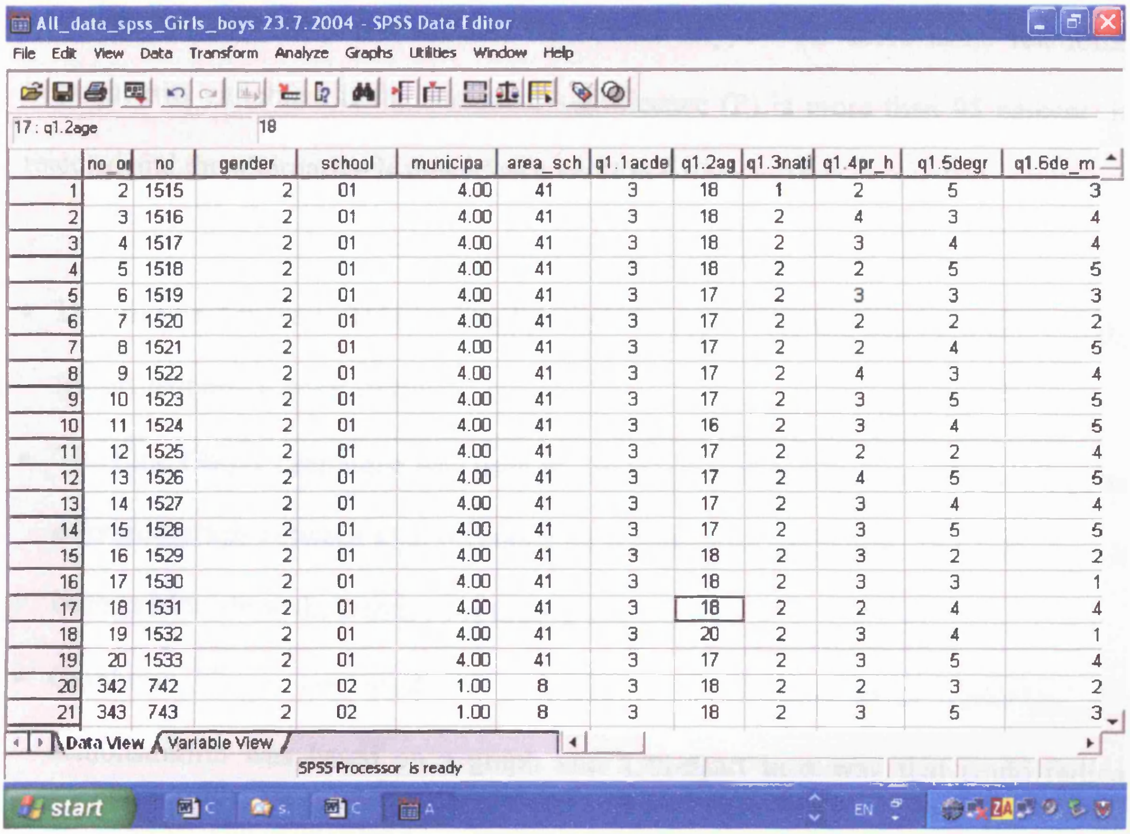
3.10 Preparation of data for statistical analysis

The questionnaires were checked fully and twenty-three questionnaires were eliminated because less than 50 percent of questions were answered, particularly those questions on the main factors that impact on the choice of schools. Twelve questionnaires were also eliminated because the answers were not clear. These 35 questionnaires are not counted in the overall response of 4742 cases. After all questionnaires had been checked, the data set was entered into the SPSS-11 (Figure 3.4). Coding the questionnaires is required at this stage, because the SPSS program is based on "Numbers", so each variable should have a coding number. For example - gender: boys are represented with a 1 and girls with a 2. The data were entered by a commercial company in and the researcher checked the entries afterwards.

Before checking the data, it is important to run the frequencies of all the variables. This descriptive statistic helps in determining the data error, and then it is easy to clean them.

The cleaning involved comparing the values entered and the real responses in the questionnaires according to their serial numbers. As a result around 47 mistakes were found and corrected.

Figure 3.4 An example from SPSS interface



	no_or	no	gender	school	municipa	area_sch	q1.1acde	q1.2ag	q1.3nati	q1.4pr_h	q1.5degr	q1.6de_m
1	2	1515	2	01	4.00	41	3	18	1	2	5	3
2	3	1516	2	01	4.00	41	3	18	2	4	3	4
3	4	1517	2	01	4.00	41	3	18	2	3	4	4
4	5	1518	2	01	4.00	41	3	18	2	2	5	5
5	6	1519	2	01	4.00	41	3	17	2	3	3	3
6	7	1520	2	01	4.00	41	3	17	2	2	2	2
7	8	1521	2	01	4.00	41	3	17	2	2	4	5
8	9	1522	2	01	4.00	41	3	17	2	4	3	4
9	10	1523	2	01	4.00	41	3	17	2	3	5	5
10	11	1524	2	01	4.00	41	3	16	2	3	4	5
11	12	1525	2	01	4.00	41	3	17	2	2	2	4
12	13	1526	2	01	4.00	41	3	17	2	4	5	5
13	14	1527	2	01	4.00	41	3	17	2	3	4	4
14	15	1528	2	01	4.00	41	3	17	2	3	5	5
15	16	1529	2	01	4.00	41	3	18	2	3	2	2
16	17	1530	2	01	4.00	41	3	18	2	3	3	1
17	18	1531	2	01	4.00	41	3	18	2	2	4	4
18	19	1532	2	01	4.00	41	3	20	2	3	4	1
19	20	1533	2	01	4.00	41	3	17	2	3	5	4
20	342	742	2	02	1.00	8	3	18	2	2	3	2
21	343	743	2	02	1.00	8	3	18	2	3	5	3

The reliability coefficient (Cronbach alpha) was calculated to ensure that the seventeen items for choice of schools were consistent with each other (Brown 2002). More details on the process are presented in Chapter Seven.

3.11 Analysing the survey data

The survey used has two features: data from the questionnaire, which was entered into SPSS and analyzed through appropriate statistical tools, and data from face-to-face interviews.

3.11.1 Analysing the questionnaire data

Only a few statistical techniques were applied to analyse the data through the use of the Statistical Package for the Social Sciences (SPSS, version 11). Before presenting these statistical tools, the significance testing level should be clarified. In the Spearman, Correlation and Chi-Square tests the statistically significant probability is 95 percent with an error rate of 5 percent. So, for the null hypothesis there is no relationship between two variables. If the statistical significance (P) is more than 95 percent, it is rejected and the alternative is treated as a valid hypothesis. These statistical tests are:

- Descriptive Analysis: This is actually used for describing the demographic variables (Bohnstedt and Knoke 1981).
- The Line Graph Technique was used to explore whether there is a consistent pattern of relationships between total revenue and spending on education. This technique has been used to show the trends over time or categories[1].
- Graphics: These are used to demonstrate the demographic variables. This demonstration was based on a graph and a bi-chart in a way that could indicate respondents' characteristics.
- The Mann-Whitney Test: This test is a non-parametric equivalent of the independent samples t-test. It was used to see the extent to which the results achieved by applying this test to our data are in agreement with the results of the independent samples t-test. Because the Mann-Whitney test is about 95 percent as powerful as the t-test this means that the t-test requires 5 percent fewer participants than the Mann-Whitney test to reject the null hypothesis when it is false. Thus if the results of these two tests, the independent samples t-test and the Mann-Whitney, are different, the results of the latter will be used to decide the fate of our null hypothesis (Siegel and Castellan, 1988). The reason for the use of the Mann-Whitney U-test results is that this test does not require, as suggested by Gravetter and Wallnau (2000, 647), homogeneity of variance or normal distributions. Moreover, the Mann-Whitney U-test, is less affected by extreme points compared with the t test

[1] Excel and SPSS graphics

- The Chi-square Test. A comparison between two or more groups on a response variable that is categorical in nature can be done by using a Chi-square Test (Cohen et al. 1989). It is also considered a non-parametric test.
- Correlation is used to explore the associations between variables. Correlation analysis can be classified into two groups: exploratory analysis, which is used where little or no previous work has been undertaken, and prediction analysis which can be used where ample empirical evidence has been established (Miller and Salkind,2002); Cohen, Manion and Morrison (2000); Clark-Carter (2001,334) and Cohen, Manion et al. (2000,199).
- The pearson's *r* test is considered a parametric test. It is used to explore whether there is a linear relationship between variables. Correlation coefficients vary between –1.00 and +1.00; any value close to 0.00 means there is no relationship between the variables. Any value close to +1 indicates a positive relationship, and any value close to –1 signifies a negative relationship. A negative correlation coefficient indicates, therefore, that the two variables co-vary in opposite directions while a positive correlation coefficient suggests that the two variables co-vary in the same directions.

Many researchers categorise the values of r into groups in order to gauge the estimated degree of a relationship between two variables. First, Cohen and Holliday (1982) suggested the following categories: 0.19 and below is very low; 0.20 to 0.39 is low; 0.40 to 0.69 is modest; 0.70 to 0.89 is high; and 0.90 to 1.00 is very high. Second, Cohen (1988) prefers to use the following categories: 0.10 and below constitutes a small r, 0.30 is a medium r and 0.50 plus is a large r.

3.12 The GIS techniques

The GIS techniques were used to illustrate the spatial distribution of secondary schools in Riyadh city. They included location-allocation and catchment area concepts and GIS, mathematical and statistical techniques.

3.12.1 Location-allocation

Generally, calculating the average distances travelled by pupils to reach their current schools assesses the geographical accessibility. However, geographical efficiency is estimated by comparing the actual with the optimal average distances. An important question here is: what is 'optimal' and how can it be identified? The answer may lie in the analysis of the location of schools. If optimality is defined in terms of geographical distance and demand (Ghosh; Rushton 1987; Rushton 1984 and Killen 1983), the main objective of location allocation models is to find out the 'optimal locations'.

In the present study, location-allocation models were run three times. Firstly, to identify the actual distances between home and secondary schools, secondly to examine the distribution of pupils for the purpose of identifying the optimal distance between home and school, and finally for the identification of proposed locations for additional schools.

3.12.2 Catchment area concepts and GIS

As mentioned previously, one of the main aims of this study is to draw a catchment area for each of the 161 schools, based on the current distribution of pupils in each secondary school in Riyadh in general and in the Oraija municipality in particular. The intention is to develop a master catchment-area map showing the actual and optimal spatial distribution of the girls' and boys' secondary schools. Therefore, the catchment area of a school to be reached on foot or by any others means of transportation is the maximum distance from pupils' home and closest school.

The data used here comes from the survey (questionnaire), which was distributed to the secondary schools in Riyadh. The information collected from pupils comprised full address details. The responses collected from boys come from 2291 households and from 2451 households for girls; of the total number of schools 69 were boys schools' and 92 were girls schools. They have been mapped as below.

- The study required maps of the city under investigation at an appropriate scale, a digital base map was produced by the High Commission for Riyadh Development (High Commission for Development of Riyadh, 2002).
- A number of schools were located on this map but most were not shown or were located on incorrect sites;
- The second map produced by the Ministry of Municipalities contains much information designed to determine the location of pupils' homes and schools and provides information such as the name of roads and neighbourhoods and public services.
- Application of x,y coordinates extension was used to relocate schools and fix the exact location of pupils' homes[1].
- Calculation and addition of a field to the database to include the number of students, owner of the building, the present number of teachers and classrooms, and the capacity of a school,
- Codification of points using a variety of measurements to ascertain the distance between home and school including the straight line distance technique. This is

[1] See: http://www.stauber.org/arcview.html Accessed 4.2. 2003

the line connecting two points with no curves or changes in bearing or direction[1]

- The geographic co-ordinates (latitude and longitude) were used to calculate the distance between the student's home and school. using. These calculation were then digitized by using a Microsoft Excel spreadsheet. This allowed measurement of the present distance between the location of pupils and schools within the study area and, as a second step, recalculation of the distance from the school nearest to the pupils' home. This technique is presented in Chapter Eight .
- A drawing catchment areas for schools by the use of extension Convex Hulls v.1.2. This extention generates a catchment area around a set of points, plotted to indicate the location of pupils' homes. These perform polygons representing the current area that contains all of the locations of the pupils. Convex Hulls can generate these polygons based on a set of selected points or sets of points with common attribute values obtained by using Arc View as GIS source layers (Jenness, 2004).

3.12.3. Using the strategy of case study

A case study process is used to investigate part of the research population. It is actually used when there are limitations in studying the whole population. It is a fact that case studies do not need to have a minimum number of cases, or to randomly "select" cases, for the researcher is called upon to work with the situation that presents itself in each case (Tellis 1997). Yin (1993, 4-5) listed suggestions for a general approach to designing case studies:

- Exploratory case studies, fieldwork, and data collection may be undertaken prior to definition of the research questions and hypotheses. This type of study has been considered as a prelude to types of social research.

[1] See: http://www.fairview-industries.com/surveyormodule/strln-surv.htm Accessed 1.2. 2003

- Explanatory cases are suitable for doing causal studies. In very complex and multivariate cases, the analysis can make use of pattern-matching techniques.
- Descriptive cases require the investigator to begin with a descriptive theory, or face the possibility that problems will occur during the project.
- Each of these three approaches can be single or multiple-case studies, where multiple-case studies are replicatory, not sampled cases., Yin (1994,38) stated that each case study is one of the following:
- The single case, which is ideally suited for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. Single-case designs require careful investigation to avoid misrepresentation and to maximize the investigator's access to the evidence.
- The multiple-case, which is used when the researcher can adopt the study through many cases (two or more cases). This method of investigation aims to improve the reliability of generalised results and to approximate more to real life. Each individual case study consists of a "whole" study, in which facts are gathered from various sources and conclusions drawn on those facts.

Both of them can be holistic or embedded. Holistic means studying the case or the multiple-case with a general investigation and embedded reflects the need for an in-depth analysis. The option of choosing one is based on the case itself and the limitations of time and cost. Furthermore, Yin (2003,21) identified five components of research design that are important for case studies:

- the questions of the study;
- the propositions, if any;
- analysis;
- the logical linking of the data to the propositions; and

- interpreting the criteria

It is important to select the unit of analysis, which is a critical factor in the case study. It is typically a system of action rather than of an individual or group of individuals. Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the system being examined. The selection of cases and the unit of analysis is developed in the same manner as the other types of case studies.

Case studies have been increasingly used in education, which has also embraced the case study for instructional use. According to the above, in presenting case study definitions of various kinds, protocol and design, and the research problem itself, it is better to choose a single-holistic case study relevant to the particular catchment area in Oriaja municipality, which has 8 schools for boys and 12 schools for girls. The Oraije municipality was selected for the present study for two reasons. First, there had been a rapid population growth since the government of Saudi Arabia started supporting citizens by giving free-interest loans to build new houses (as mentioned in Chapter Five). Unlike other municipalities, Oraija is considered one of the most attractive residential areas of the city. Secondly, the physical geography (i.e. mountains and valleys) of this municipality could easily affect parental choice on the siting of schools.

3.13 Conclusions

After presenting a clear view of the research methods used in solving the research problem, it is important to summarize these tools of research that actually help in gathering the related data and analysing it. There are five sections to the questionnaire; the most important one deals with the factors that have an impact on the choice of schools. There are seventeen variables, and they are represented with a conceptual model as independent variables and choice of school as the dependent variable. Mainly the quantitative method was used to solve this problem.

Before distributing the questionnaire, a clear frame of population and sample was presented. This sample created through probability sampling. The total population of this study is 25581 (14468 girls and 11113 boys) and the target sample is 8441 (4774 girls and 3667 boys). The returned questionnaires were 4803 (2476 from girls and 2327 from boys). The response rate for the whole sample is 0.56 (0.51 for girls and 0.63 for boys). The questionnaire consists of six sections: demographic factors, address, means of transportation, choice of school, and grades of the last year of respondents.

There were two strategies for data analysis. One for managing the survey through pilot-testing and the main survey distribution, and the second one dealing with analysis of the collected data. For analysis of the questionnaire data descriptive analysis, the line graph technique, graphics, Mann-Whitney Test, Chi-square Test., and Correlation and Spearman's rank difference coefficient (rho) were used.

CHAPTER FOUR

The Educational System in the Kingdom of Saudi Arabia

This chapter deals mainly with the system of education in the Kingdom of Saudi Arabia. It is divided into two parts; part one is concerned with an overview of educational policy in Saudi Arabia, and part two deals with the structure of the educational system.

4.1 An Overview of education policy in Kingdom Saudi Arabia

This section highlights certain points of the educational policy of Saudi Arabia. It considers the goals of educational development in the country and provides background information on Saudi culture, some historical background on education policy and the expansion of regional administration, and on the policies and aspects of the work of the Ministry of Education. Educational provision in Saudi Arabia distinguishes on the basis of gender reflecting the different for the types of education and the careers that people are trained to do. For girls, the education system focuses on how girls learn the traditions and become housewives to educate their children. They are also prepared to work in the education and teaching for girls. Some new careers are now being introduced, such as working in the hospitals and working in bank branches. For boys education, they are trained and educated to take up most of community jobs including police, military and other civilian jobs.

4.1.1 Introduction

In the Kingdom of Saudi Arabia, education in the broadest sense has been taking place since the seventh century CE. Islamic "Kuttab" schools existed in the western region (the Hijaz), in or near mosques, and were presided over by Muslim preachers. This type of education continued and spread and some Kuttabs admitted girls as well as boys, either in separate locations or, for children under six, together. The function of the Kuttab school was to study and memorize the Quran and other religious texts, which continue to be a central feature of much of the educational system of Saudi Arabia even today, and can be traced back to the approach of the Kuttab Schools. During the period of Ottoman rule in the Hijaz, government schools offered six years of education. Subjects included geography, history and even art in addition to religion, such courses were taught in Turkish. Many parents refused to send their children to these schools, fearing they would be conscripted into the Ottoman army (Alhaqil 1999, 11). They were also not satisfied with the limited education provided by the Kuttab Schools. In the nineteenth century, therefore, Hijazi merchants established private schools in Jeddah, Mecca and Medina, which offered a wider range of subjects in Arabic (Al-sallom 1995, 7-8).

Government control, one major feature of Saudi Education, started early and has continued to this day. In 1924, shortly after King Abdulaziz Al Saud had unified the country, he established a Directorate of Education and created government schools (Abd-Elwassie 1983, 65). At that time the four private schools in the Hijaz were put under the supervision of the Directorate. In 1938, the Directorate issued a regulation confirming that it had control over all educational matters in the Kingdom, except in the military academies. In 1953, the directorate became the Ministry of Education. In 1954 the first regional educational administrations were established in Riyadh and Jeddah. In 1955 more were opened in Mecca, Medina and other cities. By 1973 the number of educational regional administrations had reached 24. At present there are 42 separate educational administrations for boys and 36 for girls in the capital and the provinces. This structure is crucial for the management of educational information. The structure created in 1925 offered 6 years of elementary school. By 1958, the government had extended its provision to 6 years of primary education, and 3 years each for intermediate and secondary schooling. After this a separate higher education system was made available (Al-sallom 1995, 9-11).

At present, government control over education is exercised by several different agencies. The Ministry of Education supervises the schools for boys from the age of six to eighteen, from grade 1 through to grade 12. The General Presidency for Female Education, (GPFE), created in 1960, supervises schools from grade 1 through to grade 12, in addition to the coeducational kindergartens, pre-schools and the girls primary, intermediate, secondary schools and some colleges. The Presidency was abolished in 2002 (Al-Riyadh Newspaper 2002,12) and its responsibilities were merged with those of the old Ministry of Education to form a new Ministry: a Ministry of Education, which supervises boys and girls education at the primary and secondary level, and a Ministry of Higher Education, created in 1975, which supervises six of the seven Saudi universities.

In addition, the Counsel of Ministries supervises the Islamic University of Medina, whilst the General Organization for Technical Education and Vocational Training supervises the vocational and technical schools that have been created since the 1960s. In addition, the Ministries of Defence, the Interior and Social Affairs, and the National Guard, all supervise their own specialised training schools (Abd-Elwassie 1983, 22-26). Also, the few private educational institutions that exist at all levels are supervised by the relevant government agencies, which impose requirements relating to the curriculum and other matters.

The government of the Kingdom has placed emphasis on education under the global slogan "Education for all," and it has devoted considerable financial resources to that goal. The Ministry of Education's budget in 1947-48 was $3.1 million, but by 1954-55 it was $21.6 million, and by 1958-59 it was $50 million. By 1962-63 it was $78 million, and by 1966-67 it was $ 92 million (Rugh 2002, 40-55).

The major investment of the Kingdom of Saudi Arabia in its education system has enabled rapid and efficient growth of the education sector (Figure 4.1). Under its Fifth Development Plan, the Government spend on education in the first Five Year Development Plan (1970-75) of 666 million SR (1 Riyal SA = 3.75 US Dollars) rose to 12941 billion SR in 1975 (Al-Senbol *et al.* 1998). In the fourth Development Plan (1985-90) the Government increased its share of spending to 21294 billions SR, which was around 15.5 percent of total government expenditure (Ministry of Education 1992).

Figure 4.1 Expenditure on Education for the Kingdom of Saudi Arabia, 1970-2002

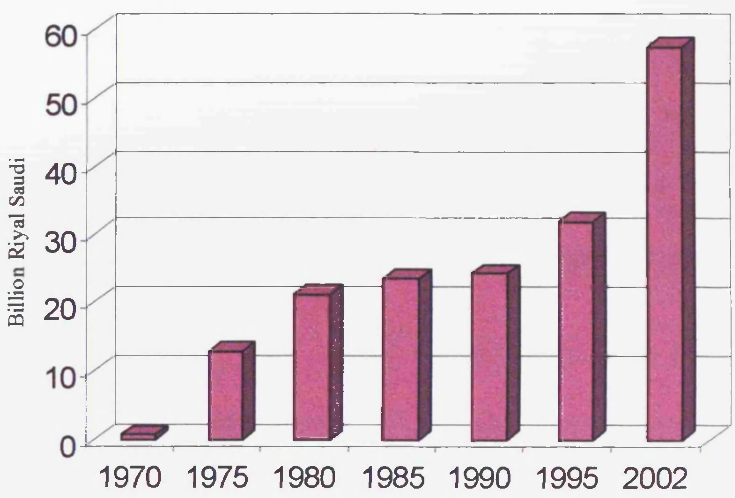


Table 4.1 Spending on education and the total number of Schools, Pupils and Teachers in the Kingdom of Saudi Arabia from 1970 to 2002

Year	Budget (billion SR)	Education budget		Total		
		Amount (million SR)	% Of the budget	Schools	Pupils	Teachers
1970	6780	666	9.8	2320	482958	20777
1975	110935	12941	11.7	4285	853253	44868
1980	245000	21294	8.7	7120	1184053	67235
1985	200000	23540	11.8	10799	1859497	125660
1990	158320	24214	15.5	12735	2537276	135018
1995	135000	31942	19.9	18428	3633499	274877
2002	157.000.000	57.500.000	27.5	26727	4338610	368007

Sources: Alhaqil (1999, 232); Ministry of Education (1994 2002); DCSS (1995 2002 Abin Dehish *etal.* (2002) and AEGRD (2002) (1422 H).

Table 4.1 above shows the increase in the number of schools during the period of the first five plans between 1970 and 1990 from 2320 schools to 18428 schools in 1995. Over that time the amount of spending on education and pupils increased, with a large rise in enrolments. At the same time, the total number of teachers increased from 20777 in 1970 to 368007 by 2002. On the other hand, the Sixth Development Plan (1995-1999) called for greater efforts to improve the quality of general and higher education and vocational training, and also focused on enabling Saudi schools, universities and training facilities to better meet the future needs of the country's increasingly sophisticated economy, by offering quality education, particularly in advanced fields of specialisation.

4.1.2 The Culture in Saudi Arabia

Culture can be defined as how groups of people live their lives (Assiri 2001, 26). The people of Saudi Arabia are Muslims and their culture can be clearly defined in religious terms. Islam is a complete way of life covering all aspects of human existence. Indeed, the obtaining and imparting of education and knowledge is an extremely important branch of Islamic culture and is given a position of very high status that is, without question, viewed holistically.

> "Islam dictates that learning is an obligation for every Muslim, man or women. This obligation, which gives education the status of a religious duty, is the cornerstone of education in the kingdom of Saudi Arabia. It is the foundation upon which the state builds its educational responsibilities, and in light of which, the citizen performs duties towards himself, his community, and his religion. The root of education in Saudi Arabia, therefore, goes deep into the Islamic education which started in the mosques and led to the establishment of schools and universities around their pillars"(Al-sallom 1995, 37).

A hundred percent of the national population believes in Islam. This has had a fundamental influence on the development of the Saudi education system. In the past religion played major and multiple roles in education and schooling as provider, legitimizer, and policymaker, influencing national educational policies, curriculum, and finance. It influences the type of schools students enrol in, the style and design of school, the type of education they receive, how long they stay in schools and the type of transportation means they use to travel to school. For example, many families do not permit their children to walk to schools, even if the distances are short. So they have to take them to school by public transport, if it is available or private transportation, if not.

Saudi Arabia's immense wealth stems from its oil and natural resources which offer enormous, almost limitless finances, enabling educational development to proceed unhindered. However, the spending of this wealth must be measured with parameters of knowledge and wisdom involved in its application (Johany; Berne and Mixon, 1986).

Another major Saudi resource is agriculture; the country has attained self-sufficiency in most food supplies. Livestock, poultry and fishing are also on the increase, with a thriving export trade. It is a misconception that Saudi wealth is merely oil-dependent. Agriculture, farming and fishing are other major sources of wealth for the Saudi Arabian economy (Ministry of Information, 2002). Hence all education development programs in Saudi Arabia must be considered of the needs of the above industries.

4.1.3 The objectives of educational development in Saudi Arabia

Saudi Arabia has its own aims to develop its education system. To achieve these aims, the Saudi government has implemented a number of five-year plans. On 1990, the Ministry of Planning (1990, 6) provided the following objectives concerning the system of education in Saudi Arabia:

- promoting the efficiency of the system;
- ensuring that the system fulfils the religious, economic and social objectives pursued by the Kingdom of Saudi Arabia;
- providing educational buildings and facilities;
- increasing the literacy rate among both male and female Saudi citizens;
- raising the awareness, efficiency and effectiveness of the professionals and administrators in the educational institutions in order to improve the standards of the content and processes in higher education institutions ;
- integrating the activities of the higher education institutions with the general and specific requirements of the social and economic development plans;
- broadening the general base of higher education by diversifying the programmes to cope with the Kingdom's development requirements;
- giving consistent support and encouragement to scientific research; and

- ensuring university education opportunities to every qualified citizens, in order to enable them to continue their education at all levels.

4.1.4 Education Policy

In terms of school education, the Ministry of Education has prioritised some of its policies (Ministry of Planning, 1990, 22). These aim at:

- providing primary education and beyond to all Saudi children through the prescribed years of state education;
- raising the intake capacity of teacher colleges in order to meet the requirements of development;
- raising the level and quality of teacher training in these colleges in order to increase their efficiency and qualifications;
- building more schools and implementing literacy campaigns in the Kingdom's regions;
- establishing adult education evening classes at intermediate and secondary stages;
- fostering and facilitating special education for the disabled, to include all types of disability;
- providing general libraries, including audio-visual libraries;
- reducing under-achievement and drop-out rates by raising the levels of education;
- developing exchange visits with Islamic, Arab and friendly nations in the field of education and culture; and
- developing new curricula and educational plans in teacher colleges in order to respond to the Ministry's future development objectives for the Kingdom.

4.1.5 Aspects of the work of the Ministry of Education

As we have seen, the Ministry of Education in the Kingdom of Saudi Arabia is responsible for the following types of education: general education that comprises the primary, intermediate, secondary schools, teacher training, special education, literacy and adult education as well. All types and levels of education in the Kingdom have witnessed a noticeable increase over the years in terms of number of students, teachers, and classes (see Table 4.1). This growth in the educational structure of the Kingdom has added a new burden of administration. Clearly, the administrative system has been unable to cope with the rate of developments. To overcome these problems, represented in the quantity, quality and equity of the distribution of its educational services, the Kingdom of Saudi Arabia has started to revise its systems and is proceeding with plans for further educational development. Although development was carefully designed, the plans have, in some ways, failed to achieve their full objectives because of a deficiency in information about the growth of the population. A lack of information also means that not enough is known about where school-age children are located. Schools, therefore, are often not in the optimum locations. From the discussion above, it is evident that the development of the Saudi education system has passed through a number of stages and different forms in its development. Recently, in order to impose development and coordination the Ministry of Education has assumed responsibility for developing the education system in Saudi Arabia.

4.2 The structure of the education system in Saudi Arabia

4.2.1 Introduction

As we have seen in the first part of this chapter, the provision of education is considered one of the government's main functions in Saudi Arabia. It employs highly qualified staff and is a major recipient of national expenditure. Many countries, particularly in the so-called developing world, have tried in the last three decades to expand education and to reform their curricula; this is in recognition of the importance of education for their economic and social development. This expansion in education has been accompanied by an expansion in administration, but in many cases management systems have failed to cope with the rapid rate of expansion, a matter that negatively affects the quality of education in schools (Al-Senbol *et al.* 1998, 86).To overcome these problems many countries, including Saudi Arabia, have revised their education systems. They have put in place plans for curriculum development, and have aimed to improve their education systems and to increase their outputs.

4.2.2 Levels and types of Saudi Education

The education system in Saudi Arabia has been subjected to systematic assessments. As a result, a number of changes have taken place. The most critical one was the integration of the boys and girls educational systems, bringing them under the control of a single administration, namely the Ministry of Education. A number of consequences have followed from this change involving budgets, school sites, employees, etc. It is important to highlight that the government controls the Saudi education system, and that it is the product of far-reaching, central strategic decisions. They have basically taken place as the result of numerous inside, small-scale efforts at the regional and institutional levels. The most important demographic reason for the structural changes to education is the increasing number of pupils who attend the schools. Between 1960 and 2002 the number of pupils in general schools rose from 118838 to 4338610 pupils, as seen in Table 4.2 below.

Table 4.2 Schools, pupils, and teaching posts in the Kingdom of Saudi Arabia

Stage	School		Pupils		Teachers	
	Male	Female	Male	Female	Male	Female
Primary Education	6267	6452	1200598	1114765	93025	103693
Intermediate	3506	2935	589654	507183	46685	47585
Secondary Education	1804	1784	407178	408734	28170	34678
Special Education	323	61	9862	4306	2774	1362
Adult Education	1101	2494	32465	63865	--	10035
Total	13001	13726	2239757	2098853	170654	197353

Source: Calculated by author based on summary statistics for male education, Computer Department, DCSS (2002) and for girls from AEGRD (2002) (1422 H).

Table 4.3 below shows the structure of the education system in the KSA, as provided by the Ministry and other government sectors such as the Ministry of Defense and Aviation, the Ministry of the Interior and the Ministry of Work and Social Affairs, which provide basic education to the children of their employees. Within the general education system in the KSA boys and girls are taught separately. However, the education of both boys and girls is the responsibility of the Ministry of Education. The system is organised over three stages. The official educational ladder begins at the primary stage, which is the base of the educational pyramid (kindergartens are not included here).

Table 4.3 Structure of education system

Age/years	Level	Age/year	Level	Age/years
				…
		…	Master and Doctoral	23+
				22+
4	Technical College (Boys)	4	University or College	21
3		3		20
2		2		19+
1		1		18+
3		3		17+
2	Technical education	2	Secondary	16+
1		1		15+
		3		14+
		2	Intermediate	13+
		1		12+
		6		11+
		5		10+
		4	Primary	9+
		3		8+
		2		7+
		1		6+
		Preliminary	Pre First Level	5+
		Nursery		4+

Children join primary education at the age of six and take six years of non-compulsory and free education, which may take place either in public or private schools. The basic education system (see Table 4.3) is divided into two stages. The first stage lasts for three years and provides a rounded education, with pupils taught by a single teacher who may, however, be assisted by others in specialist area; at this stage there are no examinations for pupils. The second stage also lasts for three years, and is organized around a unified curriculum, including a variety of vocational areas, with one teacher for each subject or group of subjects; at this stage there are examinations for pupils.

For the intermediate stage the student enters the school at the age of twelve after leaving primary school and studies for three further years. Intermediate education courses are three years in duration (corresponding to the 13th, 14th and 15th grades), and are open to students who have obtained the basic education.

Secondary schools mark the end of general education. Students who successfully complete the intermediate stage enrol here. Usually, they are fifteen years old and study for three more years. Students at this stage of education have the opportunity for both continued general education and specialized study at the same time, and thus can achieve university entrance standards (Ministry of Education 1986, 14).

Beside general education, the government has recently given great attention to technical and vocational education, with the aim of developing a well educated, technically skilled workforce. This strategy is underpinned by a framework of policies devised by the Manpower Council. Emphasis is given to the application of education in such fields as industry, agriculture and commerce. In the technical field, there are Industrial Secondary Institutes, Commercial Secondary Institutes, Agricultural Institutes, Postal

Secondary Institutes, Technical Supervisors' Institutes, Health Institutes and Telecommunication Institutes. At the next level up, there are also a number of Junior Colleges of Technology (Ministry of Information 2002, 48-50). Saudi Arabia has, at times, relied on its wealth to purchase skills from abroad in the form of skilled expatriate workers. This is no longer regarded as a desirable policy and, therefore, there is a need to train a more skilled domestic workforce.

The system of education in Saudi Arabia allows the individual to study at any time and at any age he/she wishes. This follows on from the policy of a non-compulsory basic education. The following facilities are also available:

- Centres for the combating of illiteracy: the learner joins these centres regardless of age. The duration of study is three years only. The first, second and third grades of adult education are equivalent, respectively, to the second, fourth and sixth grades of elementary education.
- Educational authorities organize summer campaigns to combat illiteracy in remote areas far from educational formal schools.
- Evening schools for males and day schools for females: the students in these schools receive an education which qualifies them to sit for the examinations of the Intermediate Education Certificate and the General Secondary Education Certificate, just as do the students in normal schools.

Special education, operated in the form of separate specialist schools, adopts a parallel line to the educational ladder of general education. Educational services are provided to students who are mentally, visually and audibly impaired. Special education is also separate for boys and girls. Special education for boy is administered by The Ministry of Education, and for girls is administered by the Girls Education Affairs. Vocational training and rehabilitation for the handicapped is the responsibility of the General Organization of Technical Education and Vocational Training

Moreover, the private education system in the Kingdom of Saudi Arabia supports public education at all its levels. Private education includes primary, intermediate, secondary and adult education. This is in addition to the institutes for the teaching of the English language. Private education contributes positively to developing the society and, at the same time, plays an active role by consolidating the economic structure of the country through preparing and training additional technical manpower.

4.3 Conclusions

This chapter has provided an overview of the education system in Saudi Arabia with specific reference to the policy and structure of the system. The aim is to provide a broader understanding of the education system in the country and thus clarify the context for further research. We have seen that some education, though limited, was being offered in Saudi Arabia as early as the seventh century CE and was then provided by the Islamic "Kuttab" schools.

A turning point in the provision of education in Saudi Arabia occurred after the unification of the country in 1924 when the government took control of the Saudi education system. This culminated in the establishment of the directorate of education and the subsequent creation of government schools. Since then, the government has endeavoured to expand the education sectors for both boys and girls. Later, in the early 1950s, the discovery and exploitation of vast oil resources proved to be another turning point in that this provided some almost limitless financial resources for investment in the education sector. Ever since, the expansion has been rapid in terms of pupils and students, teachers and physical facilities.

In the context of this research, we however note that the expansion and restructuring of the Saudi education system has not led to the achievement of the full potential of the system owing to some deficiencies in information. As a result, schools are often overcrowded, leading to the quality of education being compromised. Thus, one can conclude that this is an area that requires to be investigated to rectify the situation.

CHAPTER FIVE

The Population and Construction Growth in Riyadh

5.1 Introduction

One of the most striking features of Saudi Arabia's population is its highly uneven distribution. In almost every publication on population in the Middle East there is widespread criticism about Saudi Arabia regarding the scarcity and inaccuracy of data (El-Badry 1965). But gradually, as soon the Central Department of Statistics begun collecting and publishing national statistics, improved and reliable data are being available after mid 1960s.

The government of Saudi Arabia has so far conducted four censuses. The first official population census was undertaken during 1962 and 1963, but its results were never officially published. The Government considered the enumeration to have been largely incomplete and therefore regarded the figures as unacceptable. Nevertheless, for limited planning purposes, the Central Department of Statistics published some of its results for the cities of Jedda, Mecca, Medina, Al-Taif and Riyadh City. Government statisticians, using the output of this survey and of later investigations, arrived at an estimated total population figure of 3.3 million inhabitants. The second population census was carried out in September 1974. Detailed information was obtained about the age-sex structure of the Saudi as well as non-Saudi population; this permitted a calculation of average family size by district. But other pertinent data such as fertility and mortality rates in Saudi Arabia in general, and urban centres in particular, were almost entirely lacking. From the preliminary results of the 1974 census, it appeared that the population of the country was 7,012,642 people. The third official population census was undertaken during 1992, but the results published were largely on a provincial level only. No detailed information on the composition of the population as a whole was provided. The last official population census was undertaken during 2004, but the results published were also largely provincially based.

In addition to national censuses, Saudi Arabia maintains a registration system for the recording of vital events such as births and deaths. Unfortunately, due to incomplete coverage, its data are of limited assistance in the calculation of demographic estimates. For example, registration is limited to cases of births occurring in hospitals and a certain number of other maternity centres in the main towns, where the population is aware of the importance of birth registration in facilitating the admission of their children to the family registry. Furthermore, it should be mentioned that, until recently, there were no detailed data available on the population in Riyadh. It was as far back as 1997 that the High Commission for development of Riyadh conducted the last survey of the population of Riyadh.[1]

The study of population and construction growth is one of the necessary elements in analysing the distribution of schools in Riyadh. Construction growth and population increase provide the basic impetus for extending education services at every level. Thus the number of schools increases as the city and its population expands. Also, construction growth plays an important role in deciding school distribution and extending educational services, especially where it accompanies a large influx of people and the growth of commercial and service activity.

[1] The 1997 survey is the only source of information of that exists for Riyadh municipalities.

5.2 The stages of construction and population growth in Riyadh City

The city of Riyadh evolved from the ruins of Hajr, once the principal town in Najd. The Bani Hanifah were the earliest people to rule the town. Several groups ruled Hajr between 420-1726, (Al-Jassir 1966, 18). Furthermore, the name of Riyadh was taken from the nature of the geographical site of the city. It is a sloping land where rainfall flows in, thus it turned it into an oasis full with greenery (Al-Jassir1966, 9).

The capital Hajr formed from margins of contiguous settlements around the oasis during the eight and ninth centuries. However, the town's influence steadily diminished, and it eventually vanished in the fourteenth century. Little is known about it during the following few centuries. However, it achieved recognition again because of its distinct identity during the 18^{th} century, when a thick mud wall was built around the town in 1770 (Al-Sharif 1973, 115). Riyadh from that time and until the late 20^{th} century has passed through four phases of development (Al-Faquir 1992, 90).

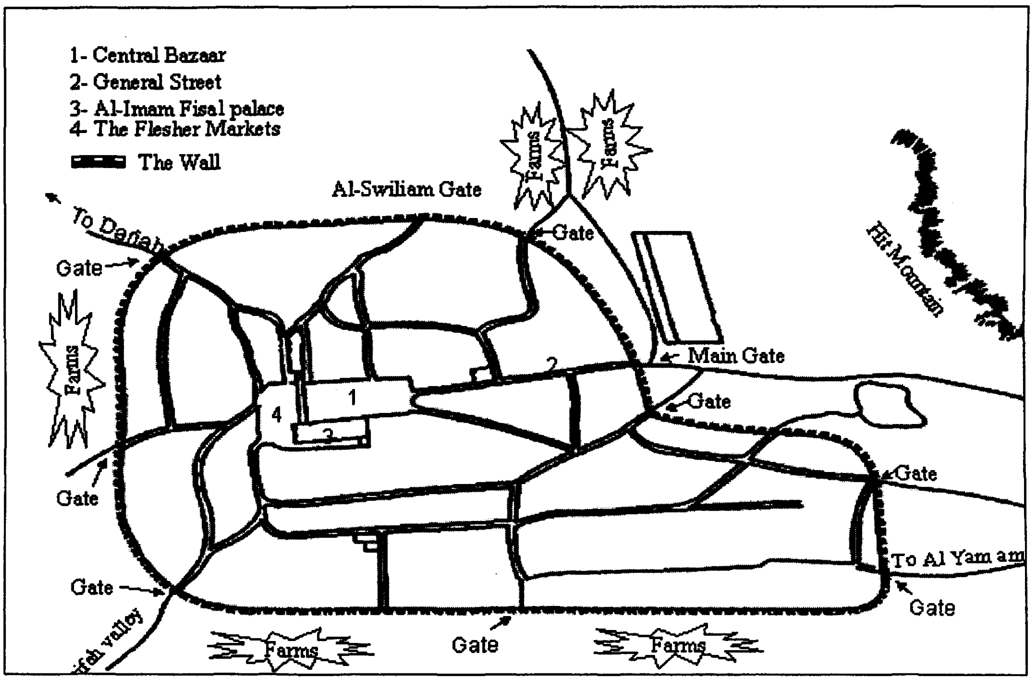
- "Pioneer" 1750- 1900;
- Slow growth 1901-1950;
- The "real development stage" 1951-1975;
- The "stage of advanced construction growth and population explosion" (Figure 5.1)

Figure 5.1 Urban expansion of Riyadh 1930- 02

5.2.1 First Stage: "Pioneer" 1750-1901 AD.

Riyadh was selected as a capital for the second Saudi state in the year 1824 after the destruction of the first one, Al-Dereia. William Palgrave, a British explorer, wrote a description on Riyadh in 1862. He noted that the town was rectangular in shape with two main streets, one running from north to south and the other extending from east to west, with the existence of a few insignificant side streets. It appears from his sketch that the Mosque, the market and the palace were in the centre of the town. A thick mud wall encompassed it with the principal entry being in the east. There were, however, a further ten gates (Figure 5.2). The two main streets crossed in the centre of the town, dividing it into four distinct quarters.

Figure 5.2 Plan of Riyadh in 1862



Adapted from Palgrave 1985, 227-228.

In the north quarter lived the political and religious dissidents. In the east resided the poor families. The descendants of Al-Sheikh and the religious leaders occupied the south division. The northwest was reserved for the Royal family and other rich families.

The population of Riyadh was approximately 7500 people as at the beginning of the twentieth century (Palgrave 1985, 227-338).

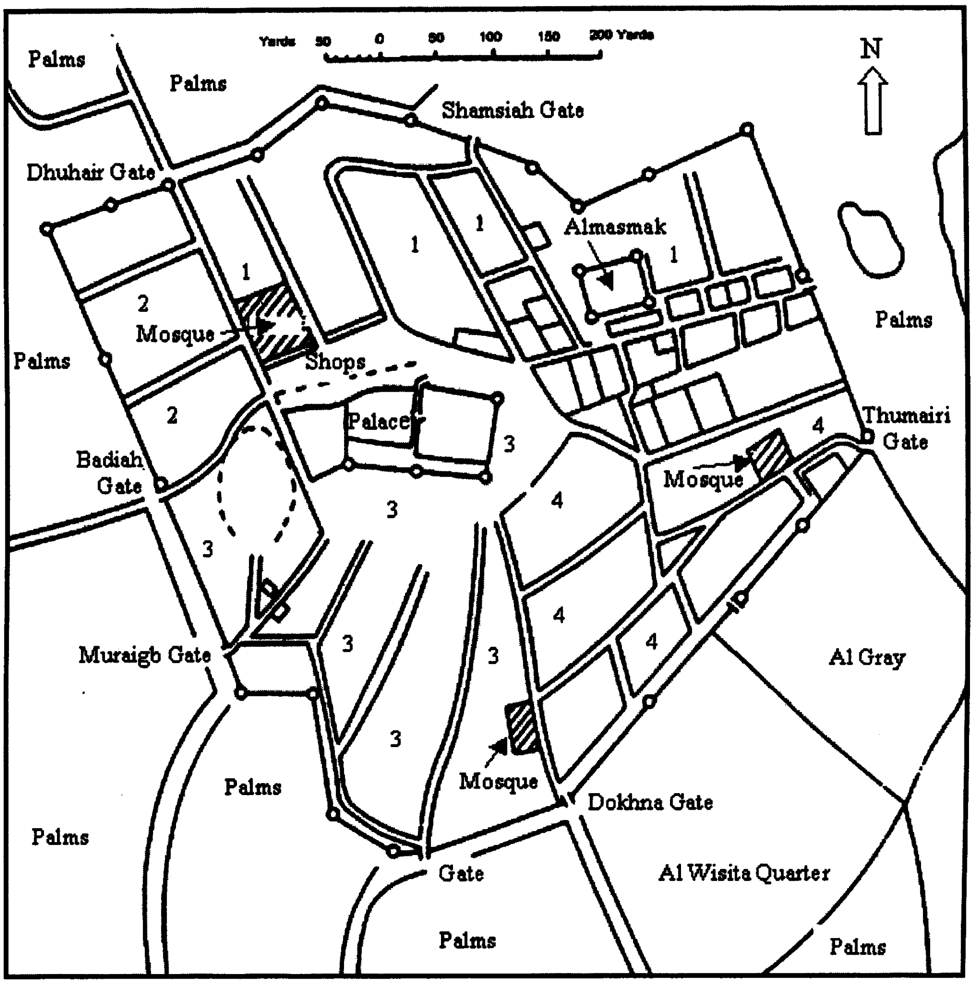
5.2.2 Second stage: the stage of slow growth 1900-1950 (the establishing stage).

John Philby gives the description of the city presented in Figure 5.2 following his visit there in 1919. He reckoned that Riyadh was a city of less than one square kilometre in area with a population that had increased from 9000 people to 11,500 inhabitants over the previous century. This implies an average annual increase of 121 people every year. From the Figure 5.3, it appears that that the mosque, shops and palace were in the centre of the town and that the town was a surrounded by a wall with nine gates.

In 1932 King Abd Al-Aziz unified the regions to form the Kingdom of Saudi Arabia. Thereafter peace and security spread everywhere in the country and a process of steady rather than rapid change began (Abul-Ela 1965, 47). The degree of construction work reflected the city's importance as the capital. Indeed the built up area doubled in size in less than 10 years to become 2.36 km^2 (Figure 5.1) by the end of third decade.

The pace of development of the city was faster in the north and west. In the lower southern parts of the city development was slower. The slope of the stream constituted a hindrance on the eastern side. With time the development went beyond the city walls and in the fourth decade the area of Riyadh became 3.46 square kilometres. Development attained a rapid pace in the 1940s following the discovery of crude oil. New compounds emerged in order to absorb the great influx of immigrants.

Figure 5.3 Plan of Riyadh in 1919



Source: adapted from Philby 1922, 70.

O Watchtowers
1- Political Religious Dissidents Quarter
2- Royal Quarter
3- Al- Sheikh Quarter
4- Poor Families Quarter

The new imperative now was to link the new areas with the city. The walls, their defensive capacity having become obsolete, were removed in1950 (AL-Sharif 1973,92). By the end of the 2nd stage, it was clear that the city was continuing to expand.

