Sustainability in the Rural Built Environment:

Vernacular Architecture of the Gezira Area/Sudan

A Thesis Submitted to the University of Newcastle
In Fulfilment for the Degree of

Doctor of Philosophy (PhD)

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2005

ABSTRACT

The Gezira area of the Sudan saw the construction of one of the major agricultural schemes in Africa in the beginning of the twentieth century (1925). The construction of this scheme led to a development of two different rural models of settlement: the colonial model established by the British Governors at the time and the traditional vernacular model built organically by the local people; the farmers who are the main stakeholder of the scheme. Through time the local settlements have been subjected to changes in many aspects of housing design and quality.

In the Sudan, the need to reorganize the organic villages is a critical issue, but government planning initiatives failed to pay attention to the simple planning issues of the organic settlements within their planning processes. The recognition of the simplicity and humbleness of the rural traditional villages may be itself a merit to those settlements that adapted themselves to changing conditions of many factors such as changing environment, changing socio-cultural behaviour and changing spatial arrangements and persist in competing with the planned organized agricultural scheme, which has exerted influential limitations on their development.

These architectural changes – in settlement patterns, structure, and in the external appearance of the local houses – indicate the complexity of their causes. We are trying to understand the changes that the relationships of spaces and society have conveyed. The basic focus will be on the relationship between the socio-cultural factors and the built environment at three levels of development: regional settlement, local settlement and dwelling.

To achieve this aim a systematic approach is used to investigate the relationship of socio-cultural behaviour with the built environment as it has evolved in the Gezira area of the Sudan. The analytical approach includes aspects of history and socio-cultural factors that could expose the complex relationships between the settlement patterns, houses and their users. A second important feature of this research is its comparative character. The comparative characters of the planned settlement of the agricultural scheme, the organic settlement and the new extension of the organic village may explain the socio-cultural relationships. The research, also, contributes to explain the impact of built environment infrastructures and the planning interventions processes carried out by the Government to organise the organic vernacular settlements on the Gezira settlements.

The research explores a wide range of literature and information resources to address these issues and draw a conceptual framework. The Gezira area is taken as a case study as it is characterised by different types of settlements that have emerged within the fabric of a developed agricultural scheme. Data collected for a case study of two space domains representing two types of settlements is used to consolidate the information used in the research.

The thesis provides evidence that, working empirically; people are well able to navigate themselves to shape resources nearer to the realisation of their values. Evidence that at least tells us there are many ways in which to make a home meaningful, sustainable and far from rural deprivation. These ways could be reflected within the traditional vernacular architecture.

ACKNOWLEDGEMENTS

Thank Allah (God) for completing this work. I ask him that this thesis would be an addition to the many information resources for the Gezira area of the Sudan and guidance for those who believe in and work for the future in faith and ethics to help the poor.

Always in this world there are candles that enlighten the way for those who love to increase their knowledge. They dedicate their time, effort and knowledge to those whom they feel worth it. Two of these candles are Dr Stephen Kite and Dr. Stuart Cameron. They are friends rather than teachers. They are talented researchers and passionate scholars. They have given me the opportunity to determine the direction of my research.

There are others who have never hesitated to advise me in different aspects of the research whenever I asked. Those are Dr. Peter Kellett and Dr. Graham Tipple who gave me good advice in many aspects of the research. I would like, also, to thank Tim Shaw, the head of department, for his advice at the beginning of the project but his responsibilities prevented him from continuing with me.

Other people were really helpful and encouraging. Here I don't forget all the secretariats of CARDO, and then PGR for their assistance and support. I thank Miss Charlotte Stuart for her support. My thanks also go to the librarians especially those of the resource centre for their assistance. I would like to appreciate the role of Allan Parry and the registration office for easing the financial tension. Thanks also to my colleagues in PGR for being very friendly and respectful. They were really talented fellow-researchers. We were always acting and working in an environment that helped us to increase our effort and time to finish the research. I would like to express my warmest regards to Kassem Egbaria who was very friendly and encouraging. He was my road fellow.

Here comes a group of especial appreciation. The group that suffered the consequences of the work, my family, but they gained my love and success. I thank my wife, Omaima for her great support in spite of the difficult circumstances she experienced. I also wish to acknowledge that my son Husham has participated technically all the time. My acknowledgement goes to those who revised the work and language to be read easily.

DEDICATION

TO

My Mother,

My Father's Soul

My Family: Wife, Sons and Daughters

My Son's Soul

My Friend Prof. Hamid's Soul

All Who Feed Me with Knowledge

All Farmers of the World

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GLOSSARY

Word	Arabic version	Meaning
Sharie'ą	الشريعة	The Islamic Law
Qura'ąn	القرآن	The Muslims Holy Book
Figih	فقه	Islamic teachings
Hajj	حاج	The pilgrimage to the holy places of Makkah
Al-Jãmią	الجمعة	The Friday Mosque
Hosh	الحوش	Compound occupied by household/s
Sharią	الشارع	Street
Tareeq	الطريق	Road
Zûgag	زقاق	Alley, usually less than 2m wide
Harah	حارة	An open space within a village
Taga	طاقة	Small window, usually 30x30cm
Zakat	زكاة	Money or commodities taken from the rich and given to the poor.
Salat	صلأة	Praying
Jumą	الجمعة	Friday
Majlis	مجلس	Sitting area
Diwan	ديوان	Guest reception area
Gebel	جبل	A mountain or range of mountains
Wagf - plural Awgaf	وقف	A religious or charitable endowment in the form of land or other revenue-yielding sources.
Maskan	مسكن	) A term used for "house" "peace and tranquility
Julūs	جلوس	A sitting room
Tukûl	تكل	A Place for making Kisra, 'a kitchen'.
Zariba	زريبة	Animal compartment
Zibala	زبالة	Rendering from fermented animal dung
Rakoba	راكوبة	A shaded area
Kashasha	كشاشة	More spacious shaded area.
Usra	اسرة	Family or Extended family
Muharam	محرم	A person allowed to be free with the other sex, and is not allowed to marry the other sex.
Non-Muharam	غير محرم	A person not allowed to be free with the other sex, and is allowed to marry the sex.
Gibla	قبلة	Orientation to Makkah
Hadeeth	حديث	Saying of the Prophet Mohammed
Hagg	حج	Right
Mawat	موات	Uncultivated land
Amiriah	اميرية	Uncultivated government land
Haram	حرم	Town or village boundary.
Wad Madani	ودمدني	Capital of the Gezira Wilaya.
Wilaya	ولاية	State or Province
Faki	فكي	Qura'ąn teacher

Shadoof	شادوف	A mechanical device to raise water
Sagia	ساقية	A watershed powered by animals instead of hand.
Feddan	فدان	1.032 acres
Hawasha	حواشة	Plot of land, 10 feddans
Wakeel	وكيل	A man who carries out the farm work on behaves of its owner.
Khalwa	خلوة	Where Faki teaches Qura'ặn
Haj	حاج	Pilgrim
Al-Nawzil	النوزل	Al Nawzil means that people come in groups to certain agricultural areas and live for a while to cultivate land and feed their animals and then leave the place to their permanent home land on the river bank
Sura	سورة	Qura'ặn chapter
Eid	عيد	Celebration for the end of both Ramadan month and Hajj days.
Thoob	ثوب	Sudanese dress, Sari
Jama'a	الجماعة	A group of people agreed on Islamic issue.
Mahr	مهر	Money given to the family of bridegroom.
Haboob	هبوب	Dusty wind as known in the area
Shuyo'	شيوع	A plot registered in the name of several persons.
Salat a'sha'	صلاة العشاء	Night praying
Mizyara	مزيرة	A place zeers are placed
Zeer	زير	Water pot
Nafeer	نفير	A group of people help in other's work.
Sarai	سراي	Farmstead house
Imam	امام	Mosque teacher

Notes:

Sources of all drawings are initiated by the author unless otherwise mentioned.

CHAPTER ONE: INTRODUCTION

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1.1 Prologue

Rural areas in the developing countries are characterized by the simplicity and humbleness of their built environments[1], which are built by the inhabitants themselves and characterised by a product of continuous knowledge, adaptation and adjustment processes. The simplicity and humbleness of their structures and appearance is generated from their functions. Oliver (1989:7) suggests that the beauty of these villages should be taken as a moral and principle for planning:

> *"The beauty of these massed village houses may be used to point a planning moral. The notion of truth is pertinent here, a proper appreciation of function, of the hierarchy of these villages, of the motives of the humility, of their conditions of services, to serve and not to show off; that bring us right into the contemporary problem."*

Because architects and planners of the modern movement admire (and have been excessively involved in) theoretical designs and abstract philosophies of their own, they have introduced alien and alternative solutions rather than advocating these humble vernacular forms and structures related to culture (Akbar 1988). Tragically, the adoption of such a view has resulted in the sweeping away of many small structures and subcultures which have been developed in rural areas in accordance to their traditional customary behaviour and socio-cultural norms. Akbar (1988:3) identifies however that some contemporary architects have turned to the wisdom of traditional environments to solve the settlement production problems rather than the modern solutions.

> *"Many architects and planners today, concerned with the failure of contemporary environments, have turned to traditional environments for answers to modern problems. They observe the forms and uses of traditional environments, analyse their roles and patterns and study the physical and social product."*

A major challenge for African rural designers is how to revitalise the humble settlements of almost 80% of the rural inhabitants to meet the new requirements of modern life and global thinking of sustainability without damaging the prudent organic development of many simple arrangements made by the people themselves. As a result of the construction of a major agricultural scheme in the 1920s in the Gezira area of the Sudan, several types of such organic

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[1] Built environment means the part of the physical surroundings which are man-made or man-organised, such as buildings and other major structures. Built environment covers big town to a village, hamlets and a very small farmhouses in a remote area (Reekie 1972:1).

settlement emerged within formalised development patterns containing geometrical regular farms and straight water canals. Thousands of informal organic settlements were thus dispersed haphazardly within the scheme beside other formal farmhouse settlements built by the scheme authorities. Villages, hamlets and camps occurred, more or less dispersed throughout the rural Gezira plain. For decades the two types of settlement (formal and informal) were found sharply in contrast. Within these local parameters certain factors apparently play significant roles, namely settlement patterns and socio-cultural images embedded in these patterns.

Here the formal settlement refers to standardised units where the Gezira Agricultural Scheme officials are housed. The users' input in design and construction of such housing is absent and a higher authority makes all decisions. The Gezira vernacular organic settlement implies an informal decision-making process, by which local people, trusting their own instincts, manage to rely on their own resources, plan their own settlements, and build their houses in the complete absence of any professions' input. The formal houses that were built by the British to manage administrative actions of the agricultural fieldworks in the Gezira Scheme have embodied aspects of their culture, while the other informal settlements that were inhabited by different people from different parts of the Sudan and West Africa have embodied other multi-cultural images. As the informal order fitted itself within the colonial agricultural structures, it is apparent that their adaptability (adjustment) to changing conditions of the built environment and socio-cultural behaviour has played a major role in the process of continuity of these emerged settlements.

The basic focus will be on the relationship between the socio-cultural factors and the built environment at three levels of development: regional settlement, local settlement and dwelling. To achieve this aim a systematic approach is used to investigate the relationship of socio-cultural behaviour with the built environment as it has evolved in the Gezira area of the Sudan. The analytical approach includes aspects of history and socio-cultural factors that could expose the complex relationships between the settlement patterns, houses and their users. A second important feature of this research is its comparative character. The comparative characters of the planned form of agricultural development, organic settlements and the new extension of the organic village may explain the socio-cultural relationships. The research, also, contributes to explain the impact of built environment infrastructures and the planning interventions processes carried out by the Government to organise the organic vernacular settlements on these settlements.

The research explores a wide range of literature and information resources to address these

issues and draw a conceptual framework. The Gezira is characterised by the rich variety of rural landscapes found within its boundaries, and this diversity provides an essential background for numerous works of literature, a framework for countless planning problems and, more importantly, a setting for the lives of the people who live, work and play amid the varied scenes. Data collected for each village in the space domain of the study is to consolidate the information used in the research.

1.2 Research Framework

Rapoport (1973), Tipple and Willis (1991) confirm that research is a process, and in order to maximise the outcomes of the research, it is important to make it as systematic as possible. The research framework is the means to build up the relationships between the social problem and the social policy in a systematic way. The uses of social research deal with the ways in which theoretical concepts and empirical social research get used in the policy-making process.

There are many different models and frameworks for the process of the social research. The author adopted Wiersma's framework (2000) shown below (Figure 1.1). This research framework is not limited to a certain type of research and can be applied to any research development. This framework shows the stages of a general research study, which include the activities in developing a research study (Further discussion will be in chapter three: the research methodology).

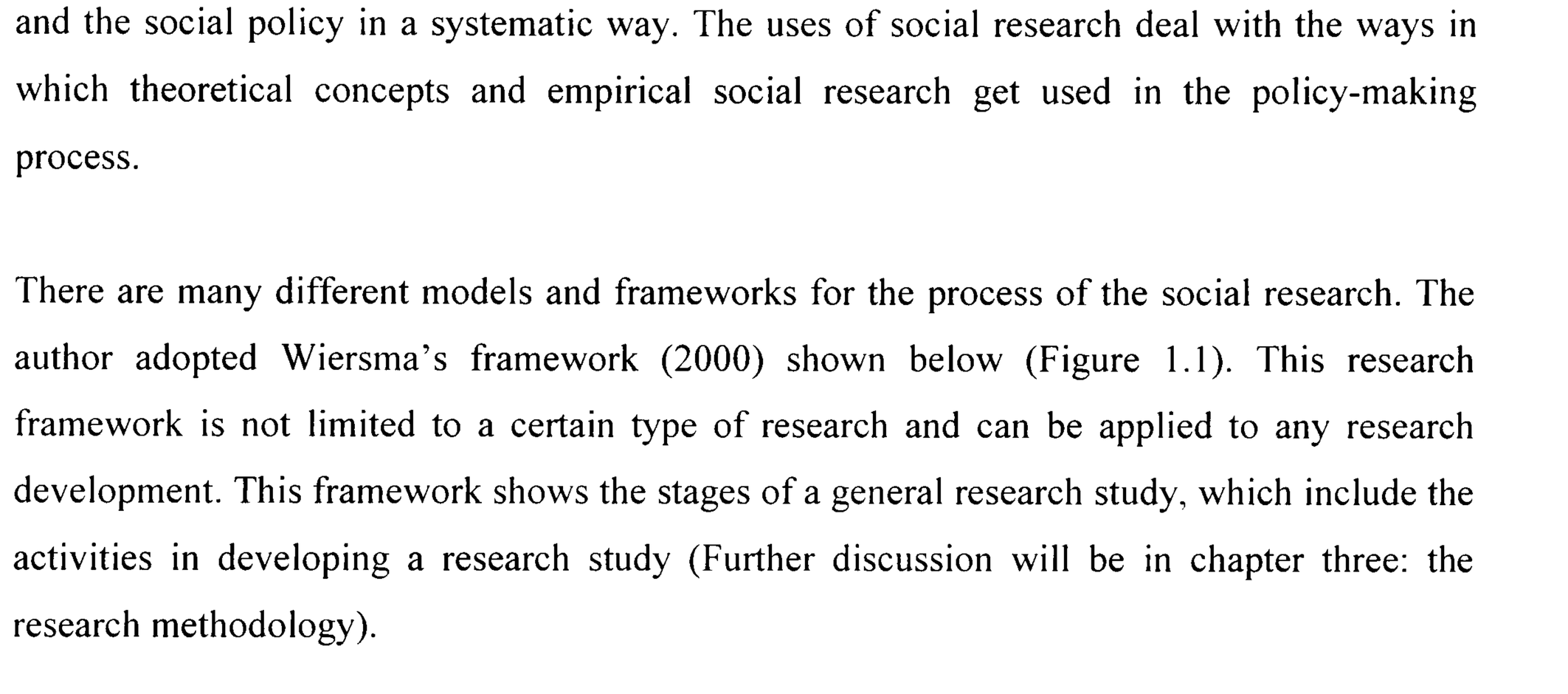

Figure1. 1: This research framework is not limited to a certain type of research. It appears to include all the activities in conducting a research study, but some activities may overlap.