5.2.3 Third Stage: The "Real Development" stage, 1951- 1970.

This period witnessed many vital achievements. The wealth derived from oil, especially after 1952, played a major factor in the growth of the city. A large number of development projects were undertaken and the city expanded in all directions. New paved roads and highways were constructed during this period in order to connect Riyadh City with the other important parts of the country, such as the Eastern Province with its oilfields, and Western Province, where the holy places of Islam and the government ministries were located. In 1953 the railway, which connects Riyadh City with Dammam on the East Coast, was built. In the same year, an airport was declared open about 10 kilometres to north of the city centre, in order to link Riyadh City not only with other Saudi Arabian cities but also with the world.

Many buildings were established especially in 1957 in the north of the city along the road to the airport to accommodate the new influx of workers. These were mainly workers of various Ministries and government departments that had been moved from Jeddah on the west coast region to Riyadh (Al-Sharif 1973, 27). Rapid expansion happened outside the central area of the city, which itself was teeming with people. New wards with better architectural designs than those in the central area of the city were constructed. Planners took into consideration the size of each plot of land that had to be not less than 500 square metres. Streets were to be not less than fifteen metres in width to permit access by ambulance, police and other public service vehicles (Al-Faquir 1992, 24). Also in the new neighbourhoods, special areas were devoted to public utilities such as schools, public gardens, clinics and mosques etc. In these new neighbourhoods the houses that had traditionally been built of mud modelled on the western pattern and the villas were replaced with new ones built of cement and bricks with a garden encompassing the property. The most important of these quarters during

this period were Malaz, Murabba, and Badia'h. However, this spatial expansion of the city was not limited to these quarters only, for there were also areas in the east and the west of the city such as Hillet Al-Qussman and Dawasir which were not designed properly. Hence there development was unplanned (Riyadh Municipality, 1986).
These changes led to the establishment of links between the capital and other Saudi cities. Another contributory factor was the expansion of road transportation that followed the rise in Saudi personal income. People could thus commute from private accommodation far from the centre of the city, and the new styles of private accommodation using villas in the neighbourhoods of Malaz, Murabba and Badia'h. The period also witnessed the development of the scientific institutes. The provision of education for all started in the city in the year 1951, the Islamic College and the Arabic Language College were established, followed by the College of Education, in 1954. The status of scientific learning in Riyadh was strengthened by the presence of these schools and institutes as well as Riyadh University, which opened in 1957. In addition, many other institutes and military colleges were established. All these institutions attracted students from different parts of the Kingdom and drew schoolteachers from different Arab countries.

The growth in construction was linked with the economic growth of the country and raising the state revenues from surplus oil sales. This was accompanied by a rise in the standard of services after the municipality of Riyadh was transformed in 1955 into a mayoralty. It had its own departments concerned with urban and environmental development and it was equipped with services and greenery. For example, a 1212 line telephone exchange was commissioned, electricity was used instead of kerosene in lighting the streets, and water supply was piped from Nisah Valley, Nammar, and Al-Hayer (Al-Faquir 1992, 24).

Since 1955, city planners have taken care to ensure that the streets in all areas should be not less than 15 meters wide. They also decided that all areas should be provided with services and facilities like electricity, gardens, schools, mosques and sanitary units. As a result, old residential sections of the city were demolished and people had to move to modern properties. Development also proceeded rapidly in the north, northeast and northwest.

Many projects were devised to attract construction in the northeast of Riyadh, especially around the railway station. The station itself attracted construction and vehicle maintenance workshops and Al-reel Street became a spinal road for the zone. The area soon joined with the old neighbouring sections as Margab and the commercial heart of Batha. The establishment of the Malaz section, which includes the residential accommodation for the University and its colleges, boosted construction activities. On the North West, Nasiriyah area was selected to be the location of the Royal palaces with a distance of five kilometres from the city centre. Development continued in the same direction with the establishment of new sites such as Ulayshah and Mather south of Nasiriyah. These buildings conferred a unique style on the area and the numerous magnificent palaces built there attracted to it others seeking luxurious palaces and housing.

Considerable construction also took place in the area between Murabba and Foutah. As to the south of Nasiriyah construction extended towards Manfuha Al-Jadeeda, and Seyah (Ben Baker) compounds were built. In the southwest Shimaisi and Ulayshah were established as well as Al Badia'h. Construction towards the east and southeast led to the emergence of Al-Salehiyah and Al-Khalidiah as well as the extension to Al-Oud, Ghubairah, Jabbrah and Al-Yamamah. The population of Riyadh in 1970 was estimated to be 350,000 people. It had thus increased by 322 percent since 1950. As its population grew, the size of the city increased to reach 77 km^2 (Table 5.1). Moreover the number of houses rose from 1216 in 1950 to 27819 in 1960 and 60,000 houses in 1970. (Agency of Municipalities and Rural Affairs, undated: 14). The1970s was a period marked by a surplus flow of currency to be spent on development projects in the capital. These projects include the sewage mains, water and telecommunication systems, the paving of all main and side streets, and new schools, institutes and medical services.

Table 5.1 Growth of the population and size for Riyadh city: 1862-1996

Year	Time duration (years)	Population	Area Sq. Km	Size of annual increase	
				No	Ratio
1862	0	7,500	0.5	---	---
1919	57	19,000	0.8	202	2.7
1930	11	27,000	1.8	727	3.8
1950	20	83,000	8.9	2,800	10.3
1960	10	160,000	36	7,700	9.3
1970	10	350,000	77	19,000	11.9
1980	10	1,000,000	245	65,000	18.6
1990	10	1,600,000	752	60,000	6
1996	6	3,139,613	992	256,602	16

Source: Area and population figures were taken from High Commission for Development of Riyadh, 1996; Ratios calculated by author.

5.2.4 The stage of population and construction explosion: 1976-2002.

This period extends from the year 1976 until now. It reflects the great economic prosperity that accompanied rising oil revenues and the extra government expenditure, which financed the First Development Plan. As personal incomes rose, people sought to have their own houses, reflecting the Saudi traditional style and desire for privacy. There was thus a high demand for land for building homes and a surge in land prices. This has encouraged the Riyadh Municipality after noticing increased demand for building plots to locate an area exceeding 22 km^2 for distribution outside the existing construction plan of the city.

It is worth mentioning that the rise in wages and salaries was one of the factors that made migration to Riyadh attractive to both Saudi and foreign labour. Indeed local labour supply fell well short of the requirements of the labour market. Hence a significant number of skilled workers, both white and blue collar came to Riyadh. Another factor that had an impact in increasing the size of area and its population was the establishment of huge government projects with their attendant services around the edges of the city. Such projects included the establishment of the King Khalid International Airport and the Islamic University of Imam Mohammed Bin Saud in the north of the city. To the northwest, the Assafarat' quarter, the sports city, King Saud University complex and the King Abdul Alziz City for science and Technology were sited. The King Fahad International Stadium was constructed in the northeast. The year 1975 witnessed a great change in residential areas especially after the establishment of the Land Development Box, in 1974, to provide easy access to housing loans. Consequently, any Saudi over the age of 21, or 18 if married, could borrow from this Fund to build a new house. Loans of 300,000 Riyals ($80,000) were given and could be repaid in instalments over a period not exceeding 25 years. In addition 20 percent of the total amount of the loan could be deducted if the load was repaid within the agreed period (Moslhi 1984, 92).

The availability of this financial assistance led to a period of unprecedented urban construction development and population in Riyadh. Expansion and growth occurred in both the older and new areas such as Ulayah. By 1975, the population had increased to 665,000 people (Ministry of Finance and National Economy 1974). That is to say, it had doubled within 5 years. Moreover, the number of licensed buildings within the municipality rose from 4957 in 1973 to 10309 in 1975 and the city had expanded to a size of approximately 90 km^2.

A number of conclusions can be drawn from the study of the city's expansion as depicted in Figure 5.1.

- There have been important variations in the distribution of this rapid construction, which had once been mainly on the east and south side of the city.
- Approximately 15 percent of new construction took place in the northeast, 7 percent in the east, 5 percent in the south and 21 percent in the northwest. Furthermore, 6 percent took place in the southeast, 8 percent in the southwest, 12 percent in the west, and 26 percent in the north.

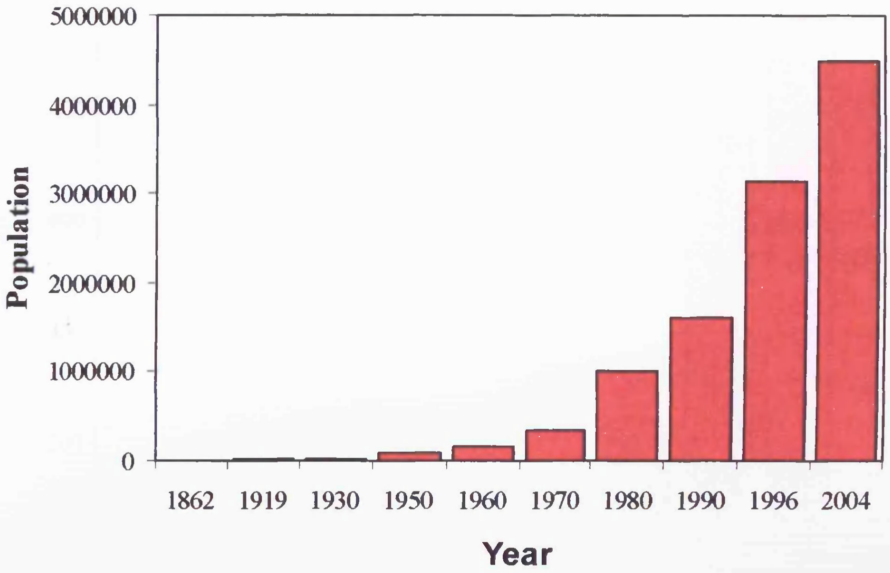
In 1980 the population of Riyadh had exceeded one million; it was spread over a huge area of about 245 km^2 but still with just a few high rise-buildings. The population continued to increase and reached 1.6 million in 1990 with a growth ratio exceeding 5 percent distributed over 752 km^2 (High Commission for development of Riyadh 1996, 7).

By 2002 it had exceeded 3 million and the land area had already reached 992km^2. Such growth was achieved not only by massive migration but also by falling death rates. Thus, the foregoing part of the Chapter has illustrated the four stages of Riyadh's development from 1750 – 2002 (see Appendix H for photos of these developments). Obviously the dramatic changes in the last of those stages were related to the massive construction projects, a huge influx of migrants and falling death rates. We shall now consider a more detailed view of the population growth and the reasons behind it.

5.3 Reasons behind the population growth

Figure 5.4 below presents the growth in the population of Riyadh over the period between 1862 and 2004. It shows that a significant increase occurred in the last 25 years during which the population grew from an estimated one million to three million.

Figure 5.4 Riyadh populations during 1862-2004

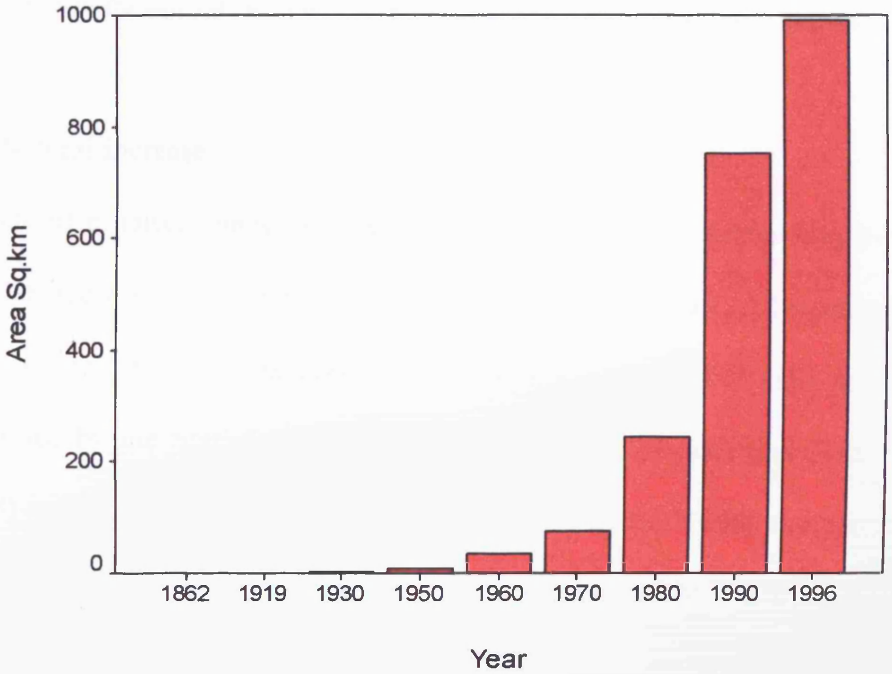


With this increase it became more urgent to plan for the provision of facilities such as schools, hospitals and recreational areas for the residents of the city. These facilities cannot be provided most optimally without a location plan.

The last point can be made clearer by referring the data on the area of the city. One can deduce from Figure 5.5 that the expansion of the land area of Riyadh is related to the rise in its population. As was observed for population growth, the land area too expanded dramatically between 1980 and 1996, growing from 245 to reach at 992 km^2.

Following the establishment Saudi Arabia as a state and the attainment of peace and stability that came along with it, people began to congregate in the capital reaching about 27,000 by 1930 (Table 5.1). During the next 30 years of the twentieth century Saudi Arabia witnessed economical, social and administrational progress due to the wealth accruing from oil.

Figure 5.5 Territorial expansion of Riyadh during 1862-1996



By 1960, the population had grown by almost six times to 160,000. Subsequently, growth increased even more rapidly, especially after 1974 when there was a huge influx of migration from inside and outside Saudi Arabia. As a result, there were many job opportunities in the city, fulfilling the 5 development plans. Undoubtedly, this population growth rate was more the outcome of inward migration than the difference between birth and death rates. The population growth of Riyadh City between 1960-1980 was higher than the growth in the previous periods, rising by nearly six times in 20 years. The authorities adopted some procedures to alleviate the impact of huge influx of rural migrants to urban places in the country, such as the distribution of free land and free interest loans to Saudi citizens to build their houses anywhere in the country.

The government also created job opportunities in rural areas and small towns by establishing development projects in these areas, and supplying water as well as electricity. For these reasons, the rapid growth of the 1970s diminished to some extent, reaching around 18.6 per cent in the 1980s. Nonetheless, the average rate was still very significant. The number increased by 16 percent (High Commission for Development of Riyadh 1996, 35). This huge number was not due to normal growth, but was brought about mainly by migration. The increase in population can be summarised as follows:

5.3.1 Natural Increase

The rate of a natural increase of population is derived by subtracting the crude death rate from the crude birth rate. A natural increase means that an increase or a decrease due to migration is not included (Fellmann et al. 2001, 110). The register of births maintained by the Statistics Department (Ministry of Finance and National Economy 1986,8) indicates that the birth rate in the city was 51 per 1000, compared with 33 per 1000 for the entire Kingdom (The World Bank 2002). The rise in birth averages has pushed the average size of the Saudi family to 6.2 persons (Lotfi 1988, 155). Moreover, birth control measures are believed to be anti-Islamic. Also the improved health care service has led to a fall in the crude death rate in the Kingdom to 4 per 1000, and the figure for infant mortality decreased from 65 per 1000 in 1980 to 18 per 1000 by 2000 (The World Bank 2002).

Education, which has a great effect on prosperity usually, takes into consideration the cultural and civilized aspects. It may be worth noting here that Al-Eiswai, writing in 1994, said that improved standards of education, particularly of females, may well lead to a decrease in their fertility rates in the future (Al-Eisawi 1994).

In 1986, a study of the annual death rate in Riyadh city found that it was approximately 5 per thousand (High Commission for development of Riyadh 1986,48). This was due of course to great improvements in living standards, health care services and preventive medicine. These factors have led to a decline in the incidence of diseases, falling death rates, especially for infant mortality and a great increase in the provision of education for the young. The natural increase of population in Riyadh has been marked with high growth rate of 46 per thousand (High Commission for Development of Riyadh, 1996, 9).

5.3.2 Migration

Undoubtedly, the population growth of Riyadh is attributable to a considerable extent to migration. Riyadh city's position in the Kingdom as the headquarters of government has attracted commerce and spurred increased job opportunities when compared to other cities. This has resulted in an influx of migrants both from inside the kingdom and from other countries around the world. This migration of people from inside the country to the urban areas, particularly in Riyadh City did not begin until the 1940s (Ashwan 1990, 198). It stemmed from a combination of limited job opportunities and diminishing returns in agriculture, a lack of social amenities in the other regions, a high birth rate and various other factors which continuously attracted rural people to the urban areas (Al-Gabbani 1999, 79). Before the 1940s, Riyadh's relative slow growth was restrained by a low rate of natural increase (birth-death).

According to the Doxiadis Associates (1968) survey, there were estimated 10,000 migrants and 180,000 people in private households in Riyadh City in 1962. This indicates a migration rate of 5.5 per cent and an overall growth rate of 7.5 per cent. At this stage of the growth of the city, Doxiadis Associates analysed the components of growth, and found that between 1960 and 1968 the population of Riyadh City increased by 88.0 per cent or by 140,000 persons. The survey found that in 1961 or later, 100,000 migrants come to the city as belong to a family. After adjusting for collective households not covered by the survey, Doxiadis estimated that there were 105,000 net migrants. They found that as much as 75.0 per cent of the total population increase between 1960 and 1968 was due to immigration and only 25.0 per cent or 35,000 persons could be attributed to natural increase. By 1967 there were 19,860 migrants living in private households in the city. Given a 1.0 per cent average death rate, the actual number of migrants arriving to Riyadh City during 1967 would have amounted to 20,000 with total population of the city established about at 25,000. This indicates a migration growth of 8.0 per cent. Therefore, if one adds the 2.0 per cent natural increase, the overall increase for that year was 10.0 per cent (Doxiadis Associates 1968, 86)

The number of migrants from abroad rose from 121,000 in 1974 to 544,000 in 1986. This was equal to 40 percent of the city's population (Al-Faquir 1992,136). By 2001 the migrants were 105,813, a fall to 34 percent (High Commission for Development of Riyadh 2001, 34). On the other hand, migration from rural areas around the city had increased to 183,577 in 1996 (High Commission for Development of Riyadh 2001, 4).

5.4 Population Distribution and its Demographic Characteristics

The following discussion is in two parts. Part one deals with the distribution of Riyadh's population and its density. Part two examines the characteristics of the population structure; these characteristics are mainly concerned with gender and age.

5.4.1 Population: distribution and density

As has already been shown, the population of Riyadh rapidly increased within a period of less than half a century. This increase was accompanied by a rapid expansion of the city's land area. As a result, population has been redistributed from the centre to the outskirts. The distributions of services, like education, have also been affected. Therefore, a study of population distribution and its density can greatly clarify the picture of the link between school distribution and population density.

A study of Table 5.2 indicates variations in the distribution of population between the various municipalities. These disparities may be attributed to factors that reflect civil conditions and manpower capabilities, such factors will include settlement age, the range of services available, in addition to the price of land and, location attractiveness to its residents.

Table 5.2 Riyadh municipalities according to distribution of population-1996

No	Municipality	No of population	%	No	Municipality	No of population	%
1	Deerah	400637	12.76	9	Arrowdah	302214	9.63
2	Ulayah	238984	7.61	10	Annassem	332048	10.58
3	Malaz	166201	5.29	11	Silay	236358	7.53
4	Batha	202267	6.44	12	Janoob	156268	4.98
5	Mather	105969	3.38	13	Manfuha	305942	9.74
6	Assafarat	1433	0.05	14	Otaygah	210408	6.70
7	Oraija	251401	8.01	15	Irgah	9441	0.30
8	Shimal	198089	6.31	16	Dariyah	21954	0.70
Total						3139613	

Source: High Commission for Development of Riyadh 1996; Ratios calculated by author.

The table above shows that:

- the most concentrated population centre was Deerah Municipality with half a million residents. This represents 12.76 percent of the total population of Riyadh. It is followed by Annassem municipality, which has a third of a million people or 10.58

percent of the total. Next come Manfouha and Arrowdah municipalities with a little over 300,000 each and a share 10.2 percent and 10.1 percent respectively. This means that these four municipalities, together with Batha, which has 6.8 percent of the population, account for half of the total population of Riyadh.

- the old city centre municipalities of (Deerah, Batha, Malaz, Manfuha and Otaygah accommodate 43 percent of the overall population of Riyadh.
- the population was attracted to the north-east municipalities of Arrowdah and Annassem which appeared in the fourth stage of the construction growth of the city. Their combined population is approximately 643,000 with a percentage of 24 percent. Nevertheless, it should be also noted that the suburbs of Irgah (0.3 percent), Dariyah (0.7 percent) and Silay (1.46 percent) are home to only (2.5 percent) of the city's overall population. This distribution shows that relocation is still ongoing with the continuing rapid development of the city. The municipalities in the suburbs have now taken the lead in terms of growth. Their populations are increasing at a faster rate than those in the city centre.

A useful graphic method of showing variations in population in a very different way is through the construction of Lorenze curves; a technique that was originally devised to indicate concentrations of population. Thus Figure 5.6 shows that 30 percent of population occupied almost 60 percent of the total area. This means that although people are distributed throughout all the city's municipalities, they are heavily concentrated in the preferred areas. The status of areas becomes manifest when studying the distribution of people in Riyadh. For example Mather, Arrowdah, Shimal, Silay, Dariyah have a disproportionately large land area relative to the size of their populations. In contrast, half of the residential accommodation of Riyadh is concentrated in 25 percent of the city, in Deerah, Batha, Malaz and Otaygah municipalities. These along with Annassem and Ulayah, form the centre of the city. Figure 5.6 emphasises that the population is not distributed evenly over the city but is still concentrated.

Figure 5.6 Lorenze curves for Riyadh

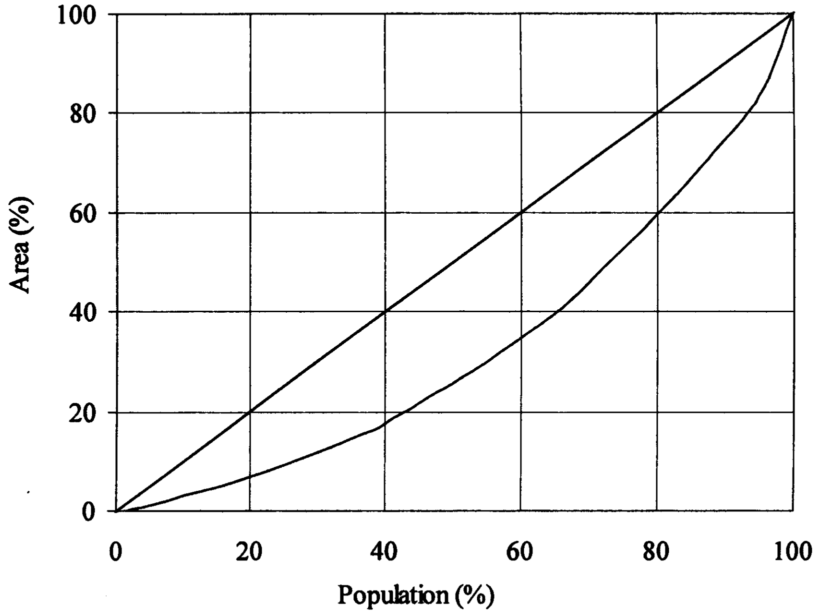


Table 5.3 Correlations between population and boys and girls secondary schools

	Girls		Boys	
	number of pupils	number of schools	number of pupils	number of schools
Pearson Correlation	.718	0.7953	.699	0.6478
Sig. (2-tailed)	0.002	0.00023	0.003	0.006658

Table 5.3 shows that there are significant correlations between the population of the municipalities and the number of pupils and the number of schools for girls. The table also shows the same result for boys. It shows also that the correlation is greater for girls than for boys. This however, suggests that the distribution of schools in the city of Riyadh is quite just and perfect in the part of the education authority.

Population density is a factor that may be used to assess the value people attach to an area as a place of residence. Often, it represent a reflection of their standard of living, at other times it represents a display of their affinities because people like to live close to those they feel comfortable with.

In 1996, the population density of Riyadh was 3,267 people per square kilometre. Al-Dammam in the Eastern Province had a density of 900 people per km^2, and Jeddah to the west had 1200 people per km^2. The density in the capital has fallen as result of the city's huge expansion from what is was at the beginning of the 20^{th} century. Then it exceeded 23,000 people per km^2. It has decreased continuously as the suburbs have steadily expanded away from the city centre. This process accelerated as car ownership increased. Thus the general density was less than 3,267 for every sq km at the end of the 20^{th} century. If the municipal areas of sparse population are excluded, and density is calculated on the basis of built up areas, then it reached 3267 per km^2 in 1996 (High commission for Development of Riyadh, 1996). The picture however, varies for the old quarter in the centre of the city. These are still really crowded because of the huge inflow of migrants preferring to live there once the native population moved to the outskirts. Density in the central area is still more than 11,000 people per square kilometre. It reduces closer to the suburbs. Stewart has suggested that the density of Riyadh matched a common pattern for other cities in K.S.A: density is heavier in the city centres than in the suburbs (Stewart. 1968, 13).

Table 5.4 The density of Riyadh population per km^2 -1996.

Municipality	Density	Municipality	Density
Deerah	11783	Oraija	3104
Batha	7491	Mather	2717
Malaz	5194	Silay	2597
Otaygah	5132	Dariah	2439
Manfuha	4780	Arrowdah	1698
Annassem	4549	Shimal	1172
Ulayah	4345	Irgah	787
Janoob	3325	Assafarat	159

Source: The density values were computed from figures obtained from the High Commission for Development of Riyadh 1996.

From Table 5.4 above and Figure 5.7 below four categories of density can be discerned:

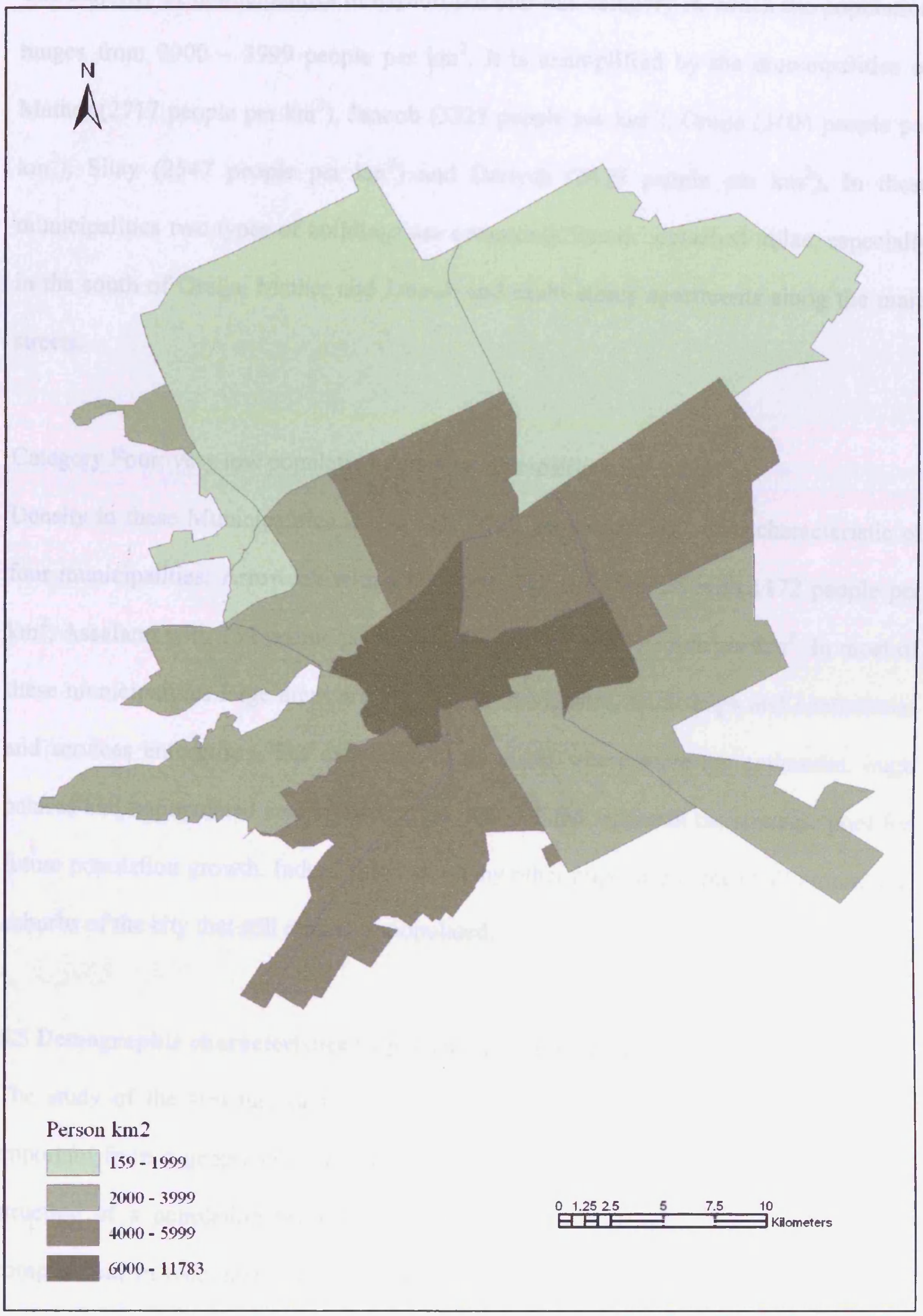
Category one: very high density municipalities

The general density in this category is upwards of 6000 persons per km^2. Examples of this are the municipality of Deerah with 11,779 people per km^2, and the municipality of Batha with 7,474 persons per km^2. In these areas, multi-storey buildings predominate, especially on the main streets. It is the preferred type of accommodation of migrants and government officials. Such areas are in the heart of Riyadh where high density is easily seen. This rise has been continuous at all stages of the city's growth.

Category Two: high density municipalities

In this category the density of population ranges between 4,000–5,999 persons per km^2 as exemplified by Annaseem (4549 people per km$^{2)}$, Otaygah (5132 people per km^2), Ulayah (4345 per km^2) and Manfuha (4780 people per km^2). These municipalities have witnessed new construction in the successive stages of growth of Riyadh. In these municipalities two different types of building can be noticed; detached villas and multi-storey apartments, especially on main roads. A similar pattern exists in the municipalities of Malaz; Ulayah west Naseem.

Figure 5.7 The density of Riyadh



Category three: moderate density municipalities

The majority of municipalities in Riyadh fall into this category in which the population ranges from 2000 – 3999 people per km^2. It is exemplified by the municipalities of Mather (2717 people per km^2), Janoob (3325 people per km^2), Oraija (3104 people per km^2), Silay (2547 people per km^2) and Dariyah (2439 people per km^2). In these municipalities two types of buildings are commonly found: detached villas, especially in the south of Oraija, Mather and Janoob and multi-storey apartments along the main streets.

Category Four: very low population density municipalities

Density in these Municipalities is less than 2000 people per km^2. It is characteristic of four municipalities: Arrowdah with 178 people per km^2, Shimal with 1172 people per km^2, Assafarat with 154 people per km^2 and Irgah with 787 people per km^2. In most of these municipalities large areas are given over to industry, workshops and commercial and services enterprises. The exception is Assafarat where there are embassies, huge palaces and unpopulated areas. These areas unpopulated represent the strategic pool for future population growth. Indeed there are many other huge areas spread all around the suburbs of the city that still remain unpopulated.

5.5 Demographic characteristics (Age structures and Gender)

The study of the structure or the demographic characteristics of populations is very important from a geographical point view. For example, the study of the age and sex structure of a population helps to identify the factors that influence the population composition, in recognizing the relationships between those factors and demographic variables and in identifying the kind of human resources it contains. The knowledge of the size of population in each age group according to each sex is very crucial in development planning as it influences the services demanded by the population. The developing countries of the world have youthful population pyramids; those under 20 years of age, for instance, comprise more than half of the total population (Fellmann *et al.* 2001, 106). This situation leads to a high dependence ratio and a high number of people entering the labour market annually; a situation that could lead to severe economic and social complications. Saudi Arabia does not differ markedly from other developing nations in this regard, 49.8 percent of population was under 20 year age (Ministry of Finance and National Economy, 2000).

Analysis of the population structure also indicates the size of the potential workforce. This information is helpful for the planners and decision makers assessing the educational needs of an area. Such analyses cover a wide range of data including age, gender, internal migrants, and immigrants among others. As stated earlier, the number of migrants to Riyadh increased significantly from the beginning of the implementation of the second development plan. This has had a great impact on both its area and the size of its population compared with other Saudi cities. Foreign labour is particularly marked by clear demographic qualities: the vast majority are aged 30-65. A study showed that three quarters of the citizens who were living in Riyadh in 1977 were originally internal migrants. Most of them were young people (Daghistani 1985, 91). The influx was boosted considerably by the perceived need on the part of government for employment specialization. This was seen as vital to push forward the wheels of development and prosperity. Migrants amounted to 18.11 percent of the city's overall population in 1974, and reached 40 percent by 1986 (Al-Faquir, 1992, 136). In 2001 the percentage fell to 34 percent as mentioned in part one.

The age and gender structures of Riyadh are shown in Table 5.5. It can be seen that the population consists predominantly of young people and that in 1996, there were 1503166 people or 47.9 percent of the population of Riyadh was below the age of 20 years. 52.8 percent of the population in this group were males and 48.2 percent were females. A possible reason for this could be the presence of migrants of working age. The table also indicates that the average ages of Saudis is 17.8 years compared with 31 years for non-Saudis. The size of the age group15–19 years was very high; they form 10.27 percent of the overall population. It is also the age range at which most are in secondary schools. The size, however, varies between the different Riyadh municipalities. It is smallest in the Assafarat municipality, 3.2 percent, while it increases in Mather, Ulayah, and Deerah to 8 percent.

The highest share of the population is in the age group 15-19 years. It is found in the Arrowdah municipality where they form 10.71 percent of the population. They are 10.64 percent in Annassem, 10.30 percent in Deerah, 10.21 percent in Oraija, and 9.54 percent in Manfuha. Furthermore they represent 8.34 percent, 6.07 percent, 6.22 percent, and respectively in the Otaygah, Janoob and Ulayah municipalities. This means that in these 7 municipalities, live about 68 percent of al 15-19 year olds (see table 5.5).

Table 5.5 The ratio of group 15-19 years in Riyadh -1996

Municipality	Male 15 -19YR	%	Female 15-19YR	%	Sum 15-19	%
Deerah	17,788	5.52	15,417	4.78	33,205	10.30
Ulayah	11,434	3.55	8,611	2.67	20,045	6.22
Malaz	8,942	2.77	6,269	1.94	15,211	4.72
Batha	9,978	3.09	8,419	2.61	18,397	5.70
Mather	4,969	1.54	4,391	1.36	9,360	2.90
Assafarat	27	0.01	20	0.01	47	0.01
Oraija	17,012	5.28	15,900	4.93	32,912	10.21
Shimal	9,156	2.84	8,762	2.72	17,918	5.56
Arrowdah	17,717	5.49	16,817	5.21	34,534	10.71
Annassem	18,680	5.79	15,639	4.85	34,319	10.64
Silay	14,794	4.59	11,244	3.49	26038	8.07
Janoob	11,343	3.52	8232	2.55	19,575	6.07
Manfuha	15,015	4.66	15,758	4.89	30,773	9.54
Otaygah	15,292	4.74	11,612	3.60	26,904	8.34
Irgah	483	0.15	407	0.13	890	0.28
Dariyah	1,229	0.38	1,133	0.35	2,362	0.73
Total	173,859	53.91	148,631	46.09	322,490	100

Source: High Commission for Development of Riyadh, 1996.

The age and sex characteristics vary between the Riyadh municipalities according to the number of non-Saudis. In the quarter where the number of foreigners is high, the share of males is high, while the share of children of secondary school age is significantly lower than the city' quarters where the number of Saudis are high. In Assafarat Municipality, the share of non-Saudis is extremely high. Non-Saudis form 90 percent of the municipality's population. There is no other municipality where Saudis are as few as 10 percent of residents (see Table 5.6).

Table 5.6 The ratio of Saudi and Non-Saudi in Riyadh -1996

Municipality	Saudi	Non-Saudi	Municipality	Saudi	Non-Saudi
Deerah	45	55	Arrowdah	85	15
Ulayah	59	61	Annassem	84	16
Malaz	56	44	Silay	79	21
Batha	45	55	Janoob	69	31
Mather	52	48	Manfuha	67	32
Assafarat	10	90	Otaygah	88	12
Oraija	94	6	Irgah	82	18
Shimal	76	24	Dariyah	77	23

The municipalities where nationals prevail are Oraija 94 percent, Otaygah 88 percent, Arrowdah and Annaseem 85 percent and 84 percent respectively.

5.6 Conclusions

This chapter has shown that the city of Riyadh has experienced a rapid growth in its population especially in the last one century from an estimated mere 7500 people at the beginning of the twentieth century to more than three million by the year 1996. Much of this increase has however happened since the middle of the twentieth century with the discovery and exploitation of oil resources. This has since attracted, and keeps attracting, many people from within and outside the country to the city and its surrounding. Indeed, the period between 1976 and 2002 has seen the development of a situation where local labour supply has felt well short of the requirements of the local labour market. Within Saudi Arabia, movement to the city was fuelled by a combination of limited job opportunities and diminishing returns in agriculture. In addition, and to a smaller extent, this rapid rise in population in the city was a result of the fall in death rates as a result of improved standards of living, and better health care services.

This rapid expansion in population has also been paralleled by some phenomenal expansion in residential housing, infrastructure and facilities meant to cope with the rising population. Indeed, the physical expansion of Riyadh from less than one square kilometre in 1919 to reach 992 square kilometre is yet another of its dramatic changes. We have also seen a trend where the older residents of the city have left the old heart of the city for the occupancy of the migrants. The building of a railway connecting the city with the east coast, construction of an international airport and the improvement and expansion of roads are particularly notable in this expansion. Also notable is the transformation of the city in 1955 from a municipality to a mayoralty and the accompanying rise in the standard of services.

We have also noted that initially, the growth of the city's population occurred most rapidly in the city centre municipalities but this has now changed and the municipalities in the suburbs have taken lead. In terms of density, the population of the city is unevenly distributed with some municipalities having very high, high, moderate and very low densities with the highest proportion of the population being in the age bracket of between 15 to 19 years. This depicts a youthful population, with implications to educational provision. In terms of the structure of the population, this has been shown to vary. In areas of the city where the number of foreigners is high, the proportion of males is high while that of children of school going age is significantly lower than where the number of Saudis is high. We can thus conclude that the city of Riyadh has experienced a rapid and relatively uneven expansion especially since the middle of the twentieth century. This calls for a better understanding of, among other aspects, the impact that this expansion has had on the provision of education. The next chapter examines the development of secondary school education in city in the face of this rapid growth.

CHAPTER SIX

The development of secondary education in Riyadh

Introduction

The purpose of this chapter is to describe the history of the development of secondary education in Riyadh and to provide a brief overview of advances over the past three decades in terms of the number of schools, students and classes.

As modest development in education in Riyadh commenced in 1975, this chapter will concentrate on comparing, analyzing and interpreting the education phenomenon from 1975 onwards. At the end a synopsis is provided of the comparison of the development of boys and girls education.

6.1. Female secondary education (1975)

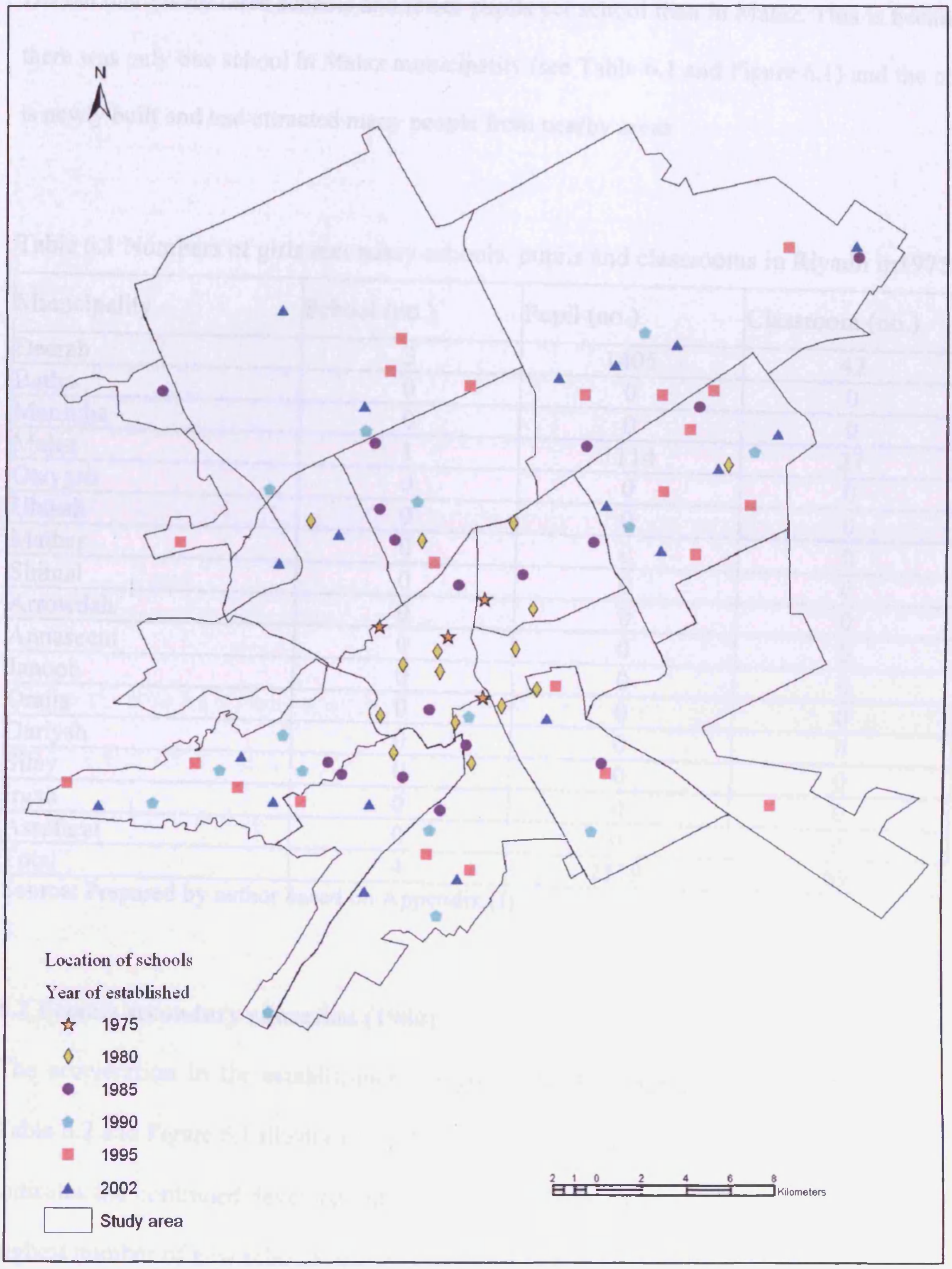
As has been discussed in Chapter four (4.1.2), one hundred percent of Saudi nationals are Muslim, which has had an influence on the development of female education. Before 1975, people usually preferred to provide religious education to their daughters privately and informally. Since 1975, provisions made by government, for instance offering free transportation to girl students and recruiting religious people as school supervisors to ensure the religious inclination of the schools, have played a significant role in increasing girls attendance at schools and thereby increasing the establishments of girls schools in Riyadh.

Figure 6.1 and Table 6.1 show that there were only four girls schools in 1975, but the number has increased since the government encouraged people to send their daughters to school by providing them with free transportation and arranging religious supervisors for schools. It is considered a relatively big increase compared with 1970 when there was only one school.

The contrasting number of girls schools can be seen in terms of schools as well. Three schools are located in Al Deerah and Al Nasiriyah wards within the Deerah municipality, which is the majority (75 percent) of the total girls schools in Riyadh city (see Table 6.1). The high number of girls schools located in the Deerah municipality is due to its central position in Riyadh city in 1975. With the advancement and extension the city towards the north-east, for the first time Malaz municipality accommodated the establishment of 25 percent of girls schools (see Table 6.1 and Figure 6.1). In the same year, the number of pupils increased from 546 to 2,519 and the number of classrooms from 13 to 69.

The increment in the number of pupils is due to the increasing population of Riyadh. In spite of a population increase of 90 percent in this period (see Table 5.1 in Chapter 5), the increment in the number of pupils was only 84.6 percent. This is because many workers migrated into this area without their families and children. In addition, some of the migrants were reluctant to admit their daughters to such schools as non-religious education was viewed as useless, if not actually dangerous, for girls. This attitude was reflected in the ratio of male to female pupils admitted to the schools, which was 5252 and 2519 respectively during the 1970s.

Figure 6.1 Girls secondary schools according to the year of establishment of the school



The concentration of pupils differs in the schools of Deerah and Malaz municipalities. In Deerah there were three schools and fewer pupils per school than in Malaz. This is because there was only one school in Malaz municipality (see Table 6.1 and Figure 6.1) and the city is newly built and had attracted many people from nearby areas.

Table 6.1 Numbers of girls secondary schools, pupils and classrooms in Riyadh in1975

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	3	1405	42
Batha	0	0	0
Manfuha	0	0	0
Malaz	1	1114	27
Otaygah	0	0	0
Ulayah	0	0	0
Mather	0	0	0
Shimal	0	0	0
Arrowdah	0	0	0
Annaseem	0	0	0
Janoob	0	0	0
Oraija	0	0	0
Dariyah	0	0	0
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	4	2519	69

Source: Prepared by author based on Appendix (I)

6.2 Female secondary education (1980)

The acceleration in the establishment of girls schools continued from 1975 to 1980. Table 6.2 and Figure 6.1 illustrate that 15 new schools were added in Riyadh city, which indicates the continued development in female education during this period. This is the highest number of new schools opened compared to earlier records and at the end of this period there were in total 19 secondary girls schools operating in Riyadh. However, during this period, the establishment of schools has spread further to other new municipalities where there were no girls schools established previously.

Table 6.2 Numbers of girls secondary schools, pupils and classrooms in Riyadh in1980

Municipality	No. School	To. Pupils	To. Classes
Deerah	7	2949	109
Batha	1	506	17
Manfuha	2	1236	36
Malaz	3	1798	55
Otaygah	1	111	4
Ulayah	1	441	11
Mather	1	54	3
Shimal	0	0	0
Arrowdah	0	0	0
Annaseem	1	48	1
Janoob	2	510	18
Oraija	0	0	0
Dariyah	0	0	0
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	19	7653	254

Source: Prepared by author based on Appendix (I)

Though the pace of expansion is still slow, it is remarkable as it has been fostered by many incentive mechanisms (such as the government encouraging people to enrol their children in the schools by providing free transportation) and religious arrangements initiated by the government. Subsequently, a number of new girls schools have been established in Malaz, Otaygah, Ulayah, Janoob, and Manfuha.