1.3 Theoretical Background

Roberts (1977) argued that in the rural landscape the traditional house is an important element, providing evidence of the complex relations between man and his environment. Building materials and house types adopted do undoubtedly illustrate some of the interactions between physical and human factors, while the plan of the house and the layout of settlement are visual clues to the functional aspects of settlements. Also, Rapoport (1999) discussed that space is a single element of the design of environment, which brings together the social, cultural, economic and environmental aspect of performance. This space can be defined as an environment that consists of both a spontaneously occurring 'natural environment' and a humanly constructed 'built environment'. So far as the socio-cultural function of the built environment is concerned space configuration affects movement, and movement of different groups of people creates patterns of settlements. Settlements 'in built environment', in turn, are the prerequisite for socio-cultural interaction and economic operations. An important aspect of the way that rural built environments function as socio-cultural and economic devices turns on the way that they structure patterns of settlements of people, as in the case of the Gezira area of the Sudan. However, built environments are not only socio-cultural and economic devices; they also act as environmental modifiers and certainly have environmental consequences on vernacular architecture.

The above discussion reflects the fact that traditional dwellings are of great significance to the relationship of man and his environment and are responsive to changes in environment and the socio-cultural behaviour of people. It is precisely in regional settings, village layouts and dwelling forms that the profound changes are now taking place. These are the areas in which detailed information on the systems of the Gezira socio-cultural aspects and their interaction on house, village and regional forms would be of the greatest value to those who bear the responsibility of designing for the future or intervening to make better settlements.

Modern public planning, by definition is a tool that sets goals which direct residents' future development in order to achieve optimal desired end states (Faludi 1973; Dror 1973). According to this definition, planning practice must conform to a human rationale to achieve socio-cultural needs. In discussing the interrelationship between public planning provided by government planning authorities, as formal planning, and informal planning processes, Moughtin (1999: 11) points out:

> *"Buildings should reflect these harmonies [professionalism versus populism], for architecture is like a language. You cannot construct pleasing sentences in English unless you have a thorough knowledge of*

the grammatical ground rules. Good architecture should be like good manners and follow a recognised code."

However, as societies develop, planners' insight into the qualities of rural built environments should be increased to ensure professional recognition of their social needs. In the Sudan, the need to reorganize the organic villages is a critical issue, but government planning initiatives failed to pay attention to the simple planning issues of the organic settlements within their planning processes. The recognition of the simplicity and humbleness of the rural traditional villages may be itself a merit to those settlements that adapted themselves to changing conditions of many factors such as changing environment, changing socio-cultural behaviour and changing spatial arrangements and persist in competing with planned organized development, which has exerted influential limitations on their development.

1.4 The Context of the study

In order to investigate the practices and relationships between the agricultural scheme of the Gezira area and other parts of Africa, it is essential to give an idea of the centrality of the Sudan in Africa and the Gezira in the Sudan.

The Gezira area is located in the middle of the Sudan, which is a large country (one million square miles) in the central part of Africa. The Sudan was known as Anglo-Egyptian Sudan ruled by both British and Egyptians who formed a Condominium Government in 1898, but it has been an independent country called the Sudan since 1956. There are ten countries that border it. People in these countries have socio-cultural relationships with the Sudanese on borders.

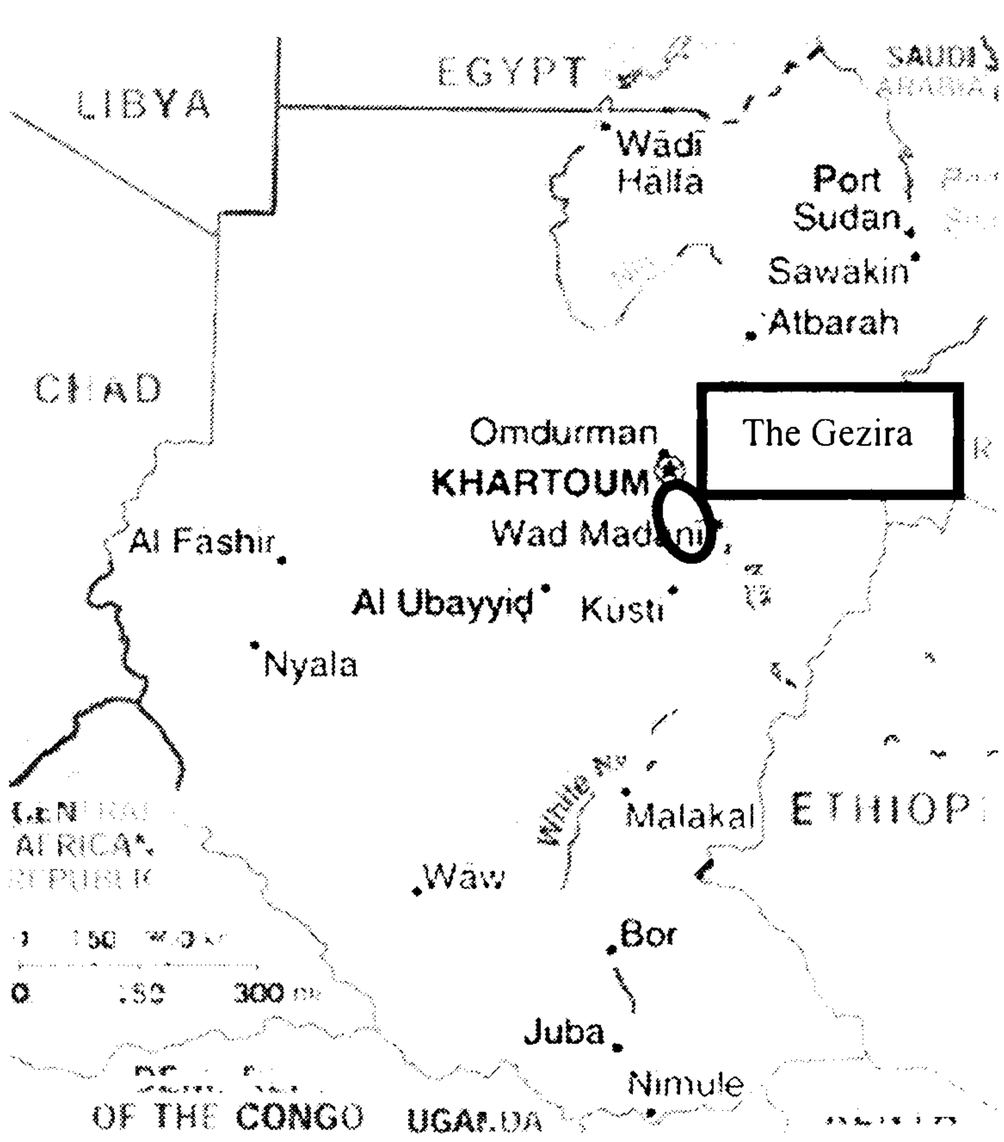

Figure 1. 2: The Sudan and the Gezira locations, Source: Survey Department/ Sudan

The Gezira Area represents an important agricultural area for the Sudan and all these countries on its borders, as it produces food such as sorghum, wheat, vegetables and cash crops such as cotton groundnuts. It supplies many of these countries with food crops and at

the same time supports the economy of the Sudan. The Gezira, therefore, has been an attractive developed area for many people of different cultures. Wageningen (1965) stated that the scheme was developed in two stages; the initial development in 1925 and in 1962, a large extension to the original scheme was brought into full production. Wageningen (1965:5) describes the development of the extension in the following terms:

> *"Its development has been based, largely, on the pattern of the 'Gezira Main Area'. There are, however, important differences between the two components of the scheme. These are partly the result of experience gained in the original scheme and partly the result of differing physical and human conditions".*

Two villages from the 'Gezira Main Area' development have been chosen as comparable space domains for this study. The two space domains are located in the Northern part of the Gezira area of the Sudan and represent two villages of great importance to the Northern Division called 'El Turabi Division' (Figure 1.3). The Gezira is a relevant context to be investigated, because of the following factors:

- The practices of relationships between different cultures that intermingled to produce organic built environments supported the process of agriculture for decades and formed settlement structures that have been of long-term concern to researchers.
- Its type of agricultural development contained many multicultural populations utilising different forms of architecture; with informal organic arrangements and western-style settlements existing in contrast for decades together with more formal planned interventions in the organic settlements.
- The large amount of documentation and reports enable researchers to discuss many problems confronting planning in the Gezira Plain.
- Nowadays, there is a tendency all over the world to both improve and protect these humble vernacular traditional forms, local materials and social cultural norms from any exotic planning intervention that might not be in favour of the objectives and benefits of inhabitants or the built environment. Most of the developed settlements in the Gezira are vernacular traditional architecture, as we will identify later in chapter two.

Until 1925 nomads, who used to come to graze herds and cattle and to grow sorghum during the rainy seasons for food, used the Gezira Plain. Now, the Gezira Plain of the Sudan is an important area for the economy of the country. It is the main area for production of cotton and other cash crops such as groundnuts and wheat as well as other food crops using a gravity

water system. It has been subjected to a substantial amount of growth and change; since the Gezira agricultural scheme was established in 1925 by the colonial regime, different people of different cultures moved to the area and developed their settlements without any intervention from the authority of the scheme, while the scheme management directed planning for the irrigational system and housing to accommodate the staff of the scheme and built administrative centres and farmhouses in a planning hierarchy that excluded the fabric of the local settlements.

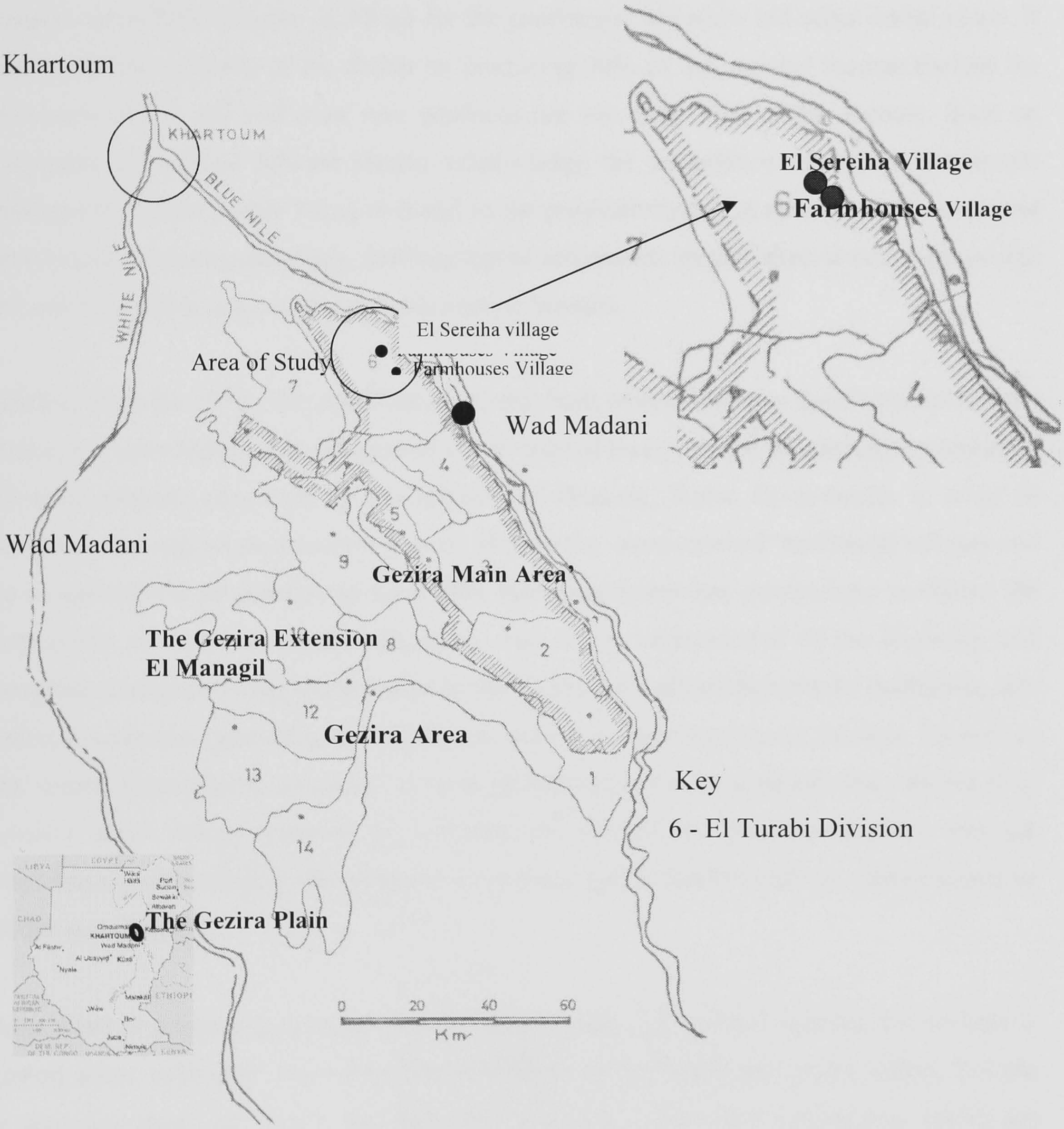

Figure 1. 3: The locations of the case study, Source: Gezira Board Documents

These space domains were chosen because the two villages are economically related and were built to facilitate the farming system in the area. The two villages form a clear contrast because of the nature of their development. We are looking at a formal settlement

(Farmhouses Village) and an informal settlement (El Sereiha Village) lying in the same context within the initial development of the Gezira area of the Sudan. Then, the importance of these villages appears in the contrast between the socio-cultural diversity of the inhabitants that live in these space domains and their interaction with the built environment created by the development of the scheme.

1.5 The Issues

As noted above the proposed study area is an important area for the Sudan as it contains the biggest agricultural scheme in Africa for the production of cotton and other cereal crops. It supported the economy of the Sudan by producing 90% of the national income (before the discovery of the oil) and even now produces not less than 50% of this income. Such an important agricultural scheme should acknowledge the importance of organic settlement emerged to sustain people living in it and so the productivity of the scheme. In planning and programming housing activities, development of settlements should be reviewed to obtain the maximum possible socio-cultural and economic benefits.

Starting from the 1970s, the significance of rural built environments in the Gezira area of the Sudan has been increasingly recognized at the national level, particularly through a number of planning projects pioneered by the Ministry of Housing, Sudan Government, in order to revitalize and regenerate a modern way of life into the 'impoverished' traditional villages and so in agricultural production. In the 1990s, the Government has increasingly promoted the importance of well-maintained villages as well as the improvement of the declining and decaying ecological living space realms in the Gezira Agricultural Scheme by publishing new policy documents, generating new funds and launching more services in the area. As well as the central Government, a number of local governments and local people have shown their concern about village planning by accepting the idea of the government plans with the emphasis on investment in the provision of services, public facilities and the enhancement of public participation.

Also, there is growing interest in research in the Gezira Agricultural Scheme, but so little is known about settlements and vernacular built forms in the Gezira area of the Sudan. So little is recorded about the people and how they extended within their settlements, which are constrained by a regular planned agricultural scheme.

However, there is recognition of certain issues that could be summarised as a framework or guidance for this research:

First, as these settlements grew through the socio-cultural interaction with the imposed scheme built environment structures, they form a system and provide more than a shelter for local people. As Kellett (1995:300) discusses:

> *"The morphology of the village and character of different residential areas undoubtedly reflect the power relations within a society".*

Rapoport (1969:46) recognises that,

> *"If the provision of a shelter is the passive function of the house, then its objective purpose is the creation of an environment best suited to the way of life of a people...in other words, a social unit."*

Secondly, the impact of external circumstances, such as other cultures and planning interventions on vernacular traditional organic planning system has its effect on the organisation of space at different rural levels of development of the Gezira. The organic planning has its effect as well.