During this stage, the number of classrooms shot up to 254, with an average of 30 pupils in each class in a school. In Deerah municipality there were 109 classrooms, more than in any of the other municipalities. Malaz municipality came second with 55 classrooms, and finally the municipality of Mather, which had three.

6.3 Female secondary education (1985)

The development of girls education from 1980 to 1985 shows remarkable growth in secondary education. Table 6.3 and Figure 6.1 illustrate that a total number of 17 new schools (89 percent) were established by 1985, giving a total of 36 schools. Deerah municipality continued to rank first in its number of girls schools as two schools were added to the 10 constituting its educational structure. This municipality houses 28 percent of girls secondary schools followed by the municipalities of Malaz, Otaygah and Ulayah having 14, 11, and 11 percent of the girls schools respectively.

Table 6.3 Numbers of girls secondary schools, pupils and classrooms in Riyadh in 1985

Municipality	School (no.)	Pupils (no.)	Classroom (no.)
Deerah	9	3904	129
Batha	1	703	21
Manfuha	4	2277	72
Malaz	5	2022	63
Otaygah	3	1263	40
Ulayah	4	1627	50
Mather	1	250	10
Shimal	0	0	0
Arrowdah	2	849	25
Annaseem	2	587	24
Janoob	3	1157	36
Oraija	1	140	5
Dariyah	1	192	6
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	36	14971	481

Source: calculated by the author based on appendix (I)

A study of the change in the number of schools from 1980 to 1985 shows that the biggest number of schools added to municipalities was in Otaygah, where 3 new schools were established. In the Ulayah municipality 3 schools were constructed making total of 4 and Oraija and Malaz had two more schools. On the other hand, only one school was added to each of the municipalities of Manfuha, Annaseem, and Janoob. The reason behind the constant increase in the number of schools is because of the on-going economic prosperity brought by oil revenues and government policies to assist the education of the increasing population. However, no secondary schools were built in Mather and Batha. In these municipalities most buildings were palaces in Mather or commercial areas in Batha. The municipalities of Assafarat, Assolay, Irgah, and Shimal remained totally deprived of female secondary schools until 1985.

The increase in the number of schools was accompanied by a tremendous increase in the enrolment of female pupils which totalled 14,971, taking the average capacity of a school to 416 from 403 previously.

The average number of female pupils in a class had increased slightly to 31 in comparison to 30 in 1980. The highest female pupil density was reported in Arrowdah municipality with 34 pupils, followed by the municipalities of Manfuha with 32 pupils and Batha with 33 pupils. In Malaz, Ulayah and Dariyah average class size was 32 pupils and in Annaseem municipality 24 pupils, which was the lowest density of pupils at that time.

6.4 Female secondary education (1990)

The steady growth in the number of pupils and the establishment of new schools maintained momentum between 1985 and 1990. Table 6.4 and Figure 6.1 illustrate that a total of 15 new schools opened in Riyadh. At the end of this period the number of schools reached 51, a growth rate of 42 percent. In addition, the number of pupils increased to 21701, a growth rate of 45 percent. The opening of new schools and the increase in the number of pupils has not followed the same trends in all the municipalities studied. Some municipalities experiencing emigration had no increment in pupil numbers and thereby no new schools were opened in this period. As illustrated in Table 6.4 and Figure 6.1, Al-Batha and Al-Mather municipalities did not witness any increase in the number of schools from 1980 until 1990 when the population started to move to new municipalities such as Shimal and Ulayah, whilst no schools were established in the municipalities of Assolay, Irgah and Assafarat.

In addition to the increasing trends in the number of schools and pupils, there is intra-municipal movement of pupils between schools. As has been discussed, the Deerah municipality, which previously had the highest number of girls schools and female pupils, experienced a greater drop in the ratio of pupils than other municipalities in this period due to the opening of new schools in municipalities where there had been previously been no or few schools. About 1114 and 114 pupils left their schools from the municipalities of Deerah and Malaz respectively.

Table 6.4 Numbers of girls secondary schools, pupils and classrooms in Riyadh in 1990

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	9	3225	99
Batha	1	618	19
Manfuha	7	2815	88
Malaz	5	1908	69
Otaygah	4	2232	61
Ulayah	5	1803	54
Mather	1	478	14
Shimal	2	672	18
Arrowdah	3	1319	39
Annaseem	4	1979	60
Janoob	4	1852	53
Oraija	5	2311	68
Dariyah	1	489	12
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	51	21701	654

Source: calculated by the author depending on appendix (I)

In this period the average number of female pupils per class reached 33. However, this rate differs from one municipality to another and is higher in Batha, Otaygah, Mather, Shimal, Adderiyaih and Oraija. The school with the lowest average number of female pupils in a single class is in Malaz municipality, with 28. Nevertheless this number exceeds the normal rate estimated by the Ministry of Education, which is 25 pupils per class. Out of 16 municipalities, 38 percent exceeded the government recommended average pupil size in Riyadh (Table 6.4)

6.5 Female secondary education (1995)

The advancement in the establishment of new girls schools was still prominent in this period. Table 6.5 shows that the number of secondary schools jumped to 73. This could be considered a significant advance in the process of establishing secondary schools for girls. Within five years, 22 schools had been added to the map of secondary education - about four schools each year. This growth played a major part in extending the service of secondary education to cover nearly all the municipalities of Riyadh.

Table 6.5 shows some facts concerning the distribution of schools. Though there was an increasing trend in the opening of new schools in nearby municipalities, Deerah still stood first in having highest number of secondary girls school in Riyadh. Table 6.5 illustrates that there were no new schools opened in Deerah in this period but in Manfuha, Annaseem, Shimal and Oraija 2, 5, 3, and 3 new schools were opened respectively. This is because the Deerah municipality is the oldest and shelters the city centre which has been accommodating foreign immigrants and Saudi people from rural areas, whereas Saudi nationals who used to be city centre residents have migrated to newly built and peripheral municipalities. Peripheral municipalities have therefore opened up new schools to accommodate demand. The establishment of new girls secondary schools has extended further to other newly built and peripheral municipalities (Figure 6.1).

During 1995, the first secondary schools in the municipalities of Silay and Irgah were opened. The same table also demonstrates that, at that time, the average number of pupils per school was 387, which is fewer than in 1990, when the average number of pupils per school was 426. This fall in the numbers on the school roll can be explained due to the building of new government schools. Furthermore, the number of classes increased noticeably from 654 in 1990 to 1164 in 1995.

Table 6.5 Numbers of girls secondary schools, pupils and classrooms in Riyadh in 1995

Municipality	No. School	To. Pupils	To. Classes
Deerah	9	3123	109
Batha	1	707	18
Manfuha	9	2964	103
Malaz	5	1911	64
Otaygah	5	2904	88
Ulayah	6	1837	62
Mather	1	526	15
Shimal	5	1257	45
Arrowdah	6	2860	81
Annaseem	9	3492	116
Janoob	6	2626	77
Oraija	8	3390	366
Dariyah	1	508	15
Silay	1	0	0
Irgah	1	132	5
Assafarat	0	0	0
Total	73	28237	1164

Source: calculated by the author depending on appendix (I)

6.6 Female secondary education (2002)

The opening of new girls schools was still continuing in this period as illustrated by Table 6.6 and Figure 6.1. The number of schools reached 93, a growth ratio of 27.4 percent. Some municipalities witnessed a dramatic change in the number of schools and overtook the number of schools established in Deerah municipality. For example, the number of schools in the centre of the city (municipality of Deerah) has not increased due to population movement to the edge of the city. As a result of that the number of schools in new areas such as Annaseem municipality, which is located on the edge of the city had increased from 9 to 13. Meanwhile, the increase in Otaygah municipality was 3 schools. Hence, 56 percent of the total numbers of schools in the city were based in the five municipalities of Annaseem, Oraija, Arrowdah, Deerah and Otaygah (Table 6.6).

The same table shows that by 2002 the number of female pupils in Oraija had increased to 8287, in Annaseem to 8723, in Arrowdah to 8382 and in Otaygah to 4008.

Table 6.6 Numbers of girls secondary schools, pupils and classrooms in Riyadh in 2002

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	9	4454	128
Batha	1	837	20
Manfuha	11	5123	141
Malaz	5	2723	75
Otaygah	6	4008	111
Ulayah	6	1806	58
Mather	2	1266	33
Shimal	7	3181	88
Arrowdah	10	8382	193
Annaseem	13	8723	227
Janoob	7	4299	115
Oraija	11	8287	205
Dariyah	1	581	15
Silay	1	619	14
Irgah	1	157	6
Assafarat	1	100	4
Total	92	54546	1433

Source: calculated by the author depending on appendix (I)

These four municipalities were accommodating the majority of the female pupils who attended schools in Riyadh. At that time, the average number of pupils was 593 compared to 387 in 1995. This is attributable to the great increase in the number of female pupils from 28237 in 1996 to 54561 in 2002, representing a 92 percent increase in pupils compared to an increase of only 27.7 percent in the number of schools. The mean of the number of female pupils in a class was also influenced by this increase, rising from 24 pupils per class to 38. This is a result of the increase in population from 1,600,000 to 3,139,613 as mentioned in Chapter Five. At the end of 2002, however, there was no municipality without a girls secondary school.

It is clear that between 1975 and 2002 there was remarkable growth in the provision of secondary education for girls, particularly in Arrowdah and Annaseem. The next section will be focused on the development of male secondary education.

6.7 Male secondary education (1975)

Before 1975, secondary education for boys in Riyadh had proceeded modestly and only three secondary schools were available. Nevertheless, due to the high number of immigrants to Riyadh and the flow of money as a result of exporting higher quantities of oil at high prices, five new schools were established. The number of schools reached eight by 1975, although most of these were established in the old city centre (municipality of Deerah). It was apparent that the concentration of schools was in Deerah municipality where 5 (nearly 63 percent) were located out of the total number of secondary schools in Riyadh[1]. In other words, the secondary schools were centred in an area with a radius of less than 3 km. One school was established in each of the municipalities of Al-Batha, Manfuha and Al-Malaz. Consequently, there were no secondary boys' schools in the municipalities of Ulayah, Mather, Assafarat, Irgah and Silay because these municipalities were still under construction and there was insufficient resident population to enable the opening and operation of schools (see Table 6.7 and Figure 6.2).

Table 6.7 demonstrates below that the total number of male pupils attending secondary schools during 1975 was 5,252, which was an increase of 76 percent over 1970. Contrastingly, the increment rate was less than that of the rate of opening up of new schools, which was 176 percent over the same period. In Deerah, the average number of pupils was 717 followed by 622 in Janoob, and 336 in Manfuha. As far as classes were

1One of these schools was transferred later to the Al-Manar ward in the Annaseem municipality concerned, the number increased considerably and climbed from 63 in 1970 to 170 in 1975.

Table 6.7 Numbers of boys secondary schools, pupils, and classrooms in Riyadh in 1975

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	4	2868	90
Batha	0	0	0
Manfuha	1	336	13
Malaz	1	629	20
Otaygah	0	0	0
Ulayah	0	0	0
Mather	0	0	0
Shimal	0	0	0
Arrowdah	0	0	0
Annaseem	1	787	24
Janoob	1	632	23
Oraija	0	0	0
Dariyah	0	0	0
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	8	5252	170

Source: calculated by the author depending on appendix (J)

6.8 Male secondary education (1980)

By 1980, a further 8 schools had been added to the map of male secondary education, raising the total to 16, i.e. an increase of 100 percent over 1975. However, this percentage increase is smaller than that of female secondary schools, which amounted to 375 percent over the same period. The average number of pupils reached 508 in a single school.

On the level of municipalities, Deerah, with 5 secondary schools, continued to have more secondary schools than any other municipality. Nevertheless, one school was added to Manfuha taking it to the second position and these were followed by the Al-

Malaz and Al-Janoob municipalities with two schools in each.This indicates that more than half the numbers of schools in Riyadh were concentrated in the municipalities that lie in the centre of the city (Figure 6.2)..

The data in Table 6.8 shows that despite the apparent increase in their population, some municipalities did not experience any increase in the number of schools. The Al-Batha municipality is a good example, where there were no secondary schools for males as this is the commercial area and is mostly populated by non-Saudi workers many of whom lived alone. During the 1980s, the municipalities of Annaseem, Otaygah and Ulayah opened new male secondary schools for the first time.

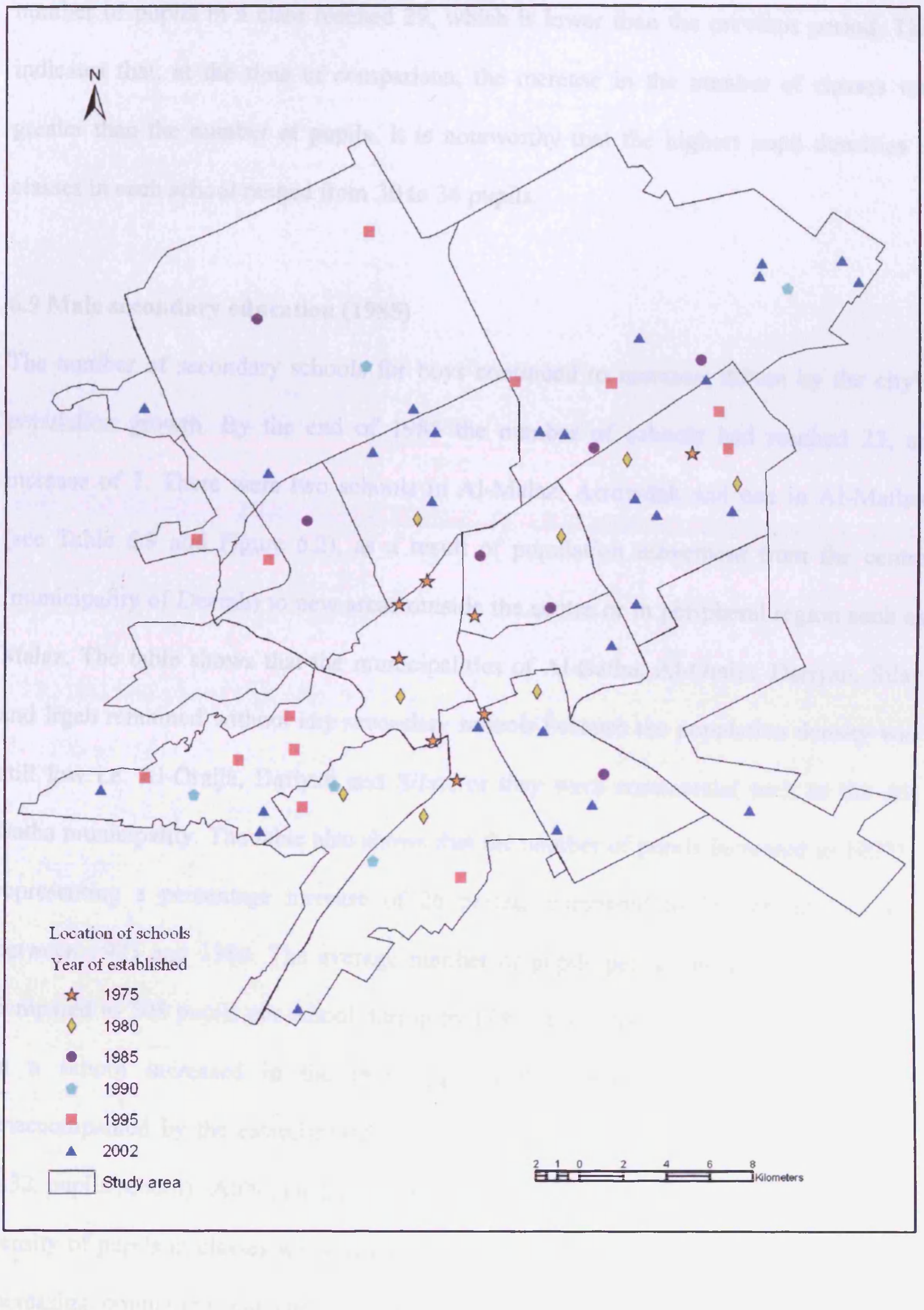
Some other municipalities such as Al-Mather, Shimal, Arrowdah, Al-Oraija, Adderiyaih, Irgah, Assolay and Assafarat remained without secondary schools as there was little resident population and construction was still ongoing.

Table 6.8 Numbers of boys secondary schools, pupils and classrooms in Riyadh in1980

Municipality	School (no)	Pupil (no)	Classroom (no)
Deerah	5	3153	113
Batha	0	0	0
Manfuha	2	976	32
Malaz	2	1058	34
Otaygah	1	605	18
Ulayah	1	477	15
Mather	0	0	0
Shimal	0	0	0
Arrowdah	0	0	0
Annaseem	3	884	32
Janoob	2	971	35
Oraija	0	0	0
Dariyah	0	0	0
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	16	8124	279

Source: calculated by the author depending on appendix (J)

Figure 6.2 Boys secondary schools according to the year of establishment



By 1980, the number of pupils reached 8124 distributed into 279 classes. The average number of pupils in a class reached 29, which is lower than the previous period. This indicates that, at the time of comparison, the increase in the number of classes was greater than the number of pupils. It is noteworthy that the highest pupil densities in classes in each school ranged from 30 to 34 pupils.

6.9 Male secondary education (1985)

The number of secondary schools for boys continued to increase, driven by the city's population growth. By the end of 1985 the number of schools had reached 23, an increase of 7. There were two schools in Al-Malaz, Arrowdah and one in Al-Mather (see Table 6.9 and Figure 6.2), as a result of population movement from the centre (municipality of Deerah) to new areas outside the centre or in peripheral region such as Malaz. The table shows that the municipalities of Al-Batha, Al-Oraija, Dariyah, Silay and Irgah remained without any secondary schools because the population density was still low i.e. Al-Oraija, Dariyah and Silay, or they were commercial such as the Al-Batha municipality. The table also shows that the number of pupils increased to 10221, representing a percentage increase of 26 percent compared to 55 percent increase between 1975 and 1980. The average number of pupils per school in 1985 was 444 compared to 508 pupils per school during by 1980. Also, the average number of pupils in a school increased in the municipalities that underwent population growth unaccompanied by the establishment of new schools such as Annaseem municipality (432 pupils/school). Although the numbers of classes jumped from 279 to 354, the density of pupils in classes was unchanged from 29 pupils as in 1980. This was due to increasing population and encouragement from the government for child education, which has raised the number of classes along with increasing the number of pupils.

Table 6.9 Numbers of boys secondary schools, pupils and classrooms in Riyadh in1985

Municipality	School (no.)	Pupils (no.)	Classroom (no.)
Deerah	5	3026	99
Batha	0	0	0
Manfuha	2	911	28
Malaz	4	1409	56
Otaygah	1	597	18
Ulayah	1	337	13
Mather	1	366	12
Shimal	1	309	10
Arrowdah	2	571	25
Annaseem	3	1297	46
Janoob	3	1398	47
Oraija	0	0	0
Dariyah	0	0	0
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	23	10221	354

Source: calculated by the author depending on appendix (J)

6.10 Male secondary education (1990)

By 1990 as shown in Table 6.10 and Figure 6.2 below the number of secondary schools had reached 28, five more than in 1985, with a total growth of 22 percent. This increase is less than the 42 percent increase seen in female schools, and therefore female secondary schools continued to outnumber male schools. During this period, one new school was opened in each of the municipalities of Manfuha, Shimal, Otaygah and Arrowdah and the first secondary school in Al-Oraija municipality due to the 9 percent increase in pupil numbers over the municipalities compared to the previous years. Until 1990 28 schools were serving 11,136 pupils. Although the number of pupils increased and the number of classes rose to 406, the average size of pupils per school went down from 444 to 398.

Table 6.10 Numbers of boys secondary schools, pupils and classrooms in Riyadh in 1990

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	5	2544	98
Batha	0	0	0
Manfuha	3	919	42
Malaz	4	1846	61
Otaygah	2	1110	46
Ulayah	1	131	6
Mather	1	308	11
Shimal	2	654	26
Arrowdah	3	705	28
Annaseem	3	1183	35
Janoob	3	1183	35
Oraija	1	553	18
Dariyah	0	0	0
Silay	0	0	0
Irgah	0	0	0
Assafarat	0	0	0
Total	28	11136	406

Source: calculated by the author depending on appendix (J)

This increase in the number of classes also reduced average number of pupils per class to 27. Most noticeable is the size of classes in some schools in the municipalities of Deerah, Al- Silay and Janoob where there was a significant decrease. In contrast, the number of classes increased in some other municipalities such as Deerah and Annaseem where the average number of pupils per class was 41 in school 534 (Badr secondary school) in Sayyah ward at Deerah and in school 540 (Gortubah secondary school) in Al-Annaseem ward at Annaseem municipality, class sizes averaged 39. However, the smallest number of classes were found in school 519 (Aljazeera secondary school) in the Ulaishah ward of Deerah municipality.

6.11 Male secondary education (1995)

The period from 1990 to 1995 is rightly considered a turning point in male secondary education. There was an unprecedented increase in the number of schools and classes within five years. From Table 6.11, it can be seen that the number of schools increased by 46 percent from 28 to 41. A total of 13 schools were added to secondary education in Riyadh. In most municipalities new schools were built including Assafarat and Irgah. These two municipalities had been deprived of secondary education until 1992, when a school was established in Assafarat. 48 pupils in four classes attended it.

Table 6.11 Numbers of boys secondary schools, pupils and classes in Riyadh in 1995

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	5	2786	96
Batha	0	0	0
Manfuha	4	1762	63
Malaz	4	2193	70
Otaygah	3	2095	63
Ulayah	1	172	6
Mather	1	550	18
Shimal	3	1151	36
Arrowdah	5	2438	78
Annaseem	5	2256	76
Janoob	3	2028	60
Oraija	5	2262	68
Dariyah	0	0	0
Silay	0	0	0
Irgah	1	48	2
Assafarat	1	203	8
Total	41	19944	644

Source: calculated by the author depending on appendix (J)

The school established in Irgah in 1993 was attended by 203 pupils in 8 classes. The largest numbers of new schools were built in the Al-Oraija municipality which showed an increase from 1 in 1990 to 5 in 1995. It continued to hold the first position along with the Annaseem and Arrowdah municipalities in having the largest number of schools - a position that had been previously occupied by the Deerah municipality. This is as a result of population growth in the city and the movement of population to these new areas following the government provision of interest-free loans and free land such as in Oraija municipality. The Annaseem and Arrowdah municipalities stood in second and third positions respectively in relation to establishment of new schools. In the Annaseem municipality, schools increased from 3 to 6 and in Arrowdah from 3 to 5. In addition to the Deerah municipality (which had 5 schools), these are three municipalities where secondary educational services in Riyadh are concentrated. It is no wonder, however, that more than half of the secondary schools are located in this area, because the population of these four municipalities represents 43 percent of the total population of Riyadh.

At the end of this period, male secondary schools served 19944 pupils (Table 6.11), an increase of 8808 over 1990, and an increase of 79 percent. The average number of pupils per school increased from 398 in 1990 to 486 by 1995 because the increase was proportionally more than the increase in the number of schools.

As far as the number of classes in Riyadh is concerned, there was an increase by 58 percent from 406 in 1990 to 644 in 1995. However, this increase was not matched by a similar increase in the number of pupils: the average number of pupils in a class grew to 31. On the municipality level, the largest number of pupils per class (33) was in the Al-Oraija municipality, and the lowest was to be found in Irgah municipality (24 pupils/class).

6.12 Male secondary education (2002)

By 2002, just as in previous years, there were 28 new boys secondary schools added and the educational provision for boys increased in an unprecedented manner compared with any of the previous periods. Between 1996 and 2002, 28 new schools were built bringing the total number to 69, an increase of 68 percent. All municipalities in the city are now serviced by secondary schools, which is a good indicator of the persistent and determined development of secondary education in the city (Figure 6.2).

This development can be explained by the spread of new schools built over all areas and particularly in the municipalities of Al-Shimal, Arrowdah, Annaseem and Al-Oraija where population growth was evident. Moreover, the government played an important role in this expansion, by allocating locations in areas which had already undergone development to provide free educational areas to the poor, and those with limited income. The government also granted citizens long-term loans to help them build their houses (Table 6.12).

Table 6.12 Numbers of boys secondary schools, pupils and classrooms in Riyadh in 2002

Municipality	School (no.)	Pupil (no.)	Classroom (no.)
Deerah	5	4012	116
Batha	1	57	2
Manfuha	6	4328	112
Malaz	4	3056	82
Otaygah	3	2098	62
Olyya	4	2591	75
Mather	1	726	20
Shimal	5	2182	73
Arrowdah	14	7933	249
Annaseem	8	6682	180
Janoob	6	4159	116
Oraija	8	6008	168
Adderiyaih	1	396	12
Assolay	1	524	15
Irgah	1	157	6
Assafarat	1	481	12
Total	69	45390	1300

Source: calculated by the author depending on appendix (J).

However, the number of pupils increased by 128 percent and reached 45390, which was a higher rate of the increase in the number of schools. Accordingly, the number of pupils in a school increased to 658, which in turn pushed the number of pupils in a class from 16 to 19 and the number of pupils per teacher to 17. To sum up, secondary education in Riyadh has experienced a real transformation and changed in all aspects from the number of new schools and pupils to their effective class sizes. These changes have taken place in less than a quarter of a century and have exerted great influence on all aspects of people's social and economic life.

From the discussions in this section (section two), it is obvious that there is a significant increase in male secondary schools, pupils and classes as well. The relative changes in both branches of secondary education at the time of comparison will be examined in the next table and will be used to present conclusions of both male and female developments.

6.13 The relative changes in secondary education at the time of comparison

Table 6.13 Numbers of girls and boys secondary schools, pupils and classrooms in Riyadh from1975 to 2002

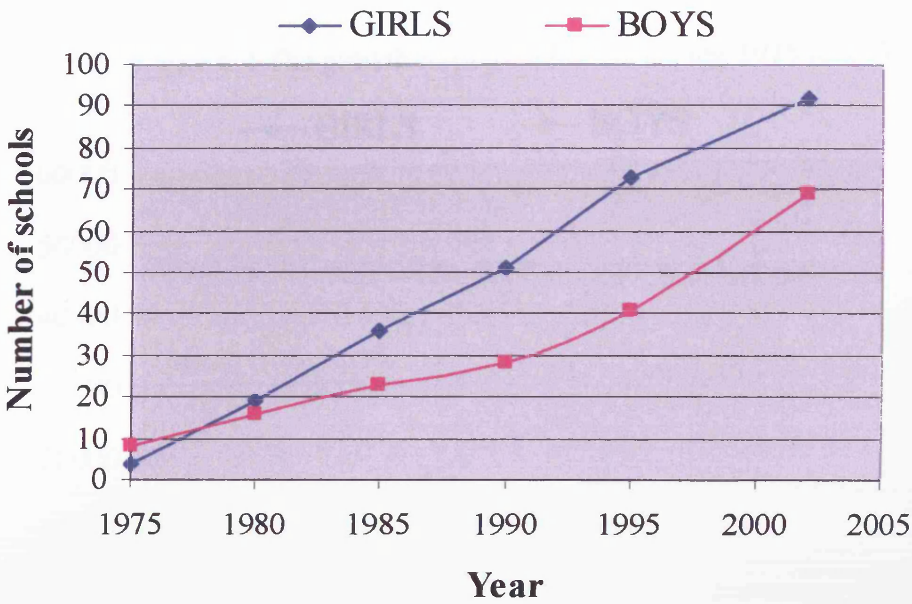
Year	Total of Schools				Total of Pupils				Total of Classes			
	G	%	B	%	G	%	B	%	G	%	B	%
1975	4	33	8	67	2519	32	5252	68	69	29	170	71
1980	19	54	16	46	7653	49	8124	51	254	48	279	52
1985	36	61	23	39	14971	59	10221	41	481	58	354	42
1990	51	65	28	35	21701	66	11136	34	654	62	406	38
1995	73	64	41	36	28237	59	19944	41	1164	64	644	36
2002	92	57	69	43	54546	55	45390	45	1433	52	1300	48

Source: calculated by the author based on the previous tables
G: Girls
B: Boys

As secondary education for boys started earlier than for girls (Al-Sallom 1995, 21), there were initially more boys schools and correspondingly more pupils compared to girls. This changed following the new government policy of encouraging girls education in Saudi Arabia.

Table 6.13 above shows the change in the number of schools, pupils and classes over the period 1975 to 2002. There were just 4 secondary girls schools in 1974, which rose to 92 in 2002, whereas 8 schools for boys in 1975 increased to 69 by 2002. It indicates that the total number of boys schools, pupils and classrooms was more than that of girls at the beginning, but after the 1980s the situation changed following government policy aimed at convincing and encouraging citizens to admit their girls to schools. The government fostered the establishment of new girls schools where possible and provided free transportation. Moreover to keep intact the religious faith underpinning formal schooling, religious supervisors were recruited to schools.

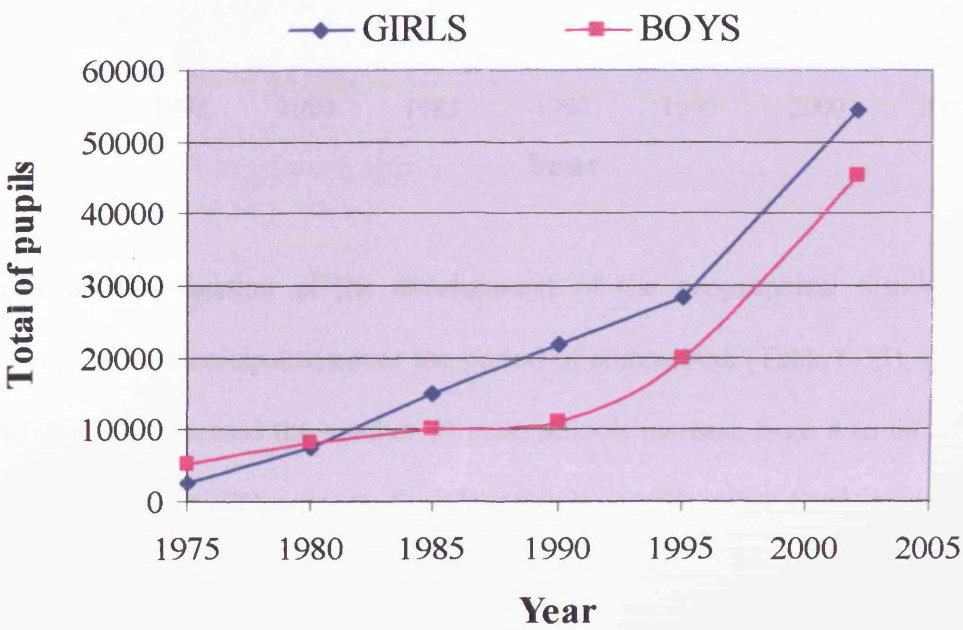
Figure 6.3 School expansion during 1975 to 2002



The Figure 6.3 above shows the growth in the number of schools from 1975 to 2002. 2002, in particular, it illustrates the more raped growth so the number of girls schools relative to boys schools.

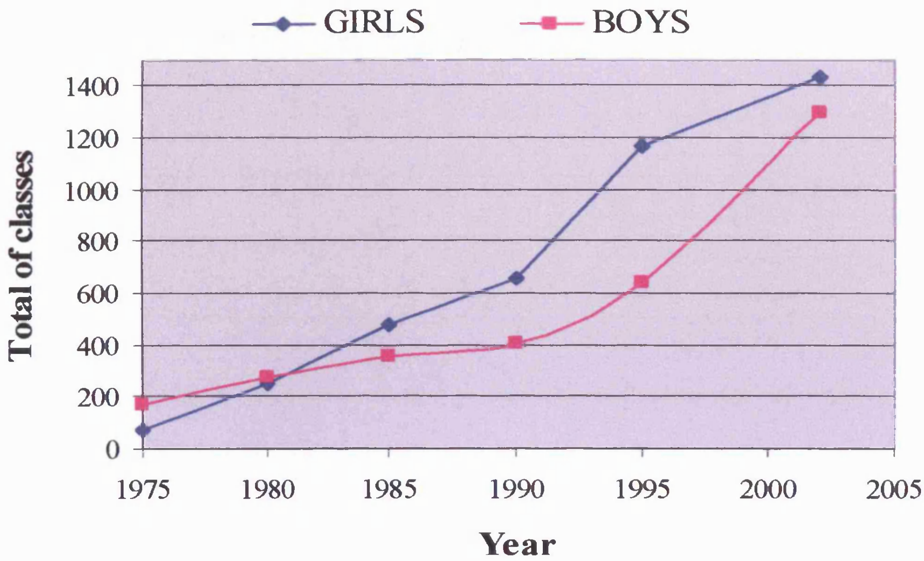
The number of girls attending schools was just 2519 in 1975, but reached 54546 in 2002. In the same period the number of male pupils increased from 5252 to 45390 (See Figure 6.4 and Table 6.13). This clearly indicates the increased importance and awareness among Saudi families of the value of education for their daughters. That is why the number of students increased rapidly from 1975 to 2002, an increase of 2065 percent. In 1970, when the majority of the city was deprived of female secondary schools, there was just one secondary school for girls. It was composed of 27 classes serving about 1114 female students. In 2002, secondary education was available in the great majority of the city's municipalities and the number of female students climbed to 54561. Similarly, the number of classes for girls increased to 1433 and female teachers to 4052.

Figure 6.4 The growth in pupil numbers during 1975 to 2002



The number of male students also increased significantly. Over the relatively short period of time, 1975-2002, the number of male students rose from 5252 to 45390. Clearly, males were more fortunate than females in getting secondary education. Until 1970, there were three secondary schools for males with 163 classes, attended by 1309 students (See Figure 6.5). However, at the end of 2002, the number of schools totalled 69 covering all municipalities in the study area. In total there were 45390 students in approximately two thousand classes (Figure 6.3, 6.4, 6.5).

Figure 6.5 The growth of classes during 1975 to 2002



From an investigation of the development of the geographical distribution of new schools in the municipalities over the period of comparison (Table 6.13), it can be stated that Riyadh witnessed the number of male schools increase from 8 to 69 with a growth ratio climbing to 723 percent. Female schools, on the other hand, increased by 2225 percent: from 4 in 1975 to 92.The largest numbers of schools in Riyadh were built in the municipalities of Annaseem, Deerah, Arrowdah and Al-Oraija. After having been totally deprived of secondary schools in 1979, 14 schools were established in Annaseem. The number grew from 1 to 6 in Manfuha; from no schools in 1975 to 8 in Arrowdah; and from no schools in 1975 to 8 in Al-Oraija.

Concerning female schools, in Annaseem the number increased from no schools at all in 1970 to 13 in 2002. It increased from 3 to 11 in Deerah and from zero to 10 in Arrowdah. As can be seen in Figure 6.1, the largest numbers of schools were built in the northern and east-north-eastern quarters of the city. Moreover, the geographical distribution of female secondary schools in the municipalities differed remarkably between 1975 and 2002. In the municipalities of Annaseem, Al-Oraija and Arrowdah – despite the fact that they had no secondary schools in 1970 - 15 to 16 new schools were built. This increase was not matched anywhere else within Riyadh.

6.14 Conclusions

This chapter has described the historical development of secondary school education in the city of Riyadh, Saudi Arabia from 1975 to the year 2002. This has been done through a review of the dynamics in the number of schools, students and classes in the city and its various municipalities. The chapter started by focusing on the female education and eventually the education of males. We have noted that initially, by 1975, the number of girls in school was less than half of boys in schools and girls schools were just a half of those for boys. Since then rapid growth in the number of both boys and girls, classrooms and schools has occurred.

However, over the period under consideration, the number of girls in schools, girls schools and classes have increased more dramatically compared to the same period for boys. This rapid expansion in the area of girls education has been accounted for by the change in the provision of their education from private and informal by parents to the provision of their education by government. The general increase in awareness of the value of education for girls has also contributed to this trend.

The overall expansion of the secondary school education sector, not unlike other sectors, has been greatly accelerated by the on-going economic prosperity brought about by steadily increasing oil revenues and by the government's explicitly stated policy aimed at promoting education. In conclusion, there is need to determine whether this dramatic expansion in quantity in the education sector has had repercussions for the spatial distribution. This research takes up this challenge.

CHAPTER SEVEN

Questionnaire Analysis

7.1 Introduction

Having established the development of secondary education in Riyadh in Chapter 6, this chapter moves on to describe the main findings from the questionnaire survey. It commences with a review of the characteristics of the respondents, how pupils resolve some transport issues such as the number of cars used, mode of transportation and journey times. It looks at the criteria which were used to investigate the status of the mode of transportation (crowding, comfort and standard of driving). It seeks to discover which people are involved in the choice of school and their ratings of the importance of the seventeen reasons for choosing a school. It uses a 5 point Likert scale ranging from 'extremely important' to 'not important' to grade their responses. Lastly it looks at the correlations between these ratings for both girls and boys and tests the hypotheses developed to clarify some important issues.

7.2 Demographic background of respondents

The demographic characteristics of the respondents in the questionnaire are gender, age, nationality and household size. Firstly, age and gender are generally recognised as important factors that have an influence on the types of education service (Al-Khraif 2003, 154). The several structures of the schools age population in Riyadh are important because single-sex education is imposed in Saudi Arabia. This is based on the teachings of Islam where women are required to remain segregated from all men who are not members of their households. In addition to that, women neither get a driving licence nor allowed to be driven by men who are not one of the closed family members.

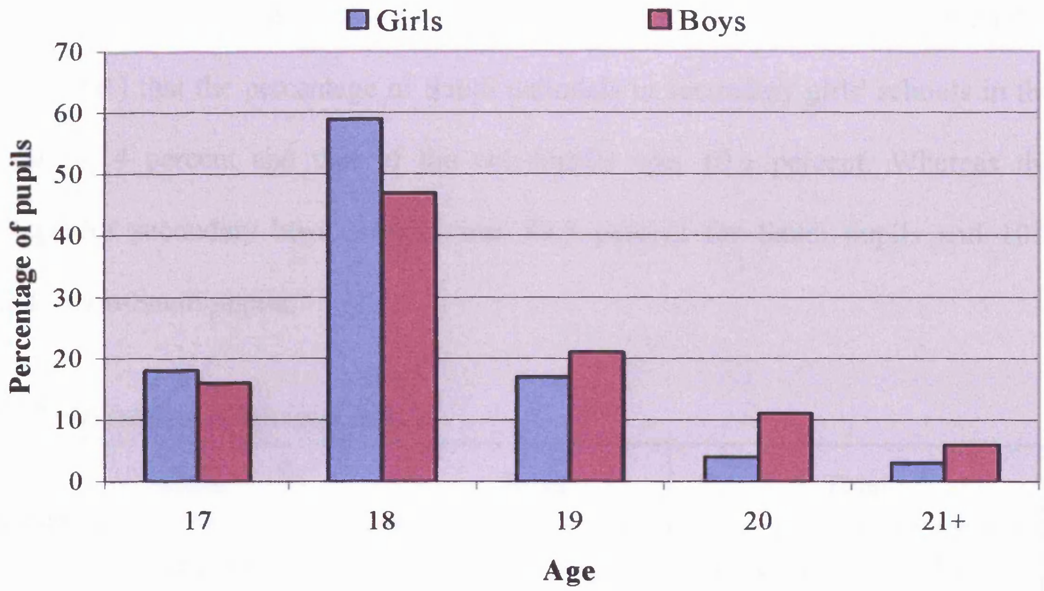
Therefore, all workplaces are segregated by sex to cater for these differences between them. Boys represented 48.3 percent of the sample and girls represented 51.7 percent. Plainly the difference is slight. This is an expected result, because there are more girls in Riyadh than boys (Ministry of Education).

Table 7.1 Age profile of respondents

Age (Year)	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
17	433	18	368	16	801	17
18	1448	59	1073	47	2521	53
19	409	17	488	21	897	19
20	89	4	252	11	341	7
21+	72	3	110	6	182	4
Total	2451	100	2291	100	4742	100

Table 7.1 above and Figure 7.1 below show the age frequency distribution for both male and female pupils. The majority of respondents be they boys or girls, fall in the 18 years old category. Moreover, the 18 and 19 year olds represent 72 percent of total respondents. This is not surprising for the age of high school students ranges from 15 to 20. The striking result here is that secondary school female pupils are younger than their male colleagues particularly in this age range, namely 18-19 years old. This may be due either to a situation in which the female students success rate in the previous educational levels, primary and intermediate, was higher than their male colleagues, and subsequently they were able to enter the high schools earlier, or to the possibility that the female educational system, which was separated from the boys educational system at the time when there data were collected, was more flexible with regards to the age admission requirements to primary schools.

Figure 7.1 Age distribution



Secondly, regarding nationality, it might seem strange to examine the use of the education service with regard to nationality, especially as the official policy in Saudi Arabia considers access to such service a basic human right regardless of citizenship. Nevertheless, due to the combination of a shortage of financial resources and the presence of a large number of non-Saudi residents, in recent years, as demonstrated in Chapter Five, the Ministry of Education has placed constraints on attendance at public schools by non-Saudis. For example the regulations instruct a school to register not more than 15 percent non-Saudi pupils (Ministry of Education, 2002)[1].

Table 7.2 shows that most of the respondents, (78 percent), are Saudi nationals, of whom 47 percent are boys and 53 percent are girls. The remaining 22 percent are considered to consist of non-Saudis, of whom 53 percent are boys and 47 percent are girls. These findings reflect what has been frequently stated in the literature as well as in

1 Based on regulation number 46406/13

Saudi official reports about the percentage of Saudis and non-Saudis in Saudi schools, particularly in public education. For example, the Ministry of Education in Saudi Arabia reported (2001) that the percentage of Saudi nationals in secondary girls' schools in the KSA was 89.4 percent and that of the non-Saudis was 10.6 percent. Whereas the percentage for secondary boys schools was 89.9 percent for Saudi pupils and 10.1 percent for non-Saudi pupils.

Table 7.2 Nationality of the respondents

Nationality	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
Saudi	1956	80	1732	76	3688	78
Non-Saudi	495	20	559	24	1054	22
Total	2451	100	2291	100	4742	100

Source: Author's survey

Moreover, the Ministry of Finance and National Economy (2000) reported that the population of KSA was 20,746,884, of which 74.8 percent were Saudis, composed of 50.04 percent males and 49.69 percent females, whereas non-Saudi residents make up 25.2 percent of which 66.85 percent were males and 33.15 percent females. Moreover, the HCRD (1996) recorded that there were 775,000 non-Saudis in Riyadh, out of a total population of 3,139,613 (HCRD, 2002:50). The study revealed that there was a 78.9 percent Saudi and a 21.3 percent non- Saudi representation in the schools which is analogous with the result achieved during the study carried by Al-Khraif *et al.* (1994). Additionally this result is comparable to the latest Saudi census carried out in 2004. The national census, 2004, indicates that the population is composed of 72.9 percent Saudi nationals and 27.1 percent non-Saudis. The statistics on Saudis alone show a composition of 49.9 percent girls and 50.1 percent boys. Whereas the statistics for non-Saudi nationals show that girls are 30.5 percent and boys are 69.5 percent (Al-Jajzirah Newspaper 2005, 3).

Thirdly, household size has several influences on education services, for instance in the choice of school or mode of transportation. As Saudi culture is patriarchal it is either the father or the senior male who heads the family. This means it is the father or the head of the family who has the sole responsibility of providing care for any children who have to leave the homestead; especially for females who are unable to hold a driving licence. This puts increased responsibility on the head of the household. When discussing education, the distance between the household and the school also plays a crucial role in enhancing this relationship. In addition, the number of children and the number of schools chosen by them is a factor that adds to the responsibility of the head of the household. The greater the number of children, especially if they are girls, and the longer the distance between school and home, together with the number of schools chosen by the children, all increases the burden of responsibility on the father or the head of the household.

Table 7.3 The household size in Riyadh

Household Size	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
< 3	72	3	52	2	124	3
3 – 5	374	15	337	15	711	15
6 – 8	1001	41	1017	44	2018	43
≥ 9	1004	41	885	39	1889	40
Total	2451	100	2291	100	4742	100

Source: Author's survey

Table 7.3 shows that 83 percent of respondent families have more than 6 people living in the house. This is a reflection of the size of Saudi households and is an indication of living style. Moreover, 40 percent of families have more than 9 members living together. This reflection of the fact that the use of contraceptives is not wide-spread in Saudi Arabia and its use is mainly for spacing rather than from a desire to limit the family size (Al-Khraif 2001). The result reflects those of the study carried out by Al-Khraif *et al.* in 1994 which indicated that 40.4 percent of Riyadh families consisted of more than 9 people, 41.3 consisted of between 6 and 8 people, and that only 17.2 percent had fewer than 5 people. The HCRD study in 2001 indicated that the average household size in the city of Riyadh was 6.90 people. Their follow up study in 2002 pointed out that the average size household had increased to 8 people.

The large number of children in Riyadh households means that the burden of responsibilities on the father to make satisfactory transportation arrangements to and from school is considerable. This makes it all the more important for the education authorities to locate new schools so that journey to times can be minimised.

7.3 Socio-economic characteristics

In this section variation in the levels of education of fathers, mothers and in family income are discussed. Although public education is free in Saudi Arabia, the education of the children may often reflect the parents own level of education and income. Since the large size of families in Riyadh demands great responsibility of the head of the household, it is obvious that family income needs to be high to purchase the facilities essential to fulfil the wants and needs of these families and especially of their children. Furthermore, higher income is a function of higher education levels of the parents, leading to a greater propensity to obtain a well-paid job to ensure a high family income. Tables 7.4 and 7.5 depict the level of education of the parents broken down into six different categories from having no formal education, having primary education, intermediate education, secondary education, university degree or postgraduate degree (Master's/PhD).

Table 7.4 Educational achievements of the fathers

Education level	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
None	256	10	350	15	606	13
Primary Education	424	17	392	17	816	17
Intermediate Education	479	20	394	17	873	18
Secondary Education	550	22	475	21	1025	22
University Degree	593	24	493	22	1086	23
Postgraduate (Master's / PhD)	149	6	187	8	336	7
Total	2451	100	2291	100	4742	100

Source: Author's survey

It is obvious from the table above that 30 percent of the fathers have a first or Master's or PhD degree, and 57 percent have a secondary degree whilst 52 percent of them are uneducated or have not received any secondary education.

Table 7.5 Educational achievements of the mothers

Education level	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
None	579	24	699	31	1278	27
Primary Education	647	26	480	21	1127	24
Intermediate Education	475	19	331	14	806	17
Secondary Education	420	17	451	20	871	18
University Degree	301	12	263	11	564	12
Postgraduate (Master's / PhD)	29	1	67	3	96	2
Total	2451	100	2291	100	4742	100

Source: Author's survey

The table 7.5 above shows the educational levels of the mothers. A third of the boys mothers have not had any kind of formal education. Also, around a quarter of the girls mothers have not had any kind of formal education. This is because national secondary education for girls started in 1980, 10 years later than boys secondary education (Al-Senbol *et al.*1998, 71). Figures for 1988-89 show that 19 percent of girls graduated from secondary schools to enter a college as compared with 7.1 percent of boys (Saddeka 1994, 33). However, 68 percent of mothers are not educated to secondary level, and only 14 percent have a university degree (or Masters/PhD). The reasons behind this are that Saudi families usually prefer marrying at the early age of 18 (Lotfi, 1988) or because the chance to get a place at university for girls is limited, and even if they obtain a degree their ability to get a job is limited. The main jobs available are in education, health and social work. For example 80 percent of Saudi working women are employed in the education field and 12 percent in health and social work (Central Department of statistics 2002).