Thirdly, the significance of regenerating the impoverished villages in the Gezira area of the Sudan with services and amenities gave rise to planning intervention into rural settlements, especially organic settlements. UNCHS (1986:171) confirms,

> *"The objective of human settlements policies...should be to make shelter, infrastructures, and services available to those who need them".*

So, the government first thought of providing organic settlements with services, especially water and electricity. Thus these issues raise the importance of interaction of socio-cultural factors and the vernacular traditional built environment and how they sustain the continuity of housing production, changes in socio-cultural values and changes in spatial organisation. Then, the process of planning intervention and how people reacted to them makes it of significance to study the phenomenon.

1.6 The Research Question(s)

The study will explore a series of interrelated themes centred on the production of the vernacular built environment by people of rural areas. The research focuses on the housing processes in a village where informality is the dominant mode of housing production and compares this with colonial settlements and the recently planned village extension. The questions that could be raised are:

- How important are the socio-cultural characteristics of the dwellers in helping to define the resulting settlement environments? To what extent do these environments express socio-cultural values?
- How successful are such environments in sustaining a range of socio-cultural activities and housing production?
- How can planners intervene to sustain socio-cultural aspects of life?

Studies of the built environment are incomplete and understanding of the housing process is partial, because the vernacular settlement as a major component of the rural environment has received limited attention as a built form, despite the massive production of built environment by dwellers. An understanding of comparative features and processes should make it possible to design policy responses that are more effective. This is particularly relevant as governments are planning to intervene in informal organic villages. It will be argued that supportive interventions or innovative planning initiatives must:

> *"Build on knowledge of existing conditions and on the domestic cultural heritage"* (Schlyter in Kellett 1995:8)

A framework could be a guide for designers and planners to enhance the processes of rural housing to continue the processes on the existing cognitive knowledge to serve the objectives of sustainable development.

1.7 Objectives

The basic objectives of the study are:

- To examine the impacts of the Gezira Scheme development on the evolution of settlements and explore the influential aspects that might be created such as canalisations, etc.
- To investigate comparative features between formal and informal settlements and dwellings, particularly where they take place in the same context.
- To explore the role of socio-cultural factors and the quality of such environments at the level of settlements and dwellings.
- To investigate to what extent planning interventions sustain socio-cultural patterns.
- To explore how the Sudanese occupants of colonial dwellings adapted themselves to given spatial organisations.

1.8 Research Methods

Due to the complexity of the object of the study under investigation, it was reasonable to begin from general to specific, from implicit to explicit and from macro-level to micro-level. The reason for choosing the Gezira area, as a regional context of this study, stemmed from its importance for both economic and socio-cultural interaction within a society of multi-cultural groups. The chosen case study areas represent two space domains of formal and informal settlements, which are characterised by their contrasting nature of form, materials and appearance, socio-cultural and physical pattern interrelationships.

Understanding the concepts of formal and informal architectural forms and the socio-cultural images behind them, needs a case study of two space domains representing the two types of development to enrich investigation in housing forms. So El Sereiha village and the Farmhouses village were chosen to represent the two types of development (Figure 1.4).

The chosen villages for the study

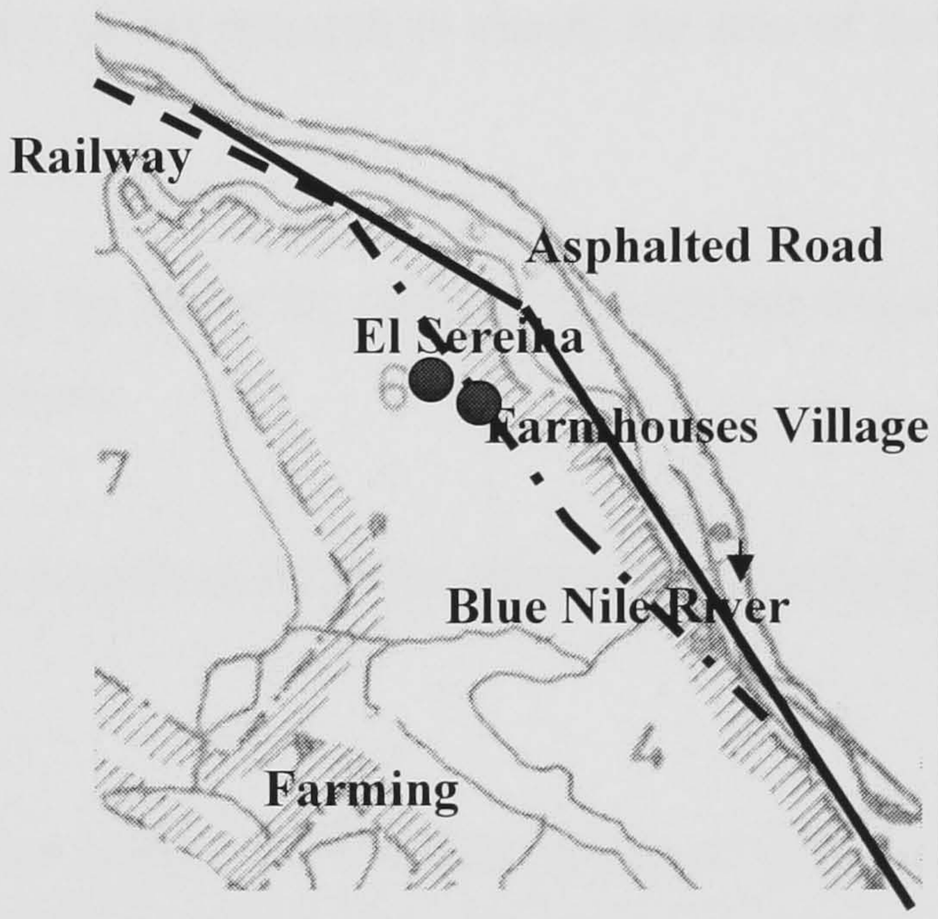

Figure 1. 4: Specific context of the two space domains of the case study (see also Figure 1.3)

Nevertheless, it was essential to increase the reliability and validity of the investigation by developing a methodological strategy for the research and data collection. Those will be identified in chapters two and three respectively. Within the scope of collecting empirical data and documentary information, both qualitative and quantitative methodological approaches have been adopted.

1.9 Significance and reasons for the Study

The purpose of this research is to investigate the vernacular architectural forms as vernacular forms built and developed by local people in a well-developed agricultural area. This investigation will be the basis for future research that may be a stimulus for improving planning interventions that affect the sustainability of settlements and socio-cultural activities in a vernacular community. Therefore, it is hoped that this study will be a further step towards an analytical approach that facilitates the examination of such issues in the rural context.

1.10 The Research Structure

To answer the questions and achieve the specified objectives, the research is described in eight chapters, each dealing with certain topic/s related to these aims and objectives building up towards the final findings and concluding recommendations.

Chapter one introduces four areas to identify the scope of the research,

- The goal of this chapter is to explore the nature of the problem of this research. Drawing together the aspects of the topic/s of the research to clarify the area of the study.

- Discussing the research problem to identify the gap in the existing research and create the research question/s relevant to the problem.

- Describing the topic and strategies of the research to fulfil the objectives of the study to answer the questions.

- The chapter specifies two settlements as a case-study. The comparison of different types of settlement is followed to enlarge the possibility of highlighting the meanings of interaction of sustainability factors, in particular, socio-cultural factors.

Chapter Two represents the overview of the conceptual issues. The chapter is an attempt to draw together the various interlinked issues that have been raised by different researchers about rural housing, the vernacular traditional built environment, and sustainability in the vernacular built environment. The chapter also visits economic growth and planning theories to highlight the relationships and impacts on both socio-cultural behaviour and physical acts. The main goal of the chapter is to investigate related knowledge and theories and identify an approach and a criterion for evaluating social and cultural factors within settlements. Settlements are considered the manifestation of those unseen forces. Rapoport (cited in

Awotona, 1999:28) concludes that:

> *"Housing not only reflects social and cultural change but also leads to it: Housing which is inappropriate, and hence inhibiting (or merely not supportive), may lead to undesirable changes in family structure, behaviour and other aspects of culture".*

Chapter three is a justification of the research methodology and the research design. It is, also, a justification of data collection, techniques, overviews data collection and fieldwork analysis techniques, and the issues that faced the author during the fieldwork. It is a discussion of the fieldwork and how the fieldwork succeeds in fulfilling the data and information needed for the study. It assesses the issues and key variables that occur in relation to the study. The chapter highlights the easiest ways of collecting data and information from traditional rural areas in developing countries and shows the difficulties of research surveys in such areas. This is an overview of fluency and hindrances, which reflect the founded culture in such societies. It investigates the household and demographical data; it reveals the social and cultural behaviour within the pattern of development in rural Gezira.

Chapter four studies the Contextual Development of the Gezira. A chronological study is presented to illustrate the degree and nature of the formal and informal developments in the rural Gezira area of the Sudan. The study shows that indigenous organic settlements are widespread in the area and that these traditional settlements are likely to affect the rural development in the future, since they serve many useful functions. Therefore, mapping out the chronological development of these settlements is essential.

Chapter five explores the socio-cultural organisations that have effects on the settlement patterns and dwelling formation. The chapter discusses the social behaviour and cultural norms, which established the values of the local people and how they have been oriented in producing their dwellings. Also it discusses the consolidated factors that sustain the processes of vernacular architecture.

Chapter six is an analysis and an assessment of the settlement patterns in two space domains in the Gezira area of the Sudan as reflected by maps, documents and surveys. It describes the evolution of the two villages, one of which has been developed organically with subsequent planned interventions while the other was planned within the overall design of the agricultural scheme. The goal here is to compare and

understand the factors that influence the settlement patterns organisation and quality of space.

Chapter seven examines the spatial organisation and building forms (dwellings, building materials and appearance). The goal is to investigate and understand the typology and performance of two types of housing development with an overview of the contrast and comparison between them.

Chapter eight discusses the findings of the vernacular residential development and socio-cultural changes that backed the changes in the physical forms and continuity in dwelling unit production process. It integrates and relates the findings to the issues and questions of the research and discusses guidelines and implications for improving planning intervention in relation to vernacular form theories.

CHAPTER TWO: THEORETICAL PERSPECTIVE

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2.1 Introduction

The purpose of this chapter is to explore relevant theoretical definitions, conceptions, ideas and arguments that can help to develop a clear framework to understand the concept of rural vernacular traditional forms, materials and socio-cultural norms. It is believed that an approach that consists of studying rural vernacular dwellings and socio-cultural factors embedded within a certain built environment will lead to answering the questions of this study. It has been observed that researchers, such as Oliver (1987) and Rapoport (1976), who have studied vernacular architecture, built forms and cultural norms, have adopted this approach for spontaneous settlements. For researchers in the Developing World, it is important to look into the wide discipline of literature to understand how different thoughts and ideas describe traditional settlements and vernacular forms. This chapter is woven around the following issues:

- Mapping out rural settlements and vernacular dwellings characteristics and definitions.

- Then, the chapter proceeds towards an approach that combines vernacular contextual understanding and sustainability issues, hoping to understand the phenomenon of sustainable principles that advance the continuity of production in those vernacular traditional built environments.

- Investigating the socio-cultural contexts could expose the real meaning of the activities of inhabitants that built those vernacular dwellings.

- Although the economic development is not the concern of this study its meanings and definitions are of significance to rural settlements in the developing countries, especially Africa.

- Studying planning theories to understand the meaning of hierarchy of both formal and informal designs and its relation to the distribution of services within rural areas. Should planning simply be about transforming spatial arrangements, or about more deeply seated social and cultural relations between spaces and society?

This chapter seeks an understanding of these issues to explore how rural communities maintain continuity in changing vernacular building processes through balancing social and cultural factors with other factors of development in the same context.

2.2 Rural Settlements

Rural settlements are most usually associated with rural economic development, especially in agriculture. It is essential to see settlement forms as a product of economic development and man's struggle to construct a shelter on land limited by factors of development. Baker and Pedersen (1992:1-3) consider rural settlements as an essential and supportive factor for agricultural development in Africa:

> *"Local, regional and national development and change in Africa are inevitably bound up with a discussion of the role, nature and repercussions of agriculture on other sectors of the economy. However, agriculture as the lead sector in most cases does not operate in a spatial vacuum and the settlement patterns play a supporting role in agricultural and rural transformation."*

Roberts, (1977:19) also argues that the organic evolution of settlements as:

> *"A dense scatter of nucleated agricultural settlements can only develop where relief, soil, and climate combine to support the folk involved."*

There are two facts that can be raised here: that the rural settlement evolution is bound to agriculture in African countries and this evolution is an essential and important factor for supporting agriculture and transforming living conditions for the better. In chapter four it is proposed to delve more deeply into certain questions concerning village settlements, in particular the forces generating and changing the overall patterns of village settlement and factors concerned in the appearance of differing village plans. The system of rural settlement patterns was one of essential co-operation by people living within an environment that has already been stressed by certain limitations. Man is essentially a social animal, and where life has to be lived and subsistence gained from the land around the dwelling, sociality becomes a necessity, (Rapoport 1969).

In the Gezira area the required environment for agricultural development was secured when the British first invested the capital for the Gezira development to produce cotton for textile industries in Britain. The economical development was guided by the British people and executed by the Condominium Government[2] and in due course a new pattern of well-planned built environment was created to accommodate farms, canals and inspectors' and other officials' houses. The local people's settlements were not planned within this new development. Local people adapted their living prudently to the new environment under the stress of the infrastructures of the geometric agricultural scheme. These informal organic settlements were considered as a supportive structure to the Agricultural Scheme as the inhabitants are the main stakeholders of the scheme; they are the farmers and related families.

[2] The Government was run by both Egyptian and British officials.

The history of settlement in the Gezira Area of the Sudan can be seen in two ways: either as a state of continuous change, as in the informal dwellings built by the local people; or as periods of rapid innovation separated by phases of relative stability, as in the formal dwellings built for colonial officials and later occupied by the Sudanese staff. In practical terms, at any time there has always been a delicate adjustment between the character of the environment, both physical and biological; the population, the extent of the cultivated area, the nature of farming systems, the administrative framework, and patterns and forms of settlement presented, to specify only salient variables. It is the combination of these variables that determines the character of settlement to be found. Roberts (1977:23) considers the combination of these salient variables determines the settlement within a particular space:

> *"It is the unique combination of these variables at a particular time within a particular region, which determines the character of the settlement to be found."*

As we saw in chapter one there are two types of dwelling, formal and informal, that have emerged in the Gezira landscapes. Formal rural dwellings in the Gezira, like the agricultural systems themselves, belong to a domain where a kind of planned structure is more effective than individual initiative. In the informal dwellings, although belonging to the same domain, the individual initiative is more effective than the collective conscience. In the informal dwellings, changes involve competition between two opposing forces; on the one hand are pressures towards innovation, the creation of new orders of a society, new economic systems, new landscapes, while on the other hand the process of inertia tends to inhibit change and encourage adaptation to new uses of existing orders, systems and patterns, (Roberts 1977:23). The end product is a complex blend of old and new, and it is a period of interaction between different variables that gives the Gezira Area of the Sudan its distinctive character. Another significant factor is that the majority of settlements that have emerged in the Gezira area are rural villages and most of these villages are informal. The Gezira Scheme as leading 'African Agricultural Development' was an evolving factor in creating the administrative centres and other formal villages while the rural organic villages evolve by themselves have supported the provision of shelter to the scheme's tenants. To understand the nature of these villages it is of significance to ask ourselves: what is a rural village?' Some researchers characterize the village by its population, others by the availability of services and sometimes by its importance of inlet and outlet of people and goods (El Agraa 1985). This may be a topic of more reading and research. Roberts (1977:17) defined the term 'rural settlement' as follows:

> *"The term rural settlement patterns is applied to the distribution of units of settlement, be these farm houses, hamlets, villages or towns, over the face of land, and a map of settlement patterns tells of presence or absence, regular or irregular spacing, in lines or in clusters. Each pattern is, furthermore, made*

> *up of individual forms, and these may be large enough to be termed villages, small enough to warrant the term hamlet, or they may be single farms or cottages."*

In this research a village is defined as a form, where dwellings were built by the dwellers themselves, as in the case of the informal organic villages or dwellings that were built for the residents as in the case of the formal Farmhouses villages. Thus the size of a village, the quality and accumulation of services within it could decide the village importance in rural Sudan. Whatever the definition of a village might be, our research largely investigates vernacular architecture in contrast to the planned colonial dwellings. The informality coincides with the concept of vernacular architecture. In recent years studies of vernacular environments have deepened and broadened in the search for more convincing and holistic explanations, (Kellett 1995:15). Oliver (1969) argues that historians like Fergusson gave great importance to an understanding of the building of the East, but he concentrated on the monumental buildings and not on the domestic dwellings of these societies. Interest in vernacular architecture has existed since the 1960's i.e. Rudofsky (1977) 'Architecture without Architects'. Oliver (1969:10) concentrated on the importance of these domestic dwellings and wondered if we can know about accurate figures of their numbers, about their density or the proportions of the world's peoples that are housed within. He concluded that:

> *"For the major proportion of mankind's buildings, overlooked in works of architectural history, no definite term has, until recently, been considered necessary. The recognition of local and regional building forms, especially of domestic buildings, altering with cultures, the environments and the climates of the areas concerned has led to the increasing use of the term 'vernacular architecture' to identify them."*

Many architects admitted that in most countries there is to be found a vernacular style especially in country villages and isolated farmhouses that owe little or nothing to formal design. Therefore, if the simple rural dwellings make no permanent mark upon the landscape, they are nevertheless forms with a history of evolution and have housed or accommodated as many people as any other housing type. It is thought that up to 80% of all buildings have been vernacular; ordinary people built them for everyday use (Oliver 1987). Ignorance of traditional vernacular buildings among designers could impoverish their understanding of the past. Their loss is to be unaware of an important type of evidence, which provides insights into the society, economy and environment. Their neglect of this useful source material may in part be attributed to the lack of research into rural housing where most dwellings are spontaneous or informal buildings.

2.3 Traditional Vernacular Architecture

As discussed before, this study is based on the definitions of the theorists who consider the simple domestic dwellings a vernacular architecture (Oliver 1969). The idea behind studying traditional vernacular architecture is to understand the physical embodiment of socio-cultural values as a lesson for the future and to encourage people to look at local dwellings and forms with a fresh eye, to note the detail as well as the overall structure and to record the current state of our rural environment. The incentive is to care for and preserve the best of what we still have. The vernacular detail, which contributes so much to a local sense of identity and place, needs to be understood and appreciated if it is to be retained and to influence those who build or modernise houses in the Gezira Area of the Sudan.

Studying vernacular dwellings through the history of the Gezira, starting with the first examples of the simple settlements and forms that have emerged, shows there has been a general evolution of basic and core types developed in regional and local cultural, climatic and geographical contexts. For example traces of early hut 'Guttia' structure (form of a room with a conical roof) built in the Gezira area and dating from the first years of the twentieth century revealed similar features of the archetypical patterns of traditional vernacular architecture as described by the recent researchers, (El Agraa 1985, Misra 1983, Oliver 1987).

Traditional vernacular architecture has indeed been able to resolve perfectly the symbolical and functional issues of dwellings through a history of the most extraordinary technological revolutions and innovations, not by pretending to change the fundamental conditions and ideals of human existence, but by embracing them and by preserving and enhancing the sense of place and of community in a perspective of permanence and continuity.

> *"Most of the people are still very happy to live in these traditional structures or belong to places which offer the material and moral comfort of traditional vernacular architecture,"* (Oliver 1987:8)

Therefore, the concerns of vernacular dwellings are not to express signs of a contemporary modernity, but to express the enduring, and to articulate the symbols of continuity and permanence. What we are in fact concerned with is the search for planning principals and the promotion of building methods of people using local skills and resources available to them. Vernacular dwellings originate from the traditional continuation of local people's traditions and sensitivity of local conditions and have their own persistence from the socio-cultural behaviour. Oliver (1987:11) discusses that:

> *"A regional vernacular develops from the appropriate continuation of local people's traditions and sensitivity toward local conditions."*

A house provides space for a home, and its size and layout was presumably appropriate for a family and its guests. The rooms are to be assigned for different domestic uses, and privacy. The size, design, layout and decoration of buildings resulted from decisions which were influenced by local traditions, changing styles and fashions, and ideas about the social standing of dwellings and owners. The dwelling should be viewed in the broadest perspective, in relation to its neighbours as part of a pattern of settlement, and within the landscape of the region. We need also to investigate the agricultural land to which it was attached. The dwellings may themselves have had economic functions, in agriculture. They may have the folk values of people for many centuries or decades. Danby (1983:200) describes such built forms as:

> *"Traditional vernacular forms in building and settlement embody the folk experience of many centuries. The adaptation of a suitable technology to the climatic and cultural requirements of a particular community has taken for granted an appropriate solution to its immediate needs. Close study of the vernacular building form reveals much wisdom, which has only recently been ignored under the pressure from internationally accepted high technology and politically and economically motivated images of modernism."*

Vernacular houses can also be viewed as items of structures. Dyer (1997:1) discusses this aspect in the following terms:

> *"The structures can be seen as feats of skill and craftsmanship, telling us about the training, specialization, mobility and organization of carpenters, and their links with other crafts and relationships with employers."*

The construction of the dwellings also demonstrates the achievement and limitations of the technology and available resources. The dwellings were the product of a process of interaction between the society and economy, which gave their owners the resources to carry out the work and which could deliver the materials and labour to the site. Man as a master designer in the spontaneous settlements has created his own environment adapting himself to different conditions to build his own vernacular form. Oliver (in El Amin, 1976: 9) also discusses:

> *"Every man in the rural society is a designer and a builder. His challenge is the balance of model (traditional form), material (available local materials) and user, the latter usually himself."*

Therefore the traditional vernacular architecture embodies experiences of generations through a method of adaptation and adjustment to fulfil the needs of a society in a certain context. The manifestation of these experiences is the material structure and forms adapting suitable technology to the social and cultural requirements of a society. Studying such phenomena is of significance to planning for the future.

2.4 Factors in Vernacular Dwellings

2.4.1 Family and Kinship: Social Hierarchy

Vernacular dwellings are relevant to a number of questions in social history and here we will consider their relationship with the family and household and the light which this can throw on socio-cultural behaviour within the built environment. One view of the relationship between families and their holdings of land emphasises their close links, which ensured that the land descended down the line of inheritance for generations. When the direct line of succession failed, more remote relatives came, sometimes from a distance, to take up the land. People only gave up their family holdings (including their farms) with the greatest reluctance, and hoped to repossess them in the future. Another perspective puts more stress on the market for land, and suggests that the attachment to the holdings was not an inherent feature of peasant society, but was forced by the acute land hunger that reappeared with the planning intervention and the growth of population in the re-planned villages.

Those who have argued on both sides of this debate have tended to focus on the holding of land, but the people saw the house and farm at the heart of the holding, and indeed the family names that were attached to the holdings referred to the houses in which generations of the same family had once lived.

The precise use made of the house involves another debate about the structure and size of the family group. The prevalent interpretation makes the extended family the normal social unit, so houses would be expected to accommodate more than one household or more remote kin. The other social dimension of housing relates to the definition of classes and their building material conditions. We tend to categorise people in the Gezira area as peasants or farmers and government officials. Houses clearly express the builders' and owners' social position, even when we are considering the subtle gradations of status among peasants or officials.

2.4.2 Local Building Traditions

We conventionally expect that different styles of vernacular dwellings will tell us about place differences. Explanation of the differences could be more difficult as there are regional cultures, no doubt influenced by the various social, economic and environmental circumstances, but ultimately moulded by traditions and practices that are not always capable of rational analysis. Here we mostly ponder the local types of dwellings in rural Gezira, and attempt to correlate regional differences with other variable factors such as settlement forms. The construction methods, building techniques and materials, or different types of roof structure and wall framing, could be explained in terms of the local terrain, available resources or social structure. Generally, the labour, materials and skills were locally available; whereas today in urban areas they have to

be obtained from somewhere else and the terms on which they are made available is the root cause of many of the features of dwellings we can observe today. Therefore, the study of vernacular traditional forms reveals much of interest in terms of cultural requirements and social and physical changes in rural housing development due to exotic interventions.

Discussing the meanings and definitions of vernacular architecture and its features and its relationship with the rural housing prompts us to ask why this phenomenon emerged in an area like the Gezira Plain as that of highly developed and planned landscape. And also to ask how it has sustained itself in an environment where everything in it is pulling to modernity, the type of plans superimposed on it, the planning intervention carried out through its existence and the economic development of its population. This state of vernacular existence leads us to the question of sustainability.

2.5 Sustainability in Vernacular Dwellings

In the field of research, there is a substantial and growing literature on the topic of sustainability, (Brown et al, 1987; Jacobs, 1993; Daly, 1990; Pearce and Turner, 1990; Shearman, 1990; Rees, 1997; Clark 1990). Much of this literature has been concerned with the meaning and application of sustainability within the field of environmental economics and the distinction between 'sustainability', 'sustainable development', 'sustainable utilization', and 'sustainable growth'. So this section deals with the conceptual background of sustainability. It covers the definitions and interaction of social, cultural and economic factors within development and, thus, attempts to define sustainable development. However, the current definitions and arguments about sustainability and sustainable development are so broad and preoccupied with the global scope that they seem to miss the meaning that can be promoted in rural areas of developing countries.

The section, thus, tries to develop a more concrete form of the concept at the local level. It, firstly, defines development, sustainability and sustainable development. Then it identifies the indicators of sustainable development, which are tools that simplify and communicate important issues and trends of sustainability in a traditional vernacular built environment. They can, also, help people understand what they themselves can do. A simple model, using these indicators, can be used to describe sustainable development to enable the researchers to identify the factors and elements of sustainable development. Then these criteria of evaluation could be developed to indicate the issues of the study.

2.5.1 Definitions of Sustainability

In general, there seems to be little disagreement that sustainability arguments stress the need for environmental protection and continuing economic growth to be viewed as mutually compatible rather than conflicting objectives.

> *"In principle, such an optimal (sustainable growth) policy would seek to maintain an "acceptable" rate of growth in per-capita real incomes without depleting the national capital asset stock or the natural environment asset stock"`* (Turner, 1988:12)

The challenges of understanding what this idea of sustainable development may mean, and how people can work towards it, are evident in a brief analysis of the widely used definition of the UN. Jennifer, (1999:7):

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs,"* (World Commission on Environment and Development 1987: 43)

Moughtin, (1999: 30) discusses the matter as:

> *"Development which is non-damaging to physical environment and which contributes to settlement to sustain its social and economic structures...."*

The above statements raise fundamental questions about sustainability and its relation to traditional solutions for settlements. Leman and Cox (1991:218) argue that:

> *"Sustainable development can not occur in any country without taking into account its human settlements and their social values and needs".*

Jennifer (1999) called for a review of the spatial circumstances of rural areas, in order to compare economic advantage and assess potential social, cultural and economic alliances to achieve sustainable development. This shows the importance of socio-cultural factors in the definitions of sustainability.

2.5.2 Interpretations of Sustainability

The ability to live effectively within a particular environment is the preference of everybody. Since the environments change and peoples' idea about living effectively varies, the idea of tackling rural problems must change. Transforming a rural settlement into a sustainable environment requires holistic thought to solve the complexity of the problem of the context and to keep pace with the socio-cultural needs of the society.

As people differ in thoughts and understanding of different aspects of life, of course, they differ in their understanding sustainability. The diversity of thinking leads to different ones of

sustainability and here we will discuss two important interpretations related to this research. The most relevant interpretations to this context are the African and Islamic ones.

In Africa, at a local level, there might be some limitations to sustainable development:

- In evaluating the sustainability of environment and economy in relation to rural planning, it should be acknowledged that the style of politics of development would either discourage or hinder participation of direct or indirect stakeholders.

- In Asia economic and social transformation relies on industrial, information and communication technology. Mostly they are value per value traded with commodities derived from Asian social labour. In Africa, unlike Asia, technological break-through is far behind because of a lack of home grown initiatives in research and development.

- Development in Africa is always a result of gradual acts of positive transformation or progressive changes which can be noted, but have instances of stagnation and at times short-lived failures in economy and management, in isolation or combination.

- Socio-cultural forces which define the human settlements and built forms and their social conditions. To many researchers in Africa sustainability of rural settlements requires a strong planning vision that considers social and cultural norms for the future.

- Complementary to that vision is the political will to help the people to put that vision into reality:

  "This is very much a political issue, which can not be imposed by forces external to the context in which changes should occur" (Ausunta in Ahmed 1996: 27).

African communities need a proper understanding to create a sustainable development. Policy makers, always, asked themselves how far the African social, cultural and economic horizons extend into the future to enable them to plan. What importance do they attach to the past as a source of inspiration and social learning, as the basis of taking on the future of African countries? The researcher considers the political will should supplement the socio-cultural understanding, which is the key factor for sustainability.

In Islamic countries more limitations are prevalent. There is a continuous discussion among Muslim thinkers regarding the need for environmental ethics to correct existing irresponsible

attitudes towards the environment. Muslims should recognize that they have to return to their original identity and ideology. Islamic law (Sharie'ą̈ law)[3] secures the stability and dynamics in human life. Planners and policy makers must recognize that all decisions affecting any part of nature are decisions about sacred space (Akbar 1988). But Muslims are not alone; many Westerners plead for an ethic to save the earth.[4]

Islam has tackled sustainability in the built environment in a philosophical way. That is reflected into main Islamic concepts, Towhead, means there is only one God, Figih that is dealing with the daily life performance and Sharie'ą̈ Law, stating the judiciary system for the Muslim and his relation with others, like people, earth, seas and skies. In the general philosophy, there are paradigms in various fields of activities. Reflection on these paradigms, as well as relevant criticism and modifications might be called philosophies within these fields of activities. There are philosophies in politics, education, sciences and so on. Development philosophy deals with the main thoughts and assumptions in development processes in the context of human beings, nature and societies. It is a change of circumstances, increase and progress to enhance the way of life, (Omer, I. 1992).

In Islam there are fixed ethics that should be mentioned here. Within the built environment context the right of men and women to private property is one of the fundamental rights in Islam, while the state only has the right to intervene when there is a beneficial public purpose, and only with prompt and just compensation. Such independence of individuals allows them to decide how best to fulfil their needs and enables them to creatively put their resources to beneficial use; however, the right to provide property is not absolute. In Islamic laws (Sharie'ą̈ Laws), there are important limitations on the acquisition and disposal of private property. Among the limitations on the acquisition and disposal of private property, which may affect planning, design and landscape, are the following according to Muslim jurists such as Malik ibn Anas and Abu Yousif (798) have formulated:

- It is beneficial utilisation and not merely land acquisition that establishes the right of ownership.

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[3] Laws stated in the holy Qura'ą̈n and consolidated by Hadeeth of the Prophet Mohammed "God blesses him"

[4] John Muir (1867), called for "the right of all the rest of creation", Albert Schweitzer (1915): "reverence for life", Liberty Hyde Bailey (1915) "ethical consideration of the holy earth" and Aldo Leopold (1940s): "a land ethic". More recently, Peter Singer "Animal liberation", Herbert Marc use, "the liberation of nature", Charles Birch and John Cobb, "the rights of life" Eugene Hargrove, "the right of the solar system and the universe", Arne Naess, "deep ecology" or "ecological egalitarianism" and last Prince Charles of Britain, (2000) " the unity: the relation between God, man and nature".