Table 7.6 Annual income of the respondents families (Riyal Saudi)

Annual Income *	Girls	%	Boys	%	Total	
	Frequency		Frequency		Frequency	%
Less than 50000	557	23	572	25	1129	24
50000 - 99999	1023	42	897	39	1920	41
100000 +	871	35	822	36	1593	34
Total	2451	100	2291	100	4742	100

* One US dollar equals 3.75 Riyal Saudi

According to the annual income distribution of the respondents' families, displayed in Table 7.6 above, the majority of respondent's annual income ranges from more than SR 50000 to more than SR 100000. The category of 50000-99999 R has the largest percentage (41 percent) and many families (both girls and boys) fall into this category. However, 24 percent of respondents' families earn less than 50000 R per year, and just 34 percent earn more than 100000 R per year. One can see that the annual income of female students families is, however, similar to that of the male students' families (see table 7.6). Moreover, this result is similar to that in the study carried out by HCRD, especially the category of more than 120 thousand Riyal which comprises 36.4 percent (HCRD, 2001, 14), but the result differs from the study carried out by Al-Khraif *et al.* (1994), where it transpires that 66.3 percent of families have a monthly income of less than 6000 R, while the category from 6000 R to 9999 R is 21.7 percent and category of more 10000 R is 12 percent.

7.4 Mode of transport

As already mentioned, the head of the household is responsible for taking his children to and from school. His responsibility increases if there are more daughters in the family. He must take into account the distance between school and home and the mode of transportation available

Table 7.7 Car ownership

Cars	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
None	113	5	68	3	181	4
One	611	25	498	22	1109	23
Two	673	27	622	27	1295	27
Three	563	23	491	21	1054	22
More than three	488	20	612	27	1100	23
Total	2448	100	2291	100	4739	100

Source: Author's survey

Table 7.7 shows that only 4 percent of students' families have no car. Families with more sons are likely to have more cars as males are allowed to drive and women are not. However, 72 percent of families have two or more cars, and 23 percent of families have just one. The cheaper oil and car prices have increased car ownership. Improved living standards in recent years and cultural changes are additional contributory factors. Furthermore, the expansion of Riyadh and the lack of public transportation have forced people to have their own means of transportation.

Transportation method and journey times are classified according to transportation method. Four modes of transport were included in the surveys: walking, private car, rental car (taxi) and government transport. In Saudi society, walking is not a common habit for several reasons: weather conditions (temperatures in Riyadh often exceed 50 centigrade in the summer), the lack of pedestrian facilities, and widespread car ownership (Al-Meteer 1999). Nevertheless, the study indicated that walking is occasionally favoured by those whose homes are very close to schools. Table 7.8 shows that the majority of students use their own transportation whereas there are few who either walk or use taxis or buses. Additionally, Table 7.8 shows the following:

Table 7.8 Means of transportation from home to school

Means of Transportation	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
Walking	280	11	534	23	814	17
Private transportation	1758	72	1594	70	3352	71
Rent car (taxi)	201	8	129	6	330	7
Public transportation	212	9	34	2	246	5
Total	2451	100	2291	100	4742	100

Source: Author's survey

- the private car is the main mode of transportation for girls (72 percent) and boys (70 percent). The percentage in the girls' case is somewhat higher as schools start work before business and thus employees have the opportunity to take their daughters to school. It must be remembered that girls are not allowed to go out unless accompanied by their father or close relatives.

- there is little desire for walking to and from school. Nearly twice as many boys walk as girls. This is because the boys can walk to school alone.
- there is also little use of government transportation on account of the limited availability of such services. Likewise, the Saudi culture inhibits girls from using taxis unless they are accompanied by very close relatives such as a father, brother or uncle.
- transportation preferences are not affected by whether the journey is to or from school

Table 7.9 Means of Transportation from school to home

Means of Transportation	Girls		Boys		Total	
	Frequenc	%	Frequenc	%	Frequen	%
Walking	391	16	569	25	960	20
Private transportation	1361	56	1486	65	2847	60
Rental car (taxi)	296	12	195	9	491	10
Public transportation	403	16	41	2	444	9
Total	2451	100	2291	100	4742	100

Source: Author's survey

The results indicate that private transportation is used by roughly 60 percent of respondents, which is less than in the morning, especially by boys. Also, boys walk from school to their home more than girls do. On the other hand, the rented car is used by girls rather than boys. It is a mutual arrangement between neighbours where children attend the same school and father has a driver. The driver is paid by the neighbour requesting the service. One interesting point to bear in mind is that some girls have to switch to public transport to get home because the father is still at work and the mother is not allowed to drive a car

However, the ranking of each form of travel varies by school and location. For example, girls attending schools in the Irgah municipality are more likely to walk to their schools (26.7 percent) whereas pupils in the other municipalities, for example in Shimal, rarely walk (5 percent). Instead they go to school by private transportation (80.1 percent) because the distances are too far to walk and public transport is too infrequent. (1670 m see table 8.1). In Batha municipality more boys are willing to walk to their schools (93.3 percent) as this area is in the city centre and more characterized by business, and the majority of the population are non-Saudi nationals (55 percent). Most pupils in Assafarat municipality rarely walk: 96 percent go to school by private transportation because this school has a large catchment area and attracts pupils from different municipalities (4122 m see table 8.1 in chapter 8).

Al-Khraif *et al.* (1994) mentioned that private means of transportation is the main mode of transportation for the majority of both (girls and boys) with 56.4 percent and 42.2 percent respectively when travelling to school. On the return journey, however, the figures fall to 40.3 percent and 33.5 percent respectively. This is seemingly higher in the case of girls than the case of boys, while the walking means for both was 27.6 percent and 55.1 percent respectively, and for the return home was 32.7 percent and 62.8 percent respectively. Concerning public transportation, the percentage for girls was 14.5 percent and for boys 0.6 percent and for the return home was 23.2 percent for girls and 0.7 percent for boys. For rented transportation it was 1.5 percent for girls and 3.7 percent for boys, while for the journey home the percentage became 1.9 percent for girls and 2.7 percent for boys. This result indicated that the finding agreed with the result of the study.

A second similar study by Al-Zeer (1992) carried out on secondary girls schools in western of Riyadh revealed that private means was the main mode of transportation for the majority of girls, used by 71.9 percent for the journey to school and 53.3 for the return home. Next came public transport with 15 percent use going to school but 26.7 percent for the return home, while walking was 13.1 percent. The Al-Zeer study did not cover the use of rental transportation by girls, as they were not strictly allowed to use this form of transportation during 1992. At the present girls travel in cars to a limited extent. This indicates that the society is now more flexible in accepting rental transportation as suitable for girls. These findings are analogous with factors identified by Jones (1996) who stated that the socio-economic condition of households is a determinant of buying education services. He also reiterated that culture affects the way pupils both sexes travel to and from school.

7.5 Travel time

Journey time typically depends upon several factors, the most important being the distance to the school and the mode of transportation. The travel time reported by respondents in secondary girls and boys is shown in table 7.10 below. Most of the respondents (60 percent) reach their schools in less than 9 minutes. One out of five (19 percent) students live in close proximately to their school as they need less than 5 minutes, while 40 percent need 5 to 9 minutes to reach their school. These categories embrace more pupils than any other. This reflects their relative proximity to their school and a good road network and consequently pupils can travel easily to the school.

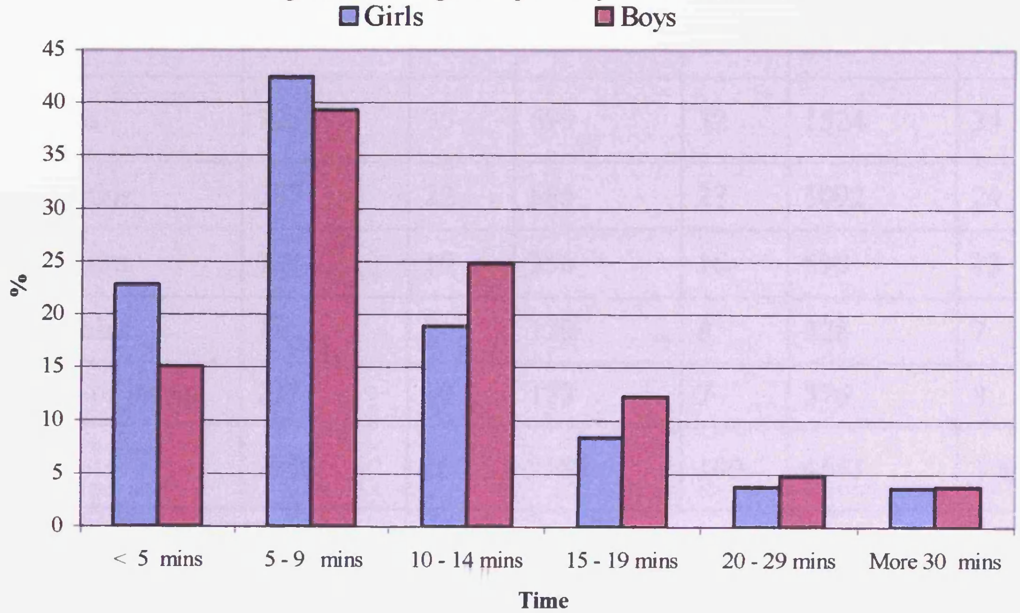
Table 7.10 Length of the journey to school

Time	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
< 5 mins	558	23	345	15	903	19
5 – 9 mins	1039	42	900	39	1939	41
10 – 14 mins	463	19	568	25	1031	22
15 – 19 mins	206	8	282	12	488	10
20 – 29 mins	94	4	110	5	204	4
30 mins or more	91	4	86	4	177	4
Total	2451	100	2291	100	4742	100

Source: Author's survey

Moreover there are no fixed catchment areas, no compulsion for a pupil to attend a particular school, and pupils are allowed to attend any school even if it is a considerable distance from their home. Only a small percentage of respondents (4 percent) need more than 30 minutes to reach school.

Figure 7.2 length of journey to school



The figure 7.2 above reveals that fewer than half of the respondents need 5 to 9 minutes to travel from home to school, with girls outnumbering boys. In general where journeys last less than 10 minutes, girls outnumber boys. For other journey times the reverse is true. This may reflect the fact that many male students drive their sisters to school before driving on to their own schools. Where the father is the driver he usually delivers the girls first.

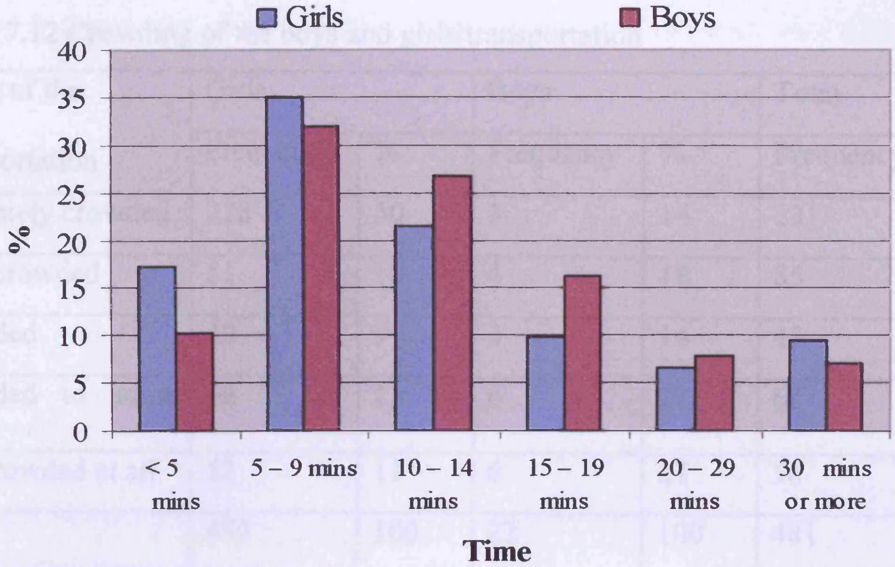
From table 7.11 it can be seen that the return journey takes longer than the one to school, especially where girls are concerned. Half of pupils take between 5 to 9 min to return home, 24 percent of pupils take 10 to 14 min, and just 8 percent of respondents need more than 30 min to reach their homes. This is largely on account of heavy traffic on the road network. This is illustrated in Figure 7.3 below.

Table 7.11 Length of the journey to home

Time from school to home	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
< 5 mins	409	17	224	10	633	14
5 – 9 mins	825	35	699	32	1524	34
10 – 14 mins	507	22	585	27	1092	24
15 – 19 mins	234	10	356	16	590	13
20 – 29 mins	158	7	170	8	328	7
30 mins or more	223	10	153	7	376	8
Total	2356	100	2187	100	4543	100

Source: Author's survey

Figure 7.3 length of journey to home



At the end of this section, it is clear that the vast majority (96 percent) of families have cars (71 percent of respondents have at least two cars). Families with boys in them are more likely to have four or more cars than girls families, this is because girls are not allowed to drive themselves to school. However, 72 percent of families have two or more cars, and 23 percent of families have just one car. The studies by Al-Gabbani (1999); Doxiadis, (1968,208) and HCRD (1993) indicated that the average number of vehicles owned per Saudi family was, 0.49, 1.31, 1.95 cars respectively.

7.6 The status of public transportation

Tables 7.8 and 7.9 indicated the number of pupils who are using public transportation in comparison with those who prefer private cars, rental cars or walking. The following criteria were used to measure the status of public transportation: crowded, comfortable and standard of driving (well driven). A five point Likert scale was used.

- Crowding

Table 7.12 Crowding of the boys and girls transportation

Status of the transportation	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
Extremely crowded	228	50	3	14	231	48
Very crowded	81	18	4	18	85	18
Crowded	40	9	3	14	43	9
Crowded to some	58	13	6	27	64	13
Not crowded at all	52	11	6	27	58	12
Total	459	100	22	100	481	100

Source: Author's survey

It is clear from Table 7.12 above that transportation can be described as 'extremely crowded' for most respondents (50 percent of whom are girls and 14 percent boys). Furthermore, more than 40 percent of the girls said that their public transport was 'very crowded', 'crowded' and 'crowded to some extent' while the percentage for the boys was 59 percent. This is because there are far too few buses (Ministry of Transportation 1998,273). Only 11 percent of girls and 17 percent of boys stated that public transportation was 'not crowded at all'.

- Comfort

The below table 7.13 shows the evaluation by students of the level of comfort experienced on their journeys between school and home. It seems that for most, transportation status was described as 'not comfortable', 71 percent of respondents stated that public transportation is 'not comfortable at all' because there are far too few buses, they are not equipped with air conditioning systems and they are very old, as against 21 percent of respondents describing their transportation as 'very comfortable'.

Table 7.13 Transportation comfort

Status of the transportation	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
Very comfortable	92	21	8	21	100	21
Comfortable	20	4	3	4	23	5
Comfortable to some extent	5	1	1	1	6	1
Not comfortable	6	1	2	1	8	2
Not comfortable at all	323	72	8	72	331	71
Total	446	100	22	100	468	100

Source: Author's survey

- The standard of driving (well driven):

Table 7.14 below demonstrates respondents' reactions to standards of driving. Most of these respondents (56 percent) were not happy with the standards encountered, probably because most drivers do not have qualifications to drive school buses (Al-Zamail 1998, 317). Nevertheless, 44 percent of respondents stated that the standard of driving is 'good' or 'very good'.

Table 7.14 The standard of driving (well driven)

Status of the transportation	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
Very badly driven	107	24	3	14	110	24
Badly to some extent	146	33	4	18	150	32
Suitably driven	127	29	5	23	132	28
Very well driven	29	7	4	18	33	7
Extremely well driven	36	8	6	27	42	9
Total	445	100	22	100	467	100

Source: Author's survey

7.7 Hire car cost

In the Saudis culture, there are two types of hire cars. The first type is hiring cars under the supervision of the government official such as hiring buses from the public transportation company. The second type is to hire cars privately by parents without the supervision from the government officials. In order to clarify transportation costs, three categories were used; less than 250 SR, more than 250 SR and less than 500 SR, and more than 500 SR. Table 7.15 shows the selected sample responses. It gives an idea of the costs of transportation actually used to convey students between home and school. Most of the respondents (59 percent) said that the cost of renting a car was probably less than 250 SR. Just 9 percent of the respondents said that their rental costs were more than 500 RS with 32 percent of the respondents stating that their costs were between 250 and 499 SR. The study by Al-Zamail (1998, 351) shows that the cost of transportation for the first child is 900 SR per term. This cost will be decreased to be 850 SR per term when there is a second child in the same family. Also, it decreases more to be 800 SR per term when there is a third child in the same family.

Table 7.15 Rental car cost (monthly)

Cost / Saudi Riyal	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
< 250 SR	138	56	163	61	301	59
250 – 499 SR	79	32	86	32	165	32
More 500 SR	30	12	18	7	48	9
Total	247	100	267	100	514	100

Source: Author's survey

7.8 The decision maker in the choice of school

Decision-making is the process of identifying and choosing alternatives based on the values and preferences of the decision maker. Making a decision implies that there are alternative choices to be considered, and in such a case respondents want to identify the best fits with their goals. Table 7.16 below shows that boys and girls have more influence on the decision than their parents. However, the comparison between boys and girls shows that boys have more influence than the girls by nearly 16 percent and boys fathers participate more than girls fathers in the decision-making process. Regarding the mother's role, it seems that mothers participate more as a decision maker in the choice of school for girls. In the case of the whole family, it seems that girls families participate more than boys families in the choice of school.

Table 7.16 The decision maker in the choice of school for the respondents

Chooser	Girls		Boys		Total	
	Frequency	%	Frequency	%	Frequency	%
Student	958	39	1310	57	2268	48
Father	345	14	565	25	910	19
Mother	214	9	73	3	287	6
Family	927	39	343	15	1270	27
Total	2444	100	2291	100	4735	100

Source: Author's survey

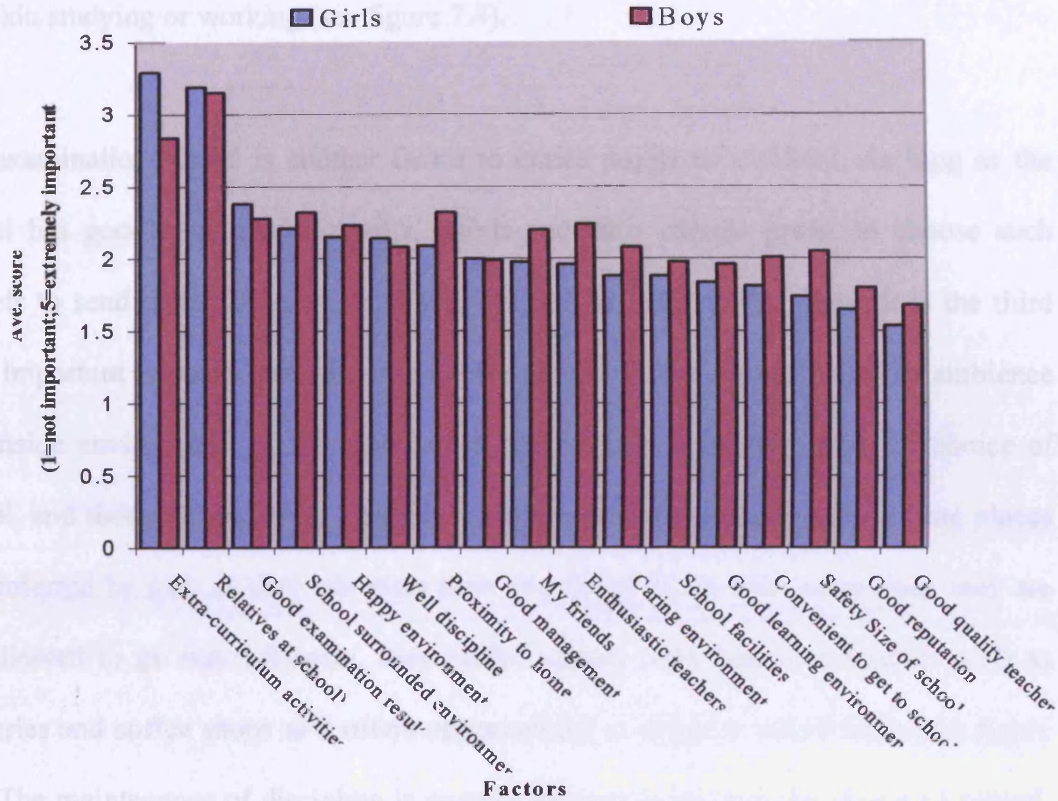
It can be concluded then that boys are making their decision more independently, with their fathers as next in line in the process of choice. This is because they drive themselves to school, whereas with girls the decision making process is influenced by the family. The decision arrived at is contingent upon the availability of private transportation, location of school as well as travel distance and cultural considerations.

7.9 Factors that influence selection of secondary schools

The evaluation criteria which determines the pupil's choice of school is mentioned in Figure 7.4 below. Pupils were given a list of 17 different factors that might have an impact on their selections. The Likert scale was used to measure the importance of each factor, ranging from 'not important' to 'extremely important' (1 = not important; 5 = extremely important).

Participants were asked to rank how important these 17 factors; they were rather asked to state to what extent they were important in the choice of school based on the girls decisions of choice of school. For example, on the good quality of the teaching, good reputation, safety size of school, convenience of access, good learning environment, school facilities, caring environment, enthusiastic teachers, student's friends, good management, proximity to home, good discipline, happy environment, environment around the school, good examination results, relatives (e.g. sisters) at the same school, and extra-curricula activities. These were used by Elliot (1982, 36-43) and were repeatedly used by Stillman and Maychel, (1986, 198-202) and Martin (1989,82).

Figure 7.4 Factors that influence selecting secondary schools



As shown in Figure 7.4 the most important factor emerging from the choice of a secondary school was extra-curricula activities with a mean of 3.29 as schools offer a range of classes to students in addition to the scheduled routine. This includes Mathematics, English language, Arabic language, Sciences and other relevant classes. Any pupil who feels him/herself weak in any particular field or is interested in other subjects can attend such classes as extra. These activities are especially important for girls to enable them to achieve high scores to gain admission to university, as only boys have the alternative to join other institutions such as the military if they are unable to gain admittance to university. Moreover, women are not allowed to leave their home either for studies or for any jobs, so they must achieve high scores if they intend to go to university. The second highest factor for girls in the choice of school is their relatives. Relatives include the close kin of the students who might accompany them during travel and school time. Most of the girls expressed a preference for those schools where they have kin studying or working (see figure 7.4).

The examination record is another factor to entice pupils to a school. As long as the school has good examination results, pupils and their parents prefer to choose such schools to send their children to and vice versa. The field survey shows it is the third most important factor determining the choice of school (see Figure 7.4). The ambience and inside environment of the schools are other factors in determining the choice of school, and those which have a pleasant environment such as gardens and sitting places are preferred by girls as they can meet their friends (girls) in such areas since they are not allowed to go out. Likewise, they prefer schools with places to interact such as cafeterias and coffee shops as it offers opportunities to socialise with friends (see figure 7.4). The maintenance of discipline is another element in shaping the choice of school. The better the discipline in school, the higher it is rated by parents and girls. Proximity is next as it offers the opportunity for girls to walk to school if they are accompanied by relatives and friends. In addition to the above, there are several other factors contributing to the choice of school by girls such as management of the school, teachers and facilities. The quality of teaching is the least important influence on choice, as it cannot be altered since the government recruits all teachers.

The Mann-Whitney Test was used to assess whether there is a statistically significant difference between the mean of level importance of the choice scores of girls and boys (Dancey; Reidy 2002, 517).

Table 7.17 below shows that the differences between girls and boys concerning most of the seventeen criteria are significant. Out of these seventeen criteria, three (relatives, good management, and good discipline) are not significant. The seventeen variables may be considered to be a large number and they need to be reduced. Principle components analysis (PCA) was used to reduce the number of variables. The process and results of PCA are presented below.

Table 7.17 Criteria that determine the girls and boys choice of school

N	Criteria	U (Sig.)	N	Criteria	U (Sig.)
1	Extra-curricula activities	0.000	10	Enthusiastic teachers	0.000
2	Relatives at school	0.242	11	Caring environment	0.000
3	Good examination results	0.024	12	School facilities	0.001
4	Environment around school	0.026	13	Good learning environment	0.000
5	Happy environment	0.006	14	Convenient to get to school	0.000
6	Well disciplined	0.088	15	Safety level of school	0.000
7	Proximity to home	0.000	16	Good reputation	0.000
8	Good management	0.567	17	Good quality teaching	0.000
9	Friends at school	0.000			

7.10 Identifying key criteria

Principal Component Analysis (PCA), is (synonymous) with factor analysis as originally conceived by Pearson (1901) and developed by Hotelling (1933). In factor analysis (FA) or principle component analysis (PCA) three criteria need to be met to produce a satisfactory result. These criteria are:

- In respect of sample size, Pallant (2001) indicated that the larger the better and added that for factor analysis at least 300 cases are required. She deduced this from the work of Tabachnick and Fiedell (1996). This requirement is met by the research data set (4742 cases).
- As to the strength of the inter-correlations among the items, if few correlations above the level of .3 are found, then according to Tabachnick and Fiedell (1996) and

Pallant (2001), factor analysis may not be appropriate. In this research most of the inter-correlations obtained are above this level and very few correlations are below, see Table 7.18.

- Sampling variables: there should be enough variables in each dimension. Kline (1997) suggested at least three variables to enable researchers to mark a factor.

Table 7.18 Correlation Matrix

N[1]	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8	Q.9	Q.10	Q.11	Q.12	Q.13	Q.14	Q.15	Q.16	Q.17
Q.1		0.51	0.11	0.10	0.06	0.36	0.39	0.22	0.40	0.40	0.36	0.17	0.26	0.24	0.34	0.34	0.27
Q.2	0.51		0.17	0.14	0.08	0.43	0.41	0.25	0.42	0.38	0.38	0.22	0.31	0.28	0.35	0.34	0.30
Q.3	0.11	0.17		0.16	0.19	0.14	0.11	0.46	0.13	0.10	0.10	0.10	0.12	0.10	0.10	0.10	0.16
Q.4	0.10	0.14	0.16		0.13	0.20	0.07	0.18	0.12	0.11	0.12	0.07	0.12	0.23	0.09	0.10	0.09
Q.5	0.06	0.08	0.19	0.13		0.16	0.10	0.17	0.13	0.06	0.08	0.19	0.14	0.11	0.13	0.05	0.16
Q.6	0.36	0.43	0.14	0.20	0.16		0.42	0.33	0.46	0.42	0.41	0.23	0.29	0.28	0.34	0.33	0.29
Q.7	0.39	0.41	0.11	0.07	0.10	0.42		0.27	0.42	0.46	0.45	0.23	0.29	0.23	0.40	0.38	0.32
Q.8	0.22	0.25	0.46	0.18	0.17	0.33	0.27		0.35	0.27	0.28	0.18	0.24	0.22	0.24	0.23	0.26
Q.9	0.40	0.42	0.13	0.12	0.13	0.46	0.42	0.35		0.48	0.43	0.29	0.35	0.29	0.40	0.38	0.34
Q.10	0.40	0.38	0.10	0.11	0.06	0.42	0.46	0.27	0.48		0.59	0.19	0.34	0.26	0.37	0.43	0.32
Q.11	0.36	0.38	0.10	0.12	0.08	0.41	0.45	0.28	0.43	0.59		0.26	0.31	0.22	0.35	0.38	0.35
Q.12	0.17	0.22	0.10	0.07	0.19	0.23	0.23	0.18	0.29	0.19	0.26		0.34	0.20	0.23	0.16	0.23
Q.13	0.26	0.31	0.12	0.12	0.14	0.29	0.29	0.24	0.35	0.34	0.31	0.34		0.38	0.37	0.31	0.29
Q.14	0.24	0.28	0.10	0.23	0.11	0.28	0.23	0.22	0.29	0.26	0.22	0.20	0.38		0.41	0.30	0.28
Q.15	0.34	0.35	0.10	0.09	0.13	0.34	0.40	0.24	0.40	0.37	0.35	0.23	0.37	0.41		0.47	0.38
Q.16	0.34	0.34	0.10	0.10	0.05	0.33	0.38	0.23	0.38	0.43	0.38	0.16	0.31	0.30	0.47		0.34
Q.17	0.27	0.30	0.16	0.09	0.16	0.29	0.32	0.26	0.34	0.32	0.35	0.23	0.29	0.28	0.38	0.34	

Table 7.19 indicates that many correlations have absolute values above .3 (rounding used for two decimal points) therefore all items in the matrix were kept for factor analysis and the second condition of performing FA was met.

Two statistical measures are also generated by SPSS to help assess the factorability of the data: Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. The Bartlett's test of sphericity should be significant ($p<.05$) for the factor analysis to be considered appropriate. The KMO index ranges from 0 to 1, with .6

[1] N, it means number of factor as in table 7.17.

suggested as the minimum value for a good factor analysis (Tabachnick and Fiedell 1996).

From Table 7.19 the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value is .911 (greater than .6) and Bartlett's Test of Sphericity is significant with (.0000), so factor analysis is appropriate.

Table 7.19 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.911
Bartlett's Test of Sphericity	Approx. Chi-Square	21682.057
	df	136
	Sig.	.000

After meeting the first and second requirements the third requirement will be dealt with while considering variable rotation. When performing factor analysis the next step is to undertake factor extraction. Factor extraction involves determining the smallest number of factors that can be used to represent best inter-relations among the set of variables (Gorsuch 1974; Pallant 2001). One extraction technique[1] is the principal components technique, which was chosen to perform the extraction. The researcher has depended on Kaiser's criterion (the Eigenvalue rule) to determine the number of factors to be extracted. Three factors score more than 1 as in Table 7.20.

[1] Other techniques are: principal factors, image factoring, maximum likelihood factoring, alpha factoring, unweighted least squares and generalised least squares.

Table 7.20 Total variance explained[1]						
Initial Eigenvalues				Extraction Sums of Squared Loadings		
Component	Total	% of variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.486	32.269	32.269	5.486	32.269	32.269
2	1.438	8.459	40.728	1.438	8.459	40.728
3	1.112	6.542	47.270	1.112	6.542	47.270
4	1.000	5.881	53.151			
5	.912	5.365	58.516			
6	.823	4.842	63.358			
7	.807	4.747	68.105			
8	.688	4.050	72.155			
9	.640	3.762	75.917			
10	.633	3.723	79.640			
11	.582	3.426	83.065			
12	.554	3.258	86.323			
13	.526	3.093	89.417			
14	.484	2.848	92.265			
15	.477	2.807	95.072			
16	.449	2.641	97.713			
17	.389	2.287	100.000			

In Table 7.20 the loading in these three factors are 5.486, 1.438 and 1.112. The following score is 1.0 which cannot be extracted. These three components explain a total of 47.270 percent of the variance (see cumulative % column). Another assurance of confidence about the researcher's choice can be obtained by plotting the data using Catell's scree test as in Figure 7.5.

[1] Extraction Method: Principal Component Analysis.

Figure 7.5 Scree Plot for choice of school items

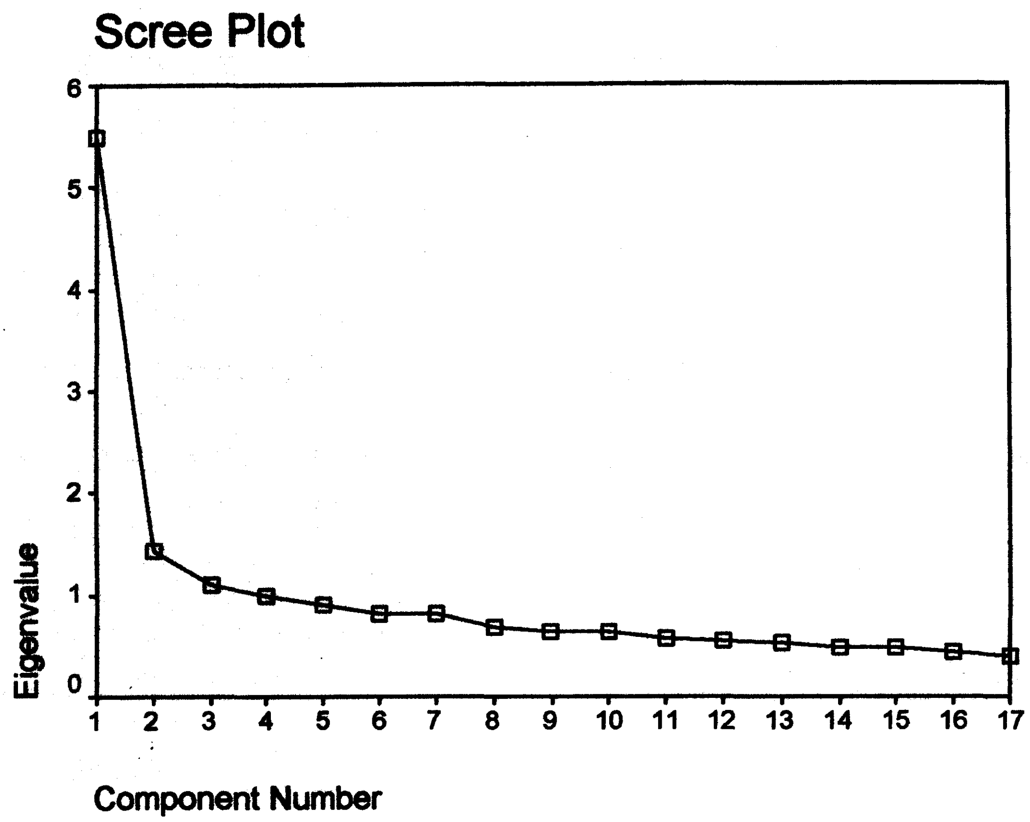


Figure 7.5 shows another approach that can be used to extract underlying variables. This involves plotting each of the Eigenvalues of factors and inspecting the plot to find a point at which the shape of the curve changes direction and becomes horizontal. This approach recommends retaining all factors above the elbow, or seeking a break in the plot, as these factors contribute most in explaining the variance in the data set. It is clear from the graph that only three factors are above the elbow. This gives an assurance for the main method used for extraction. One more process to assist in performing factor analysis is checking the loading of each item in the three components. See the component matrix in Table 7.21.

Table 7.21 Component matrix[1]

	Component		
Component	1	2	3
Q.9 School facilities	.703		
Q.10 Good reputation	.694		
Q11 Good discipline	.673		
Q.7 Good management	.659		
Q.6 Safety level of school	.659		
Q.2 Caring environment	.654		
Q.15 Enthusiastic teachers[i]	.652		
Q.16 Good quality teaching	.623		
Q.1 Good learning environment	.610		
Q.13 Good examination results	.578		.409
Q.17 Environment around school	.571		
Q.14 Happy environment	.520		.460
Q.8 Convenient to get to school	.512	.499	-.333
Q.12 Extra-curricula activities	.430		.400
Q.3 Proximity to home		.674	-.370
Q.5 Relatives at school		.525	
Q.4 Friends		.411	

In Table 7.21 the Kaiser criterion was used to check the loading of each item in the three components. Most of the items load quite strongly (above .4 and only one is .33) on these three components. This supports the researcher's conclusion from the Scree Plot to retain only three factors for further investigation.

Once the number of factors has been determined, the next step is to try to interpret them. To assist in this process the factors are 'rotated'. This does not change the underlying solution, but rather presents the pattern of loadings in a manner that is easier to interpret. One method of rotation is chosen for its ease of interpretation: it is orthogonal (uncorrelated) with Varimax and Kaiser normalization (Tabachnick and Fiedell 1996)[2]. Table 7.22 shows the rotated component[3] matrix.

[1] Extraction Method: Principal Component Analysis. A 3 components extracted
[2] The other method for rotation is oblique (correlated)
[3] Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table 7.22 Rotated component matrix[1]			
Factors	Component		
	1	2	3
Q.10 Good reputation	.745		
Q.11 Good discipline	.704		
Q.7 Good management	.689		
Q.1 Good learning environment	.668		
Q.2 Caring environment	.652		
Q.9 School facilities	.634		
Q.6 Safety level of school	.598		
Q.16 Good quality teaching	.582	.301	
Q.17 Environment around school	.415	.381	
Q.14 Happy environment		.664	
Q.13 Good examination results	.305	.638	
Q.12 Extra-curricula activities		.578	
Q.15 Enthusiastic teachers	.482	.526	
Q.3 Proximity to home			.811
Q4 5.8 Convenient to get to school	.354		.703
Q.5 Relatives at school		.407	.455
Q.4 Friends			.421

In Table 7.22 three factors are extracted and the related items clumped together in each factor. The main loadings on component 1 are: Good reputation, good discipline, good management, good learning environment, caring environment, school facilities, safety level of school, good quality teaching, and environment around the school. These represent the school environment. The main items on component 2 are good examination results, extra-curricula activities and enthusiastic teachers. One item was omitted because of non relevance of the meaning - Q.14 happy environment. This item, however, cannot be moved to the first dimension, school environment, because the loading is not compatible (empty cell). The second components represent the school

[1] A Rotation converged in 6 iterations.

activities. The main items in the last component are proximity to home, convenient to get to school, relatives at the same school and friends at school. This dimension represents accessibility to school. As can be seen, the number of variables in one factor is not less than 3 and the load of the variable is not less than 0.4. These are the main criteria for determining the underlying variable. The result of these criteria is shown in the three tables below (7.23, 7.24, 7.25, with nine items included under school environment, three items under school activities and four items under accessibility to school.

Table 7.23 School environment dimension

Items	Loading
Q.10 Good reputation	.745
Q.11 Good discipline	.704
Q.7 Good management	.689
Q.1 Good learning environment	.668
Q.2 Caring environment	.652
Q.9 School facilities	.634
Q4.5.6 Safety level of school	.598
Q.16 Good quality teaching	.582
Q.17 Environment around school	.415

Table 7.24 School activities dimension

Items	Loading
Q.13 Good examination results	.638
Q.12 Extra-curricula activities	.578
Q.15 Enthusiastic teachers	.526

Table 7.25 School accessibility dimension

Items	Loading
Q.3 Proximity to home	.811
Q.8 Convenient to get to school	.703
Q.5 Relatives	.455
Q.4 Friends	.421

These three factors need to be tested for reliability, with Cronbach Alpha. See Table 7.26 for the results.

Table 7.26 Scale reliability test for choice of school			
	Environment	Activities	Accessibilities
No. of variables	9	3	4
No. of cases	4712	4737	4728
Reliability coefficients Alpha (Cronbach)[1]	.8508	.5754	.5047
Mean	1.9324	2.5000	2.3411

As in Table 7.26 the scales, school environment, school activities and accessibilities, are reliable. Alpha coefficients, respectively, are 0.85, 0.60 and .50. These levels of reliability along with the factor analysis result permit the researcher to consider these three factors as representatives for choice of school[2].

As can be seen from Table 7.26 the mean of school activities is greater than the mean for the other two dimensions and school accessibility is ranked second. This indicates that the school activities are the most important factor for choice of school, followed by accessibility to school. The Friedman test is also a good tool to show the ranking of these dimensions. See tables 7.27 and 7.28.

Table 7.27 Friedman Test for choice of school dimensions

Dimensions	Mean Rank
School environment	1.58
School activities	2.29
School accessibility	2.14

---

[1] Alpha Cronbach, this is a model of internal consistency, based on the average inter-item correlation.

[2] According to George and Mallery (2003: 231) Alpha Cronbach of .5 and upper is an acceptable level. Similarly, Nunnally (1967) recommended .50 to .60 for the early stages of research. But also Nunnaly (1978) has indicated .70 to be an acceptable reliability coefficient but lower thresholds are sometimes used in the literature. See this website for more support and literature: http://216.239.59.104/search?q=cache:hRlWPlw7xu4J:gilbreth.ecn.purdue.edu/~ie556/cronbach_alpha.ppt+Alpha+cronbach+score&hl=en, 12/3/2005.

Table 7.28 Test Statistics	
N	4742
Chi-Square	1418.796
df	2
Asymp. Sig.	.000

The test in Table 7.28 assures the significance of the ranking order of these three dimensions. Chi-square is 1418.8 and the significant level is .000,so the ranking difference is genuine and can be confidently reported in this research thesis. After these statistical preparations (FA and Alpha) and the test of ranking order with descriptive statistics, the comparison between genders will follow.

Comparison between boys and girls in choice of school

Tables 7.29 and 7.30 show the descriptive statistics and T-test results of the difference between boys and girls in their choice of school. The T-test was used having converted the data from ordinal data to continue data and the power of the data was increased.[1]

Table 7.29 Choice of school statistics and the difference between genders

	School environment		School activities		School accessibility	
GENDER	Boys	Girls	Boys	Girls	Boys	Girls
N	2291	2451	2291	2451	2291	2451
Mean	1.9932	1.8756	2.4522	2.5447	2.4203	2.267
Std. Deviation	0.84627	0.78042	1.01798	0.99825	0.89225	0.76555

[1] Data become ratio scale as the T-test requires at least interval scale data. See Spss 12.0 help.

Table 7.30 shows that boys are giving more importance to the school environment than girls. This may indicate the nature of boys in respect to their attitudes and hobbies. However, girls give more importance to school activities than boys. This is because girls see school time as an enjoyable time, as in Saudi Arabia girls generally stay at home, whereas boys can go out freely. The result of accessibility to school was unexpected as boys have given this more importance than girls have. The possible explanation could be that boys are more often responsible for transporting their sisters to school so they are more concerned with accessibility. This explanation is consistent with the previous result about means of transportation to and from school, with 60 percent and 70 percent respectively using private transportation. The main drivers are the boys or the fathers.

Table 7.30 T-test of the difference between boys and girls in their choice of school

	t-test for Equality of Means	df	Sig. (2-tailed)	Mean Difference
School environment	4.967	4638.278	.000	.1177
School activities	-3.155	4704.327	.002	-.0925
School accessibility	6.331	4523.743	.000	.1533

Table 7.30 shows the significance of the difference mentioned in the previous table (7.31). The result indicates a significant difference between boys and girls in the three dimensions. The T-test respectively are 4.967, -3.155[1] and 6.331. the significant level of the differences are .000, .002 and .000.

[1] The negative sign here due to the subtraction direction as boys scores were put first and girls scores were put second which is a normal mathematical process.

7.11 Conclusions

This chapter shows that, compared to foreigners, Saudi students numerically dominate the schools in Riyadh. We have also seen that the average family size by 2002 was as high as 8 people per family. This had repercussions to the provision of transportation to schools as the larger the family, and by implication numbers of children, the bigger the responsibility. Parents' educational attainment has also been noted to vary with more fathers having relatively higher levels of attainment than mothers.

the Majority of Saudi families also posses their own means of transport with 71 per cent using such means to access schools, while only about 5 percent of the students use public transport. However, the use of private transport is lower for journeys made from school to home with 60 per cent using this mode of transport while the users of public transport rose to 9 percent. Most of those who did not use either private or public means for both journeys walked home to and from school. Journey time also varied mainly according to distance to school and the mode of transport used with 60 percent reaching school in less than 9 minutes. In general, where journeys lasted for more than ten minutes, girls outnumber boys. For other journey times, the reverse has been seen to be true owing to the fact that many male students drive their sisters to school before driving on to their own schools. For those who used public transport, many identified crowding as a major problem

The decision making on the choice of school varied with more boys and girls making choices on the schools they attended than their parents made the choices for them. More boys made choices on their schools than girls, while mothers made relatively more choices for their daughters that fathers did. Three main factors were identified as determining the choices made for schools: school environment, school activities and accessibility.

Compared to girls, boys gave higher consideration to the school environment in their choice of schools. However, girls gave more consideration to school activities than boys did. We have noted that this could more likely be as a result of the fact that there are very few other opportunities for girls to be out of home than is the case for boys. Boys also gave higher regard in their choice to the factor of accessibility than was the case for girls. We have seen that this could be attributed to the fact that many boys have a higher responsibility of driving themselves and their sisters to school, as girls in Saudi Arabia are not allowed to drive. All in all, we can conclude that transport to school and the choice of school in Riyadh vary between and within families and localities and this variation is mediated by a number of factors.

CHAPTER EIGHT

Evaluation of the location of schools in Riyadh

8.1 Introduction

This chapter presents a full description of the results of the analysis of school location in Riyadh. This includes the application of the straight-line distance method to calculate the actual and optimum distances between pupils' homes and their schools. The density of schools is also investigated and the concentration of schools in Riyadh is examined. In addition, an investigation is made of the size of each school's catchment area. School capacity is also calculated, taking into account the extent to which schools exceeded their capacity. A case study is used to illustrate the different methods employed in the calculation of distance and the treatment of very high pupil numbers in Oraija municipality. Weighted and unweighted methods are used in the case study. The use of these methods will enable the researcher to identify the best location for schools to minimize the distance between pupils' residences and their schools.

8.2 Distance travelled (Straight line)

Instead of using a GIS in the KSA for working out the distance between homes and schools, the researcher measured the distance by using the straight-line method. The absence of a postcode based reference system in Riyadh, such as those used in other countries e.g. the UK or USA (Raper *et al*, 1992), did not prevent the researcher from trying to geo-reference the survey respondents by asking them to record the name of the wards where they live, the street name and house number. This enabled a straight-line method to be used to calculate a pupil's travelling distance to school. This method was applied in Riyadh by Al-Shahrani in 2004 to measure the distance between primary care health centres and patients' homes due to the absence of a postcode system in Riyadh. The procedure for calculating these distances was based on two scenarios:

- Scenario One: calculation of the actual distance between a pupil's home and his/her school, i.e. the school that they are currently attending.
- Scenario Two: calculation of the optimum distances between schools and pupils' homes i.e. distance to the closest school. Calculating straight-line distances between a pupil's home and the closest school represents the most logical method that can be used to calculate the distance between the pupils' homes and their schools in Riyadh (Love and Lindquist 1995).

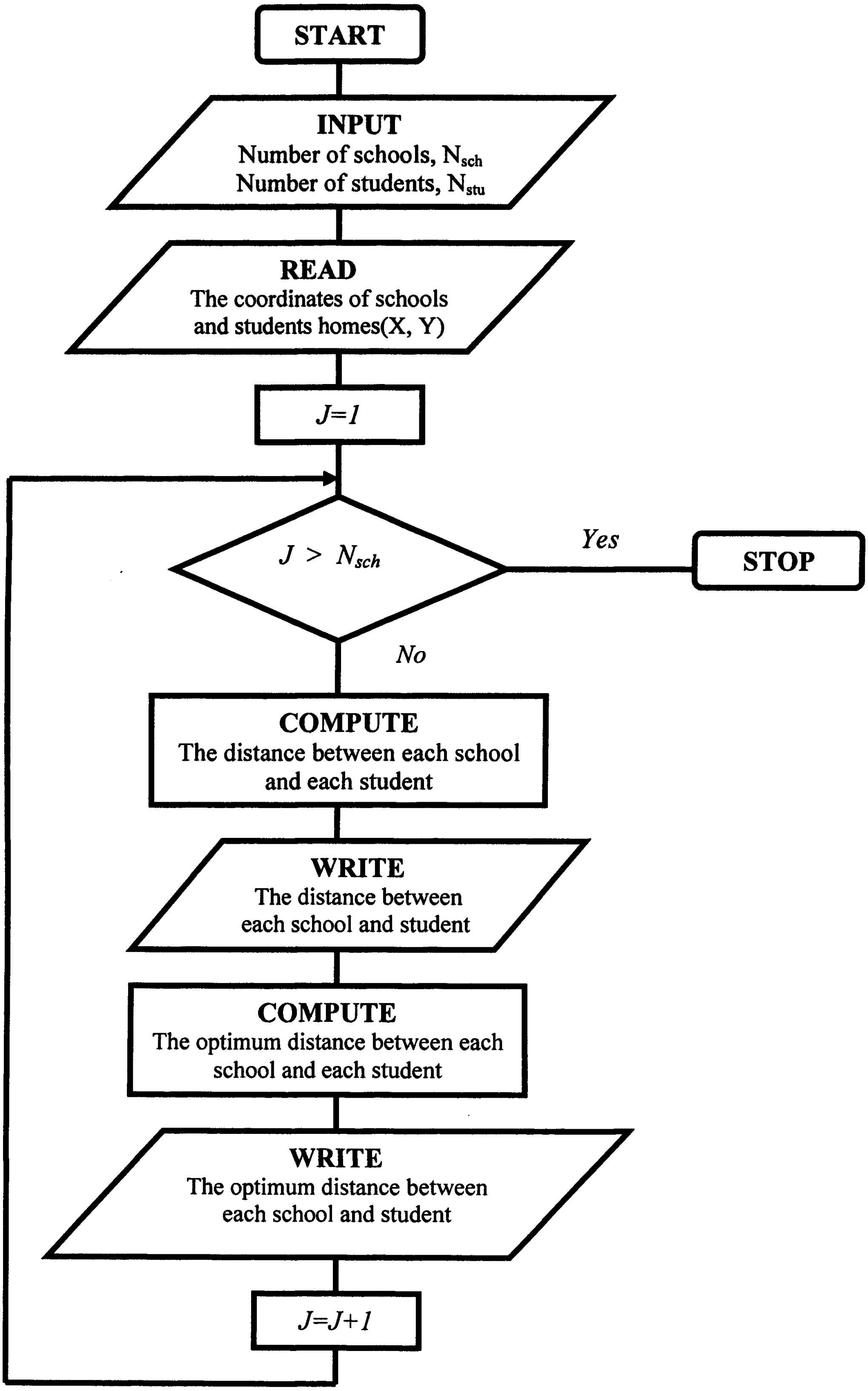
It was necessary, therefore, to identify the coordinates (x, y) of the locations of all pupils and the schools that they attended in Riyadh. Initially, coordinates were identified using the base map of Riyadh. In addition, to achieve accurate results in calculating distances to and from schools, the researcher used the residential areas map.

The flow chart in Figure 8.1 describes the calculation steps of the code. The code inputs were the total number of students, N_{st}, and the total number of schools, N_{sch}, as well as the (x,y) coordinates of the students' locations and schools' locations. Therefore the distance between each home and school was computed and stored in a file based on the following mathematical relation:

$$D = \sqrt{(x_{st} - x_{sch})^2 + (y_{st} - y_{sch})^2} \qquad \text{(Kitchin and Tate 2000, 195)}$$

where D was the distance between the student's home and the school, (x_{st}, y_{st}) were the student's home location coordinates and (x_{sch}, y_{sch}) were the school's location coordinates. Thus the code generated a table of $(N_{st} \text{ X } N_{sch})$ size, which indicated the distance between each student and each school. The code then reordered the distances between the student and each school to obtain another table of the same size. The first column in the table indicated the distance between the student's home location and the nearest school and the next column indicated the second nearest school and so on in the following columns. This table then enabled reallocation of each student to the nearest school to minimise the daily travelling distance. The maximum number of reallocated students could thus be controlled according to school capacity. Below is a listing of the code steps, which are written in *VisualBasic* language (Morris 2001) and linked to Excel software to ease the handling process of the spreadsheets as shown in Appendix (K). This code can be applied to a single district or to whole city districts.

Figure 8.1 Students reallocation code flow chart



The actual and optimum distances to schools were calculated using the method described above. The results were tabulated and summarized in Table 8.1 and are shown in Figures 8.2.A and 8.2.B. They indicate clearly the effect of the relocation of pupils on average travelling distances. For instance, the relocation of girls has reduced total journeys to schools from 2,575 km to 1,851 km while the total distance for boys reduced from 3,703 to 2,225.4 km.

Table 8.1 Actual and optimum average distance to girls and boys secondary schools by municipality

Municipality	Girls			Boys		
	Current Average Distance (m)	Optimum Average Distance (m)	% Change	Current Average Distance (m)	Optimum Average Distance (m)	% Change
Deerah	953	697	27	1952	1041	47
Batha	805	706	12	420	445	-6
Manfuha	1075	676	37	1174	914	22
Malaz	1201	736	39	2555	1192	53
Otaygah	697	578	17	1005	758	25
Ulayah	1254	857	32	3401	1126	67
Mather	759	535	30	2242	1085	52
Shimal	1370	1043	24	2720	1468	46
Arrowdah	1091	876	20	1568	1057	33
Annassem	1024	776	24	1367	833	39
Janoob	777	670	14	911	911	0
Oraija	1075	716	33	1185	852	28
Dariyah	1453	766	47	744	972	-31
Silay	845	845	0	915	915	0
Irgah	800	800	0	3610	581	84
Assafarat	4122	1875	55	861	929	-8
Average	1050	755	28	1616	971	40

Figure 8.2.A: Current and optimum average distances to girls secondary schools by municipality

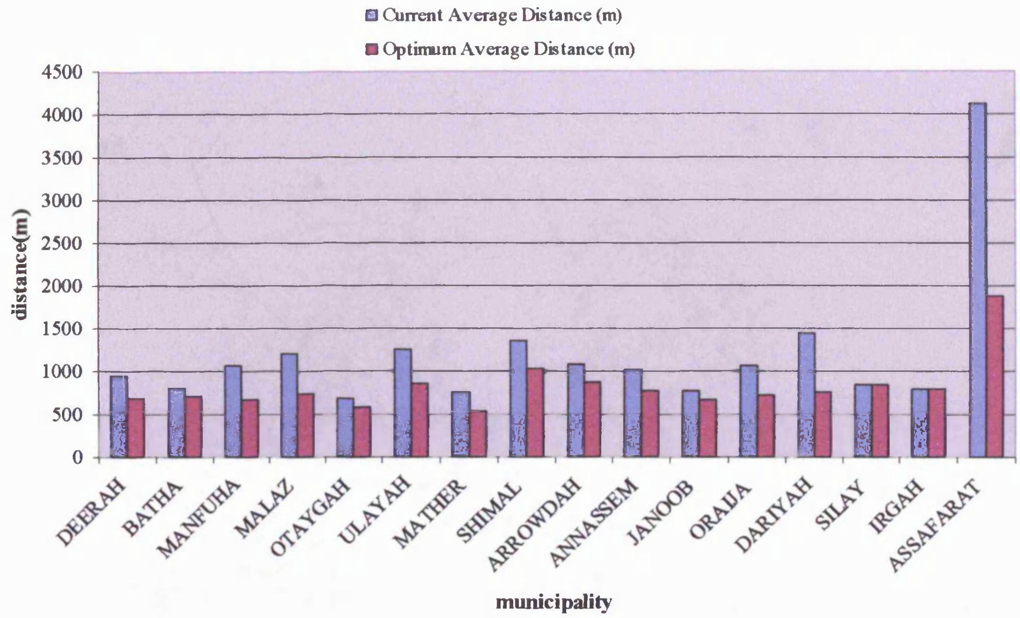
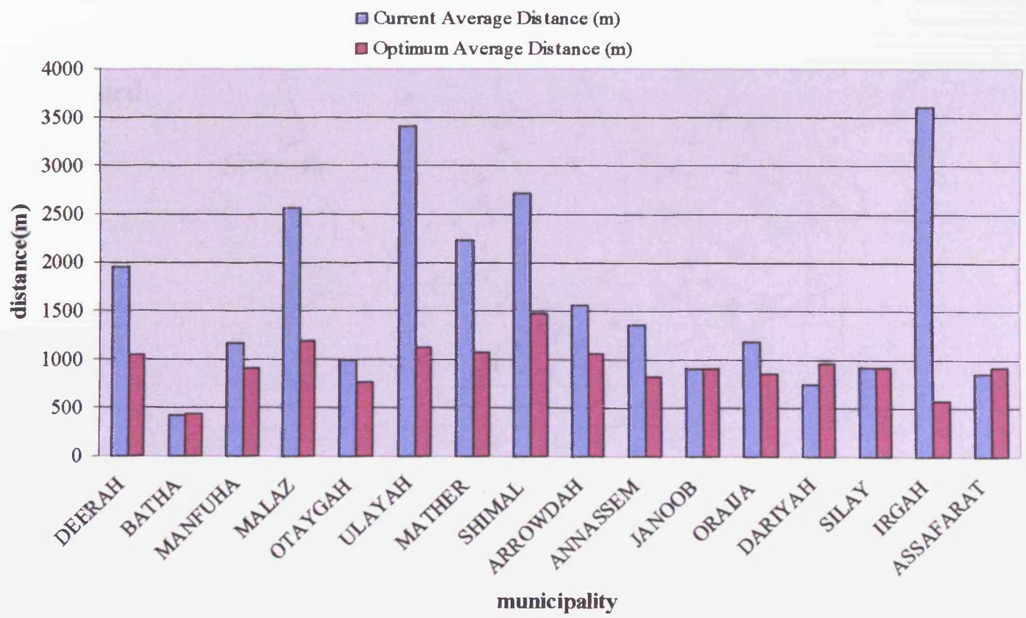


Figure 8.2.B: Current and optimum average distances to boys secondary schools by municpality



In addition, the current distribution and relocation of pupils in map form are illustrated in Figures 8.3 and 8.4.

Figure 8.3 Current distribution and relocation of girls according to their nearest school for the districts of Riyadh

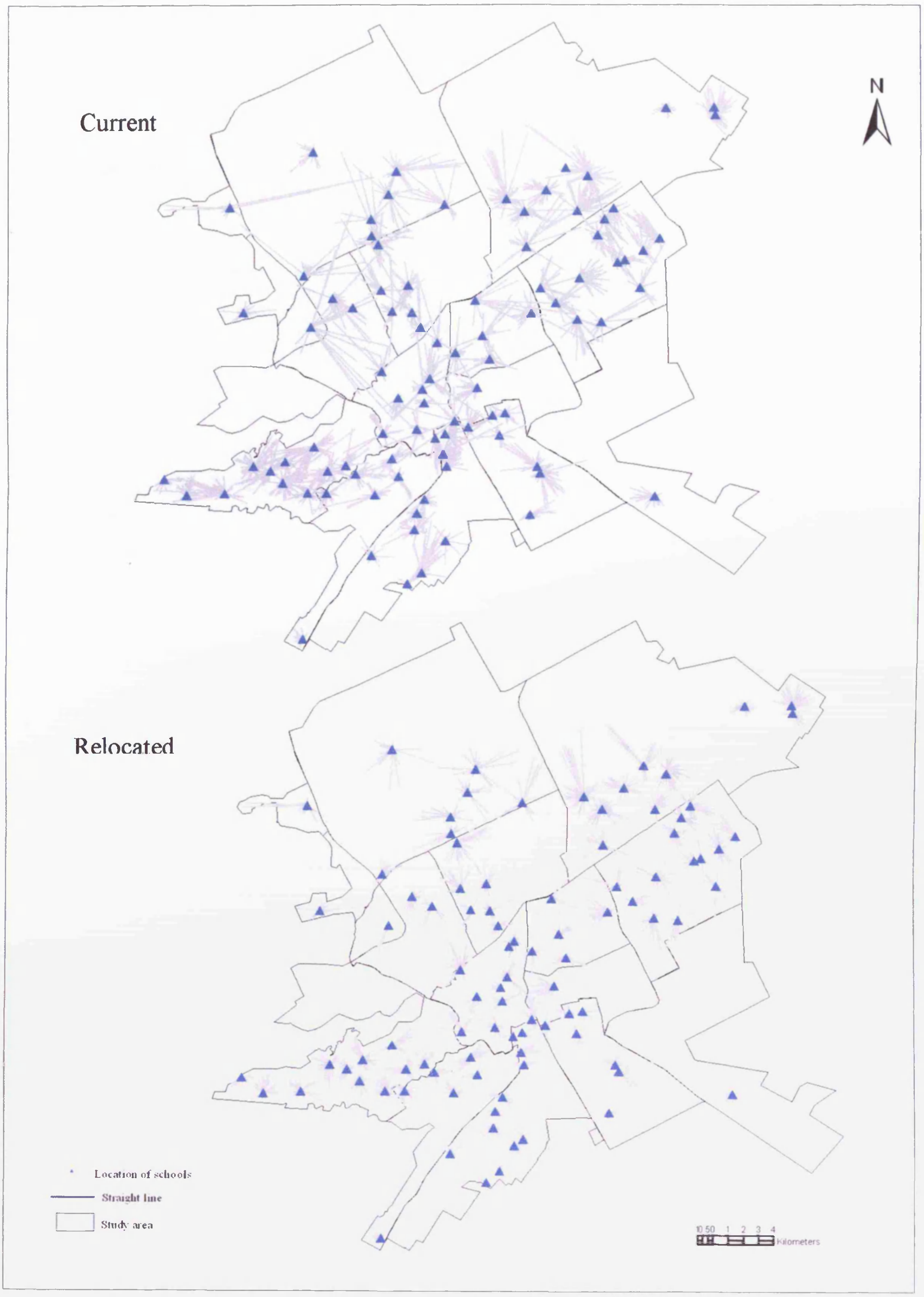
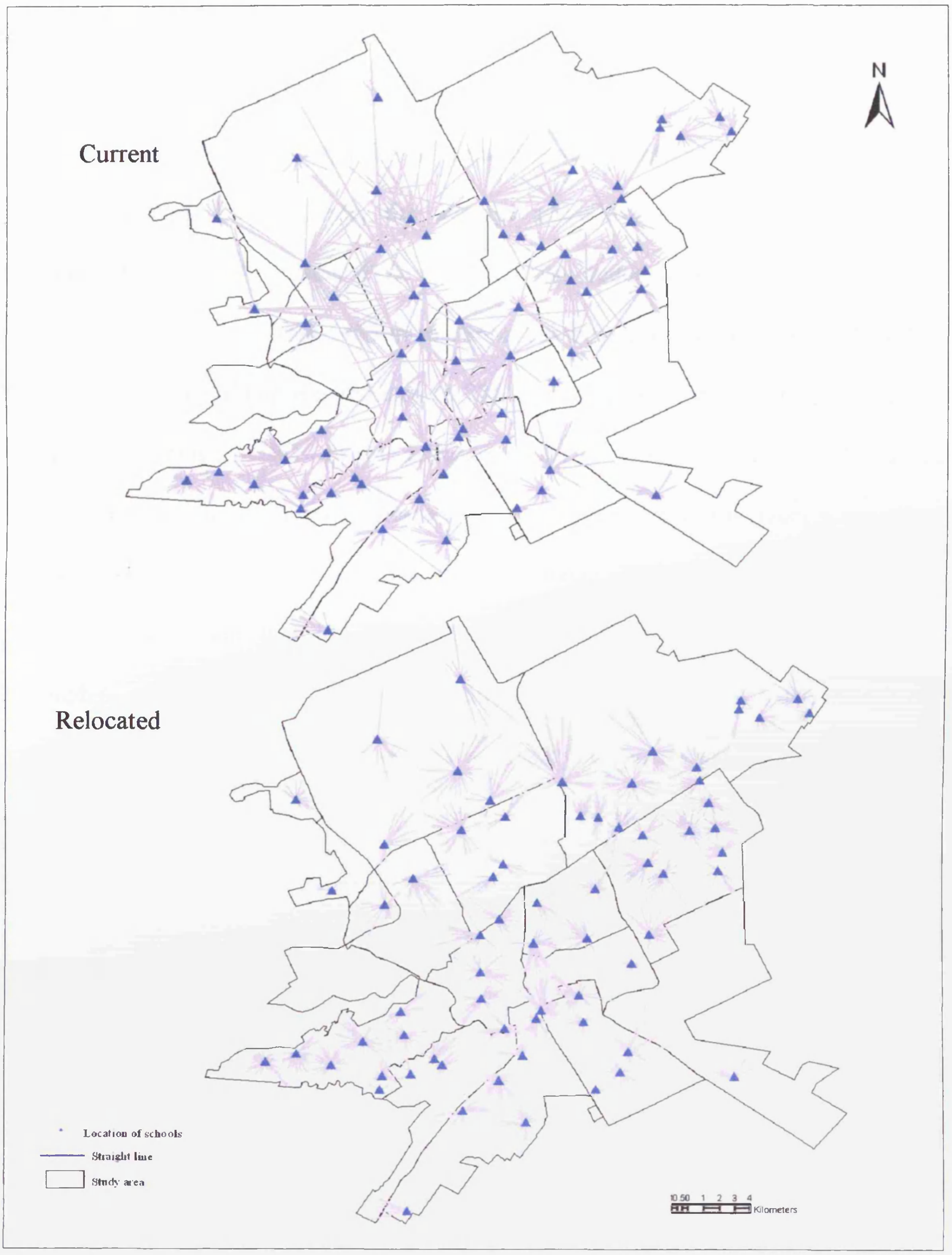


Figure 8.4 Current distribution and relocation of boys according to their nearest school for the districts of Riyadh



In terms of the average distance travelled within the municipalities, the average current distance for both girls and boys decreased after pupils were reallocated to the nearest school. As Table 8.1 shows, the average current distance for girls decreased from 1050 to 755 m, a reduction of 28 percent, whilst for boys it decreased from 1616 to 971 m, a reduction of 40 percent. The variation is more conspicuous when it is compared in terms of municipalities. For example, the average travelling distance for girls in the municipality of Assafarat was 4122 m. This was reduced to 1875 m and in the municipality of Dariyah from 1453 m to 766m. For boys the average journey length in the municipality of Malaz was reduced to 736 m from 1201 m and in the municipality of Irgah the average of 3610 m was reduced to 581m. Al-Zeer's study (1992), carried out on secondary girls schools in western Riyadh, revealed that the average travelling distance was 2340 m. However, the average distance travelled identified by this research is less than that identified then. This is because of the effect of the establishment of new schools and the different methods applied in calculating these distances. In total 82 new boys and girls secondary schools were opened during the period from 1992-2002 (see Chapter Six). Naturally, students admitted to schools closer to their homes have less far to travel. Al-Zeer used a subjective interpretation of the distance travelled by students rather than one using the sophisticated measuring tools employed in this research.

8.3 Secondary school density

In order to generate density maps for secondary schools, it was necessary to create point Shapefiles for each type of school. This process is summarized in the following paragraphs. The first step was to produce point maps of the schools as detailed in Chapter Three. The next step was to use the Spatial Analyst extension in Arc Map in order to make an individual density map for each point file. Several important parameters needed to be set before starting this process: the cell size, the extent of the analysis and the directory where the output was to be saved. These were specified through the options tab in the Spatial Analyst extension.

In generating a density map several more issues have to be considered. At the beginning, the type of density (kernel or simple) needs to be specified. In kernel density, the points lying near the centre of a raster cell's search area are weighted more heavily than other points that are lying further away from the centre. The simple density method, however, is based on calculating the points that fall within the search area and dividing them by the search area size (McCoy and Johanston 2001; Bailey and Gatrell 1995). In this research, the kernel density mode was selected to calculate the density of schools as it simplifies complex spatial point patterns and creates a smooth map of density values in which the density at each location reflects the concentration of points in the surrounding area.

Another issue for consideration is the value of the radius. To achieve a smooth surface, more than one radius should be tried: 2000, 3000, and 4000 metres were applied in this research. However, the radius needs to reflect the results from the survey (questionnaires), which showed that 94.7 percent of pupils lived within a radius of between 2001 to 4000 m from the school. As a consequence, 3000 m was considered to be the most suitable radius for all the density maps and was used in the outputs shown in Figures 8.5 and 8.6.

Figure 8.5 Density map for girls secondary schools in Riyadh.

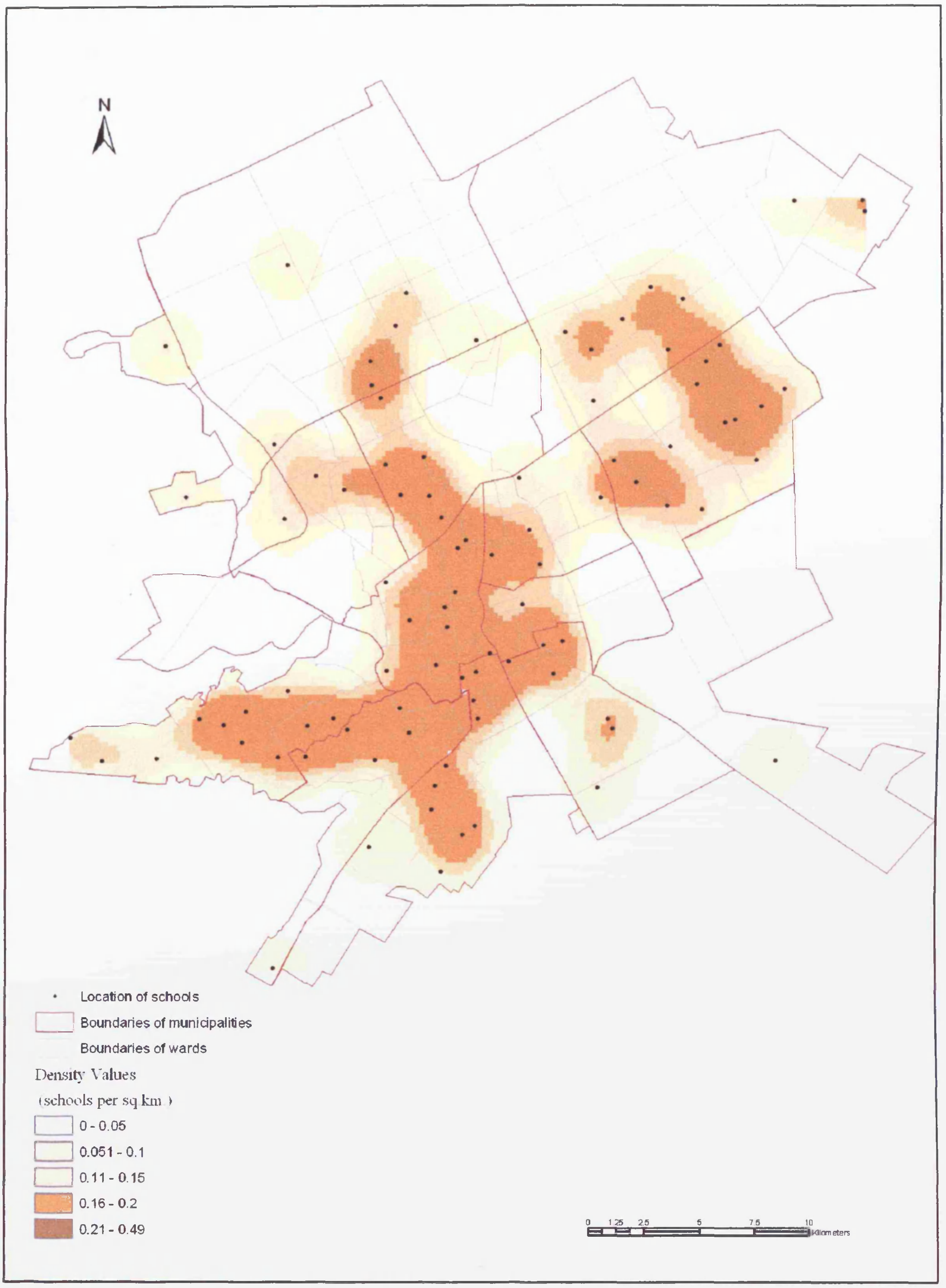
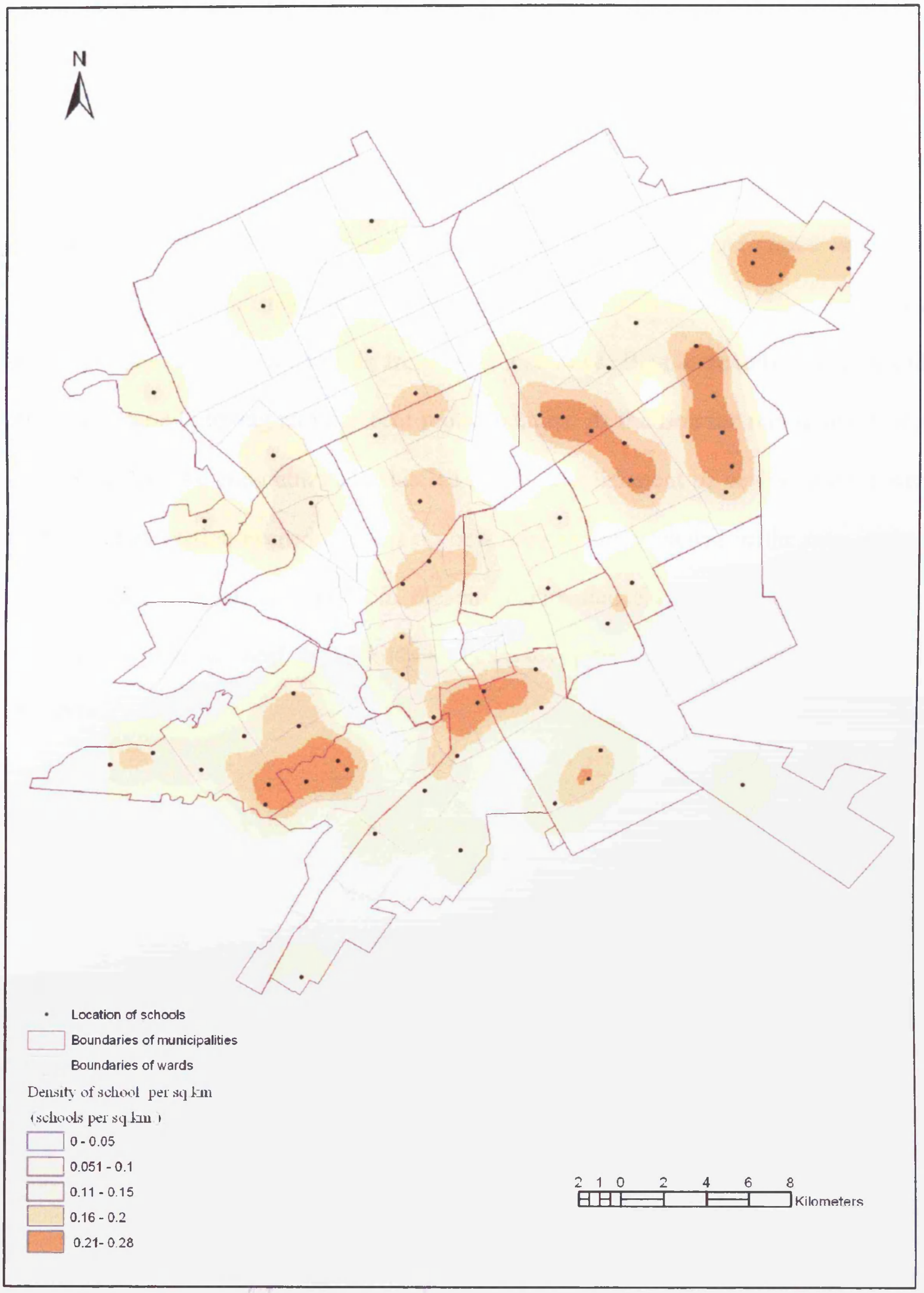


Figure 8.6 Density map for boys secondary schools in Riyadh



As can be seen in Figures 8.5 and 8.6, there was a concentration of schools in the central wards of Riyadh because most of these schools are owned by the government and were built during the period when adequate revenue was generated by the oil trade (see Chapter Two). At that time the government equipped the schools and supplied all their needs. Today it is not economically viable to close them and build new schools elsewhere. The other reason for the concentration of schools in the centre was that migrants were attracted here from central, south and south-western areas of Saudi Arabia (HCRD, 2001:5) as well as from other countries. People already living in the city centre started moving into adjacent municipalities. At the first the immigration rate was higher than the emigration and this led to the establishment of new schools. Later the trend of migration evened out and no new schools were opened in the city centre. Moreover, the number of schools in the city centre had risen since the government encouraged people to send their children, especially girls, to them by providing free transportation.

Additionally Figures 8.5 and 8.6 show concentrations in the density of schools in the municipalities around the edge of the city, in the east (Arrowdah and Annaseem) and the south-west (Oraija and Otaygah). These municipalities have experienced population growth due to the arrival of new immigrants from the centre of the city and from nearby cities.

Figures 8.5 and 8.6 also show that the concentration level of girls schools was higher than that of boys schools in the old municipalities. On the one hand, this is because of the availability of transport for girls and government encouragement for them to enrol in city centre girls schools after 1975. On the other hand, the concentration of boys schools was lower than that of the girls schools on the edge of the city's municipalities because boys can travel freely by themselves and are less restricted geographically in their choice of school. The lowest density of girls and boys schools can be seen in the north (Shimal), north west (Deraiah) and south east (Silay) areas. This low density was due to: 1) the fact that these are new areas and therefore less populated than they are on the edge of the city e.g. Shimal; 2) they are commercial areas such as some parts of Shimal; 3) most residences are big palaces such as in Mather; and 4) the area has large warehouses and fewer residential places, such as Silay. However, when comparing the density of the girls and boys schools, it can be noticed that the highest density category for girls schools (0.21.49) covers a greater area than for boys schools (Figures 8.5 and 8.6).

8.4 Riyadh secondary schools catchment areas

The literature defines a catchment area as the administratively defined geographical area served by a school. However, the interviews with the Saudi Ministry of Education officials indicate a different definition for the catchment area. It simply defines it as an area where pupils live away from a particular school. Therefore, such catchment areas were found to be of three categories (Figure 8.7 and Appendix: L).

Category one: small catchment areas (under 5 km^2)

Around 53 of the girls schools fall into this category. Among them is school number 88, the smallest in the area. It is situated on the east side of Um Hamam ward inside the Internal Security Accommodations buildings. Most of the girls who attend this school live in the ward. This is reflected in an average journey length of 57 m. Another school with a smaller than average catchment area is school number 63 in Jinadriyah ward in the municipality of Arrowdah, which has a catchment area of 1.1km^2 and an average travelling distance to school of 493 m. All its pupils live in the ward. In total 34 percent of boys schools fall into this small catchment category. The Hafith Hakmi Boys School in Faisaliyah ward in the Batha municipality has the smallest catchment area of just 0.63

km^2. The average travelling distance to this school is 420m. The next largest is Ibin Hatem School in Aziziyah ward in Janoob municipality. Here the catchment area is 0.94 km^2 and the average travelling distance to school is 490m. All Hafith Hakmi pupils and 79 percent of Ibin Hatem pupils live within the school's wards.

Category two: medium catchment areas (5 km^2 to10 km^2)

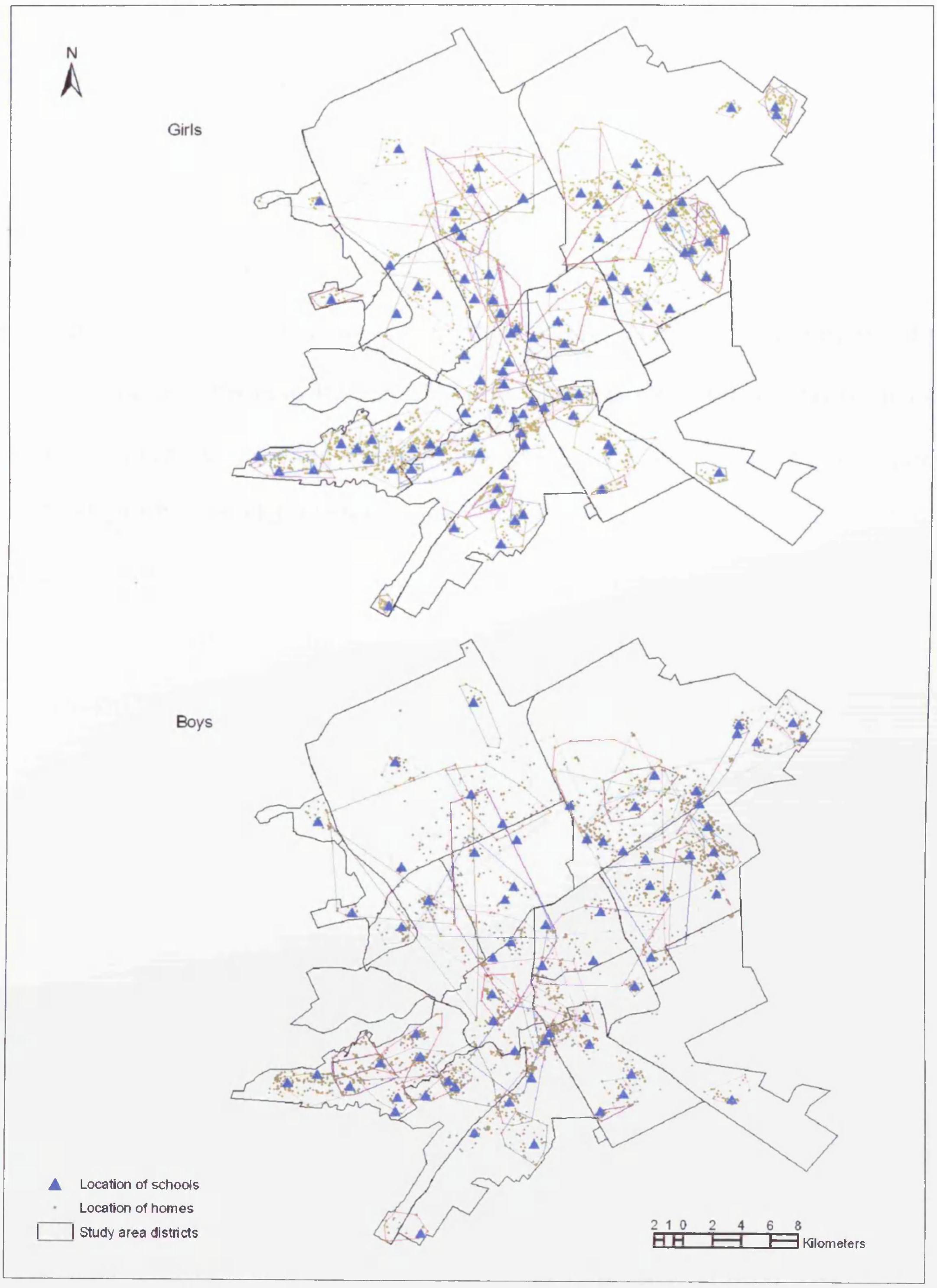
The girls schools in this category comprise 22.82 percent of all the girls schools. Among these, school number 53 in Oraija Municipality (Western Oraija ward) has a catchment area of 5.3 km^2 with an average travelling distance to school of 876 m. A total of 98 percent of its pupils live within the school ward. Similarly school number 84 in Nadheem ward has a catchment area of 5.8 km^2 and 100 percent of its pupils live within the ward. In contrast only 22 percent of the boys schools fall into in this category. For instance Abd Allah bin Saud school in Oraija Municipality (Western Swaidi ward) has a catchment area of 5.3 km^2 with an average travelling distance to school of 999 m.

Category three: wide catchment areas (over 10 km^2)

All schools with a catchment area of more than 10 km^2 are included in this category, including 23.91 percent of girls schools. For example, school number 57has a catchment area of 10.1 $km^{2,}$ the smallest catchment area in this category, with an average travelling distance of 1119 m, and school 337 in the municipality of Assafarat, the largest school, has a catchment area of 66.1 km^2 with an average travelling distance to school of 4122m.

In total, 43.47 percent of boys schools are in this category. The Alalbani Secondary School in Manfuha municipality, the smallest school in this category, has a catchment area of 10.4 km^2 with an average travelling distance to school of 1147 m, followed by Nahawend in Swaidi ward in Otaygah municipality with a catchment area of 11.5 km^2 and an average travelling distance of 1245 m, whilst Abd Alaziz nin Baz school in Worood ward at Ulayah municipality has the largest catchment area, because it covers an area of 148.7 km^2 with an average travelling distance of 3283 m. This is because 63 percent of its pupils live out side the school's ward.

Figure 8.7 Current catchment areas for secondary girls and boys schools in Riyadh.



A study of catchment areas in Riyadh revealed that the configuration of the boys schools differs from those of the girls. This is because boys usually travel farther than girls as they are able to use their cars to drive themselves to school. Based on Figure 8.7 and Appendix L, it can be said:

- Catchment areas of most girls and boys schools overlap. Many students travel long distances to their schools by private transport.
- Travelling times from home to school (and vice versa) are more important than the distances, because Riyadh city now has a modern transportation network well served by the King Fahad Road, the Ring Road (Al-dairi), Almadienah Road and Prince Abd Allah Road.
- Many of the school catchment areas overlap, reflecting the significance of time rather than distance. The excessive use of private vehicles, however, leads to frequent traffic jams, which can delay arrival times.
- The current system for admitting pupils allows parents to register them in the most convenient school relative to their place of work or the location of their home.

8.5 Investigation of the capacities of schools in Riyadh

Figure 8.8 illustrates the capacities of schools and Table 8.2 identifies respectively the number of schools in each municipality, and the excess or shortage of pupils. The first column of the table, for example, indicates that the Municipality of Deerah has 9 schools for girls and 5 schools for boys and that the number of pupils attending schools in the municipality is 4454 girls and 4012 boys. Since the optimum capacity of the schools is 2568 for girls schools and 2442 for boys schools (HCRD 2002), the capacities have exceeded the optimum by 73 percent (1,886 pupils) in girls schools and 64 percent (1570 pupils) in boys schools.

On the right and left side of the display (Figure 8.8), the brown colour in the two maps for both girls and boys indicates the areas with high levels of excess pupils (more than 127 percent), orange indicates the areas between 82-126 percent, beige shows the areas between 43-81 percent, yellow indicates the municipalities with below than 43 percent overcrowding and sand represents the areas with a capacity shortage. Not surprisingly, the brown, orange and beige colours cover those areas of the city of more recent occupation that have been subjected to a high rate of demographic expansion.

The overcrowding in schools reflects the huge growth of population in Riyadh, as mentioned in Chapter Five and has required the government to open new schools to address the demand. The newly opened schools are often in rented homes (privately owned) and have not been equipped well for the purpose of education[1]. Despite government efforts, the problem of overcrowding is still prevalent. The poor quality of rented schools is leading not only to poor levels of education but also to safety problems. Overcrowding, for instance, caused an accident in Makkah School where 14 girls died in a fire due to poor emergency exits (Al -Rajhi *et al* 2002; Abdul Wahab and Hasan), see Appendix (M) for photos of this incident. Overcrowding was also mentioned by officials of the Ministry of Education during the interview. They indicated that over 50 percent of schools are exceeding their designated capacity.

[1] The percentage of rented schools is 17 percent for boys (total schools 69) and 26 percent at girls schools (total schools 92).

Figure 8.8 Current school positions and areas of excess pupil numbers for girls and boys schools

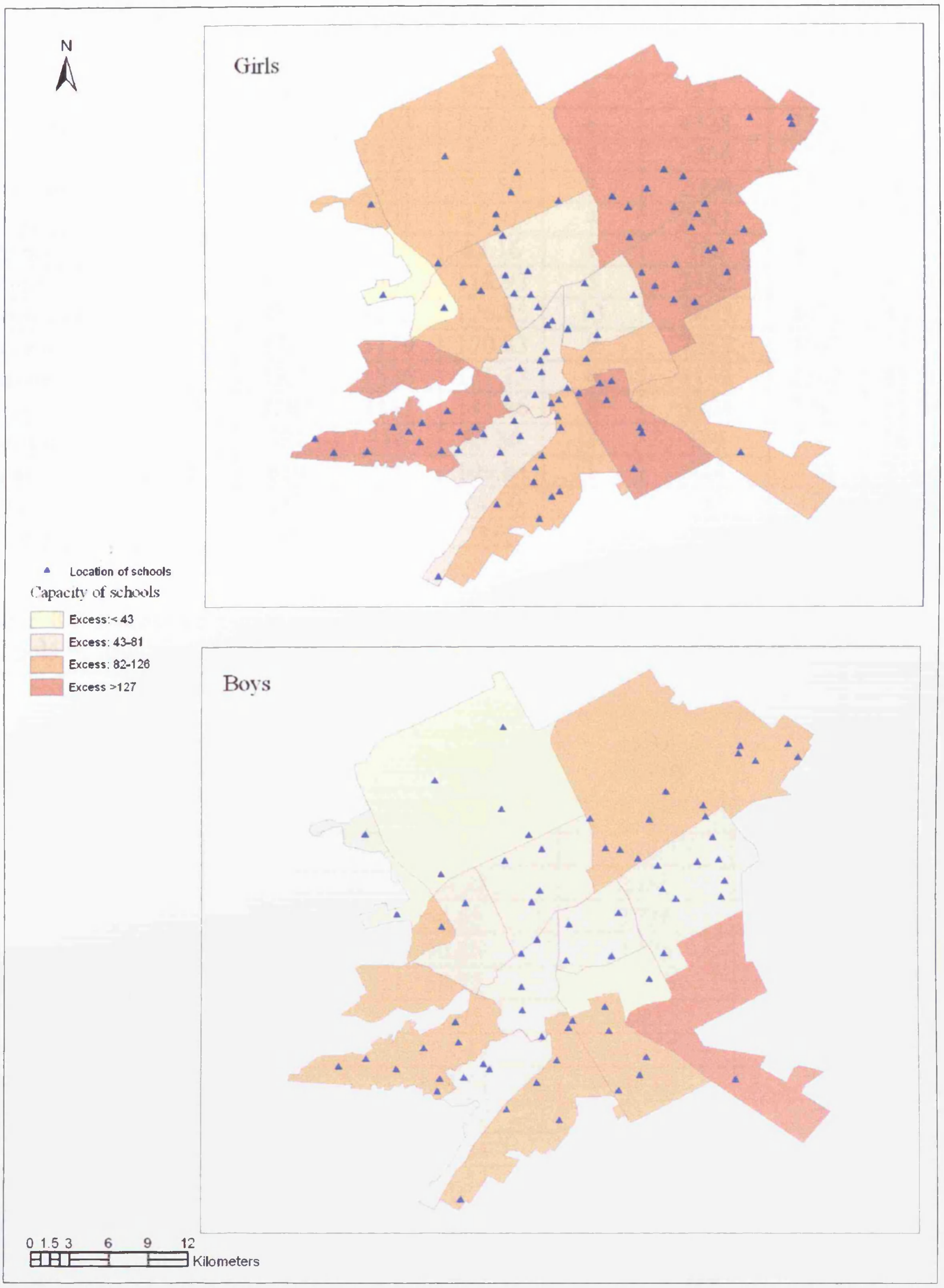


Table 8.2 Excess pupil numbers for girls and boys schools by municipality

Municipality	Girls				Boys			
	Number of Schools	Number of Students	Actual Capacity	Excess over Capacity %	Number of Schools	Number of Students	Actual Capacity	Excess over Capacity %
Deerah	9	4454	2568	73.44	5	4012	2442	64.29
Batha	2	1609	842	91.09	1	57	42	35.71
Manfuha	11	5123	2453	108.85	6	4328	2358	83.55
Malaz	5	2723	1579	72.45	4	3056	1726	77.06
Otaygah	6	4008	2337	71.50	3	2098	1305	60.77
Ulayah	6	1806	1221	47.91	4	2591	1579	64.09
Mather	2	1266	695	82.16	1	726	421	72.45
Shimal	7	3181	1453	118.93	5	2182	1537	41.96
Arrowdah	10	8382	3695	126.85	13	7403	4032	83.61
Annassem	13	8723	3779	130.83	9	7212	4147	73.91
Janoob	6	3527	1526	131.13	6	4159	2242	85.50
Oraija	11	8287	3432	141.46	8	6008	3295	82.34
Dariyah	1	581	316	83.86	1	396	253	56.52
Silay	1	619	295	109.83	1	524	158	231.6
Irgah	1	157	126	24.60	1	157	126	24.60
Assafarat	1	100	84	19.05	1	481	253	90.12

Table 8.3 Excess of pupils over capacity after relocation of pupils at girls and boys schools by municipality

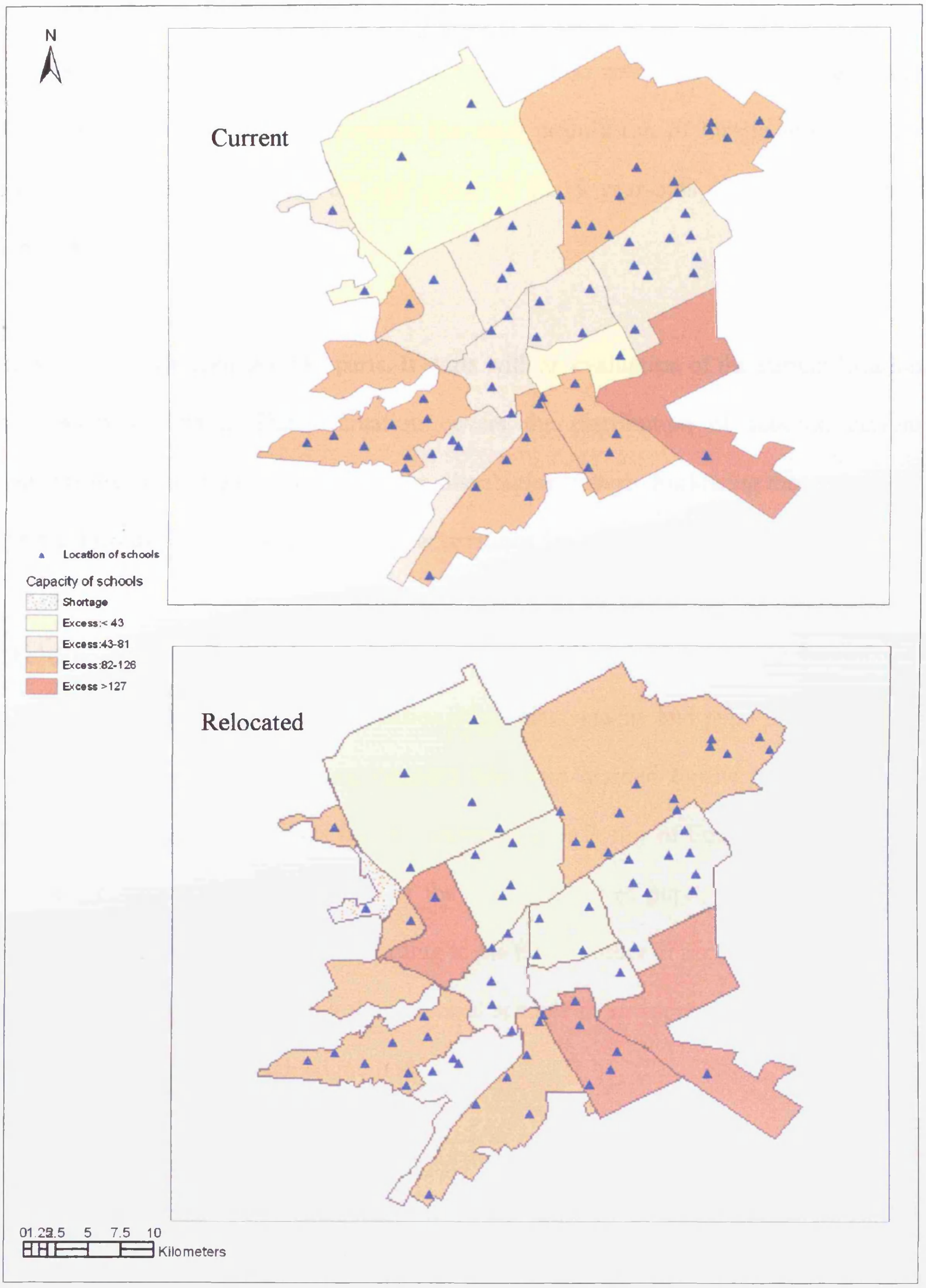
Municipality	Girls		Boys	
	Actual Capacity	Excess over Capacity %	Actual Capacity	Excess over Capacity %
Deerah	2568	79.36	2442	57.90
Batha	842	91.09	42	45.24
Manfuha	2453	104.28	2358	88.85
Malaz	1579	54.65	1726	37.89
Otaygah	2337	70.86	1305	51.65
Ulayah	1221	58.72	1579	4.88
Mather	695	88.92	421	166.03
Shimal	1453	123.47	1537	39.43
Arrowdah	3695	118.54	4032	92.04
Annassem	3779	145.38	4147	79.74
Janoob	1526	140.24	2242	144.16
Oraija	3432	145.34	3295	87.68
Dariyah	316	70.25	253	100.00
Silay	295	109.83	158	231.65
Irgah	126	24.60	126	-42.06
Assafarat	84	-84.52	253	117.39

Tables 8.2 and 8.3 above show the level of capacity at secondary schools before and after student relocation[1]. They indicate that overcrowding is still high despite redistribution. In some municipalities the number of pupils has actually increased, while in others the situation is unchanged whereas the expected result would have been a decrease (see Figures 8.9, 8.10). Generally, there is no increase in overcrowding in the municipalities' girls schools, except in Assafarat municipality which has surplus places (see Figure 8.10). This is because most pupils in this school still come from outside the school municipality. The situation for boys schools shows an increase in the capacity in Mather, Silay and Janoob municipalities. The only municipality with surplus places is located is Irgah. In this municipality more than half the pupils were relocated to other nearby schools outside the municipality. This situation is similar to the case of Assafarat girl school. As far as overcrowding is concerned in other schools, this might be due to the fact that the school is the only one in the municipality. All these factors explain the lack of change in capacity. This suggests that the only solution to solve the problem is to build new schools because the majority of schools overcrowded, even are reallocation.