- The right to cultivate virgin lands may not be exercised by either individuals or the state where the result would be injurious.
- A landlord may not, without reason, prevent development on his land if his neighbour needs it, and if it brings no injuries to him or others.
- Design must ensure privacy for the family with sufficient air and sunlight. This affects the relation of building design, heights, openings, gardens, and rooftop (terraces) and parapets. The interiors and courtyard should not be exposed to strangers.
- No farm beside a stream may monopolise its water, and if water is likely to be insufficient for all farms, a new farm may not be irrigated until the needs of all previously established farms have been satisfied.
- It is a must to provide adequate maintenance to animals and not to harm or kill them except for legal purposes and by legal methods.
- Use of public and semi-public property is subject to the condition that it is not injurious to the society.

According to the above principles, the property has been divided into different kinds: hagg, (private right) mawat, (not exploited land) amiriah, (the state land) awgaf, (land located for charitable purposes) and haram (Land bordering and surrounding a village). Prophet Mohammed, God bless him, says:

> *"There is no legal validity to any action that brings excessive injury to oneself or others."*

Thus the individual's property rights are subject to his neighbour's rights and are superseded by the community's welfare. Furthermore the abuse of rights leads to legal sanctions.

These Islamic laws or principles for Islamic societies had ruled the shape of land until the condominium government established the new ownership system in 1904 to rule the transaction in land. Within the built environment context in the Sudan, a search for Sudanese authenticity and assimilation has been going on to identify traditional solutions from both the Muslim world and the African countries. This shows the great effect of cultural values on people's way of life. Any solution must consider these values, though the scheme experience reflects the intimate interaction between the new and traditional ownership systems.

2.5.3 Sustainable Development Model

We saw earlier in this chapter the concept of sustainable rural development as being composed of four significant aspects, broadly identifiable as, social, cultural, economic and environmental. The components interact freely in the course of organic settlements, moulding and supporting each other.

In the scientific fabrication of models several types of 'languages' are used to represent these aspects to form a criterion of evaluation for sustainable development, many of which have, originally been borrowed from architecture and arts. Usually, these scientific model languages include written languages, icon models, analogous models, arithmetical models and typological models. The reasonable language for the model of sustainability in rural settlements is the "Typological Model." It depends on variables, which may be dependant, variable or independent. As we saw earlier the social, cultural, economic and environmental factors are independent factors that freely interacted within sustainable development.

The complexity in the combination of these social, cultural, economic, and environmental factors is reflected in the particular arrangements of settlements and built forms. Thus one of the prominent questions that this research tries to tackle is how to understand sustainable planning intervention within the traditional built environment in rural areas and how to understand the relationship between social, cultural, economic, and environmental aspects of sustainability. Before discussing the relationship of sustainability factors that assist the criteria of evaluation, it is important to draw on how a model can be formulated and how these aspects fit into a model that assures efficacy and meanings that guide future collective action, required by the users to deal with their task environment (Mulford & Rogers 1982: 12).

2.5.3.1 Model Formation

The following diagrams (Figures 2.1, 2.2 and 2.3) show those forces or factors of development represented by different models in the discipline of literature. One is shown in Jeff Hulse's notes[5] on sustainable development (Oct. 2000):

> *"The simple model we will use to describe Sustainable Development is shown 'below'. This is also known as the Triple Bottom Line of business decision-making in the 21st century. The optimum solution is described as a balance between Economic Environment and Social issues."*

Hulse's Model considers that sustainable development originates when the three factors interact with each other, and equilibrium between them will achieve sustainability in development. This

[5] www.environment.detr.gov.uk/sustainable/index.htm

model omits the factor of culture because it is oriented for business decision-making. but it gives some important indicators of sustainable development.

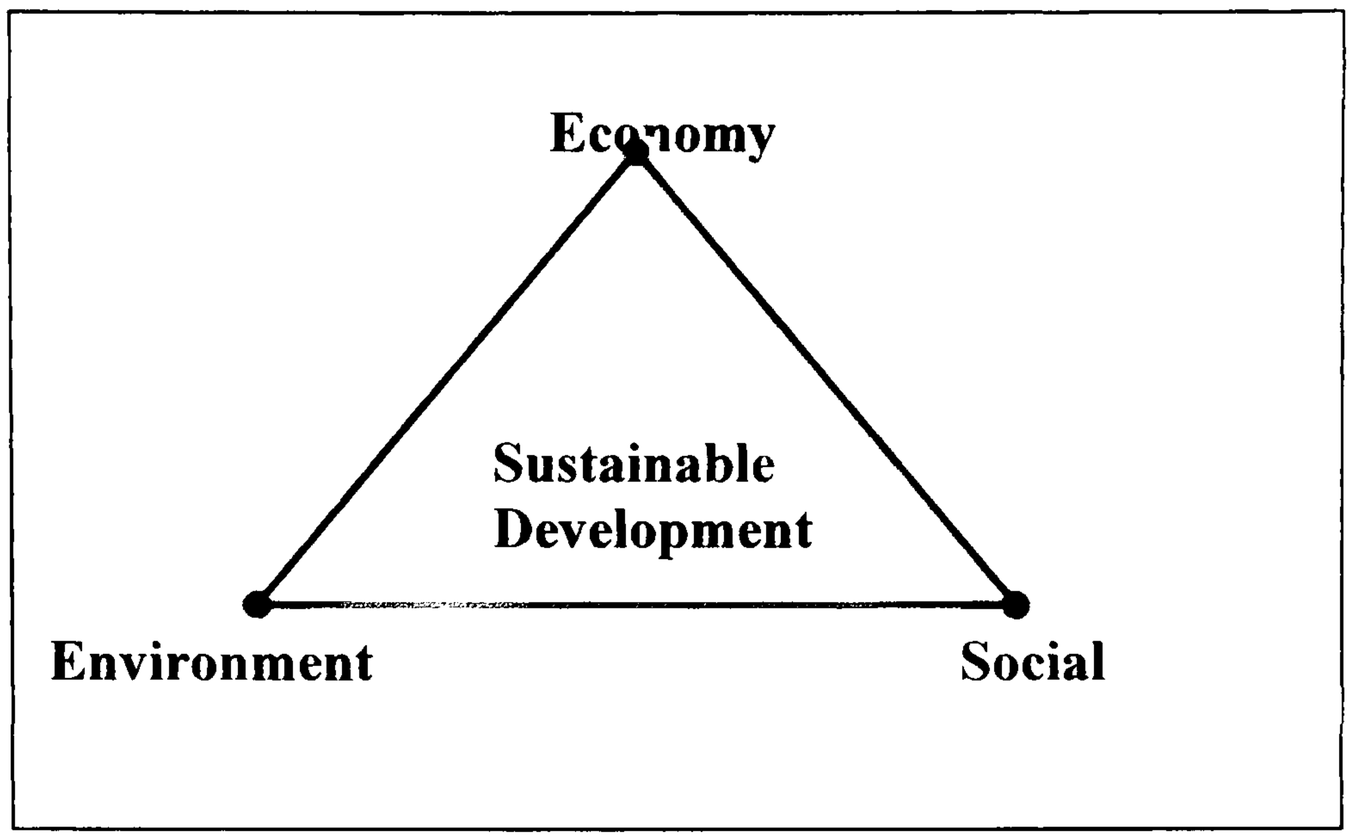

Figure 2. 1: The triangle-base model

But those who discuss sustainability in housing problems have stressed the cultural factor in the process of development. Bandyopadhyay (1992:94-127) suggests another model of sustainable development, considering these three factors but including culture as a factor rather than environment:

> *"The vector of a pyramid of triangular base represents the true progress of development. Indicators are tools that measure, simplify and communicate important issues and trends. They are benchmarks against which future progress can be measured. They can also help people understand what they themselves can do."*

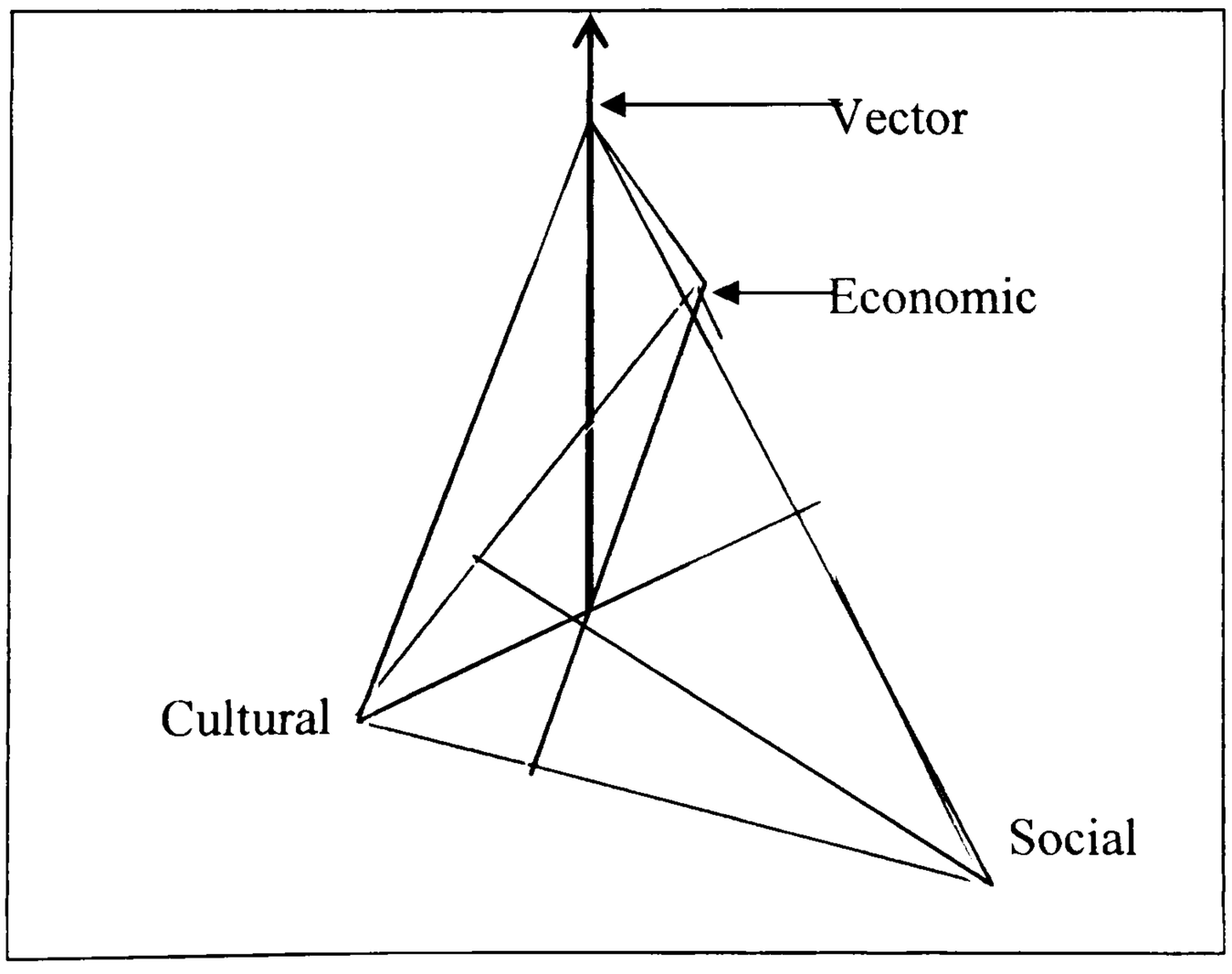

Figure 2. 2: A pyramid of triangular base-model

Bandyopadhyay (1992) stressed two main tools that can be achieved by this model.

- The model can measure, simplify and communicate important issues and trends in the process of progress of future development in a housing context.
- It can also help people understand what can be done in the evaluation of what people have done.

The second tool consolidates the idea that a model can help in understanding the issues which assure the efficacy and meanings of environment in which people built their own living environment [6]. In this sense we can extract a model of a pyramid of square base that combines the four indicators, social, cultural, economic and environment. The research focuses on key elements, which are extracted from the suggestion of researchers in the field of social sciences such as Roberts (1979) Elliott (1999) and Rapoport (1993) in his model of culture/built environment, which was discussed at the beginning of this chapter. The aim of the model is for all headline indicators to move in the right direction over time, or, where a satisfactory level has been reached, to prevent a reversal. Where the trend is unacceptable, the planners and designers will adjust policies accordingly, and will look to others to join them in taking corrective action

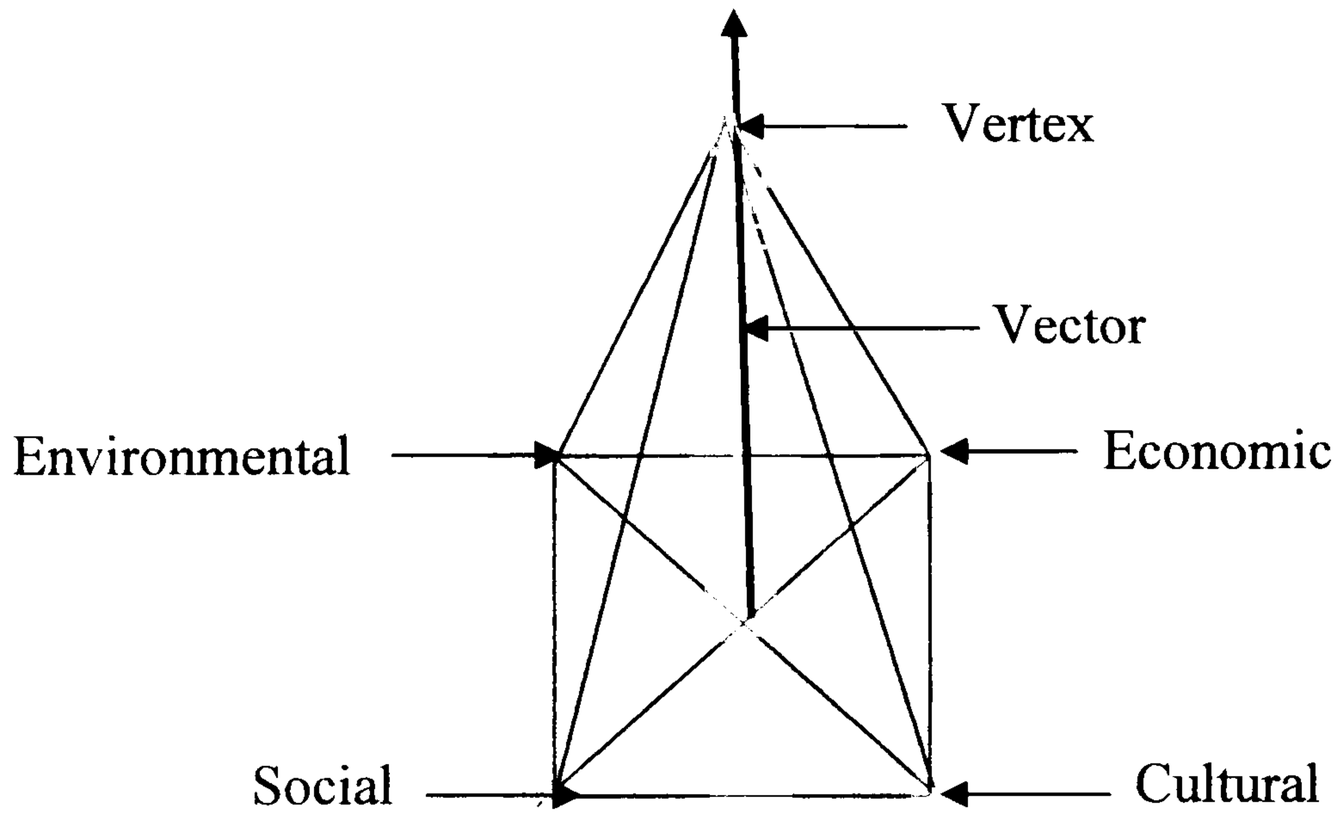

Figure 2. 3: The forces of development represented by the pyramid model.

The four corners of the base are occupied by the social, cultural, economic and environmental factors in constant interaction with each other resulting in the creation of forces of development that form the four pyramid surfaces that converge at the vertex. The vector, which runs perpendicular to the base and passes through the vertex, represents sustainable development. The optimum solution is described as a balance between economic, social, cultural and environmental issues. The question, therefore, is how can we balance these issues within vernacular organic development?