[1] Relocation means reconstructing the description based on optimum distance by computing.

Figure 8.9 Excess of pupils over capacity at girls secondary schools before and after redistribution of pupils

Figure 8.10 Excess of pupils over capacity at boys secondary schools before and after redistribution of pupils



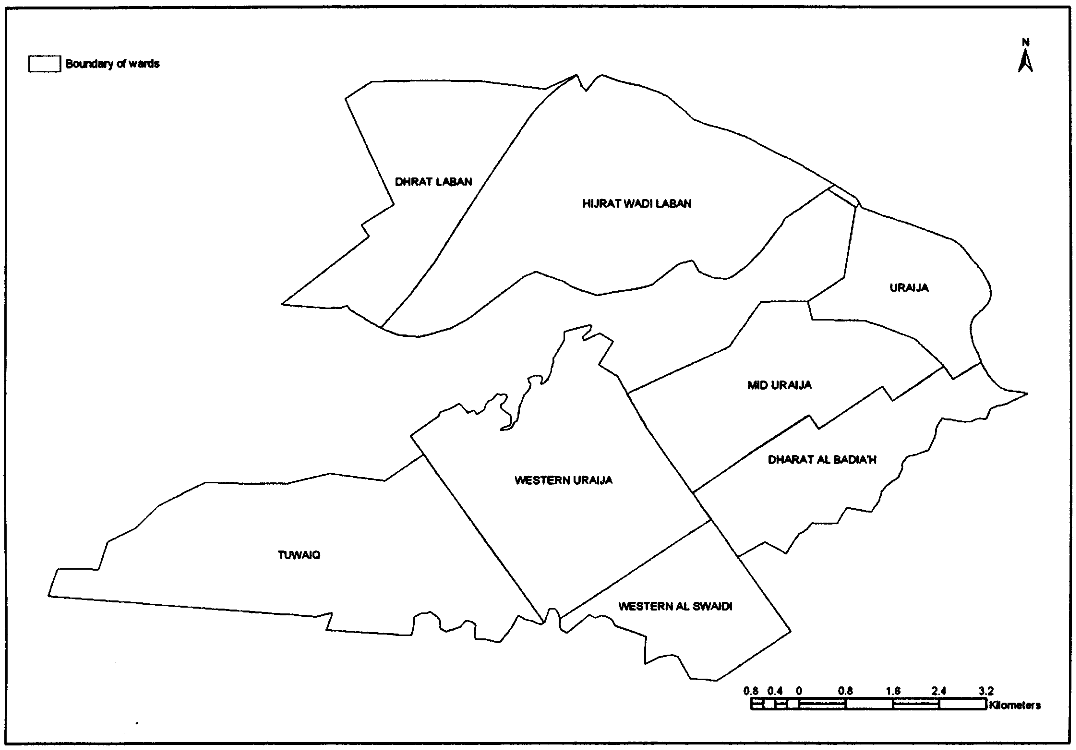
8.6 A case study of Oraija Municipality

Only one of the sixteen municipalities of Riyadh was chosen as the case study because it is impossible to cover all of the city. Oraija municipality was selected. It is divided into seven wards, and is located about 3 km from the centre of the city (see Figure 8.11). According to the 1996 census, the total population of Oraija municipality was 251,401 inhabitants with the age group of 15-19 year-olds (those of secondary school age) estimated at 8 percent.

This section is divided into two parts. It starts with an evaluation of the current location of schools in Oraija. This evaluation covers the distribution of schools, current catchment areas and an assessment of the distribution pattern. Following the evaluation, the methods used to choose proposed new locations for schools are discussed.

The case study was conducted in three stages: The first stage identified a proposed number of new schools from a calculation of present capacity and pupil numbers in all schools in the municipality. Total capacity was then divided by the ideal nationally desirable class size of 30 pupils (High Commission for Policy of Education 2002). The second stage involved identification of the total number of pupils in each school by dividing the study area into parts according to the total number of proposed schools.
The third stage involved locating the proposed schools in an appropriate location based on the weighted and unweighted method.

Figure 8.11 Oraija Muincipality



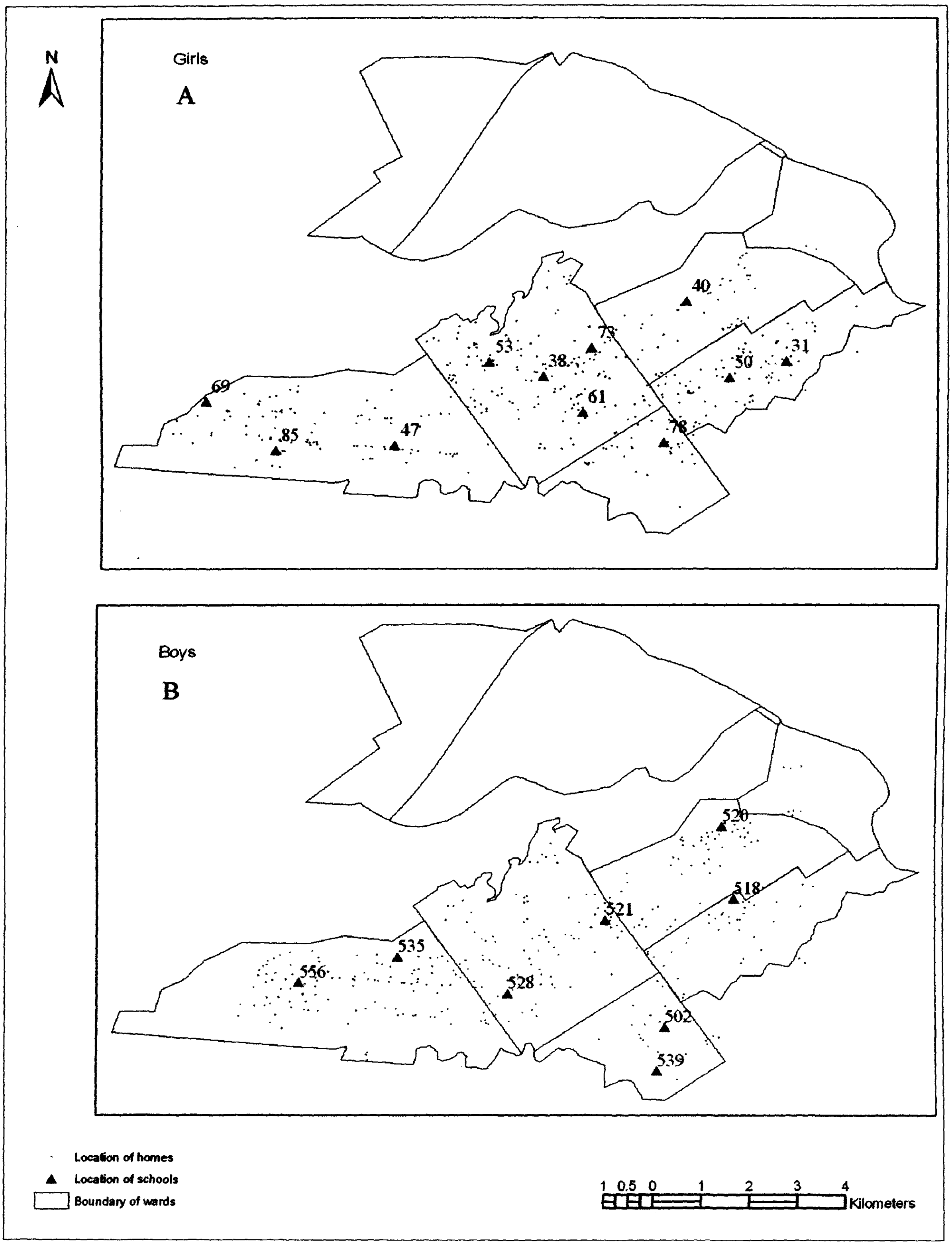
8.6.1 Evaluation of the current location of secondary schools in Oraija municipality

The evaluation of the present locations of schools required mapping the existing schools and identifying their relevant characteristics such as current distribution, current catchment areas and capacity and assessment of the distribution patterns of schools. The evaluation of the spatial distribution is the objective of the first part of this section:

8.6.1.1 Distribution of secondary schools in Oraija municipality

In Oraija municipality, there are nineteen secondary schools for girls and boys (see Figures 8.12 A and 8.12 B) but there are no schools in the north of the municipality. This is because the Wadi (valley) of Laban isolates the area from other municipality wards. This isolation further reduces the density of population which is now too small to justify

Figure 8.12 Current distribution densities of secondary girls and boys schools in Oraija municipality



the building of a new school, so the few pupils in the north travel to other schools in nearby wards. The government has to date been providing free transport to girls to encourage them to attend school. These upper wards are however expected to become a developing area in the future as the government has started building a new bridge and ring road through the area to link it with other muncipalities.

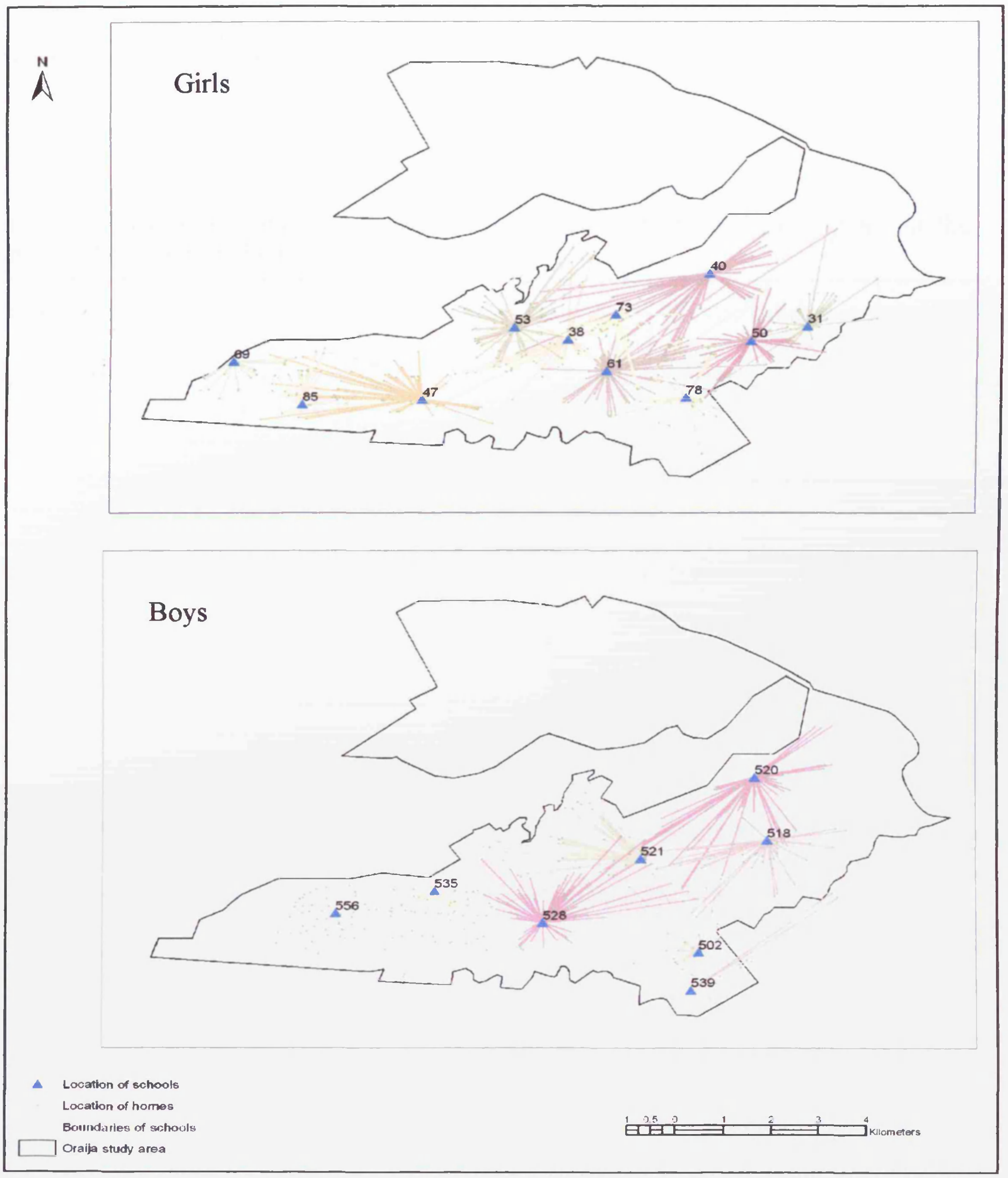
It appears from the figures above that there are more girls schools (11) than boys (8) in the municiplaity. This might be due to the government wish to locate girls schools as close as possible to their homes. This minimises the cost and effort for transportation and shortens travel times which is important because, as stated earlier, girls are forbidden to drive themselves.

The distribution of the schools was not based on objective criteria such as the growth of population, road network and the tophoghraphy of the area . It was based mainly on an administrative evaluation of need. For example, boys schools numbers 539 and 502 were located too close to each other despite there being another ward close by without any school. Moreover, the study by Al-Meteer (1999,42) indicated that 38 percent of girls schools and 42 percent of boys schools in Riyadh were located near risk areas such as gas stations (See Appendix N for photos of this situation) and crowded roads. This had increased the risk of accidents as 93 percent of girls and 90 percent of boys schools did not have safety requirements such as pedestrian crosswalks, flashing zone beacons and pedestrian warning signs. Al-Meteer's (1999,42) survey of 1.5 million pupils indicated that there were 12,029 pupils accidents, of which 37 died, 958 were disabled and 10,937 returned to school after treatment.

8.6.1.2 The current catchment areas for secondary schools

Figure 8.13 below represents the current catchment area shapes for secondary girls and boys schools and shows clearly the overlap between catchment areas.

Figure 8.13 Current catchment area shapes for secondary girls and boys schools in Oraija municipality



Eight girls schools (73 percent) are concentrated in the central and eastern side of the municipality, 3 schools (27 percent) are located on the western side. Where these schools are concentrated has clearly affected the catchment area size and shape. The size of catchment areas varies depending on the geographical factors influencing the distribution of pupils' homes throughout the municipality. The size of catchment area for each school is shown in Table 8.4. An illustration of the size of catchment areas is significant to allow comparison.

Table 8.4 Girls secondary schools according to the size of catchment area and the mean of distance travelled

School number	Catchment area km^2	Mean of distance (m)
31	7.59	727
38	10.72	1208
40	11.13	1649
47	8.13	1456
50	4.18	798
53	5.26	876
61	12.43	1208
69	0.92	740
73	3.30	756
78	3.25	774
85	3.29	851
Average	6.38	1079

Table 8.4 above presents current catchment areas and the average distance travelled by girls. The second column of the table above demonstrates the variations between schools according to the size of the catchment areas. It indicates that the average size of the catchment area is 6.38 km^2. It is observed that there are 5 schools (45 percent) with a higher than average catchment area (schools 31, 38, 40, 47 and 61) while 6 schools (55 percent) have a lower than average catchment area (6.38 Km^2) such as schools 50, 53, 69, 73, 78 and 85. The three reasons for the variations between the sizes of catchment areas are: first, because of the flexible regulations allowing Saudi pupils to

attend any school, even if it is a considerable distance from home; second; choice of school may reflect the work location of the male head of the household third; because of the constraints on attendance of non-Saudi pupils at public schools. For example the regulations allow no more than 15 percent non-Saudi pupils in each public school. This has led many non-Saudis to register in any available school regardless of distance from home. Furthermore, the third column shows that the average travelling distance is 1,079m. It also shows that four girls schools (36 percent) show greater travelling distances than the mean (schools 38, 47, 40 and 61) while seven schools (64 percent) show less than the mean (schools 31, 50, 53,69,73,78 and 85). This result indicates that journey lengths are reasonable, and that the minimum mean distance travelled is less than one kilometre for girls. This was supported by the interview with the Ministry of Education officials who declared that the distance for girls or boys to walk or travel to school should not exceed one kilometre.

However, when comparing the catchment area shapes for boys schools with that for girls (Figure 8.13), several differences between two maps become apparent. Perhaps the most noticeable aspect is that the distribution of schools over an area affects the size and shape of the school catchment areas. This is particularly clear with schools in the east and centre of the municipality, where the overlapping of catchment areas is more pronounced due to the high population density in this ward (in the west of Oraija). Furthermore, Table 8.5 column two shows the average size catchment area to be 8.56 km^2. This is higher than the girls school average (6.38 km^2). It is observed that there are 5 schools with less than the average and 3 schools (37.5 percent) with more than the average. The reason is that boys can travel to anywhere in the city and are able to join schools of their choice, whereas this is not the case for girls. This freedom also means boys can go to sport clubs, cafés, shopping centres and other attractions, where they can make many friends throughout the city. These friendships encourage some of them to join their friends' schools further away from their homes and consequently increase the catchment areas of these schools. As has been mentioned before, every school is authorised to register a maximum of 15 percent of its places to non Saudi nationals, so that when a school is full students have to attend elsewhere, a situation which will increase the catchment areas of some schools.

Table 8.5 Boys secondary schools according to the size of catchment area and the mean of distance travelled

School number	Catchment area km^2	Mean of distance (m)
502	5.31	999
518	6.27	1142
520	12.67	1290
521	6.12	1624
528	8.61	1197
535	6.68	1117
539	17.96	1590
556	4.87	793
Average	8.56	1185

There were also considerable differences between boys schools when considering the mean distance travelled to school. In table 8.5 below, column three shows that the mean distance travelled is 1,185 m, i.e. higher than the girls schools. This indicates that pupils at these schools travel a greater than average distance. This is because boys choose their schools more independently as they drive themselves to school, whereas the father or the family influence the choice of girls schools as mentioned in Chapter Seven.

Based on the data in Table 8.6, the girls and boys schools have been categorised into three groups; low, medium and high. This categorisation was based on the number of wards that each school serves. Those in the low category serve one or two wards. There are five girls schools and two boys schools in this category. Those in the medium category serve three or four wards. There are four girls schools and five boys schools in the medium category. Those in the high category serve more than four wards. There is one girls school and one boys school in this category.

Table 8.6 The number of wards served by schools in Oraija

Girls		Boys	
School name	No. of wards	School name	No. of wards
31	3	502	3
38	2	518	4
40	2	520	4
47	1	521	4
50	4	528	4
53	2	535	1
61	6	539	5
69	1	556	1
73	3		
78	3		
85	1		

These wards are shown on Figures 8.14A and 8.14 B for girls and Figures 8.15A and 8.15B for boys. Using data obtained from the questionnaire each ward was identified by a separate colour. As part of this survey, all respondents were asked to specify the ward in which they lived and which school they attended. This technique produced three categories; low, medium and high. According to the interview with the Ministry of Education official it is acceptable for 10 percent of pupils to come from outside a school's ward. Figures 8.14A and 8.14 B for girls show that five out of 11 girls schools exceed this percentage. School number 61 in western Oraija is a good example for only 62.7 percent of pupils live in the school's ward. The other pupils come from five other wards. The reason for this may be that the schools on these five wards are overcrowded, or it may simply be that these pupils' homes are closer to school number 61 than to their normal catchment area school. In the other schools the percentage of pupils from other wards is less than 10 percent. This result indicates that the distribution of schools in

Oraija municipality is in the recommended pattern. Figures 8.15A and 8.15B show that five out of eight boys schools in Oraija are exceeding the recommended limit. For example, school 539 has 50 percent of its pupils coming from other wards (four wards). This again is either due to overcrowding in the other wards or because these schools are closest to the pupils home.

Figure 8.14A Girls secondary schools according to pupils from within and outside the school's ward

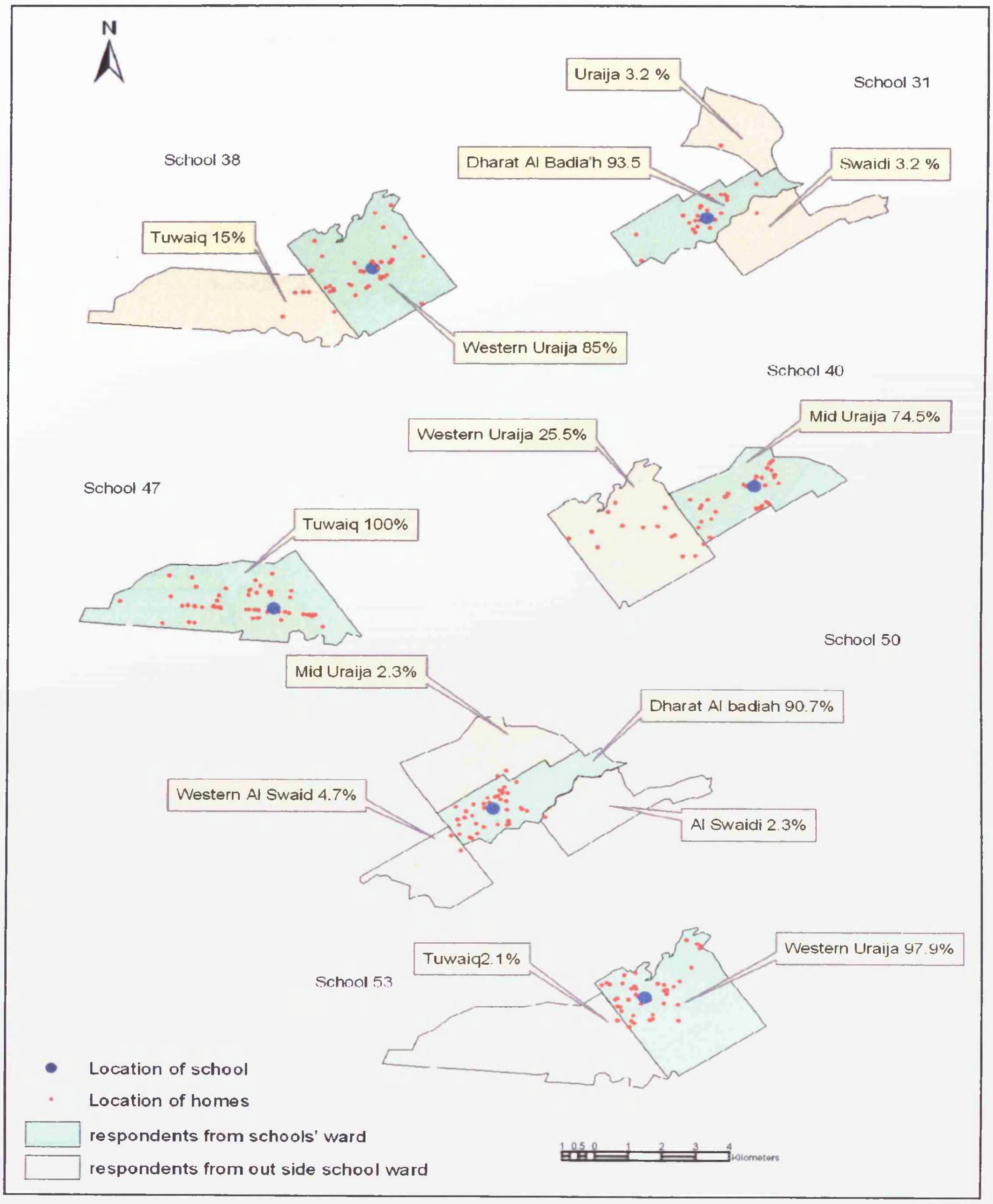


Figure 8.14B Girls secondary schools according to pupils from within and outside the school's ward

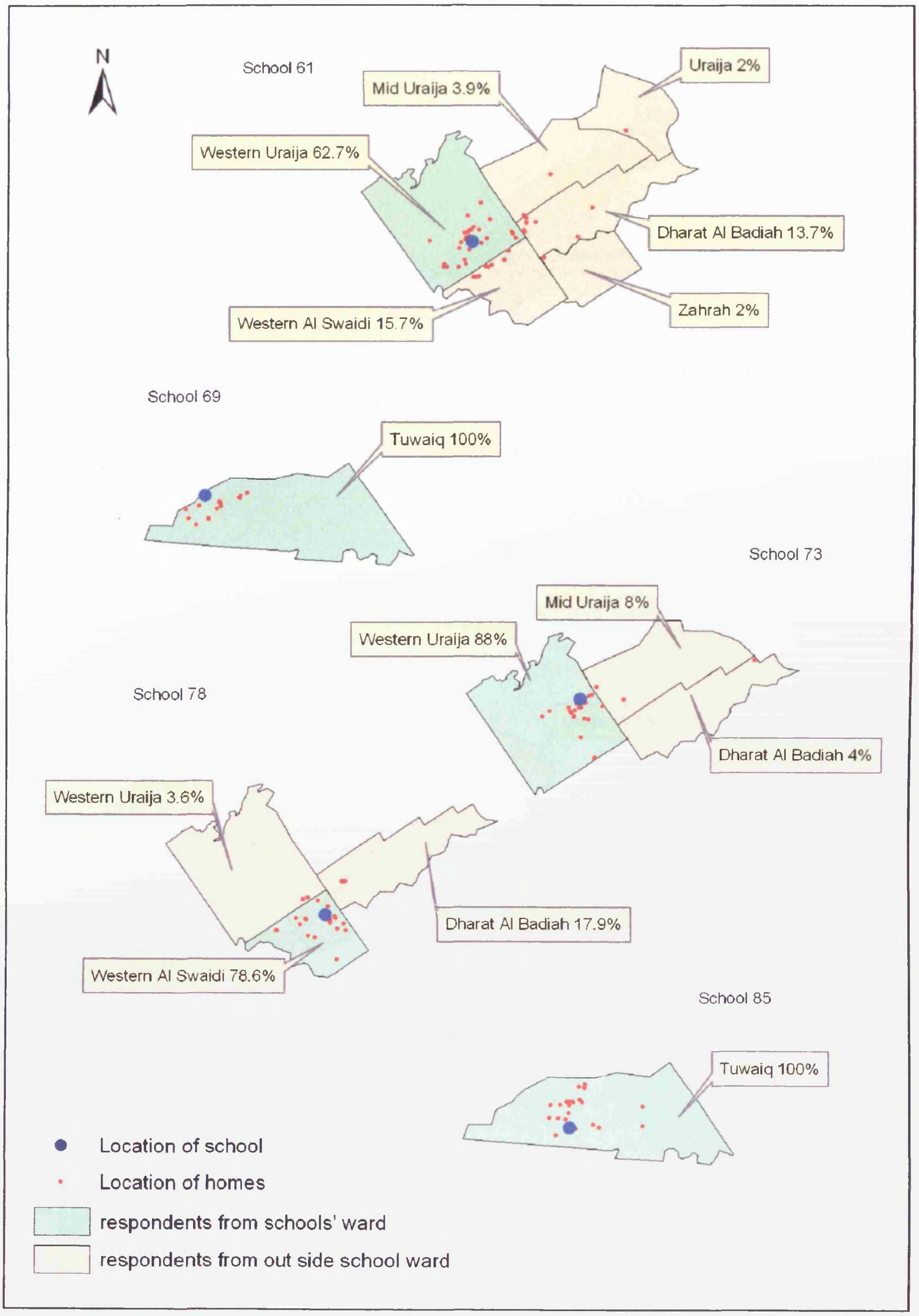


Figure 8.15A Boys secondary schools according pupils from within and outside the school's ward

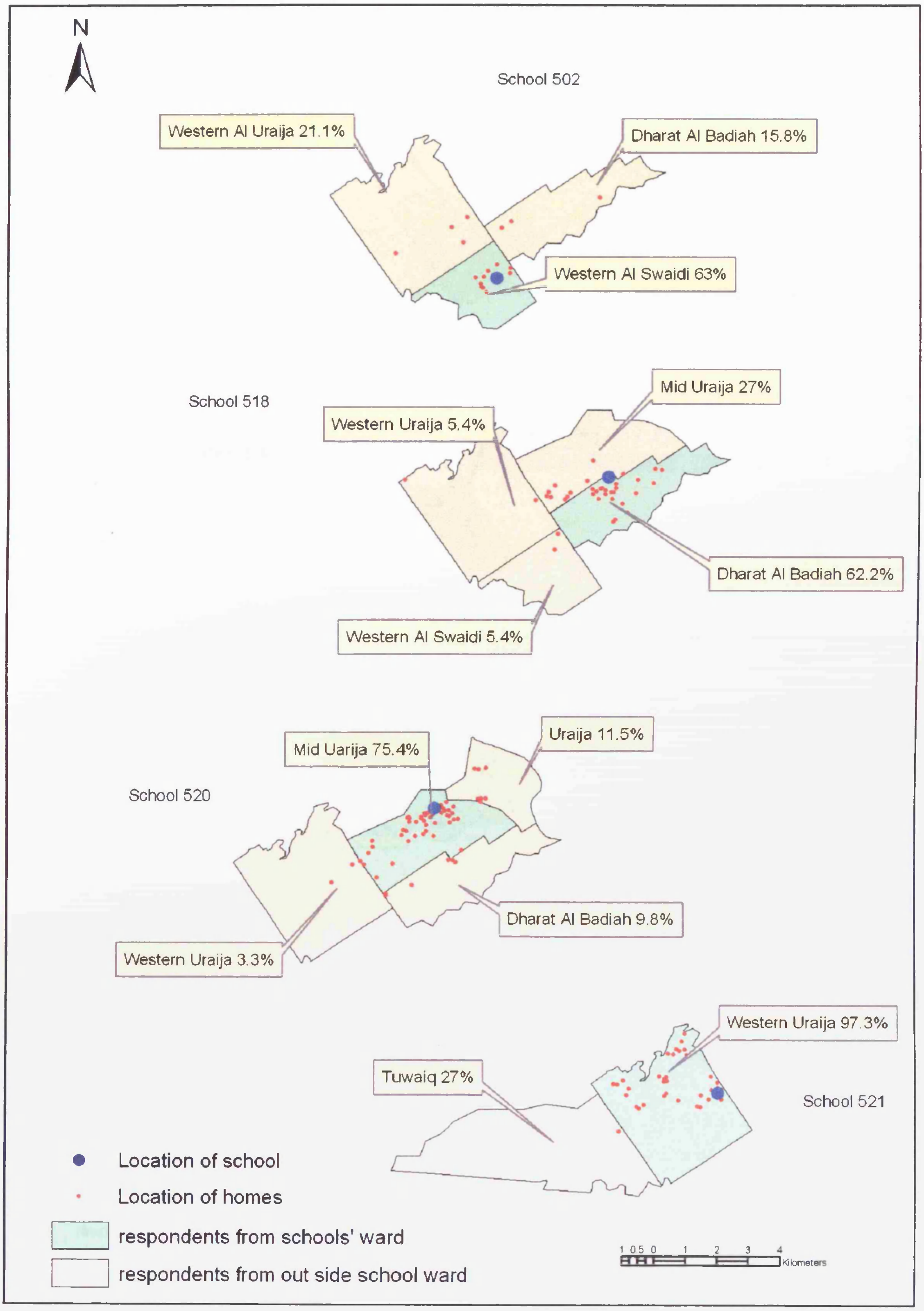
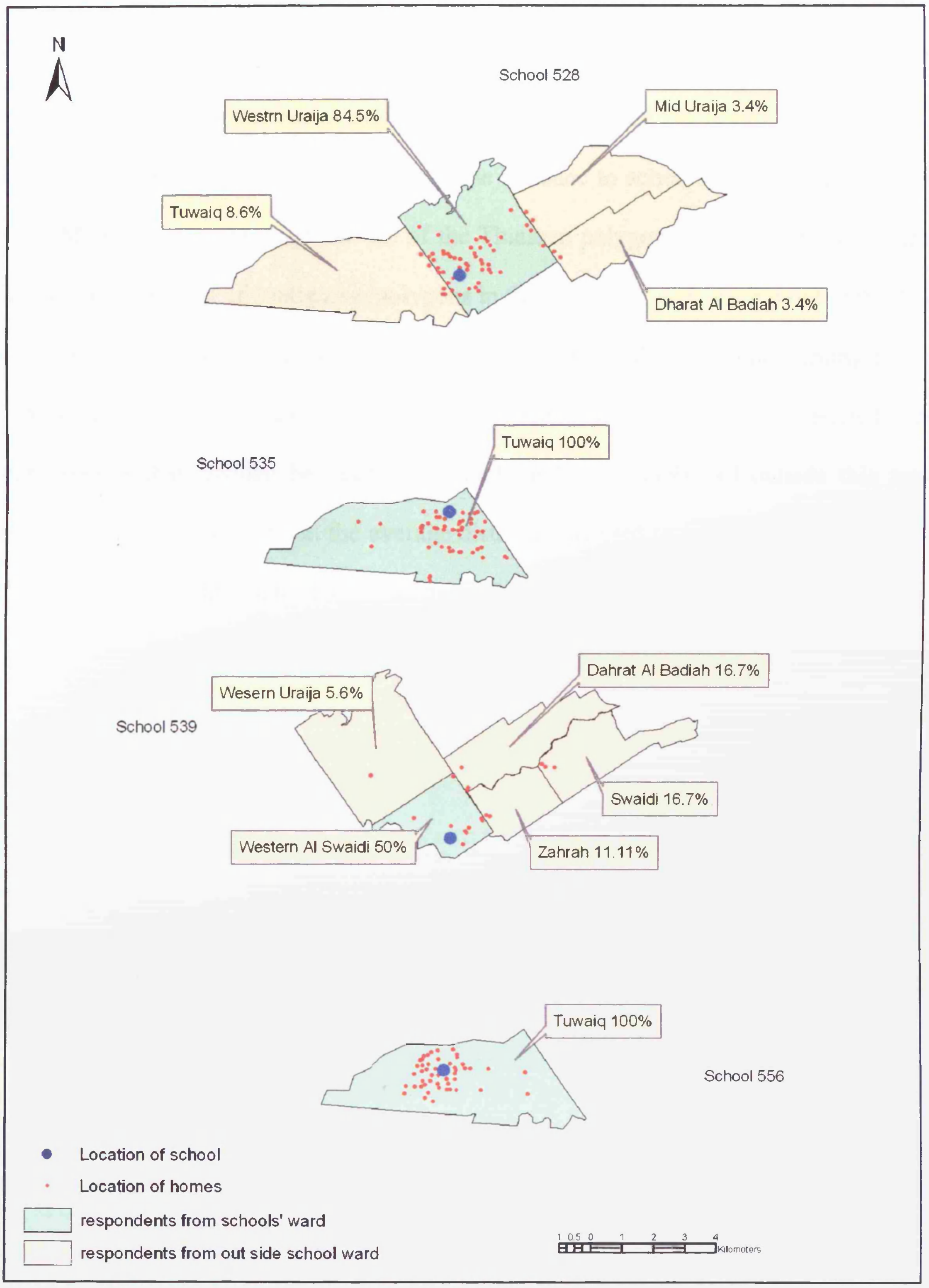


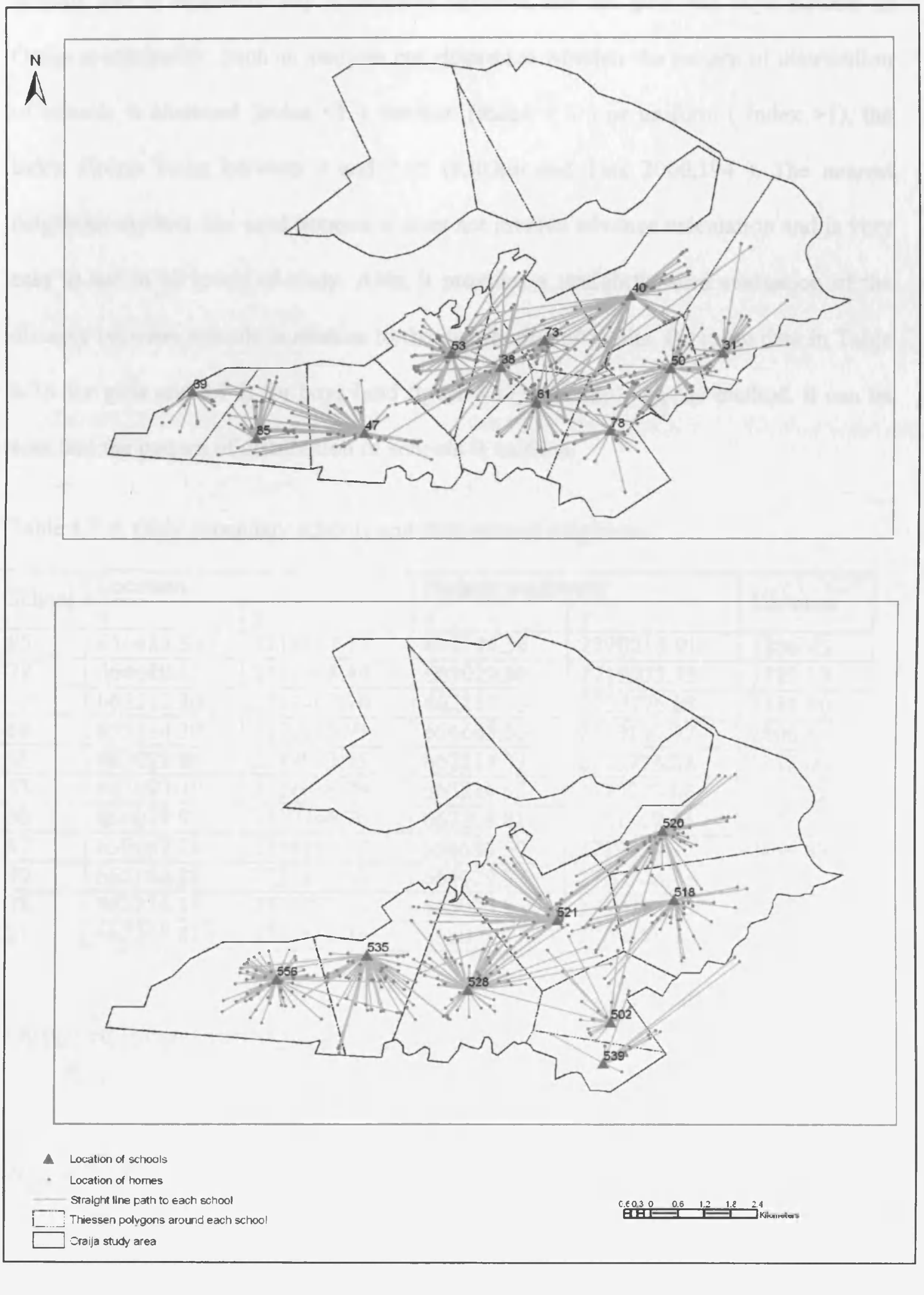
Figure 8.15B Boys secondary schools according to pupils from within and outside the school's ward



8.6.1.3 The current catchment areas for secondary schools

Figure 8.16 shows the distribution of homes of pupils attending nineteen secondary girls and boys schools in Oraija municipality. It can be seen that whilst the majority of pupils choose schools near their home, many pupils do not attend the school geographically closest to their home. The average straight-line distance to schools was 1079 m for girls and 1185 m for boys. Through the use of the Thiessen polygon technique, the study area was divided into a set of contiguous polygons in the following way: each point (school) is joined by lines to two of its neighbours, which are also linked to form a triangle. The perpendicular bisector of each triangle edge is generated and the original deleted. The entire area is thus divided between the schools and no schools fall outside this area. However, it was calculated that the average distance travelled to school would have been 727 m for girls, and 864 m for boys if all pupils had chosen their closest school.

Figure 8.16 Thiessen Polygon around school locations and straight lines to each school



8.6.1.4 Assessment of the distribution patterns of secondary schools:

The nearest neighbour index was used to assess a pattern of distribution of secondary schools and to determine any differences between that for girls and boys schools in Oraija municipality. Such an analysis can determine whether the pattern of distribution of schools is clustered (index <1), random (index = 1) or uniform (index >1), the index always being between 0 and 2.15 (Kitchin and Tate 2000,194). The nearest neighbour method was used because it does not involve advance calculation and is very easy to use in all levels of study. Also, it provides a straightforward evaluation of the distance between schools in relation to the distribution of pupils. By using data in Table 8.7A for girls and 8.7 B for boys (and figure 8.17) and applying the method, it can be seen that the pattern of distribution of schools is uniform.