[6] For more discussion visit the web site of the 1999 International Institute for Sustainable Development.

2.5.3.2 Criteria for Evaluation

The following table (Table 2.1) shows the criteria of evaluation for the settlement's Levels and sustainability indicators and what criteria of evaluation are suitable at a certain level and for the sustainability indicators. This table is drawn from the summary of discussion of these factors of development in rural settlements.

	Category	Description	Evaluation
Contextual Levels	The Regional Level	The regional setting of the built environment	Chronological Contextual understanding of a context and changes in structure and settlement evolution. Continuation and adaptation assessment through assimilation and morphological arrangements
	The Village Level	Settlement patterns	
	The Dwelling Level	Dwelling forms	
Sustainability Indicators	Social	Kinship, Family structure, Social networks, Roles, Status, Identity, Institutions, etc	Mapping out changes in relation to temporal development; changes in lifestyle, activities and quality of living, Adaptation assessment through changes in community values and cultural norms, Changes in built environment and system of settlements, how they react to environment, Do economic expectations valued socio-cultural and built environment changes?
	Cultural	Worldview, Values, Images and Schemata, Lifestyle and Activity System	
	Economic	Economic values, Access to work, Home-base Enterprises and Farming production	
	Environmental	Built Environment, as Cultural Landscape, System of Settlements, organisation of: Space Time Meaning Communication	

Table 2. 1: A framework that can be used for evaluation of how vernacular settlements achieved continuity in building processes in vernacular development, Source: the model adapted from different thoughts of cultural analysis.

2.6 Socio-Cultural Context

2.6.1 Culture and Traditions

The discussion of traditional vernacular architecture leads to the consideration of the socio-cultural contexts. Researchers like Low and Chambers (1987) consider culture as a fact of history and a basis for the historical process. It describes both the materialistic and the spiritual basis of human activities. The elements of the materialistic culture are technology, communication, productivity, etc. Built environment is 'indeed' related to images of self-value and symbols that must be intimately linked with culture. Low and Chambers (1987:2) conceptually summarize 'culture' as follows:

> *"It is a way of life typical of a group, it is a system of schemata transmitted symbolically, and it is a way of coping with the ecological setting."*

These factors of culture act as a blueprint for bringing components together, it also gives meanings to particulars, and it gives meaning to define groups. Therefore the term culture can be applied to many different sized units of society, from global culture to regional culture, or even family culture. Thus there are many levels of culture emanating from aspects of society, from global to very small social units, such as the family dwelling unit. Therefore the term attracted many researchers from different fields to study the concept. For the purpose of the discussion, two meanings of culture are taken into consideration, anthropological and social descriptive. According to Altman, (1980:3) culture has several components,

- First, *"it refers to beliefs and perception, values and norms, customs and behaviours of a group or society"*. Therefore culture includes what people believe to be true of their lives and environment.
- Second, *"the term culture is used to indicate that cognition, feelings, and behaviour are shared among a group of people in consensus."* This means that for culture to exist, they share a common way of viewing living and the environment. This does not mean that they agree in all respects of their lives but they share a common consensus.
- Third, *"culture implies that there are shared believes, values, and styles of behaviour are passed on to others, especially children, and that the socialization and education of new members of the culture help preserve consensus from one generation to the next."* Thus children learn their behaviour, moods, beliefs and values appropriate and congruent to the family and to the larger society.
- Fourth, *"in addition the three discussed components of culture that reflect society's values, beliefs and practice (mental and behavioural process) culture can appear in objects and physical environment."* Altman (1980:4) confirms, *"Home design, community layouts, and public buildings often explicitly reflect the values and beliefs of a culture"*.

In this sense the physical built environment and settlements, are the manifestation and indicators of larger configurations of cultural facts. Therefore culture is an important variable in explaining artefacts, behaviour and any other work. Some researchers used these types to trace the spatial origins and dispersal of cultures. Wagner (cited in Duncan 1981:100-101) speaks of culture as an active force which:

> *"Moves a process or property by a dynamic system on new states and aspects, as does the medium of community in which it circulates."*

People express ideas (culture products) through their built environment which is a cultural object. The manifestation of culture in the built environment is linked to continuity of the settlement pattern. Therefore historic preservation is regarded as one of several design criteria that link people to their environment across the past, the present and the future (Altman 1984). Culture, in this context, can be interpreted as the way in which people use their experiences to guide them to express their ideas through the built environment:

> *"Homes and dwelling objects are also important to identify a symbol of the past, enabling the individual to define his other relationship to public and private worlds of the former times"*, (Hummon, 1984 in Low & Chambers 1989:218).

Therefore, old homes and the way they were designed and used constitute the major public links to the past in everyday life. Built environment, dwellings and household objects may play a significant role in mediating time and reality to the extent that they become signs of temporal process:

> *"Facilitating either the differentiation of time into socially or personally significant unity or acting as material of the past and the future periods"*, (Hummon, in Low & Chambers1989:218). *"Anthropologists have learned that tradition is a dynamic and ever current."* (Zuniga in Bounder1989:38). *"Lessons about the continuity of inventor of tradition in human societies are well known by now."*

Zuniga has even noted that, although people often position tradition in contrast to modernity, in fact tradition was defined in the past as a modernist idea. This can be contrasted with Avilson's (1938 cited in Keipal 1998:5)[7] statement that:

> *"Society can not be both modern and traditional at the same time."*

However, the habits of tradition may continue in comparing societies, but people should realize that those habits might reject the right tradition, and then traditions are desirable to continue in modern societies. The ambiguity and flexibility of tradition has enabled new concepts to survive

[7] www-rak.sggw.waw.pl/~rol_kbot/histo_an.html

and develop. In this regard, tradition does not only provide order and regularity of social environment, but it also provides the possibility of communication.

Rapoport (1969:6) has discussed the significant values of traditions in contemporary societies. He states:

> *"As long as the tradition is alive, this shared and accepted image operates, when tradition goes, the picture changes."* He continues, *"Without tradition, there can no longer be reliance on the accepted norms."*

Therefore tradition is an important factor to develop cultural norms but we argue that ethical values and laws enhance the traditional values and sometimes force them to change some traditional habits. Islamic laws are very strict in refining these traditions. However, for our purposes the term culture has several key components, which can be referred to, (see Altman 1989:4); or to summarise the key points made by Altman earlier:

- Beliefs and perceptions, values and norms, customs and behaviours of a society,
- Feelings shared between the members of a society,
- Beliefs and feelings inherited by consecutive generations or successors,
- All these norms, values and feelings appear in the built environment, Rapoport (1982) also defines that, the tradition inherited through built environment.

Traditions operate these values. Interaction and change in society and its built environment keep what is modern in the past to be traditional for the present and so the future. But the questions are how these different aspects of culture influence or are influenced by the built environment.

2.6.2 Culture/Built Environment relations

As we saw, there is a relationship between culture and housing or in other words, between family and housing, which can be discussed either in terms of a process or by looking at housing as a product or by looking at both. Culture is a theoretical construct. No one has ever seen or will ever see or observe culture, only its manifestations, effects or products. Some of the expressions of culture are mostly lifestyles, activity systems, values and images, which characterize families and will be used as indicators for future ways of living. Thus, studying the traditions' acts as:

> *"A mechanism, which has no authority but it forms the most important service of our knowledge and serves as the basis of our thought and action",* (Rapoport, 1969:6).

This will introduce us to the continuity of settlements that adapt their surrounding environment. In this research an orientation to the relation of components within the built environment, culture and people who created the vernacular traditional system interplay to form a social system, which means that all these components are in unity.

2.6.3 Social System

Society and space are clearly related. Many researchers like Rapoport (1969), Carmona (2003) have identified that an understanding of the relationship between people and their environment is essential in urban and rural design. Researchers identified many claims of the relationships between people and their environment:

- The first claim is that the environment has a determining influence on human behaviour.
- The second claim is that people are not passive. They influence and change the environment. So they are a determining factor in environment change.
- The third claim is that both people and environment freely affect each other. They can both influence and change each other. It is therefore a two-way process.

It could be argued that whenever the individuals know and adapt to their environmental surroundings they can live mutually with them. Thus, the situation of individuals in each environment is of significance. The person's goals and values, available resources, past experiences, etc., develop this situation (Carmona 2003). This individual and its family form the structure of a society that establishes an order on their living spaces and reflects their character on these spaces. The family contains the socio-economical structure of society in itself. Even though it is a small element, it forms the core, which makes up the future of society. The family needs a certain space, namely the dwelling, to achieve this function. Dwelling will be discussed in detail in chapter seven. Furthermore, it might be argued that the true test of an organised society is one that attempts to meet all the human needs concurrently (Carmona 2003). Such human needs differ from society to society and place to place. The choices people make in any given settlement are influenced by society and culture involving beliefs and values, which are passed from generation to generation. The work of Maslow (1968)[8] on hierarchies of human needs stated a five-stage hierarchy of basic needs, in order as follows:

- Physiological needs: to achieve warmth and comfort for individuals,
- Security and safety needs: to feel safe and secure from harm,
- Affiliation needs: to belong to a community or group of people,
- Esteem needs: to feel valued by the others
- Self-actualisation: to express the artistic feelings.

This work could be relevant to people of well-settled places rather than in traditional rural settlements in places like the Gezira area of the Sudan. It is noticeable that the affiliation needs may be made to the higher order in the hierarchy.

[8] www.marketresearch.org.uk/net**work**ing/erg/downloads/14jul04

2.6.4 Cross-cultural Perception

Part of the research strategy is to adopt cross-cultural perception. Altman (1980:4) argues that

> *"Cross-cultural analysis is rewarding in itself, and it also provides a vehicle for learning about one's own culture through the window of other cultures".*

The research discusses both the colonial culture and local culture in the built environment in the Gezira. The relationship between culture and environment is a two-way process. Over time, people's choices create distinctive local cultures that shape and reinforce their environments and are symbolised within them. Based on prior experience, such choices are motivated by shifting criteria related to goals, values (both individual and societal) and preferences. While people--and the choices they make--collectively create a socio-cultural context, they do not do so in a vacuum. Choices are shaped by, for example, the ability and willingness to pay (economic situation); the constraints and opportunities offered by the environment; the availability and cost of technology and resources. As the rural settlements and socio-cultural contexts grew in an economical background in the case of the Gezira area of the Sudan, it is of significance to draw on the economic growth and its relationship with the social, cultural and built environment aspects to complete the picture of changes and adaptation to the built environment. King (cited in Rapoport 1982:52) argues that in the colonial settlements:

> *"The distinctions between the cultural sections are not only social and spatial but are also physical, being manifested in the built environment of each cultural section. In this sense, the colonial city (or rural settlements) can be seen as a cross-cultural laboratory for investigating how two or more cultures, operating in the same geographical environment but at different levels of social, economic, political and technological development, respond under conditions of colonialism to that environment and provide for human needs each according to the values, beliefs and behaviour of its own social and cultural system".*

2.7 Economic Development

Economic development has two potential benefits to societies, whatever the intention of its implementation and the theories that have been put forward to distinguish between the economic growth and real progress in a society. The two supposed benefits are the income growth and improvement of the quality of people's lives in the form of its social and cultural values. These factors interact to increase the probability of enhancing the quality of life. But how they could interact within the process of development is questionable. In the twentieth century the World has experienced major changes pertinent to the planning and environmental quality of human settlements due to the establishment of agricultural projects, especially in Africa, as in the Sudan.

where the phenomenon of imbalance in the process of development was recorded by many of the UN organisations. The exclusion of the peasants' settlements from project planning at the first beginning and the bias to urban development excludes the rural areas from progressive and integrated development. Rural areas are meant to achieve economic growth rather than a development that embraces the wider concerns of the quality of life or even satisfies the minimum requirements of people's socio-cultural needs, such as shelter, health facilities and education.

Thus this imbalance in the process of development has inserted limitations to the rural settlement development. Then how can we achieve this balance? Many organisations developed ideas to remedy the pitfalls as follows:

- The World Bank strongly supported the economic growth with redistribution, aiming to increase income by creating more jobs in the informal sector and hence easy access to public utilities, which, unfortunately, were directed to the urban areas only.
- The International Labour Organization (ILO) considered the basic Needs solution was the way to deal with poverty. The development of the human being, socially, mentally and physically should be first and then seeking ways of achieving that.
- The Stockholm Conference (1999) raised the ecological approach. The old view of the Earth, as a storehouse of resources to be freely developed to the human use, means exploitation of land. In the new view Earth is to be considered as an ultimately unified system of living species and interactive, regenerative biological processes that may supply human needs as long as they are respected.

The three international bodies agreed on certain issues to develop the poor; first to secure the basic social needs, access to economic facilities and enhance the environmental conditions for the sake of future generations. The pace of economic growth, as a direct result of the inauguration of the Gezira Agricultural Scheme has brought about significant changes in the social and cultural atmosphere in the Gezira area of the Sudan. Although some achievements have been recorded in terms of economic growth, certain mistakes may have been committed in the process, which may have seriously affected the holistic development, and these changes are nowhere more clearly manifested than in the built environment and settlements. Thus development can be defined as a process, which initiates social, cultural and economic factors that interact together for improving living conditions. Bandyopadhyay (1992:102) discusses the progress and development as shown in the Model (Figure 2.2) in the following terms:

> *"Thus, it can be said development and progress are holistic processes, which for the purpose of analysis, can be broken into three component parts, broadly identifiable as, economic, social and cultural development. These components*

> *interact freely in the course of true progress, moulding each other and supporting each other on its way."*

The above arguments make it clear that neither the economic approach nor the cultural approach is reliable to lead development. Thus other approaches were developed. The arguments of Sharma (in Bandyopadhyay 1992:103)) about the relation of economic factors and non-economic factors highlighted the following views:

- It may be argued that social and cultural forces do not interact with the economic forces. No factor has any influence on the other.
- It may be argued that socio-cultural forces and economic forces dominate each other. Economic factors determine social and cultural forces and vice-versa.
- It may be argued that social cultural forces interact freely with economic forces. Factors influence each other and no one dominates the other.

According to Professor Myrdal (cited in Sharma 1980) there are two theories which could be conducted.

- The material case factor theory, which regards economic factors as determining all social relationships, cultural peculiarities and human consciousness, Karl Marx backed this idea, (Carmona, 2003)
- The ideal case factor theory, which regards social and cultural factors as determinant of economic change, Hegel backed this idea (Bandyopadhyay 1992).

According to reality in life it is difficult to maintain such approaches. This identifies the economic factors and non-economic factors as possessing independent quantities of their own. Both factors should interact freely and the final result is the result of their free interaction. Thus middle approach could be reliable:

> *"A middle position in which social and cultural factors are only two variables among many, including the economic, in which there is interaction between economic factors on the one hand and social and cultural on the other."* (Kindleberger, 1965:19)

This approach coincides with the third argument above, which states that social and cultural forces relationships with the economic forces are freely interacted can be an ideal way of thinking of development in settlements and the built environment. Although definitions of development suggest no end point or final condition, there is nevertheless a limiting factor, the factor of sustainability. (Moughtin, 1999: 30) discusses that:

> *"It is not only important that each country should sustain or improve upon its own level of development, and also, important to manage resources to avoid global sustainability limits being surpassed."*

2.8 Planning and Government Interventions

Usually, planners and designers take the lead in implementing the policies that are supported by laws to achieve what they think sustainable. Do these planning and designing theories fulfil their purposes? The following section will trace some of the planning theories and machinery forces related to the subject of the thesis hoping to clarify the purposes that are to be achieved.

As we identified before, planning is a tool to think ahead as to how to organise virgin or occupied lands through different methods and theories, hoping to achieve goals at both the national level and local level. It is, also, of significance to understand the related planning theories that support the idea of intervention into the informal built environment and how the researchers look at it to understand the commitment towards the settlement orders formed informally and the machinery used to implement such theories in the Sudan, especially in the Gezira area of study.

2.8.1 Definitions of Planning

In the literature planning definitions range from broad to narrow meanings, emphasising various aspects. They range from a broad definition by Chadwick (in Alexander 1992) that planning is a process of a human thought and action based on that thought which is a very general activity. Westley (1995) considers that planning acts as an intervening variable between knowledge and action. Webber (in Alexander 1992) defines planning as a procedure for arranging beforehand, by deliberately sequencing actions so as to achieve an objective. And at the narrowest end that is defined by Vickers (in Alexander 1992:72) that 'planning is what planners do'. On the wider scale Dror (1973), Hall (1992) note that planning is a process of identifying or defining issues or problems, formulating objectives or goals, and thinking of ways to accomplish goals and measuring progress towards goal achievements. According to these definitions, planning can involve various disciplines, such as urban/rural and regional planning, residential planning etc.

In addition, planning refers to decision making about future action and reform (making things better and sustainable) of human settlement, with the focus of rural residential development. In other words, delivering better national, regional and local planning that promotes a better quality of life for all community members in rural areas. Here, residential development refers to the process of provision of dwelling units (houses, buildings, or other rural structures that are suitable or capable of being used for residential purposes), with easy access to: land, social activities, commercial activities, cultural activities and public services. In this light, human residential development encompasses 'the physical world and also the realm of public and social services' (Wachs 1995:xiii). To understand the phenomena of residential development planning, planning will be explored according to the idea of the 'linkage between knowledge and action'. This 'link' idea addresses the importance of the theoretical knowledge of planning process. Planning will not

be restricted to only the purview of planners; however, planning will be interpreted as human social activities carried out by public institutions with varying degrees of concern for, and definitions of, the social interest. This position on the continuum fits with the most attractive definition stated by Westley (1995:396):

> *"Planning acts as an intervening variable between knowledge and action".*

The line builds on Friedman's concept (1987) of linking knowledge and action. Friedman (1987) argues that this link guarantees efficient planning that achieves preferred end products of social reform and progress. According to Davidoff & Reiner (1973:15), efficient planning has meant the promotion of sustainable social, cultural, economic and physical development. They define efficiency as the:

> *"Utilisation of resources that satisfy the particular preferences of individual actors, as such preferences are determined and aggregated in a manner accepted in a given society. Efficiency thus is measured in terms of the purpose it serves."*

An effective and efficient planning system, therefore, is an essential tool for delivering the government's wider sustainable development objectives. To integrate the discussion in the literature, it will be helpful to describe the interrelationships between planning and the Gezira vernacular settlements.

2.8.2 Regional Planning

Murison & Lea (1979:2) describe the realisation of planning strategies in the Third World in these terms:

> *"The realisation that many planning strategies, which have been adopted in the Third World, are more concerned with symptoms rather than the real causes of development problems. It is obvious to any student of housing policy that few Governments can escape this reality."*

The Sudan has contributed to the problem and followed the same unrealistic solutions by trying to re-plan organic Gezira villages, forgetting that the traditional planning could be a system of planning and building continuity which may be needed for sustainability in architecture. The history of the Gezira area of the Sudan has much to do with strategies designed to benefit Europeans. Initially this led to the establishment of housing areas of European styles. Therefore, the strategy was meant to build government houses, mainly for the accommodation of British administrators. The Sudanese governments of Independence followed the same pace of strategy and continued producing housing only for government staff. Oram (in Murison 1979:43) discusses that in the following terms:

> *"Europeans living in colonies faced dangers to their health from tropical diseases. They tried to overcome this problem by erecting* cordons sanitary

> *round enclaves in which very high building and sanitary standards were enforced by government regulation. This policy still maintained today by indigenous élites, has led to planned, well serviced and well administered areas within town boundaries and unplanned, unserviced and often badly sited development on the fringes of towns (and rural villages.)"*

Apart from the British quarters or centres that were established within the agricultural scheme. which heralded by the colonial economic structure, the agricultural process, in addition to farmers, has led to an unprecedented influx of migrants from surrounding regions; even distant parts of West Africa. These groups of residents, depending on the prevalent tradition and social cultural circumstances, built their settlements in empty lands between the planned farms. That means the British approach to the exploitation of economic resources attracted migrants to the area and resulted in organic and overcrowded small hamlets and villages dispersed all over the scheme.

Then, these unplanned settlements became increasingly significant as later governments established schools, clinics and provided drinking water to most of them. This has added another dimension to the rural space domains dilemma in recent decades, that planning institutions have been unable to cope with properly. The reality of planning interventions in traditional settlements of rural Sudan often disappoints. In its operation and outcomes, planning practice fails to live up to its theoretical promise. Into an ideal vision of planning policy and decision-making come either economic or political realities. Actual socio-cultural reality is an assembly of relations through which people's everyday lives are conducted; sustainable thinking permits exploration of the interaction between the diverse networks of social, cultural, economic and environmental relations which contextualise the planning interventions into traditional vernacular forms. Understanding the context in a more specific way, it is better to state the main issues to be discussed in the study.

2.8.3 Planning Impact on Settlement Developments

Generally, planning has been fundamentally important throughout the ages in moulding the physical and social form of settlements (Herington 1989). In the Sudan, the word 'planning' first appeared in the land ordinances put forward by the 'Condominium Government' (Anglo-Egyptian Government 1904) to regulate the ownership of land in the Sudan (Gaitskell 1959). Then this was followed by the land ordinances (1905) to give the Local Authorities power to control land in connection with the layout and use of land for any purposes in the villages. And finally planning carried out by the State in the 1970s emerged as a desirable and credible alternative to the traditional planning that occurred in the vernacular villages.

Traditionally, settlements in the pre-scheme of the Gezira, depended on agriculture and pasture; however changes sweeping through the economy over the decades after 1925 have substantially altered the settlement patterns and built forms. They also developed a new base for the society. The profound traditional change in the area is the social, cultural and economic change which had its origin following the execution of the scheme in 1925. Cultivation became a labour intensive phenomenon, carried out by machines, men and women. Machines plough and hoe, men plant and women participate in the harvesting. This intimate relationship between the technology and people with traditional behaviour should be thought of as a force of sustainability to rural settlements. Rural populations and settlements have been increasingly affected by the results of many acts implemented in the area throughout history that may be summarised as follows:

- Traditionally Islamic and customary laws governed all the provisions of planning, land subdivisions, building regulations and ordinances in the traditional settlements but the economic development phenomenon created more settlements in new development patterns with a new land ownership system.
- Social conventions and cultural norms are part of the process which has influenced the planning and management of land. Therefore, the ownership system should account for establishing settlements by considering cultural relationships with other communities. In realization these relationships have affected the direction of the regional organic system of movement.
- The climatic characteristics influenced the way people adapted to natural forces. This is clearly seen in the way buildings are aligned and oriented towards favourable winds in arid zone areas. Shaded areas are being provided to cover the openings and walls, especially in the East or the South, from direct sunrays (insulation).

Later, after independence in 1956, it seems the area underwent a process of re-planning to enhance the way of living and inject some social amenities into these settlements. According to the reports of the Ministry of Housing in the Sudan and the UN about the area (1970), these trials of interventions have been unsatisfactory either for the residents or for professionals. They failed to accommodate growth and social cultural change in the villages, where planning interventions were envisaged. So the Government started to execute the following programmes, hoping to enhance the quality of life and production processes:

- Re-plan existing villages, which had grown organically, the programme started in the 1970s when the Ministry of Housing established a planning office in Wad Madani, capital of the Gezira State for the above-mentioned purpose.
- Serve the villages with water points and electricity; actually the provision of services began with securing drinking water sources from the 1950s while, after the 1970s, other services, especially electricity, were provided to most villages of the area.

- Confiscate farmlands for further residential development to meet the housing needs for the area. For the first time, in the 1970s, a plan was prepared of how to take farmlands for the extension of the villages without great effect on the ownership of the peasants in the village[9].
- Delegate some power to local authorities to decrease pressure by rural people on the local governance. Rural people have started to know their needs, when the central Government started the programme of participation in localities and this increased when this Government introduced more local authorities in the area in the 1990s.

However, despite these new strategies and good intentions, the government's thinking on sustainability is far behind in the field of the built environment:

- Many biases have served to limit the understanding of the needs of people in rural communities and settlements.
- All attention was given to supplying areas with services in a piecemeal way.
- Initiations and studies of rural communities have mostly focused on economic outcomes rather than an understanding of people's social needs that support sustainability.
- No considerations has been given to the morphology of organic settlement patterns, vernacular traditional forms, materials and cultural norms as an aspect of quality of life and verification of cultural and ethical values.

In the UN 21 agenda shown in table 2.2 there are two main issues of significance to rural Gezira, the management of human settlements and provision of social and cultural aspects to improve the environment:

- *Planning and management of human settlement for environmental quality;*
- *Environmental aspects of natural resources management;*
- *Identification and control of pollution and nuisances of broad international significance;*
- *Educational, informational, social and cultural aspects of environmental issues;*
- *Environment and development; International organization implications of action proposal;*

Table 2. 2: The main subject of the UN Conference on Human Environment Agenda (1993): Source Caldwell (1999)

[9] Before this action each farmer has 40 feddans for full rotation; 10 feddans for cotton, 10 feddans for wheat, 10 feddans for dura and vegetables and 10 feddans to be left fallow. In 1970 a new policy was introduced to take on feddan from each farmer in the village, therefore one of his rotations would be one feddan less. Then many feddans would be reasonable for the extension. This system satisfied the tenants and the Gezira Board.

2.9 Conclusion

Mostly rural settlements are characterised by their vernacular traditional development. Rural settlements are always bound to agricultural development and agricultural areas are always characterised by poverty, especially in African countries.

The development of such cultural language of development has been the focus of many researchers, as seen in this chapter. Researchers identified the importance of sustainability within such environments through exploring the meanings and values behind such behaviour. Also they raised the importance of planning to regulate and order these settlements.

Thus the challenges here are to understand the evolution of these built environments and how they sustain the living of those poor people who do a lot through their socio-cultural factors to support its fabrication. The question is how important the socio-cultural structures are to the future planning intervention, if we want to sustain built environment in traditional vernacular forms and materials.

CHAPTER THREE: RESEARCH METHODOLOGY

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3.1 Background

There is a long-running debate within the social sciences centred on the relationship between knowledge and the research methodology and the problem to be solved. The research methodology is a scientific way (social science or humanistic), which guides the research to solve the problem or answer the question/s of the subject being studied. Research into housing in developing countries has been one of the major challenges facing African professionals since the last decades of the twentieth century. The challenge is particularly important in agricultural projects where populations built their own environments. Rural housing in the Gezira Agricultural Scheme emerged organically as a result of political feasibility, rather than informed analysis of the existing situation of settlements or the demands of individual households for housing. However, in any field of research in African countries one may now and then find oneself:

- Exploring a virgin territory which has not been studied earlier; beginning with a rather vague impression of what should be studied, or

- Improving the existing information by enlarging the mapped area and connecting the new intelligence to the known facts that have been studied earlier; or

- Investigating object behaviour in a specific situation on the condition that the object is well known and perfectly studied, (Bulmer and Warwick, 1983).

In the map of Africa there are white areas, or gaps in knowledge, and the Gezira area is one of these African areas which have some gaps of knowledge to be filled but it has a chance of being well-studied locally and globally for its international importance as a cotton-producing area. Extensive theoretical knowledge and explorative research can achieve the filling of such gaps, (Bulmer and Warwick 1983). The method of the research depends on how much is already known about the Gezira area of the Sudan, the object of the study. One of the best ways to understand the object and the complex nature of its built environments is to examine the most ordinary scenes and events of a location without prejudice in order to uncover the rural vernacular traditional housing process (El Agraa 1985). Designing environments for tenants in the Gezira area is particularly important because the problems are acute because of its complexity and urgent need of better solutions. Design is always seen as a responsible attempt to provide an order suitable for the living of specific groups of people. It is considered a problem-solving activity that must be based on reality or an understanding of environment-behaviour relations.

The basic purpose of social research is to observe and collect information to make sense out of this information and observation to achieve the aims. This becomes evident when we consider that all social problems, nowadays, persist despite the clear presence of viable technological solutions. For example, the causes of housing problems can be due to the neglect of the forms, values and customs that make up organized social life and these are where the solutions are hidden. Those causes include beliefs about what is real in life such as the perceived importance of cultural traditions. Therefore, we cannot solve our problems until we understand how cultural traditions come about and persist. Babbie, (1998-xxi) said:

> *"The simple fact is that technology alone will never save us. It will never make the world work. You and I are the only ones who can do that."* He added, *"The only real solutions lie in the ways we organize and run our social research."*

Therefore, tracing the real information from the users and creators of the settlements is the proper method to explore the meaning and values of communities who developed the phenomenon of housing organisations that supported the production process in vernacular architecture and sustained the way of life.

The study of relationships between people and their built environment could theoretically be carried out in an infinite number of places; however, considerations of suitable issues for data collection for specific setting must be compatible with the criteria of evaluation. The previous chapter examined the main issues of the research within the theoretical literature. This chapter will focus on the research framework to explain how the fieldwork process itself directly influenced the direction and approach of the study.

The diagram (Figure 3.1) is a further step to address the sequential stages of this thesis. The first step is identifying the problem and what question/s could be answered. It also illustrates the objective of the study, then the steps of how to collect the data and the methods of analysis of the data to reach the research framework.

3.2 The Conceptual Framework

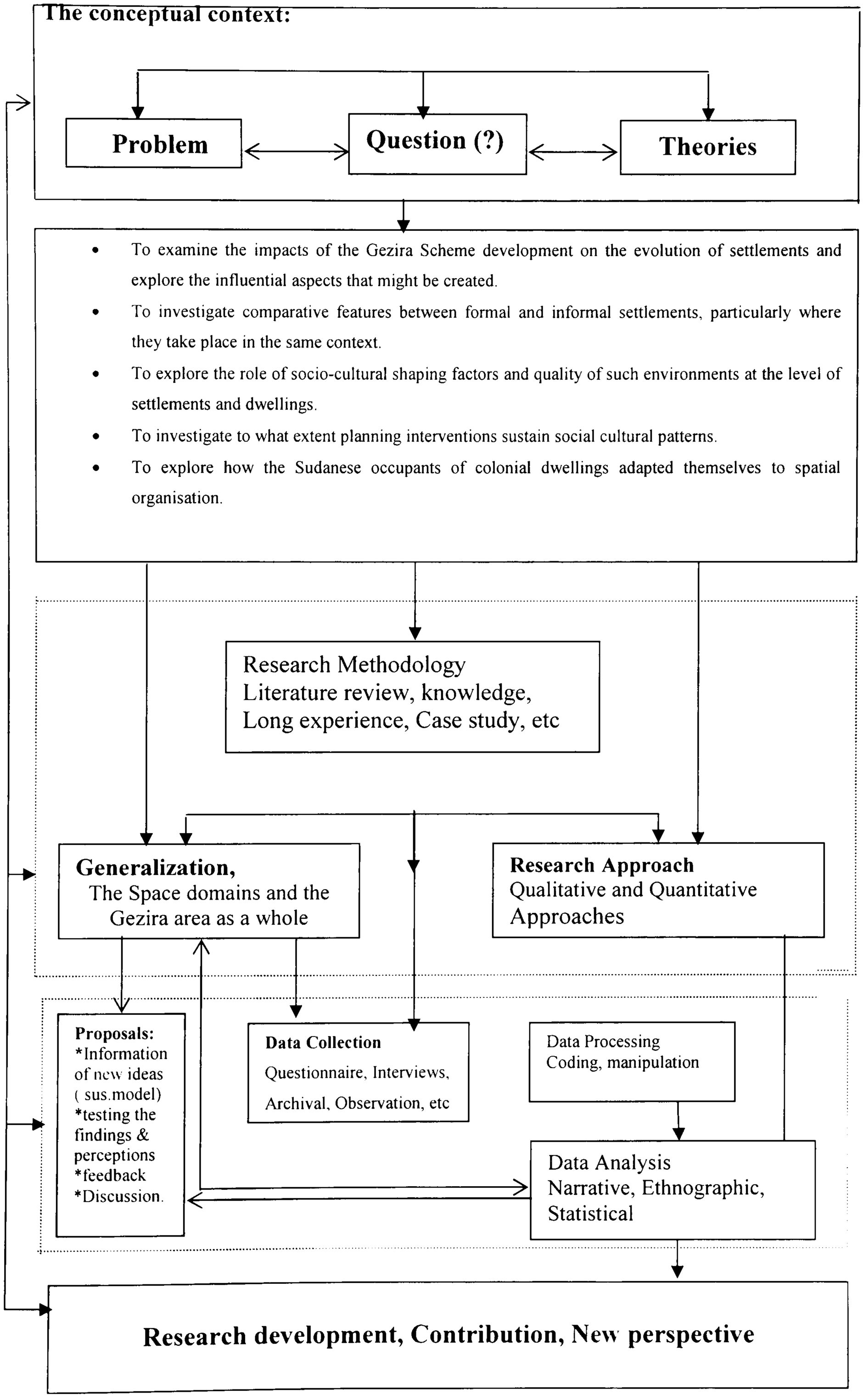


Figure 3. 1: The conceptual framework of the research. Source: based on theoretical studies.