Table 8.7 A Girls' secondary schools and their nearest neighbour

School	Location		Nearest neighbour		Distance
	x	y	x	y	
85	656685.50	2719137.17	655224.30	2720215.91	1806.45
78	664680.17	2719308.44	663029.86	2719973.75	1783.13
73	663212.30	2721403.10	662214.33	2720776.08	1181.40
69	655224.30	2720215.91	656685.50	2719137.17	1806.45
61	663029.86	2719973.75	662214.33	2720776.08	1148.06
53	661093.39	2721086.79	662214.33	2720776.08	1161.62
50	666029.97	2720746.76	667208.81	2721112.75	1233.17
47	659167.78	2719250.79	656685.50	2719137.17	2499.88
40	665142.38	2722439.02	666029.97	2720746.76	1912.77
38	662214.33	2720776.08	663029.86	2719973.75	1148.06
31	667208.81	2721112.75	666029.97	2720746.76	1233.17

$$\sum d = 16914.16$$

Observed mean nearest neighbour distance:

$$d_{obs} = \frac{\sum_{i=1}^{n} d}{n}$$

$$d_{obs} = \frac{16914.16}{11} = 1537.65091\text{m}$$

Expected mean nearest neighbour distance:

$$d_{ran} = 0.5\sqrt{\frac{A}{n}}$$

$$d_{ran} = 0.5\sqrt{\frac{55118172 \qquad .38}{11}} = 1119.234442\text{m}$$

Nearest neighbour index:

$$\text{NNI} = \frac{d_{obs}}{d_{ran}}$$

$$\text{NNI} = \frac{1537.65091}{1119.234442} = 1.37384$$

NNI > 1

Table 8.7 B Boys' secondary schools and their nearest neighbour

	Location		Nearest neighbor		
School	x	y	x	y	Distance
518	666227.33	2721749.52	665974.62	2723344.85	1622.11
520	665974.62	2723344.85	666227.33	2721749.52	1622.11
528	661532.29	2719655.16	659260.54	2720457.37	2434.69
539	664616.61	2717949.02	664778.68	2718909.18	971.46
521	663588.03	2721277.09	664778.68	2718909.18	2648.87
535	659260.54	2720457.37	657212.16	2719897.72	2097.09
502	664778.68	2718909.18	664616.61	2717949.02	971.46
556	657212.16	2719897.72	659260.54	2720457.37	2097.09

$\sum d = 14464.88$

Observed mean nearest neighbour distance:

$$d_{obs} = \frac{\sum_{i=1}^{n} d}{n}$$

$$d_{obs} = \frac{14484.88}{8} = 1808.11\text{m}$$

Expected mean nearest neighbour distance:

$$d_{ran}=0.5\sqrt{\frac{A}{n}}$$

$$d_{ran}=0.5\sqrt{\frac{55118172.38}{8}}=1312.418716\text{m}$$

Nearest neighbour index:

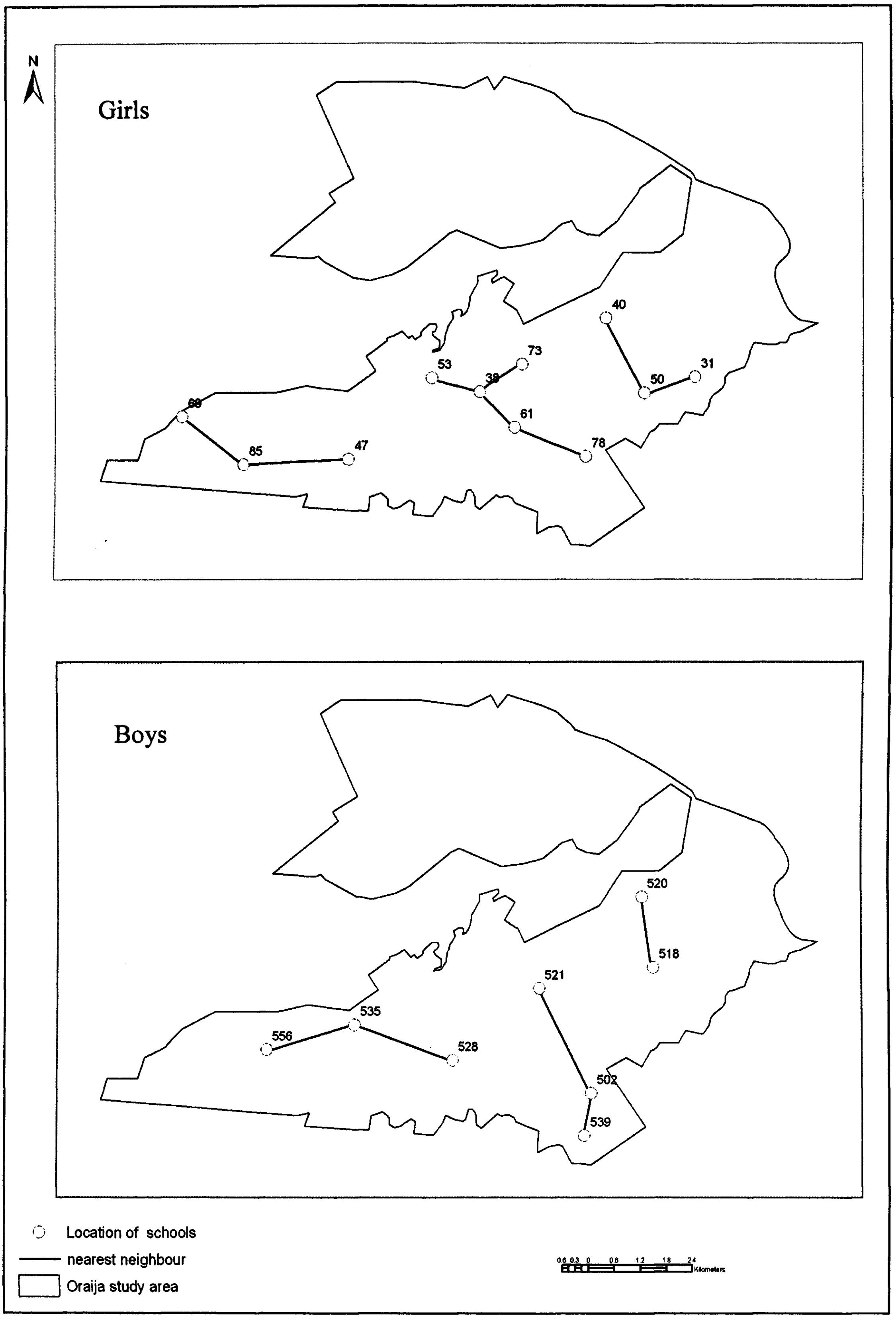
$$\text{NNI}=\frac{d_{obs}}{d_{ran}}$$

$$\text{NNI}=\frac{1808.11}{1312.418716}=1.38$$

$$NNI>1$$

Therefore the point patterns of both boys and girls secondary schools in Oraija are uniform. These findings give an indication that distribution is regular and that the distances between these schools are irregular for both. This irregularity of distances between schools can be attributed to the fact that Oraija has a specific geographical environment. The geography of Oraija consists largely of wadis and highlands which give it its unique shape. Some parts of this municipality were considered isolated until recently when the government established bridges to connect more regions. In addition, the boundary of this municipality plays a very important role in the distribution of schools and distances to them. Oraija municipality is not actually an isolated area in Riyadh, but is surrounded by other municipalities. Indeed, pupils, both girls and boys, living in Oraija can choose to attend other schools in the neighbouring municipalities or further away and other municipalities' pupils may choose to attend Oraija schools. This situation, therefore, affects both distribution of and distances between Oraija schools.

Figure 8.17 Plotting the nearest neighbours for girls and boys secondary schools



8.6.2 Dealing with excess student numbers in the schools

As mentioned in Chapter Two, location-allocation modelling was originally developed to solve site selection problems in respect of schools. Thus the building of new schools is the main solution to the problem of overcrowding. This involves the relocation of pupils to schools which are geographically closest to their homes. These procedures would transfer capacity between schools. The building of new schools is very important because relocation of pupils within existing schools cannot solve the problem as the demand exceeds supply. Therefore the solution has to be the construction of new schools.

One of the tasks of this study is to investigate the capacity of each school according to the collected data and the ideal capacity parameters discussed previously. There are also three important factors that affect the location of new schools and these were taken into consideration. They are the excess number of students, the location of the schools with excess numbers of students and the ideal capacity of the school. Five more factors should be considered in the future when locating new schools. They are the accessibility of the school, the availability of land at prices within the education budget, the reasonable distance from mosques (at least 500 m from boys or girls schools) and a collective opinion of special committee from visiting the suggested location.

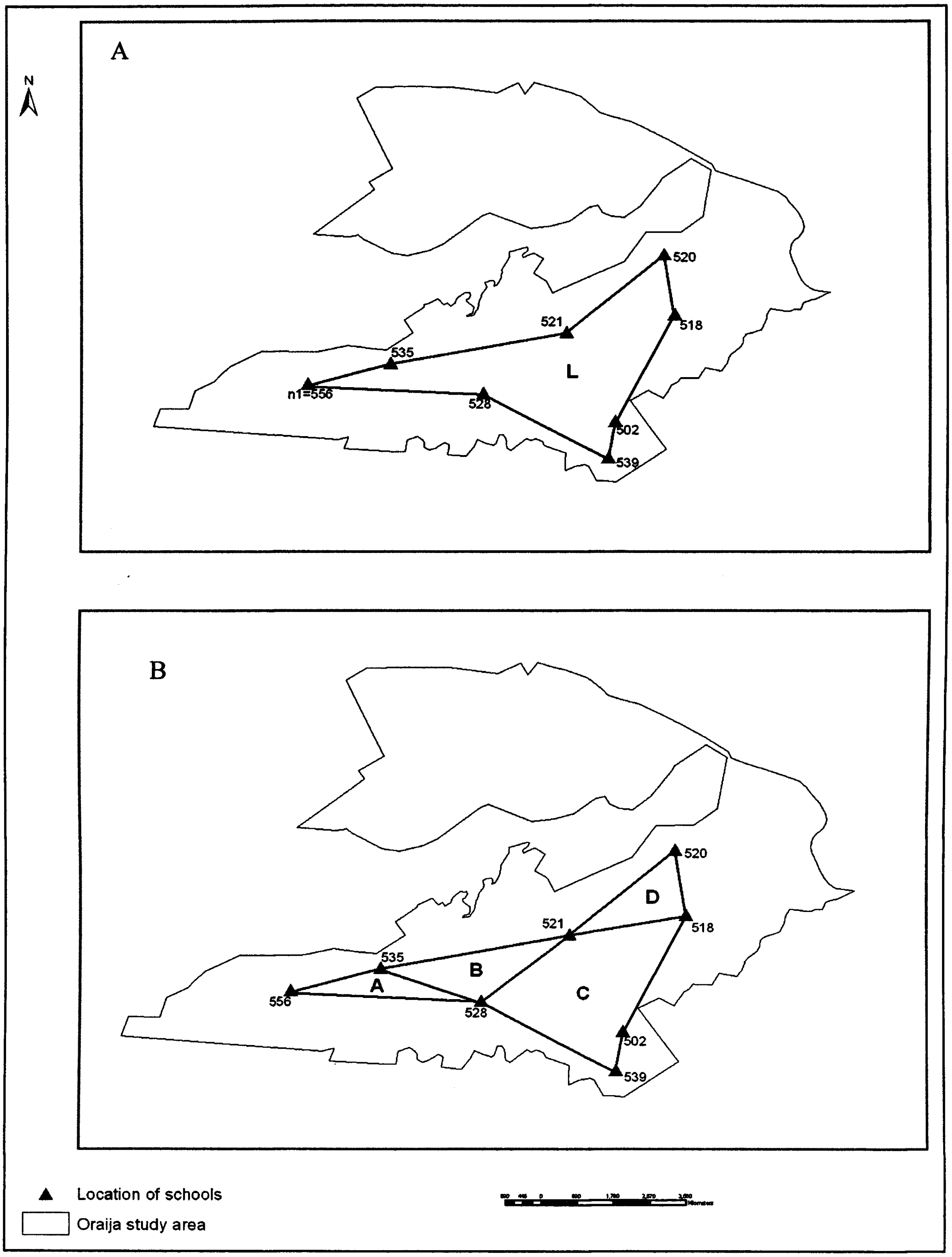
Below is an illustrative example to describe the method employed in this study. The first step was to draw a map of the Oraija municipality. After that it was necessary to triangulate a polygon sub-region as shown in Figure 8.18 and tabulate the data for each school as in Table 8.8.

Table 8.8 The current ideal capacity and the excess number of students in each school in Oraija Municipality.

Name of school	Access/pupils (n)	Coordinates of schools	
		X	Y
556	511	657212.1613	2719897.722
535	487	659260.5361	2720457.367
528	438	661532.2916	2719655.157
521	238	663588.0261	2721277.088
518	324	666227.3269	2721749.518
502	192	664778.681	2718909.184
539	80	664616.6079	2717949.024
520	445	665974.6232	2723344.848

This technique is similar to that in the study carried out by Belal in (1999) in which he divided the study area (El Salam District, Egypt) into shapes (subsections) which were either rectangular or circular. This enabled him to propose a method for calculating the approximate number of schools for each subsection. By using a different technique, a similar study was done by Al-Zeer (1992) for girls secondary schools in western Riyadh. Al-Zeer's (1992) study took into consideration the total number of pupils in intermediate schools, the ideal capacity of the school, accessibility to schools and availability of land and fieldwork observations.

Figure 8.18 Students access analysis in Oraija Municipality



The total excess number of students, n_{total}, in all schools in region (L) is calculated as follows:

$$n_{total} = \sum_{i=1}^{8} n_i$$

The number of new schools, N_{new}, can be determined by two methods, one of which is according to the total excess number of pupils and the ideal school capacity n_{ideal}

where

$$n_{ideal} = \frac{total_{pupils}}{total_{schools}}$$

1. $N_{new} = 1$ If $n_{total} <= n_{ideal}$

2. $N_{new} = 2$ If $1 < \frac{n_{total}}{n_{ideal}} \leq 2$

The other method depends on dividing the total excess pupil numbers in all schools by 30 - " the number of pupils in class" - the figure suggested by the Ministry of Education, then dividing the result by 27 - " the total classes in each school" - (Ministry of Education, 2000)[1], according to the following conditions:

$$N_{new} = \frac{n_{total}}{30} \div 27$$

The first possible case is one new school. The new school would be located in the median of the polygon (L) constructed as in Figure 8.18 A and calculated as follows:

[1] This is according to the Projective Administrative Section, Ministry of Education 2000.

$$x_{new} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$y_{new} = \frac{\sum_{i=1}^{n} y_i}{n}$$

The second possible, more complex, case is to have four new boys schools[1]. Region L would then be triangulated as shown in Figure 8.19 B. Each of the four new schools would be located in the median of a triangle.

8.6.2.1 The location of the new schools

The new schools can be located by using two methods (weighted and unweighted). The aim is to determine the best site for a new school minimizing the travelling distance to/from school. According to the first method (weighted), the following equation was used to calculate the weighted mean centre of a cluster of points:

$$\bar{x}_{wc} = \frac{\sum f_i x_i}{\sum f_i} \qquad \bar{y}_{wc} = \frac{\sum f_i y_i}{\sum f_i}$$

where:

wc = weighted centre

f = frequency (or weighting factor)

(Jenness 2004)

According to Table 8.6, the excess number of pupils was used as a weight factor as per the following:

in area A

$$\mathrm{x_{new}}\ \bar{x}_{wc} = \frac{(x_1 \times n_1 + x_2 \times n_2 + x_3 \times n_3)}{n_1 + n_2 + n_3}$$

[1] Boys schools were used to illustrate the processes.

$$y_{new} \quad \bar{y}_{wc} = \frac{(y_1 \times n_1 + y_2 \times n_2 + y_3 \times n_3)}{n_1 + n_2 + n_3}$$

while in area B

$$x_{new} \quad \bar{x}_{wc} = \frac{(x_2 \times n_2 + x_3 \times n_3 + x_4 \times n_4)}{n_2 + n_3 + n_4}$$

$$y_{new} \quad \bar{y}_{wc} = \frac{(y_2 \times n_2 + y_3 \times n_3 + y_4 \times n_4)}{n_2 + n_3 + n_4}$$

whereas in area C

$$x_{new} \quad \bar{x}_{wc} = \frac{(x_3 \times n_3 + x_4 \times n_4 + x_5 \times n_5 + x_6 \times n_6 + x_7 \times n_7)}{n_3 + n_4 + n_5 + n_6 + n_7}$$

$$y_{new} \quad \bar{y}_{wc} = \frac{(y_3 \times n_3 + y_4 \times n_4 + y_5 \times n_5 + y_6 \times n_6 + y_7 \times n_7)}{n_3 + n_4 + n_5 + n_6 + n_7}$$

while in area D

$$x_{new} \quad \bar{x}_{wc} = \frac{(x_4 \times n_4 + x_5 \times n_5 + x_8 \times n_8)}{n_4 + n_5 + n_8}$$

$$y_{new} \quad \bar{y}_{wc} = \frac{(y_4 \times n_4 + y_5 \times n_5 + y_8 \times n_8)}{n_4 + n_5 + n_8}$$

By considering the density of the excess students in each of the sub-regions, the distribution of the excess students between the four schools[1] can be calculated as fractions of the total number of excess students, n_{total}, as follows:

Area A, Occupation Percentage (OP_A) = $\dfrac{n_1 + n_2 + n_3}{n_A + n_B + n_C + n_D}$

[1] Boys schools were used to illustrate the processes.

Area B, Occupation Percentage (OP_B) = $\dfrac{n_2 + n_3 + n_4}{n_A + n_B + n_C + n_D}$

Area C, Occupation Percentage (OP_C) = $\dfrac{n_3 + n_4 + n_5 + n_6 + n_7}{n_A + n_B + n_C + n_D}$

Area D, Occupation Percentage (OP_D) = $\dfrac{n_4 + n_5 + n_8}{n_A + n_B + n_C + n_D}$

Where n_A, n_B, n_C and n_D are the total excess numbers of students in each area. Therefore, the number of students in each of the four new schools is as follows:

Number of students in new school A= OP_A X n_{total}

Number of students in new school B= OP_B X n_{total}

Number of students in new school C= OP_C X n_{total}

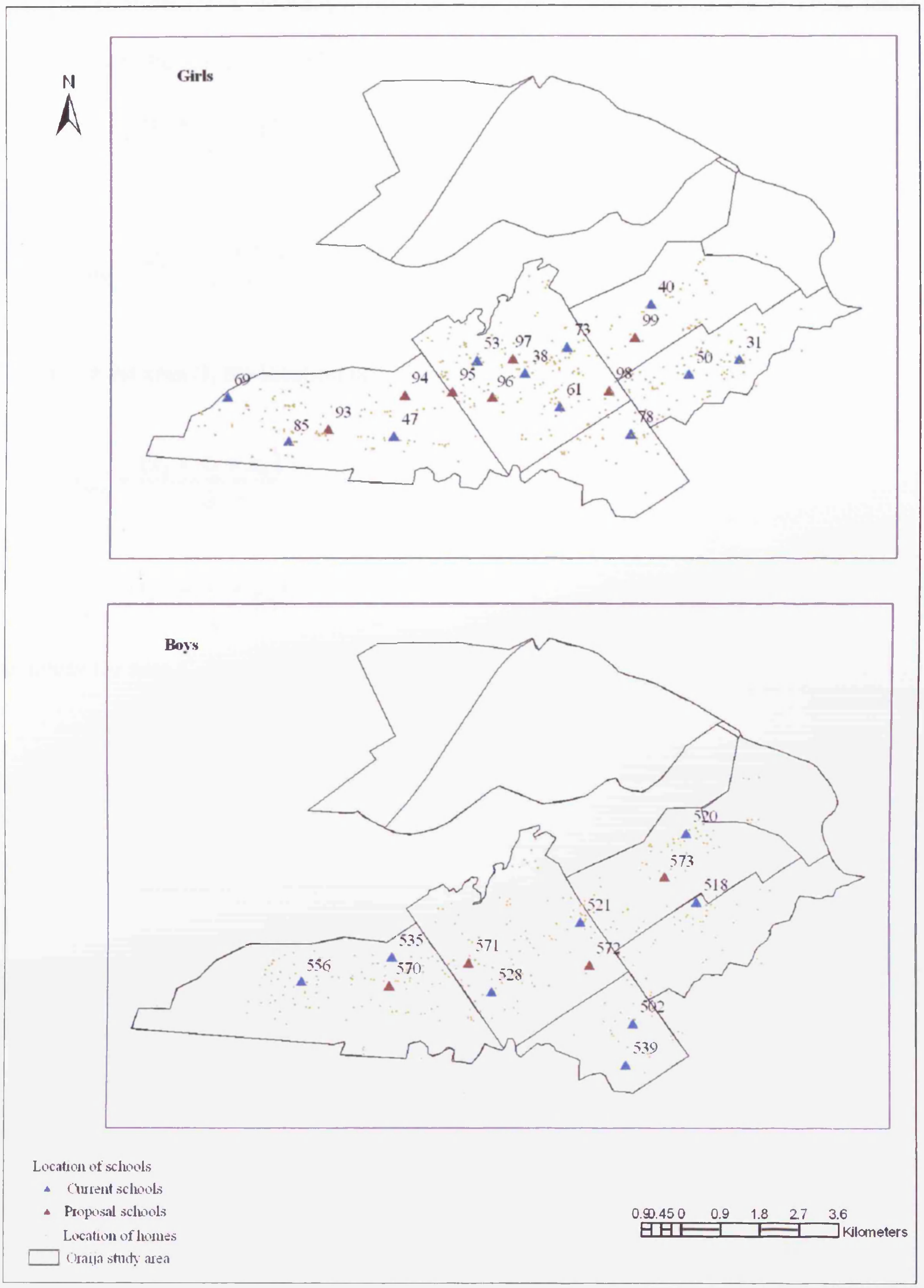
Number of students in new school D= OP_D X n_{total}

Table 8.9 clarifies that the average distance travelled for both girls and boys decreased after the above method was applied. This was as a result of adding seven new girls schools and four new boys schools, (see Figure 8.19). For example, the average travelling distance for the girls in School 38 in western Oraija ward was reduced from 1208m to 384m, a reduction of 68 percent. This was as a direct result of establishing two new schools, one in the north of the ward which coded as school number 97, and another in the west coded as school number 96, followed by school number 47 (girls school), which reduced travelling distances from 1456 m to 714 m, a reduction of 51 percent. The percent reduction continued to decrease gradually to 4.7 percent (the lowest) for secondary school number 69 (girls school). The average travelling distance for boys schools decreased as well, but differed between schools. For instance, the highest decrease was in school 556 where journey lengths fell from 1802 m to 672 m, a reduction of 62.7 percent, followed by school 535 where they fell from 1117 m to 563 m, a reduction of 49.59 percent. The smallest reduction was boys school number 556, where the average travelling distance fell from 787 m to 659 m, a reduction of 16 percent (see Table 8.9).

Table 8.9 Percentage of change between current and optimum distances travelled by using the weighted method with the addition of new schools

Girls				Boys			
School	Current Average Distance (m)	Average Distance (m) Weighted	Percentage Change (%)	School	Current Average Distance (m)	Average Distance (m) Weighted	Percentage Change (%)
31	728	669	8.02	502	999	653	34.59
38	1208	384	68.21	518	1142	850	25.55
40	1649	972	41.06	520	1290	732	43.21
47	1456	714	50.99	521	1624	889	45.26
50	798	638	20.01	528	1197	688	42.5
53	876	521	40.57	535	1117	563	49.59
61	1209	623	48.48	539	1802	672	62.72
69	740	704	4.97	556	787	659	16.26
73	756	710	6.01	570			
78	774	585	24.34	571			
85	851	598	29.64	572			

Figure 8.19 Distribution of secondary girls and boys schools by using weighted method



The second method deals with the mean centre of the unweighted points of a school and uses the coordinates (x_coord, y_coord) at the mean of x and y. The site of a new school in area A can be calculated as follows:

$$x_{new} = \frac{(x_1 + x_2 + x_3)}{3}$$

$$y_{new} = \frac{(y_1 + y_2 + y_3)}{3}$$

while for the area B, the location is:

$$x_{new} = \frac{(x_2 + x_3 + x_4)}{3}$$

$$y_{new} = \frac{(y_2 + y_3 + y_4)}{3}$$

whereas for area C, the location is:

$$x_{new} = \frac{(x_3 + x_4 + x_5 + x_6 + x_7)}{5}$$

$$y_{new} = \frac{(y_3 + y_4 + y_6 + y_6 + y_7)}{5}$$

while for area D, the location is:

$$x_{new} = \frac{(x_4 + x_5 + x_8)}{3}$$

$$y_{new} = \frac{(y_4 + y_5 + y_8)}{3}$$

Table 8.10 Percentage of change between current and optimum distances travelled by using the unweighted method with the addition of new schools

Girls				Boys			
School	Current Average Distance (m)	Average Distance Unweighted (m)	Percentage Change (%)	School	Current Average Distance (m)	Average Distance Unweighted (m)	Percentage Change (%)
31	728	666	8.52	502	999	608	39.12
38	1208	378	68.71	518	1142	820	28.18
40	1649	937	43.17	520	1290	740	42.65
47	1456	715	50.88	521	1624	818	49.6
50	798	609	23.64	528	1197	644	46.22
53	876	595	32.05	535	1117	723	35.23
61	1209	590	51.15	539	1802	672	62.73
69	740	650	12.15	556	787	673	14.42
73	756	720	4.7				
78	774	585	24.34				
85	851	413	51.45				

Table 8.10 above shows that there was a difference between the current average distance and the new unweighted average distance after the above method was applied. The total and average distances decreased, reflecting create new boundaries for girls and boys schools and seven additional girls schools and four additional boys schools (see Figures 8.20 and 8.21). The total travelling distance for girls schools was reduced from 444,715 m to 254,188 m, a reduction of 43 percent and the average distance decreased from 1079 m to 617 m, again by 43 percent. For example, the average travelling distance for school number 38 in western Oraija ward (girls school) was reduced from 1208 m to 384 m, a reduction of 68.7 percent, followed by school number 47 (girls school), where the distance fell from 1456 m to 715 m, or 55.8 percent.

Figure 8.20 Distribution of secondary girls and boys schools by using the unweighted method

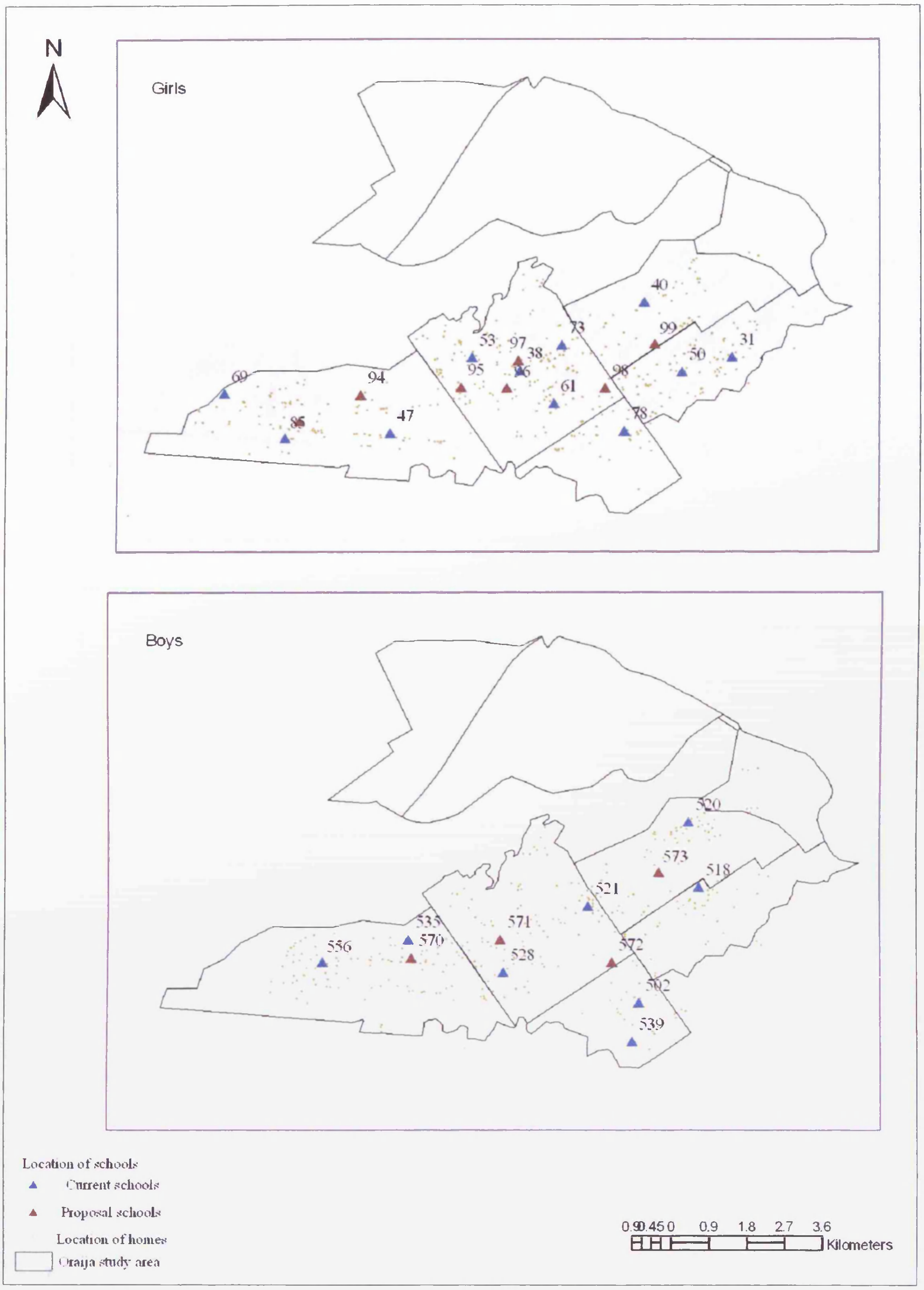
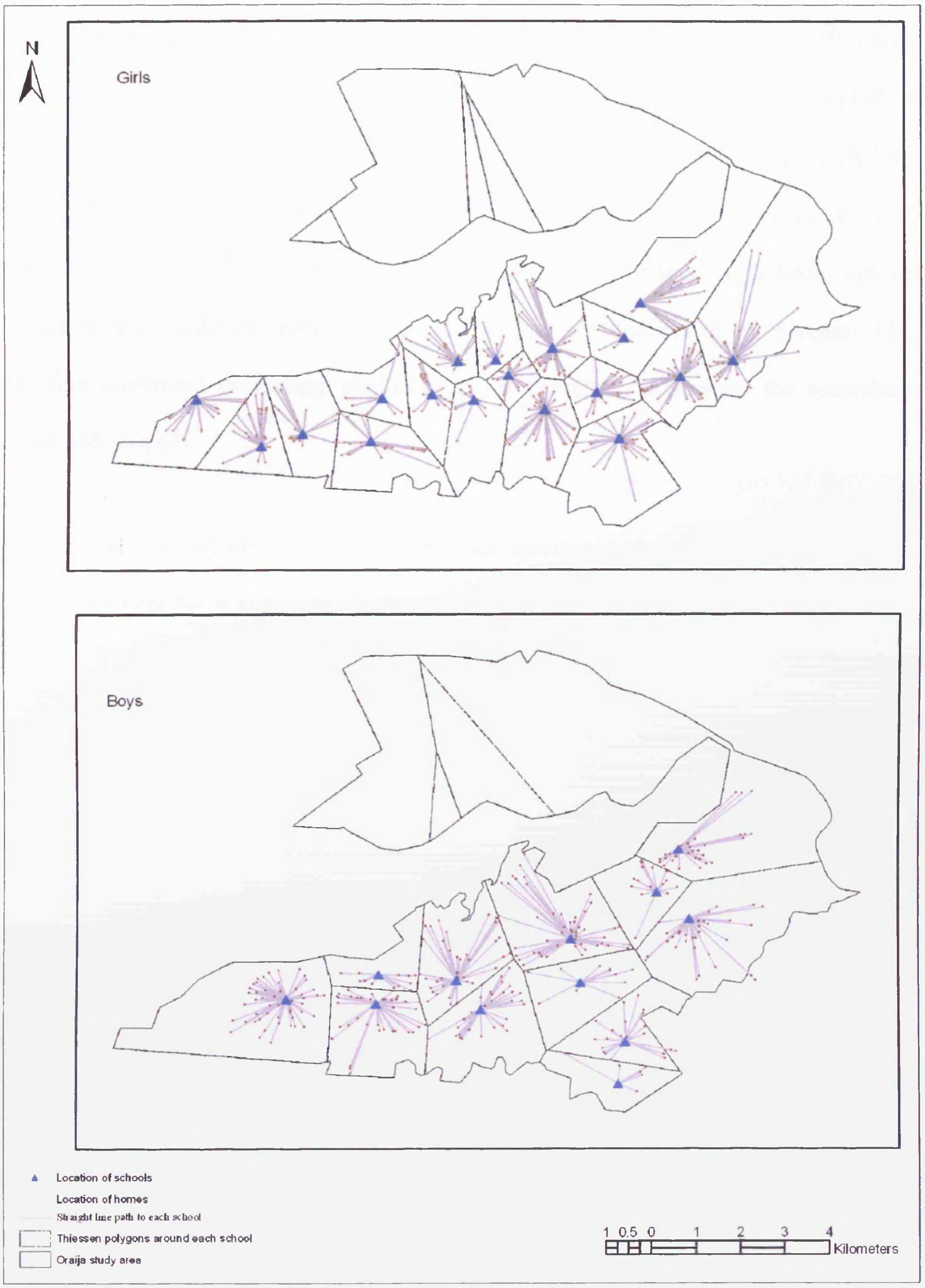


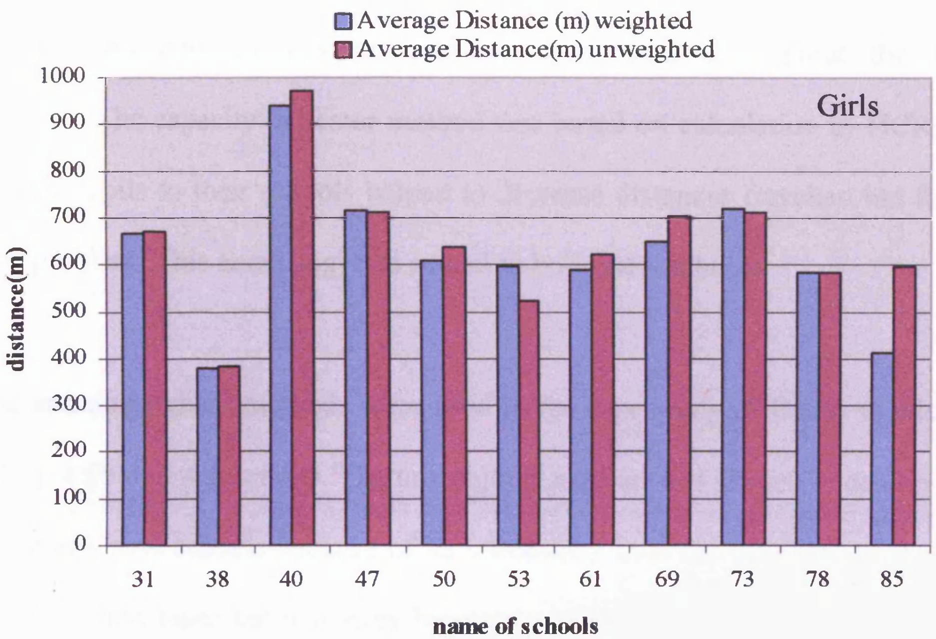
Figure 8.21 The final distribution of schools and their catchment areas in Oraija

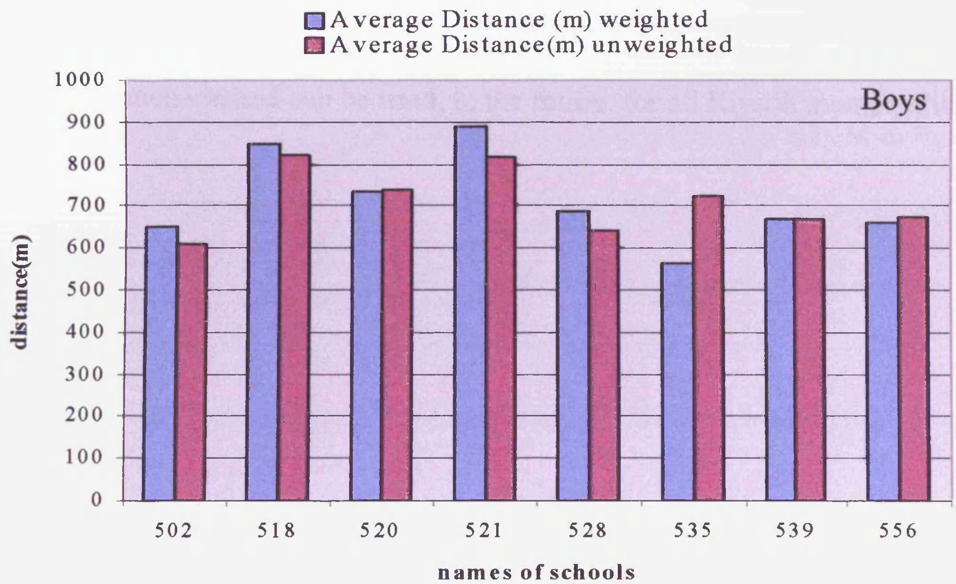


The smallest journey reduction, 4.7 percent, occurred in girls school number 73. Moreover, the total and average distance for boys decreased as well. The total distance to be travelled decreased from 393,552 m to 247,801 m. There were also differences between schools. For instance, at school 539 (Gasim Bin Salam), which is located in Western Swaidi and where around 50 percent of the pupils come from three wards (see Figure 8.9), the average length of journey fell from 1802 m to 672 m, or by 62.7 percent. This was followed by the students at school 535 (Balat Alshuhada) whose average journey reduced from 1117 m to 563 m, a reduction of 50 percent. The reduction continued decreasing gradually to 16 percent (the lowest) for secondary school 556 (Najed).

However, when comparing the average distance calculated by using the two methods, slight differences were apparent. The results of these calculations are shown in Figure 8.22.

Figure 8.22 Comparison of average distance travelled for secondary schools using weighted and unweighted methods





8.7 Conclusions

This chapter presented the method used for choosing the best location for new schools to reduce overcapacity, using straight-line and capacity indicator methods. A map was produced to represent the current capacity of schools throughout the Riyadh municipalities. The capacity indicator method was based on calculation by HCRD. The relocation of pupils to their schools helped to decrease distances travelled but failed to rectify the problem. This result suggests a need to build new schools.

Weighted and unweighted methods were used in the case study of Oraija municipality to identify possible new locations. The unweighted method was chosen to determine the locations of any new schools because of its superiority over the weighted method. The unweighted method takes the distances between current schools to determine the new schools regardless of the number of pupils in each. The boundaries of each old and new school were drawn using Theissen polygon method. This method enabled the researcher to determine the catchment area of each school in the Oraija municipality. It can be recommended that such method can be used, in the future, for all Riyadh municipalities.

CHAPTER NINE

Conclusion and Recommendation

Introduction

The research presented in this study has highlighted a number of issues that need to be carefully considered in relation to the spatial distribution of girls and boys secondary schools in Riyadh. The six objectives identified for this research have been met.

One of the objectives was to carry out an examination of the current system of secondary schools in Saudi Arabia, with particular regard to the number of schools and the number of pupils, classes and teachers in each school. Another objective was the identification of the relationship between the population and the number of pupils and schools in the municipalities. These objectives were fulfilled through the analysis of documentation and official statistics. The remaining objectives were achieved by the use of a questionnaire and the application of a GIS, and were as follows: the evaluation of criteria determining a pupil's choice of school; a mapping of the geographical distribution of pupils' residences relative to the locations of schools (including accessibility in terms of travel time); an investigation of the catchment areas of girls and boys secondary schools in Riyadh, to determine any differences between the two with regard to their locations; and an investigation of the application of location-allocation theory to determine school locations and catchment areas.

These objectives were refined through a review of existing literature as well as the use of documentation and official statistics. The documentation and statistics were obtained from the Ministry of Education, the General Presidency for Female Education and the High Commission for Riyadh Development. The study utilised a survey research method which included interviewing key officials and a questionnaire survey of the pupils of girls and boys secondary schools. Interviews were used mainly to collect general information about the education system in Saudi Arabia. The questionnaire was used to collect data about the location of pupils' homes in relation to their schools. In addition, the factors affecting the choice of school were investigated as well as an evaluation of transportation to and from schools. Time and distance from home to schools as well as return journeys have been examined. A GIS was used to construct maps and to determine the location of both schools and pupils homes.

This chapter covers four areas: first, it presents an integrated summary of the research findings. Second, it deals with the contribution and implications of the research. Third, suggestions for possible future research in to the spatial distribution of schools and in the application of GIS are presented. Finally, the limitations of the study are discussed.

9.1 Summary of main research findings

It is not very common in Saudi Arabia for pupils to go to schools on foot. This is because of the lack of pedestrian facilities, weather condition, Saudi culture, safety and high ownership of private cars. The research showed that private transportation to and from schools for both girls and boys exceeds all other modes of transportation. These findings are similar to that reported by (Al-Mateer 1999; Al-zeer 1992 and Al-Kharaif et al., 1994). Additionally, a lack of comfort (*inter alia* over crowdedness and inefficient air-conditioning) is the main problem that besieges school buses as a mode of transportation, the Ministry of transportation (1998) has also confirmed this.

According to this study the extra-curriculum activities and relatives in the schools are the most important factors in the choice schools by pupils and their families. West (1992) and Taylor (2002) supported the first factor, and indicated the need for a good learning environment.

The study used a GIS to analyze the distribution of schools in Riyadh and the current catchment areas. The case study demonstrated that the distribution of schools in Oraija was adequate, but the schools are overcrowded. As there is no spare capacity in the system, the only solution to this problem is the establishment of new schools to absorb this overcapacity.

9.2 Contribution and Implications

This section presents a discussion of the implications of the spatial distribution of secondary schools in Riyadh, the means of transport, choice of school, distance and time travelled, and the utilization of geographical information systems.

9.2.1 Secondary schools distribution

The research showed that girls and boys secondary schools were well distributed throughout all the municipalities of Riyadh. However, more wards included girls schools than boys. The main problem uncovered was the overcrowding of schools in all areas of the city. This problem needs to be resolved. One solution would be to redistribute pupils within existing schools to absorb the excess numbers. The first technique used to address this problem was a theoretical exercise to redistribute excess pupils to the nearest schools with spare capacity. Unfortunately this exercise did not solve the problem because the majority of schools in Riyadh are overcrowded. This suggests that the only solution would be to build new schools. Thus, the 'location-allocation' technique was employed. Using the location-allocation method enables the researcher to suggest the establishment of new schools and their appropriate locations. The application of this method (weighted and unweighted method) involves identifying the number of schools needed to absorb the excess pupil numbers. This method produced the main contribution of this research. To the best of the researcher's knowledge, this is the first such study to be undertaken in Saudi Arabia, for both boys and girls secondary education.

9.2.2 Means of Transportation

The study shows that school transportation services are limited for boys compared to transportation for girls. Furthermore, despite the availability of services for girls, there was found to be a big gap between bus capacities and the number of girl passengers. Consequently, buses were overloaded to double their service capacity and therefore these services face several problems. The main problem is the continuous increase in student numbers, which is not compatible with the limited increase in bus provision. Based on that we can say that transportation problems still exist and are likely to increase year on year when it is taken into account that most of the girls buses are old models (1979 or older) and are likely to be taken out of service soon. Factors such as a bad standard of driving and lack of comfort led to an increase in the number of pupils using private transportation to and from school, which in turn has exacerbated other problems. One of these has been an increase in traffic jams leading to delays as well as an increase in the level of pollution. One solution is to reduce the number of cars which in turn will lead to fewer accidents and less pollution. This, however, indicates that the whole of the school transportation system needs to be reorganized, not only for pupils but generally in Saudi Arabia and specifically in Riyadh where it is considered inadequate.

Public transportation in Riyadh is not ubiquitous, but is limited to servicing the main roads. This needs to be expanded to cover all areas. There is currently only one company in Saudi Arabia providing this service and several improvements are needed. More than one transportation company is recommended to create a competitive environment. Each municipality needs adequate bus stops and each municipality needs at least one bus station. These stations would be used as connections between municipalities. The existing school transportation would be included with the public transportation. School buses are heavily used in the early morning and at the end of school for school journeys. The school authorities could devote the transportation budget to support pupils' school transportation. The price for transportation for school age passengers could be set at a reasonable level and pupils with financial need could be granted free bus passes. The improvement of transportation in general demands qualified drivers and buses in good condition i.e. air conditioned, clean, safe and with enough seats for passengers. Morning and afternoon (end of school time) priority should be for pupils. For cultural and social reasons buses should be segregated for girls and boys.

9.2.3 Choice of school

The study shows that there are differences in the factors affecting girls and boys in their choice of schools. It appears that boys have more freedom than girls regarding their choice of school, while for girls the choice is influenced by many factors. The most important factors in the choice of school are extra-curricula activities, relatives (brothers, sisters or cousins), examination results and the environment around the school. Although there are no differences in terms of resources and services between public school, some of them are experiences a high demand for places, while others not. The reason behind this is identified because of the skewed spatial distribution of public schools. Thus, to achieve a uniform distribution pupil each of the public schools should have a strictly specified catchment area.

9.2.4 Distance and time

Based on the results of this study, the current average distance travelled to school (1050m for girls schools and 1616m for boys schools) exceeds the acceptable average distance (1000m). Applying the suggested system of catchment areas and establishing new schools in appropriate locations will help to minimize the use of private transportation and will encourage pupils to walk to school. This, ultimately, will make public transport function well.

Social, economic and environmental benefits will be derived from such a catchment system policy. It would reduce the burden on public transportation which would then be available to pupils who travel longer distances. Improvements in pedestrian facilities are also needed. There are further advantages to be gained from a catchment area system. New jobs will be created for helpers of pupils on the streets. Also, the households' cost of transportation will be reduced. Fathers and brothers will be released from the pressure of the driving. More importantly, fathers will then refrain from the intermittent absences from their work due to travelling to schools. For the sense of safety and security, families will have peace of mind because their children are close to their schools which will make it easy for the families to contact when needed and for the school to contact them. Applying a catchment area policy could also make the school a good community centre to be used after school hours for public services such as sport, health and fitness, sewing and cooking and first aid training. Moreover, it will reduce the level of pollution in the whole area as both private and public transportation are reduced.

9.2.5 Application of a GIS

One of the main contributions of this study has been in the use of a GIS as a tool to draw the maps, delineate catchment areas, show school density and locate current and proposed schools. Because of the rapid development in GIS capabilities, it has become an important tool, not just for education services (schools) but many other applications as well. The application of GIS in the education sector expanded considerably in the 1990s and is expected to continue to grow. The importance of GIS for education sector research stems from its capabilities in managing and presenting spatial databases, which are spatially referenced. The display functions of GIS i.e. its ability to display education data in several types of maps also increases its applicability. As an attempt to reduce the cost of using GIS, Plewe (1997) developed a client-server model which aimed to give the user who has a computer a chance to benefit from GIS functions without installing the software on the client computer. If we believe that GIS applications in developed countries still pose challenges to researchers, it is to be expected that there will be extra constraints in the developing countries. Dunn *et al.* (1997) summarised these obstacles into three categories: technical problems, data and organizational issues. Each obstacle is assessed in turn below.

The basic issue in implementing a GIS project is financial support. It should be said that Saudi Arabia does not have problem with funding GIS programmes. That includes buying the software and long-term agreements for maintenance and support systems. At a national level, the Directorate of Military Survey (DMS) started using GIS at the beginning of the 1990s. Despite the fact that such military use of GIS has been criticized (Smith, 1992), the DMS has started to use GIS in civil applications. Another government agency that has used GIS in a civil context is the High Commission for Development of Riyadh (HCRD). The capabilities of GIS have attracted the HCRD to use it in development plans for the city. As this study has demonstrated, the education sector could use a GIS to implement rational catchment policy.

The second constraint mentioned by Dunn *et al.* (1997) is the existence of sufficient data. Worboys (1995) considered that data is the foundation of any GIS application. Based on the researcher's experience in the fieldwork phases, the existence of good data is the weakest link. The difficulty becomes more serious when collecting socioeconomic data, as this can require expensive field surveys.

Another obstacle associated with data in Riyadh is bureaucracy and complications in both collecting and releasing data. It is impossible to distribute any kind of questionnaire without prior permission from the associated Ministry and if the questionnaire is about socio-economic issues, it becomes more difficult because of the culture of privacy in KSA. This was a factor in this research where more than a month was lost in getting permission from the university, the AEDGR and the AEDBR before commencing field work.

In addition, great care needs to be given to the quality of the data used in GIS applications in Riyadh. Much of this data is derived from different sources, and as such is subject to differing levels of accuracy and in several cases includes errors that may make data non-comparable. In the case of Saudi Arabia and Riyadh, the different divisions of the country and the city operated by various organisations may influence the quality and comparability of the data. It is hoped the most recently proposed administrative divisions of the city will become compulsory for all government ministries to follow and that data will be collected consistently on this basis.

9.3 Recommendations

Based on the results obtained in this study the following recommendations are made:

- To increase financial support allocated for the school transport sector to alleviate transportation problems.
- To cooperate with specialist transport companies such as the Common Transportation Saudi Company, Car General Union and others to cover school transportation.
- To provide transport services for male students as they are available for girls
- To encourage pedestrian students, especially when crossing streets and to assign a person to provide guidance for them to increase safety.
- The municipalities in Riyadh should allocate land and infrastructure for planning new areas for schools.
- To increase state expenditure in order to build new schools in Riyadh and stop the renting private unsafe properties for schools.
- To introduce a law to regulate the catchment area system.
- To encourage and update research that relates to school distribution.
- To improve the availability of GIS applications as part of a long-term strategy. In the case of Riyadh, the DMS and the HCRD have used GIS for a considerable time. However, in other ministries, for instance the Ministry of Education, at the time of the research there was no GIS use.

9.4 Limitations

Researchers identify specific limitations, not only to show the extent to which they are prevented from making their findings more rigorous and conclusive, but also to help others to avoid them to the benefit of their own field of investigation. This study, indeed, is no exception. Thus, the following limitations need to be listed and noted by researchers interested in the study of spatial distribution of schools.

Any study is limited by its research methodology. The empirical evidence of this study is based on a questionnaire survey of pupils and therefore the usual limitations of this method apply. Thus, this study may not capture the depth of the respondents' views which might be better obtained by using an alternative approach. To enhance the findings it may be profitable to use additional respondents such as parents and school officials in future research. This is to assure responses from other groups who may be concerned with and have views on this type of study. Also a structured interview with a smaller sample may have advantages for further study of school locations and their relationships to school transportation. However, the researcher feels that it is possible to argue validly that the research method chosen was appropriate in providing insight into the research objectives and responses to the questions posed (see Methods Chapter three for justifications of this method).

This study is limited by its context. Its results may be applicable only to the Saudi environment and to other developing countries, particularly other Gulf Countries which share the influence of a similar socio-economic environment which experience very rapid growth in the cities. Nevertheless, it would be interesting to extend the study to such countries, especially of the Gulf Corporation Council (GCC) countries.

9.5 Future work

Future research should extend the investigation of issues related to the education service and GIS applications started in this thesis. Possible projects include the following:

- One of the most needed areas of research is the study of Riyadh's population characteristics, such as age, gender and the distribution of the school-age population. Analysis of the most resent census data (2004) could provide useful information toward this end. As part of this work, it would also be beneficial to include more direct measures of the demand for education services than were possible in this study
- Further research should focus on the development of the geocoding (postcode) project in the city, this could help future research to identify exact location of schools and pupils homes (the use of GPS might help in this respect).
- A GIS project for studying the distribution of schools in Riyadh and the catchment areas for each school should cover not only public sector but also the private sectore.

In conclusion, this research highlights the present situation of girls and boys secondary schools in Riyadh. The application of GIS shows the benefits that could be derived from the use of such tools, even if there are currently limitations with respect to postcodes and other spatial data. The visual display capability of GIS was successfully used through the production of maps that illustrate the current secondary schools in Riyadh and proposals for the future research of the sector. It is hoped that the examples and analyses presented in this thesis will help to persuade decision makers in the education sector of the benefits that could be obtained from the wider use of GIS. The wider benefit to Riyadh of a more effective catchment system is that it will improve the quality of life of all who live in the city.

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Appendixes

APPENDIX: A Riyadh wards name

No.	Ward names	Code	Ward names	No.	Ward names
1	Umm Sulaim	50	Nammar	99	Ghournada
2	Wesham	51	Hazim	100	Hamra
3	Namodhajiyah	52	Dahrat Nammar	101	Ashbayliyah
4	Murabba	53	Dirab	102	Khaleej
5	Wazarat	54	Mu'tamarat	103	King Faisal
6	Foutah	55	Ulayah	104	Quds
7	Deerah	56	Sulaimaniyah	105	Prince Abdullah
8	Jabbrah	57	King Abdu Alziz	106	Roudah
9	Maikal	58	Al Wahah	107	Andalus
10	Shimaisi	59	Salah Al Din	108	Nahdah
11	Jarradiyah	60	Worood	109	Maizilah
12	Seyah	61	Rahmaniyah	110	Jinadriyah Old
13	Sultanah	62	Northern Al Ma'ther	111	Nadheem
14	Badia'h	63	Ma'ther	112	Remayah
15	Ulayshah	64	Sharafiyah	113	Eastern Al Naseem
16	Rafiah	65	Hadda	114	Western Al Naseem
17	Fakhriyah	66	Um Al Hammam East	115	A'sa'adah
18	Nasiriyah	67	Um Al Hammam West	116	Faiha'a
19	Salehiyah	68	A'ra'aeed	117	A'salam
20	Onouz	69	King Saud University	118	Manar
21	Oud	70	Nakhil	119	Rayan
22	Margab	71	Mohammadiyah	120	Rawabi
23	Thela'im	72	King Fahad	121	Jazirah
24	A'amal	73	Mursalat	122	Khalidiah
25	Sinaieyah	74	Nuzha	123	Ghubairah
26	Farook	75	Mugharazat	124	Mansorah
27	Faisaliyah	76	Izdihar	125	Aziziyah
28	Manfuha Al Jadeeda	77	Ta'awon	126	Aldar Albaidah
29	Manfuha	78	Maseef	128	Uraija
30	Yamamah	79	Marooj	129	Dharat Al Badia'h
31	Masanay	80	Ghadeer	130	Western Al Swaidi
32	Shafa	81	Nafal	131	Tuwaiq
33	Marwah	82	Wadi	132	Western Uraija
34	Okadh	83	Falah	133	Mid Uraija
35	Ohod	84	Imam Mohamad Ibin Saud University	135	Hijrat Wadi Laban
36	Badr	85	Nad'a	136	Dhrat Laban
37	Assafarat	86	Rabee	137	Dariyah
38	Jareer	87	Ageeg	138	Silay
39	Rabwa	88	Hiteen	139	Noor
40	Safaa	89	Malga	140	Manakh
41	Malaz	90	Yasmeen	141	Defaa
42	Dhobbat	91	Narjis	142	Al Iskan
43	Zahra'a	92	Al Girawan	143	SinaieyahAl Jadeedah
44	Zahrah	93	Qortobah	144	Mishael
45	Swaidi	94	Mouanisiayah	145	Khozama
47	Itaiygah	95	Remaal	146	Irgah
48	Derihmiyah	97	Qadisiyah		
49	Shobra	98	Yarmouk		

APPENDIX: B English version of the secondary school spatial distribution survey

This questionnaire is to obtain information about spatial distributions of secondary schools in Riyadh in order to evaluate the present location of schools. I would be most grateful if you complete this questionnaire with appropriate and candid responses, which will play an effective role in the evaluation.

Respected people, I should draw to your attention that the information you supply will be treated confidentially and will be used only for the aim of the study. Therefore, it is absolutely not necessary to write your name.

Therefore, would you please try to answer all the questions with accuracy and care, in order to further the aims of the research, to produce better solutions and decisions with school location in Riyadh City, to provide better services for the city's pupils as a result of the rapid growth of the city in terms both of population and area in recent years. If you have any questions you can ask the manager of the school.

I must add that I do respect and appreciate your participation in this research which has the potential of contributing to the betterment of our dear country.

May Allah be with you.

Researcher: Nasser Marshad Alzeer

The Secondary school spatial distribution survey [translation]

The name of your current school: ……….

Section A: Demographics Factors

Please provide me with the following personal information about yourself by ticking the correct answer.

1. Your current academic year:

1-1. First year [ ] 2-2. Second year [ ] 2-3.Third year [ ]

2. Your age [ ] years

3. Nationality:

3-1. Saudi [ ] 3-2. Non-Saudi [ ]

4. How many persons (including yourself) live with you in your current house? Please tick one answer.

< 3	
3 – 5	
6 – 8	
+ 9	

5. Your father's highest educational qualification:

5-1 None ☐ 5-2. Primary Education ☐ 5-3. Intermediate Education ☐

5.4 Secondary Education ☐ 5-4. University degree. ☐ 5-5. Postgraduate degree (Master's / PhD) ☐

6. Your father's highest educational qualification:

6-1 None ☐ 6-2. Primary Education. ☐ 5-3. Intermediate Education ☐

6.4 Secondary Education ☐ 6-4. University degree ☐ 6-5. Postgraduate degree (Master's / PhD) ☐

7. How many persons living with you in your current house can drive cars, including private driver, if any?

None	☐
One	☐
Two	☐
Three	☐
More than three	☐

8. How many cars does your family have (please tick the right answer)?

None	☐
One	☐
Two	☐
Three	☐
More than three	☐

9. **Please indicate, by ticking the right answer, the total monthly income of your family, (Including your father's income as well as your mother's) per month:**

< 1999 R	
2000 - 3999 R	
4000 - 5999 R	
6000 - 7999 R	
8000 - 9999 R	
10000 + R	

<u>Section B: The address</u>

Please answer each of the following questions:

1.Please write down the name of the neighbourhood in which your house is located:

....

2. Please write down the name of the street on which your house is located:.

....

3. Please write down your house number:...

<u>Section C: Transportation of means</u>

1. Which of the following means of transportation do you use most often to get to your current school?

Walking (foot)	
Private transportation	
Rent car (taxi car)	
Public transportation	

12- Extra- curriculum activities	☐	☐	☐	☐	☐
13- Good examination result	☐	☐	☐	☐	☐
14- Happy environment	☐	☐	☐	☐	☐
15- Enthusiastic teachers	☐	☐	☐	☐	☐
16- Good quality teaching	☐	☐	☐	☐	☐
17- School surrounded environment	☐	☐	☐	☐	☐

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE

APPENDIX: C English Version of the Secondary School Spatial Distribution Interview

1. What is the average capacity for girls and boys' schools in Riyadh?
2. What is the ideal distance for girls and boys to walk or travel to their secondary schools?
3. How much percentage of pupils can a school accept from other wards?
4. Which are the factors that are taken into account when determining the site of a secondary school?

APPENDIX: D Arabic version of the questionnaire

الخصائص المكانية لمواقع المدارس الثانوية في مدينة الرياض

صمم هذا الاستبيان للحصول على بيانات عن الخصائص المكانية لمواقع المدارس الثانوية في مدينة الرياض
بهدف التعرف على الواقع الحالي وتقويمهً. أرجوك شاكراً مساعدتي على تعبئة هذا الاستبيان بالإجابة المناسبة والصريحة. حيث سيكون لهل دور فعال في العرف على الوضع الحالي للمدارس الثانويةً.

أود أن ألفت انتباهك عزيزي الطالب أن المعلومات التي تدلي بها ستكون سرية وسوف تستخدم لأغراض البحث فقط. لهذا ليس من الضروري إطلاقاً أن تكتب اسمك ولا أي شيء يدل على شخصيتك نهائياً.

لذلك أرجو الإجابة على جميع الأسئلة بدقة وعناية لأنها تحقق هدف البحث في تقويم الوضع الحالي للتوزيع وكفاءته لإيجاد أفضل الحلول والقرارات التي تخدم الطالب وفي حالة أي استفسار يمكن الاستفسار من إدارة المدرسة او عن طريق الاتصال بي مباشرةً.

أقدم شكري واحترامي وتقديري لكم جميعاً لحسن تعاونكم لخدمة هذا الوطن العزيز علينا جميعاً والله ولي التوفيق.

الباحث: ناصر مرشد الزير

٩ ـ أختي الطالبة . فضلا أجيبي على السؤل التالي بوضع إشارة [√] تحت الإجابة المناسبة:

الدخل الشهر: للأسرة	اقل من١٩٩٩	٢٠٠٠ ـ ٣٩٩٩	٤٠٠٠ ـ ٥٩٩٩	٦٠٠٠ـ ٧٩٩٩	٨٠٠٠ـ ٩٩٩٩	١٠٠٠٠ ريال فأكثر

ثانيا : العنوان

أختي الطالبة فضلا أجيبي غلى كل مما يلي :

١-	اسم الحي التي تسكنين فيه حاليا	
٢-	رقم المنزل	
٣-	اسم الشارع الذي يقع عليه منزلك	

ثالثا : وسائل النقل

أختي الطالبة أجيبي على التالي بوضع إشارة [√] تحت الإجابة المناسبة مع وسيلة الذهاب إلى المدرسة.

١-	وسيلة النقل التي تستخدميها في الغالب للوصول الى المدرسة هي	(١) مشيا على الأقدام	(٢) وسيلة خاصة	(٣) وسيلة مستأجرة	(٤) نقل حكومي

٢- كم تستغرقي من الوقت منذ خروجك من المنزل وحتى وصولك إلى المدرسة تقريبا ؟

اقل من ٥ دقائق	
من ٥ - ٩ دقائق	
من ١٠ - ١٤ دقيقة	
من ١٥ ـ ١٩ دقيقة	
من ٢٠ - ٢٩ دقيقة	
٣٠ دقيقة فأكثر	

أختي الطالبة. أجيبي على التالي بوضع إشارة [√] تحت الإجابة المناسبة مع وسيلة الذهاب الى المدرسة .

٣-	وسيلة النقل التي تستخدميها في الغالب للعودة من المدرسة هي	(١) مشيا على الأقدام	(٢) وسيلة خاصة	(٣) وسيلة مستأجرة	(٤) نقل حكومي

٤ - كم تستغرقي من الوقت منذ خروجك من المدرسة وحتى عودتك الى المنزل تقريبا ؟

اقل من ٥ دقائق	
من ٥ - ٩ دقائق	
من ١٠ - ١٤ دقيقة	
من ١٥ – ١٩ دقيقة	
من ٢٠ - ٢٩ دقيقة	
٣٠ دقيقة فأكثر	

٥- اذا كنت ممن يستخدمون وسيلة النقل الحكومي . الرجاء الأجابة على جميع الأسئلة التالية وذلك بوضع ✓ تحت الإجابة المناسبة.

		(١)	(٢)	(٣)	(٤)	(٥)
١	درجة الازدحام	مزدحم جدا جدا	مزدحم جدا	مزدحم	مزدحم الى درجة ما	غير مزدحم
٢	درجة الراحة	غير مريح	مريح الى درجة ما	مريح	مريح جداً	مريح جدا جدا
٣	مستوى التكييف	غير مناسب	مناسب الى درجة ما	مناسب	مناسب جدا	مناسب جدا جدا
٤	مستوى القيادة	غير مناسبة	مناسبة الى درجة ما	مناسبة	مناسبة جداً	مناسبة جدا جدا
٥	مستوى الانضباط	غير منضبط	منضبط الى درجة	منضبط	منضبط جدا	منضبط جدا جدا

٦- اذا كنت ممن لا يستخدمون وسيلة مستاجرة . كم يدفع شهريا لذلك الرجاء الأجابة على جميع الأسئلة التالية وذلك بوضع ✓ تحت الإجابة المناسبة.

اقل من ٢٥٠ ريال	
٢٥٠ - ٤٩٩ ريال	
٥٠٠ ريال فأكثر	

رابعا : قرار اختيار المدرسة

أختي الطالبة فضلا حددي من كان له الدور الأساسي في اختيار مدرستك الحالية؟ فضلا ضعي إشارة √ تحت الإجابة المناسبة.

انت	
الأب	
الأم	
العائلة	

أختي الطالبة فضلا ضعي إشارة √ تحت الإجابة التي تتلاءم ودرجة الأهمية والتي قررت على أساسها اختيار مدرستك الحالية

		مستوى الأهمية				
		٥ مهم جدا جدا	٤ مهم جدا	٣ مهم	٢ غير مهم	١ غير مهم على الإطلاق
١	بيئة المدرسة التعليمية					
٢	توفر الرعاية داخل المدرسة					
٣	قربها من المنزل					
٤	وجود صديقات في نفس المدرسة					
٥	وجود أحد الأقرباء (أخت)					
٦	توفر وسائل الأمان					
٧	إدارة المدرسة					
٨	سهولة الوصول إلى المدرسة					
٩	توفر الوسائل التعليمية المناسبة					
١٠	السمعة الحسنة للمدرسة					
١١	درجة الانضباط عالية					
١٢	تعطي دروس إضافية (التقوية)					
١٣	نتائج المتخرجات منها مرتفعة					
١٤	البيئة المدرسية مرحة					
١٥	حماس أعضاء الهيئة التعليمية					
١٦	المعلمات ذو كفاءة عالية					
١٧	البيئة المحيطة بالمدرسة					

خامسا : المستوى الدراسي

فضلا حددي المستوى الدراسي الذي حصلت عليه في الفصل الدراسي الأول لكل من المراحل التالية وحتى هذا العام (١٤٢٣/ ١٤٢٤ وذلك بوضع ✓ تحت الإجابة المناسبة إذا كنت في نفس المدرسة.

أولى ثانوي

ممتازة	
جيد جدا	
جيد	
مقبول	
راسب	

ثاني ثانوي

ممتازة	
جيد جدا	
جيد	
مقبول	
راسب	

ثالث ثانوي

ممتازة	
جيد جدا	
جيد	
مقبول	
راسب	

مع تمنياتي بالتوفيق

APPENDIX: E The first research permission

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك سعود
كلية الآداب

الرقم
التاريخ: / / ١٤هـ
المرفقات:
الموضوع:

سعادة مدير تعليم البنين بمنطقة الرياض المحترم

السلام عليكم ورحمة الله وبركاته وبعد

نرفق لسعادتكم خطاب مبتعث القسم طالب الدكتوراه بجامعة لستر بالمملكة المتحدة البريطانية / ناصر بن مرشد الزير وموضوع رسالته " الخصائص المكانية للمدارس الثانوية في مدينة الرياض " وحيث أن من متطلبات الدراسة القيام بتوزيع اسبانات على الطلاب وكذلك الحصول على بعض المعلومات ذات الصلة بموضوع دراسته والمتوفرة لديكم

نأمل من سعادتكم تزويده بالمعلومات حول موضوع دراسته وتسهيل مهمته بتوزيع الاستبيانات.

ولكم خالص تحياتي وتقديري ،،،

رئيس قسم الجغرافيا

أ.د. عبد العزيز بن عبد اللطيف الشيخ
٢٦/١/١٤٢٤هـ

APPENDIX: F The second research permission for boys schools

المملكة العربية السعودية
وزارة المعـــــارف
الإدارة العامة للتعليم بمنطقة الرياض
إدارة التطوير التربوي
قسـم البحوث التربوية

بسم الله الرحمن الرحيم

وزارة المعارف
MINISTRY OF EDUCATION

الرقم : ٤/٢/٤ ١٠٢٤٢٤
التاريخ : ٢٠/٩/١٤١٦هـ
المرفقات : ....

إلـى : مدير ثانوية يحفظه الله
مـن : المدير العام للتعليم بمنطقة الرياض
بشـأن : تسـهيل مهمـة باحث

السـلام عليكم ورحمـة الله وبـركاتـه وبعـد :

تقدم إلينا الباحث الأستاذ / ناصر بن مرشد الزير – المبتعث لدراسة الدكتوراه بجامعة لستر بالمملكة المتحدة ـ بطلب إجراء دراسة بعنوان ((الخصائص المكانية للمدارس الثانوية في مدينة الرياض)) و تتطلب الدراسة تطبيق أداة الدراسة على عينة من الطلاب.

وبنـاء على تعميم معالي الوزير رقم ٥٥/٦١٠ وتاريخ ١٤١٦/٩/١٧هـ القاضي بتفويض الإدارات العامة للتعليم بإصدار خطابات السماح للباحثين بإجراء البحوث والدراسات ، ونظراً لاكتمال الأوراق المطلوبة ، نأمل تسهيل مهمة الباحث بتطبيق تلك الدراسة لديكم مع ملاحظة أن الباحث يتحمل كامل المسؤولية المتعلقة بمختلف جوانب البحث ، ولا يعني سماح الإدارة العامة للتعليم موافقتها بالضرورة على مشكلة البحث أو على الطرق والأساليب المستخدمة في دراستها ومعالجتها .

والله يحفظكم ويرعاكم ،،،،

د . عبدالله بن عبدالعزيز المعيلي

تعاد مع لجنة العشم
الإدارة المدرسية بالمركز

ص. لقسم البحوث التربوية
ص. للصادر العام

APPENDIX: G The third research permission for girls schools

المملكة العربية السعودية
وزارة المعارف / شئون تعليم البنات
إدارة تعليم البنات بمنطقة الرياض
إدارة الإشراف التربوي بمنطقة الرياض

الرقم: ٣٠٩.../٢٠/ع
التاريخ: ٢٧/١/١٤٢٤هـ
المرفقات: طي جم.

الموضوع : بشأن تسهيل مهمة الباحث / ناصر الزير

المكرمة مديرة الثانوية ....١٠٨.........

السلام عليكم ورحمة الله وبركاته وبعد ،،،

بناء على خطاب سعادة مدير عام تعليم البنات رقم (٥/٢٣) وتاريخ ١٤٢١/١/٧هـ على خطاب رئيس قسم الجغرافيا بكلية الآداب بجامعة الملك سعود رقم (١٥/٥/١٠) وتاريخ ١٤٢٢/١/٦هـ والمتضمن طلب تسهيل مهمة الباحث (ناصر مرشد الزير) لتطبيق استبانته والتي بعنوان " الخصائص المكانية لمدارس البنات الثانوية في مدينة الرياض ".

عليه نأمل تسهيل مهمة الباحث وتعبئة الاستبانات المرفقة من قبل جميع طالبات المرحلة الثانوية وبالأخص الصف الثالث ثانوي بقسميه العلمي والأدبي ومن ثم إعادتها إلى إدارة الإشراف التربوي بمنطقة الرياض في موعد أقصاه ١٤٢٤/٢/١٧هـ بكتابة إسم الباحث وعنوان البحث على الظروف الخارجية. وفي حال مراجعة الباحث لكم نرجو منكم تسليمها له.

ولكم جزيل الشكر ،،،،،،،،

مديرة إدارة الإشراف التربوي بمنطقة الرياض
[illegible]
موضي بنت محمد العذل

APPENDIX: H Photos for development of Riyadh

Riyadh in 1960s

Riyadh in 1970s

Riyadh in 1980s

Riyadh 1990s

Riyadh 2002

(Source: HCRD, 1999:12-13)

APPENDIX: I Secondary girls' schools according to the total of schools, pupils, classes and teachers during the period 1975-2002

N	Municipality	Na.school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
1	MANFUHA	6	0	0	0	0	1	546	15	35	1	433	17	33	1	395	14	24	1	323	12	23	1	702	17	51
2		19	0	0	0	0	0	0	0	0	1	740	18	22	1	670	21	40	1	483	16	38	1	500	16	47
3		37	0	0	0	0	0	0	0	0	0	0	0	0	1	226	8	16	1	269	11	20	1	531	13	43
4		39	0	0	0	0	0	0	0	0	0	0	0	0	1	423	13	29	1	337	12	26	1	622	13	35
5		49	0	0	0	0	0	0	0	0	0	0	0	0	1	404	12	24	1	365	14	38	1	565	17	34
6		51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	281	10	25	1	417	12	33
7		66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	218	8	19	1	277	9	34
8		89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	348	11	18
9		8	0	0	0	0	1	690	21	48	1	716	24	45	1	281	7	27	1	232	7	25	1	348	9	41
10		29	0	0	0	0	0	0	0	0	1	388	13	24	1	416	13	20	1	456	13	31	1	471	14	40
11		94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	342	10	24
12	ANNASEEM	17	0	0	0	0	1	48	1	4	1	353	13	26	1	531	14	31	1	521	17	42	1	1165	25	64
13		27	0	0	0	0	0	0	0	0	1	234	11	22	1	707	23	44	1	774	21	51	1	1047	27	65
14		44	0	0	0	0	0	0	0	0	0	0	0	0	1	498	15	28	1	376	13	35	1	525	14	40
15		46	0	0	0	0	0	0	0	0	0	0	0	0	1	243	8	17	1	621	18	55	1	1280	28	78
16		54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	411	13	34	1	617	20	55
17		56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	208	11	22	1	572	15	42
18		60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	366	12	30	1	748	20	50
19		62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	157	8	19	1	402	12	39
20		71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	58	3	11	1	456	12	34
21		77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	374	12	38
22		79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	369	11	28
23		86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	801	20	52
24		90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	367	11	21
25	ERGAH	542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	132	5	9	1	157	6	22
26	MATHER	14	0	0	0	0	1	54	3	3	1	250	10	22	1	478	14	34	1	526	15	34	1	956	24	63
27		88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	310	9	36

APPENDIX: I Continued.

N	Municipality	Na.school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
28	OTAYGAH	18	0	0	0	0	1	111	4	10	1	424	12	25	1	564	15	29	1	635	19	37	1	630	18	53
29		24	0	0	0	0	0	0	0	0	1	374	14	28	1	552	15	32	1	751	18	40	1	715	19	52
14		28	0	0	0	0	0	0	0	0	1	465	14	28	1	978	25	49	1	788	24	46	1	841	26	59
15		41	0	0	0	0	0	0	0	0	0	0	0	0	1	138	6	13	1	286	11	27	1	688	14	26
16		52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	444	16	27	1	586	18	42
17		82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	548	16	42
31	MALAZ	1	1	1114	27	47	1	644	19	39	1	418	14	31	1	288	10	26	1	297	11	23	1	371	12	33
32		4	0	0	0	0	1	433	15	25	1	256	10	26	1	259	10	33	1	262	10	27	1	489	14	35
33		10	0	0	0	0	1	721	21	40	1	797	22	44	1	701	24	48	1	672	20	43	1	703	20	51
34		22	0	0	0	0	0	0	0	0	1	374	11	24	1	315	12	25	1	255	8	26	1	363	10	35
35		32	0	0	0	0	0	0	0	0	1	177	6	20	1	345	13	32	1	425	15	35	1	797	19	67
39	ULAYAH	12	0	0	0	0	1	441	11	25	1	334	11	22	1	331	12	27	1	326	12	28	1	340	11	42
40		20	0	0	0	0	0	0	0	0	1	508	14	33	1	323	9	25	1	327	10	29	1	248	9	34
41		25	0	0	0	0	0	0	0	0	1	610	16	33	1	613	15	39	1	504	14	33	1	486	12	52
42		34	0	0	0	0	0	0	0	0	1	175	9	11	1	310	10	29	1	351	11	33	1	345	11	37
43		36	0	0	0	0	0	0	0	0	0	0	0	0	1	226	8	23	1	240	9	24	1	240	9	35
44		57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	89	6	17	1	147	6	24
57	SHIMAL	35	0	0	0	0	0	0	0	0	0	0	0	0	1	584	14	31	1	551	18	38	1	472	16	59
58		45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	549	18	32	1	510	14	38
59		48	0	0	0	0	0	0	0	0	0	0	0	0	1	88	4	13	1	153	7	17	1	330	9	35
60		65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	9	1	486	12	56
61		68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	2	6	1	625	14	48
62		81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	373	12	32
63		83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	385	11	30
56	SILAY	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	1	619	14	37

APPENDIX: I Continued.

N	Municipality	Na.school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
45	ORAIJA	31	0	0	0	0	0	0	0	0	1	140	5	13	1	664	17	35	1	399	16	36	1	393	16	43
46		38	0	0	0	0	0	0	0	0	0	0	0	0	1	469	17	38	1	619	20	38	1	701	20	41
47		40	0	0	0	0	0	0	0	0	0	0	0	0	1	509	13	29	1	675	23	41	1	1130	25	65
48		47	0	0	0	0	0	0	0	0	0	0	0	0	1	403	13	21	1	776	24	40	1	1243	25	55
49		50	0	0	0	0	0	0	0	0	0	0	0	0	1	266	8	21	1	457	12	30	1	680	16	50
50		53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	225	9	19	1	1121	26	62
51		61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	230	9	20	1	746	19	47
52		69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	253	9	32	1	413	11	31
53		73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	627	13	32
54		78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	671	18	41
55		85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	562	16	33
64	ARROWDAH	21	0	0	0	0	0	0	0	0	1	498	15	33	1	781	22	46	1	795	22	43	1	773	25	58
65		33	0	0	0	0	0	0	0	0	1	351	10	25	1	97	4	12	1	416	10	29	1	857	23	67
66		42	0	0	0	0	0	0	0	0	0	0	0	0	1	441	13	30	1	549	16	37	1	815	18	45
67		55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	397	12	27	1	790	16	46
68		59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	533	15	27	1	1058	20	61
69		63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	170	6	16	1	537	16	58
70		75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	856	20	55
71		76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	989	18	55
72		84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	810	17	40
73		87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	897	20	56
83	BATHA	9	0	0	0	0	1	506	17	33	1	703	21	43	1	618	19	42	1	707	18	43	1	837	20	57
84	ASSAFARAT	559	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100	4	13
85	ADDERIYAIH	505	0	0	0	0	0	0	0	0	1	192	6	24	1	489	12	31	1	508	15	41	1	581	15	44

APPENDIX: I Continued.

N	Municipality	Na.school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
86	JANOOB	16	0	0	0	0	1	317	10	23	1	419	13	31	1	508	13	28	1	330	13	37	1	518	13	36
87		23	0	0	0	0	0	0	0	0	1	271	9	22	1	498	14	25	1	755	16	36	1	802	20	63
88		43	0	0	0	0	0	0	0	0	0	0	0	0	1	136	6	13	1	235	9	34	1	679	17	55
89		58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	267	10	19	1	445	13	41
90		70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	311	8	27	1	622	17	48
91		74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	461	15	40
92		7	0	0	0	0	1	193	8	12	1	467	14	25	1	710	20	42	1	728	21	48	1	772	20	54
74	DEERAH	546	1	457	13	25	1	317	10	25	1	351	10	25	1	405	8	24	1	362	13	27	1	445	13	42
75		2	1	514	18	32	1	588	21	38	1	654	22	43	1	344	10	38	1	475	15	29	1	766	19	54
76		3	1	434	11	19	1	449	17	23	1	386	12	26	1	422	13	38	1	395	12	34	1	622	13	41
77		5	0	0	0	0	1	564	23	40	1	680	23	49	1	387	14	30	1	334	12	30	1	501	13	36
78		11	0	0	0	0	1	382	14	27	1	358	14	25	1	307	8	21	1	274	11	19	1	408	13	38
79		13	0	0	0	0	1	430	16	24	1	459	16	33	1	294	10	23	1	321	11	26	1	292	11	38
80		15	0	0	0	0	1	219	8	20	1	348	12	26	1	285	9	16	1	257	10	23	1	337	12	41
81		26	0	0	0	0	0	0	0	0	1	325	10	21	1	329	12	40	1	311	11	28	1	361	10	32
82		30	0	0	0	0	0	0	0	0	1	343	10	18	1	452	15	29	1	394	14	31	1	722	24	57
TOTAL			4	2519	69	123	19	7653	254	494	36	14971	481	1001	51	21701	654	1480	73	28237	1164	2156	92	54546	1433	4052

Sources: Calculated by author based on statistics published by General Presidency for Female Education for years 1975; 1980; 1985; 1990 and 1995. According to the year 2002 from AEGRD.

APPENDIX : J Secondary boys' schools according to the total of schools, pupils, classes and teachers during the period 1975-2002

N	Municipality	No.school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
1	JANOOB	ABN ABI HATIM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	305	9	22
2		AL EMAM AL LOSI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	888	24	47
3		AL GADISIAH	0	0	0	0	1	344	11	20	1	467	14	25	1	338	9	33	1	607	18	32	1	763	18	37
4		ALEIZ BIN ABD AL	0	0	0	0	0	0	0	0	1	253	10	16	1	607	18	29	1	665	18	34	1	795	20	38
5		KING ABD AL AZIZ	1	632	23	47	1	627	24	45	1	678	23	41	1	238	8	16	1	756	24	45	1	902	26	49
6		YARMOUK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	506	19	37
7	ANNASSEM	ABD ALRIHMAM BIN M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	636	19	40
8		AL RIYADH	1	787	24	43	1	576	20	36	1	503	18	31	1	247	9	19	1	628	19	34	1	717	18	34
9		AL RUODWAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	537	17	30	1	969	29	55
10		AL SIDIQ	0	0	0	0	1	261	10	17	1	405	14	26	1	233	8	16	1	301	14	28	1	677	19	41
11		ALBIRUNI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	186	8	16	1	990	29	53
12		GORTUBAH	0	0	0	0	1	47	2	9	1	389	14	26	1	703	18	44	1	604	18	33	1	905	20	40
13		MOHAMMED BIN SAU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	631	16	35
14		ABN AKEAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	530	17	37
15		MUJAMAA AL ULIAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1157	30	60
16	BATHA	HAFID HAKAMI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	57	2	0

APPENDIX J: Continued.

N	Municipality	Name of school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
17	ORAIJA	ABD ALAH BIN SAU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	350	15	33
18		AL JAWHARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	647	19	39	1	724	19	41
19		AL JOWINI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	105	4	12	1	971	25	46
20		AL SHAWKANI	0	0	0	0	0	0	0	0	0	0	0	0	1	553	18	38	1	658	17	33	1	1027	28	51
21		BALAT ALSHUHADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	528	16	28	1	1013	25	51
22		GASIM BIN SALAM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	164	8	19
23		NAJED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1079	27	51
24		AL MADAIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	324	12	27	1	680	21	40
25	ASSAFARAT	SAFRAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	203	8	19	1	481	12	30
26	MATHER	ABD ALRUOHMAM AL	0	0	0	0	0	0	0	0	1	366	12	31	1	308	11	18	1	550	18	36	1	726	20	40
27	DEERAH	AL ARID	0	0	0	0	1	691	22	38	1	560	18	35	1	54	2	6	1	673	21	102	1	714	20	40
28		AL JAZEERA	1	932	24	42	1	466	20	33	1	573	17	28	1	576	36	43	1	660	21	37	1	776	23	45
29		BADAR	1	350	13	25	1	626	20	35	1	656	19	33	1	773	19	30	1	179	6	17	1	1101	26	50
30		MAHAD AL ASEMAH	1	385	16	26	1	476	21	33	1	566	24	41	1	632	20	32	1	608	26	36	1	493	19	45
31		YAMAMAH	1	1201	37	68	1	894	30	55	1	671	21	37	1	509	21	32	1	666	22	38	1	928	28	57
32	SILAY	UTHMAN BIN ASS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	524	15	31
33	IRGAH	IRGAH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	48	2	5	1	157	6	13
34	DARIYAH	ABDALZEIZ BIN MO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	396	12	26

APPENDIX J: Continued.

N	Municipality	Name of school	1975 No. schools	1975 No. pupils	1975 No. classes	1975 No.teachers	1980 No. schools	1980 No. pupils	1980 No. classes	1980 No.teachers	1985 No. schools	1985 No. pupils	1985 No. classes	1985 No.teachers	1990 No. schools	1990 No. pupils	1990 No. classes	1990 No.teachers	1995 No. schools	1995 No. pupils	1995 No. classes	1995 No.teachers	2002 No. schools	2002 No. pupils	2002 No. classes	2002 No.teachers
35	MANFUHA	ABI BAKAR AL AR	0	0	0	0	0	0	0	0	0	0	0	0	1	114	5	12	1	424	18	32	1	735	20	41
36		ABI TAMAM	1	336	13	23	1	600	20	35	1	434	14	28	1	470	26	37	1	653	19	35	1	818	22	46
37		AL ALBANI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	715	13	34
38		PRINCE SALMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	150	5	11	1	723	21	39
39		SHAFA	0	0	0	0	1	376	12	21	1	477	14	29	1	335	11	28	1	535	21	38	1	1045	28	54
40		TUOLITELAH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	292	8	22
41	OTAYGAH	MUSA BIN NUSAIR	0	0	0	0	1	605	18	34	1	597	18	34	1	408	13	23	1	632	19	34	1	622	18	41
42		NAHAWEND	0	0	0	0	0	0	0	0	0	0	0	0	1	702	33	51	1	796	24	45	1	726	20	44
43		SHATIBI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	667	20	15	1	750	24	47
44	SHIMAL	AL MUOTAMAD BIN	0	0	0	0	0	0	0	0	0	0	0	0	1	276	14	32	1	477	15	31	1	552	20	40
45		AL NAJASHI	0	0	0	0	0	0	0	0	1	309	10	20	1	378	12	29	1	602	18	34	1	240	10	20
46		MUJAMAA KING SAU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	856	26	52
47		YAGUT HAMAWI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	72	3	2	1	136	5	2
48		FISAL BIN FAHAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	398	12	27
49	ULAYAH	ABD AL AZIZ BIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	858	25	50
50		MUJAMAA PRINCE S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	829	23	46
51		SULAIMANIYAH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	404	12	32
52		ULAYAH	0	0	0	0	1	477	15	38	1	337	13	26	1	131	6	10	1	172	6	35	1	500	15	31

APPENDIX J: Continued

N	Municipality	Name of school	1975				1980				1985				1990				1995				2002			
			No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers	No. schools	No. pupils	No. classes	No.teachers
53	ARROWDAH	ABI BAKAR AL MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	415	13	30
54		ABN ALMUNTHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	373	12	33
55		AL ADRECE	0	0	0	0	0	0	0	0	1	252	12	22	1	419	18	30	1	467	16	31	1	507	18	35
56		AL HARAWI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	319	15	34
57		AL MAWRDI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	602	17	30	1	782	23	48
58		AL SHUORA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1096	30	61
59		ALHASAN BIN ALI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	369	16	35
60		JABAL TARIQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	471	15	31
61		KING FAHAD	0	0	0	0	0	0	0	0	1	319	13	22	1	172	5	10	1	699	20	32	1	603	18	39
62		MOHAMMED ALFATEH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	315	10	30
63		MUJAMA PRINCE SALMAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	846	24	51
64		NADHEEM	0	0	0	0	0	0	0	0	0	0	0	0	1	114	5	12	1	453	16	31	1	668	16	33
65		QUDS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	217	9	19	1	639	22	48
66	MALAZ	FAISAL	1	629	20	37	1	588	19	32	1	481	17	30	1	267	9	19	1	428	15	29	1	569	15	29
67		FARUQ	0	0	0	0	1	470	15	24	1	618	18	30	1	155	5	10	1	479	18	37	1	763	18	40
68		MAHMUOD ALGHAZNA	0	0	0	0	0	0	0	0	1	173	5	12	1	258	9	20	1	557	16	30	1	758	21	45
69		SEQLEAH	0	0	0	0	0	0	0	0	1	137	16	15	1	1166	38	65	1	729	21	40	1	966	28	57
Total			8	5252	170	311	16	8124	279	505	23	10221	354	638	28	11136	406	744	41	19944	644	1272	69	45390	1300	2681

Sources: calculated by author based on statistics published by Ministry of Education for year Education for years 1975; 1980; 1985; 1990 and 1995. According to the year 2002 from AEBRD.

APPENDIX: K The code steps for measurement the distances between homes' pupils and their schools

```
Sub sort()
Dim temp As Double
Dim I As Integer
 '
Dim dat(12) As Double, NB(369), XBOY(369), YBOY(369), ns(13), XSCH(13),
YSCH(13), D(369, 13(
Dim done As Boolean
Dim gap As Integer, max As Integer, nst As Integer
'
 'THIS CODE IS TO OPTIMIZE THE DISTANCE BETWEEN BOY'S HOUSE AND
SCHOOLS
'
Open "C:\Hind\ARROWDAH\Boys\SL.CSV" For Input As #1
Open "C:\Hind\ARROWDAH\Boys\BHL.CSV" For Input As #4
Open "C:\Hind\ARROWDAH\Boys\MATRIX-RE-ALLOCATE.CSV" For Output As
#7
Open "C:\Hind\ARROWDAH\Boys\MARTIX-CURRENT.CSV" For Output As #5
 '
max = 13  ' number of schools
'
nst = 369 ' number of students
'
  'Reading the schools coordinates

For I = 1 To max
Input #1, ns(I), XSCH(I), YSCH(I(
Next
'
Rem
'
For I = 1 To nst
Appendix     continue
Input #4, NB(I), XBOY(I), YBOY(I(
Next
'
Rem
  'Calculate the distances between schools and boy's houses
 '
For I = 1 To nst
For J = 1 To max
D(I, J) = ((XBOY(I) - XSCH(J)) ^ 2 + (YBOY(I) - YSCH(J)) ^ 2) ^ 0.5
Next
Next
'
```

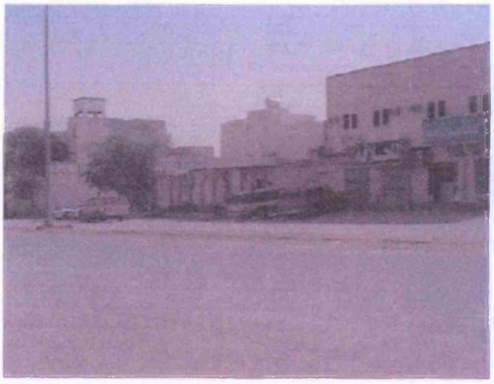
APPENDIX K: continued

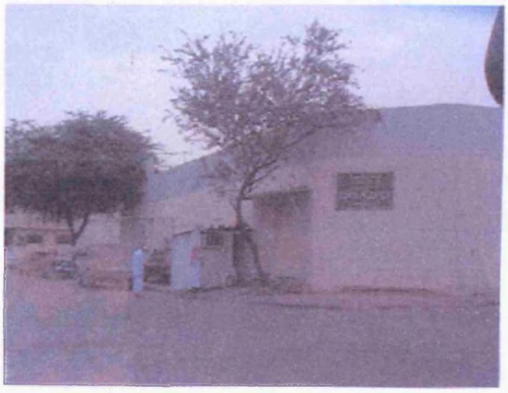
```
Rem
Rem
'
'max = 10
For I = 1 To nst
For J = 1 To max
Print #5, D(I, J;(
Next
Print #5,
Next
Close #5
N = 0
:999
N = 1 + N
If N > nst Then Close #7: Stop
For J = 1 To max
dat(J - 1) = D(N, J(
Next
GoTo 777:
Stop
Close #7
Appendix     continue
Stop
Rem
:777
gap = max / 2
Do While (gap >= 1(
Do
   done = True
   For K = 0 To max - gap - 1
        If (dat(K) > dat(K + gap)) Then
        temp = dat(K(
        dat(K) = dat(K + gap(
        dat(K + gap) = temp
        done = False
        End If
   Next K
Loop While (Not done(
gap = Int(gap / 2(
Loop
For K = 0 To max - 1
Print #7, dat(K;(
Next K
Print #7,
GoTo 999
End Sub
```

APPENDIX: L Size of current catchment areas for girls and boys secondary schools

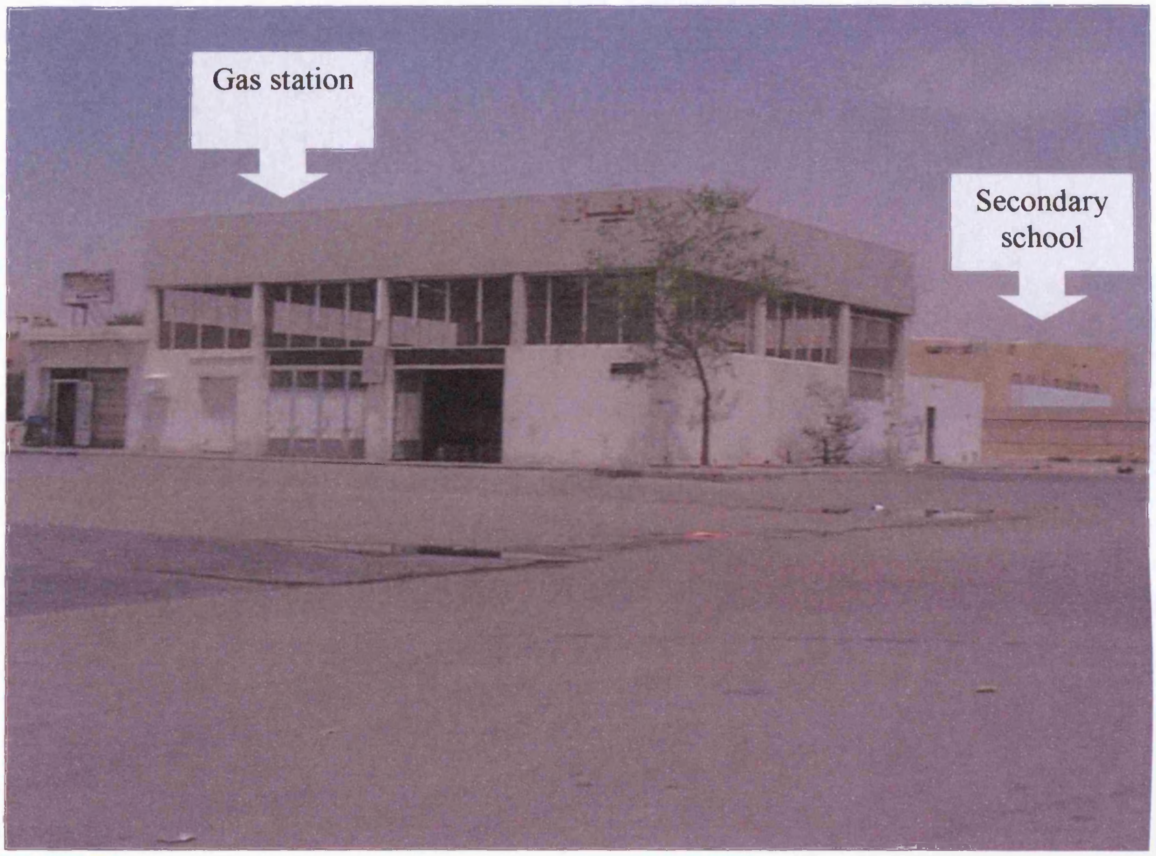
Girls				Boys			
School	Area km^2	School	Area km^2	School	Area km^2	School	Area km^2
88	0.01	82	4.50	541	0.63	511	8.39
41	0.88	17	4.71	509	0.94	528	8.61
15	0.88	83	4.97	516	1.61	520	8.89
69	0.92	53	5.26	533	1.81	515	9.22
63	1.09	84	5.77	505	1.89	513	10.39
43	1.37	118	5.94	517	2.19	555	11.55
11	1.38	49	5.94	554	2.38	540	11.80
7	1.46	70	5.95	508	2.86	503	12.31
39	1.60	59	6.25	569	2.96	512	12.40
58	1.62	79	6.57	544	3.02	522	12.70
9	1.67	34	6.60	527	3.05	506	14.52
37	1.84	14	6.77	525	3.25	532	15.96
8	1.96	5	6.78	566	3.37	534	18.18
52	1.98	77	6.91	531	3.45	545	18.72
24	2.10	62	6.95	543	3.50	504	19.00
30	2.20	10	7.04	559	3.57	536	19.33
67	2.34	56	7.53	507	3.58	523	19.62
86	2.34	31	7.59	548	4.14	551	24.76
18	2.40	32	7.78	564	4.30	538	26.07
146	2.53	27	8.03	524	4.31	542	26.67
74	2.57	47	8.13	549	4.52	558	28.18
89	2.60	23	8.70	526	4.70	529	31.71
6	2.62	44	8.84	567	4.81	510	32.83
16	2.77	20	9.16	556	4.87	530	34.16
81	2.79	57	10.06	502	5.31	547	34.64
29	2.80	22	10.21	521	6.12	565	37.21
12	2.83	35	10.32	562	6.18	537	42.24
90	3.02	137	10.54	518	6.28	560	43.18
46	3.22	38	10.72	519	6.47	568	45.89
78	3.25	40	11.13	550	6.56	553	49.50
85	3.29	3	11.21	535	6.68	563	64.62
73	3.30	55	11.66	514	7.34	552	89.71
36	3.43	68	11.72	557	7.48	546	91.36
54	3.54	13	11.84	539	7.69	501	148.72
28	3.54	61	12.43	561	8.23		
19	3.63	4	13.44				
60	3.64	75	13.52				
51	3.68	42	13.86				
87	3.83	65	13.93				
76	3.97	48	14.59				
94	4.04	45	15.21				
50	4.18	1	15.49				
33	4.21	25	17.26				
66	4.25	21	18.10				
71	4.32	2	22.66				
26	4.40	337	66.12				

APPENDIX: M Example of poor safety and overcrowding in some schools





APPENDIX: N A further example of a hazardous location (gas station very close to a school)



Source: field work survey, 2002