3.3 Analytical Techniques

Information and data must be combined with some technique of analysis to investigate and make sense of any environment, project or policy. Tipple and Willis (1991: 3) discuss the aspect in these terms:

> *"Depending on the context, the data may range from intuitive perceptions on the part of the analyst, to a highly sophisticated set of physical and socio-economic measurements; whilst the technique or method of analysis can vary from some form of intuitive judgement or 'black box' in the analyst's head, to a well-specified and structured quantitative model in which the assumptions and the logical relationships in the model are explicitly documented."*

Research in housing covers both visual (physical components) and unseen parts (ethical values). Therefore both quantitative and qualitative (intuitive) methods will be used. Tipple and Willis (1991: 5) discuss the issue in the following terms:

> *"This is not to argue that intuitive analysis is irrelevant. Intuitive judgement can be extremely important in analysing issues not amenable to quantitative modelling, and also in reflecting on the results or output of quantitative analysis or methods. Quantitative analysis can, on occasion, throw up very spurious results, so the ability to reflect on such results in context is an art worth cultivating, serious errors can be avoided in this way."*

All techniques have their strengths and weaknesses and the researcher is responsible for assessing them and choosing an appropriate and suitable method for the analysis to be undertaken, bearing in mind the resources and the constraints of local conditions. This chapter is aimed at satisfying the need to bring together methods of research with analysis designed for local conditions of housing in the Gezira area of the Sudan. Tipple and Willis (1991) in the preface to their study stated that:

> *"Housing the poor in the developing world aims to show how methods of analysis can be used to improve efficacy and equity in housing projects and polices, with analysis designed for local circumstances."*

In this sense, the chapter describes a rich and untapped source of housing information and data for the Gezira area of the Sudan: that of how people have produced their settlements and adjust them to a given structured environment.

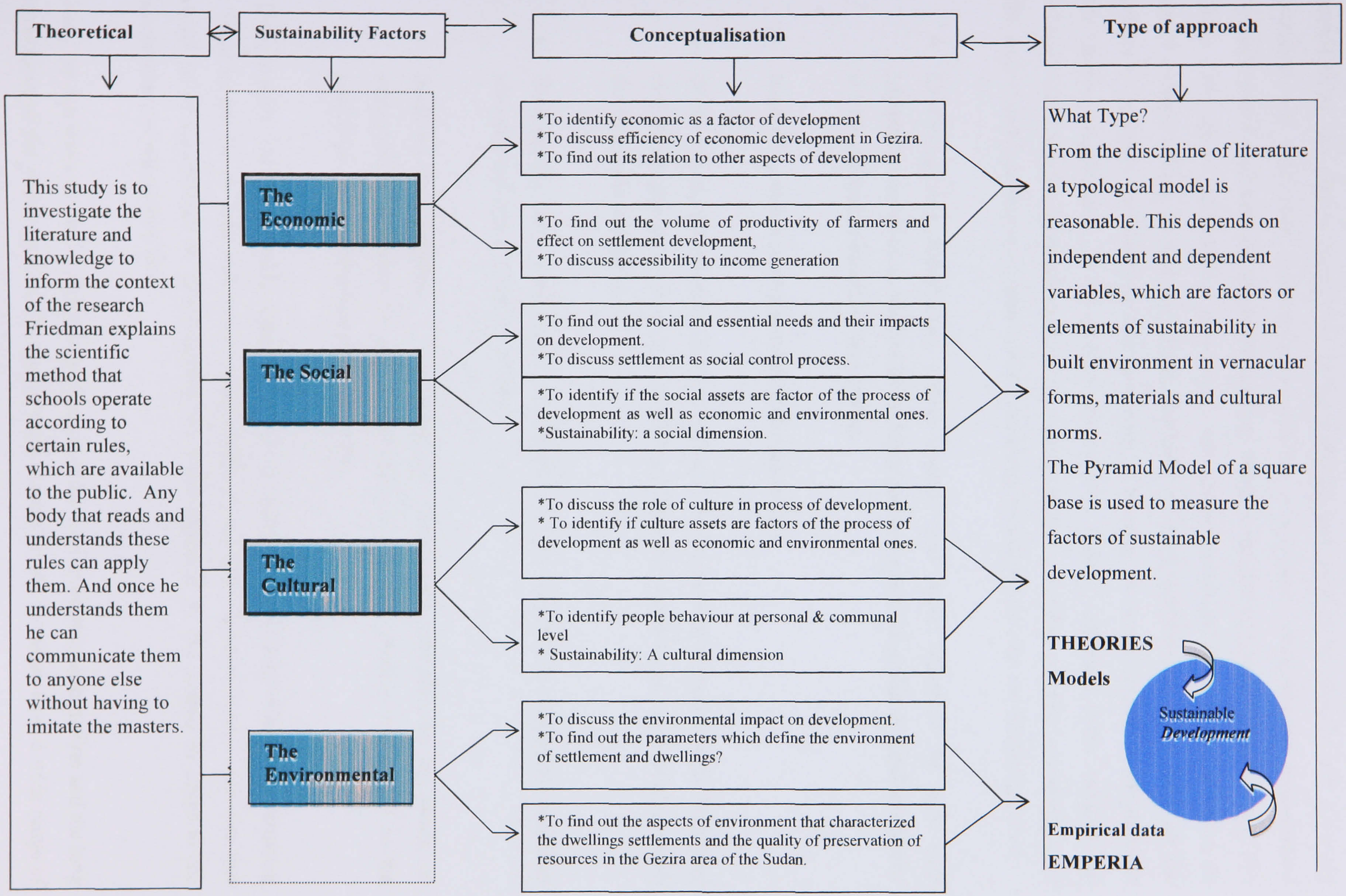
3.4 The Strategy of the Research

The research focuses on the socio-cultural behaviour and housing forms and highlights the sustainability in vernacular traditional forms. Since the study is investigating social cultural behaviour and formal and informal forms, the way of life and domestic activities will guide the research in data collection as well as the method of analysis of this data. The approach framework (chapter two) will be a principle for evaluating the socio-cultural production of forms in the built environment and the continuity process in producing vernacular architecture in the Gezira area of the Sudan.

The broad concept of this study is the nature of the interrelation of social and cultural structures within the holistic development process or man-made built environment. The goal of the analysis is the method of unveiling general laws and structures, which are true in all similar situations and perhaps anywhere. In more specific terms it is an attempt to uncover the expression of the Gezira identity, which is the product of social, cultural and economical factors that are based on the human response to the geophysical constants of the built environment. So the space domain is shifted from the Gezira at large to a region of a variety of villages as representative settlements to tell the story of development in the Gezira area. Then the investigation becomes more and more specific to the dwelling.

The main theme of this study is to explore the socio-cultural factors and their relationship to other development factors that have shaped the vernacular traditional built environment and helped in the continuation of building processes and the production of an adjusted organic order that increased the possibility of sustainable ways of living. The following diagram (Figure 3.2) explains the factors of sustainability that were discussed in the previous chapter in order to explain the main issues of importance to the evaluation of the organic orders created by the local people and how their forms fit the introduced built environment and match the planning intervention carried out by the Government.

Figure 3. 2: How to investigate sustainable development factors:



3.5 Design and Methods of the Research

The debate about the Gezira area of the Sudan recognises that living and working rural communities can play a strong role in the economy and need to be socially and culturally sustained and their built environment should be consolidated. Underpinning socio-cultural interaction and analysing the vernacular housing forms is the assumption of the questions of this thesis. The aim of the fieldwork is to obtain more focused evidence of the factors affecting the social cultural effects on both the formal and informal built environment. Then, what are the factors to be found out? Many factors have been involved in the formation and development of the Gezira villages, such as the physical environment, canals, cultivated farms, religion and ethical values, which will be discussed in the coming chapters. Further progress in understanding the socio-cultural factors in relation to both forms may be attained through the following issues:

- Examining and documenting values systems and social behaviour of both local inhabitants involved in traditional building processes and the group of inhabitants who use the colonial oriented housing setting.

- Identifying values in traditional built environments.

- Observing and documenting changes over time in the value systems and social behaviour of different groups involved in the traditional built environment and the manner in which these changes take place.

- Studying the users' preferences to document the conflict between traditional vernacular planning and formal planning systems.

- Studying the interaction of the factors of sustainability identified by the thesis, as sustainability embraces the social, economic and cultural dimensions as well as the contextual parties, as an integrated approach.

These aspects will be studied through two sources of information, the wide resource information related to the Gezira area and social survey fieldwork that may uncover certain activities that could be of significance to understanding the ways followed by the people to adapt to the environment in which they live.

First, the two ways are based on the large amount of the Gezira resource information and the long experience of the author in the field, and through examining the literature from a wide range of

disciplines, a concept for meaningful analysis of vernacular rural settlements can be explored through investigating the present situation of settlements. The investigation includes a range of built forms and building systems, which introduce a comparative study within the research. The arrangements for procedure will be examined through an analysis based upon those three levels of planning as known in the Sudan:

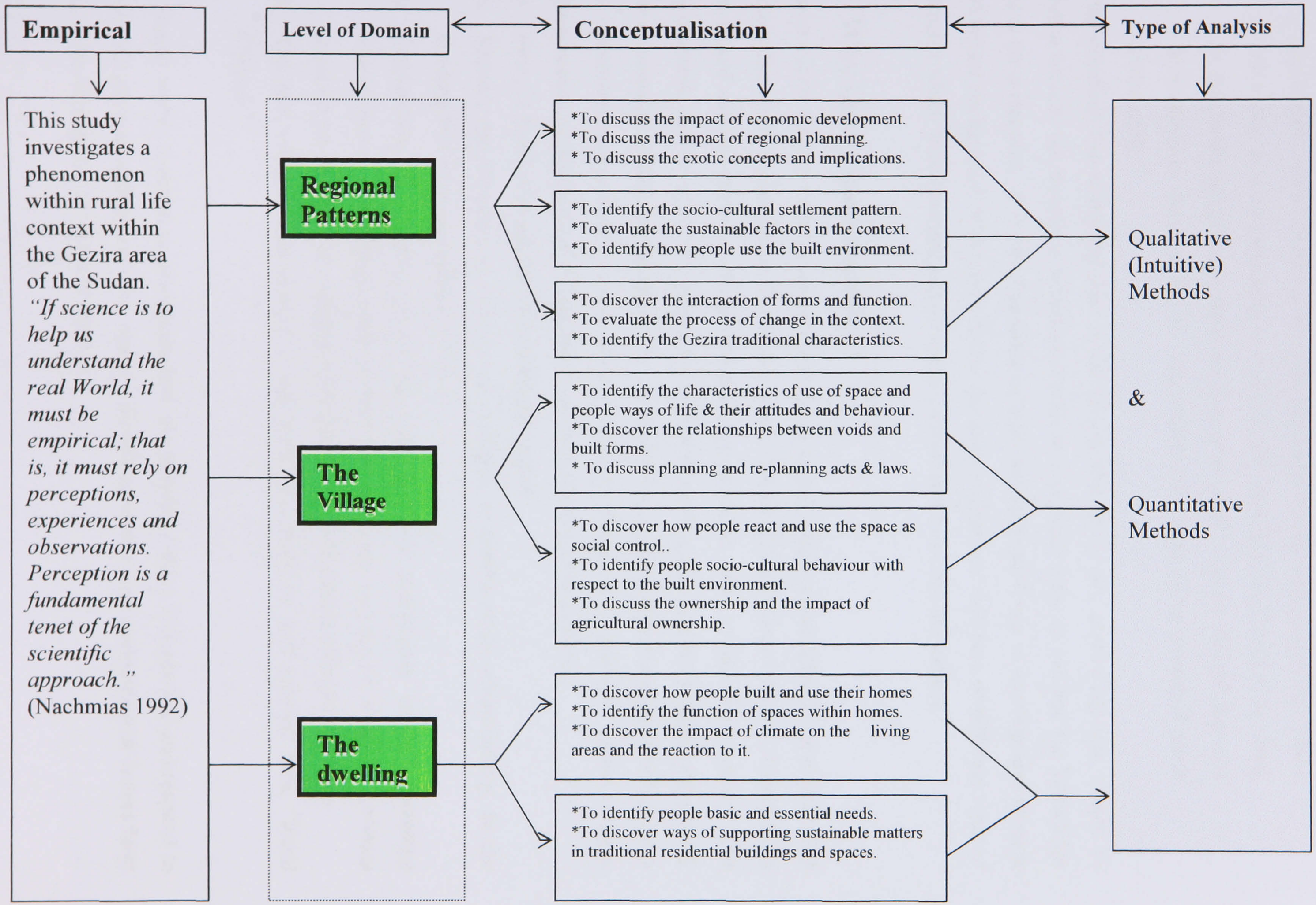
- The settlement patterns at the regional level so as to discover the cross-cultural interaction and how it works within the settlements taking into consideration social, cultural, economic and environmental factors (Figure 3.2). How do they interact within the process of development to create an order?

- The settlement patterns at the 'villages layout', taking into consideration different space elements, and their characteristics, and man-made sequence of mass and void, which result from the use of different types of spaces. That means the investigation of spatial organization at the local level represented by two space domains in the Gezira area of the Sudan.

- The dwelling organization, taking into consideration the plan typology and the mode of organization and its various types, its different architectural elements, the relationship between elements, the location of these elements and how they are configured within the houses. A more integrated way of using domestic space reflects less formal relationships between men and women and between adults and children. Segregation of use of space within the dwelling expresses an acute consciousness of status and represents formal relationships among household members. Such a phenomenon reflects the link between lifestyles and use of space. These meanings of use of space then indicate the meanings of the design of the home. These levels can be more clearly illustrated by the diagram ((Figure 3.3).

Second: the empirical study is of great importance for fieldwork accuracy and updating the information. Different methods of the research work could minimize the errors of each other, (Bulmer & Warwick 1999). The interviews, which were carried out parallel with the housing questionnaire and the comparisons with the other surveys, which had been undertaken in the area, gave reasonable results. The resource information gathered from Government officials translated ideas about the area and helped in minimizing the errors.

Figure 3. 3: How to investigate the Space domain:



Bulmer & Warwick (1983:23) consider empirical study as an instrument that unveils the mystery of an object or location of the study.

> *"Actually, reality exists in the empirical world and not in the methods used to study that world; methods are mere instruments designed to identify and analyse the obdurate character of the empirical world, and as such their value exists only in their suitability in enabling this task (the fieldwork) to be done. In this fundamental sense the procedure of scientific inquiry should and must be assessed in terms of whether they respect the nature of the empirical world under study,"*

We can conclude that collecting data in the Gezira area, as in any developing area, should be careful to include the historical information with an empirical study to validate the knowledge required for a research. It is also important to look into different levels of development through the historical background, which may reveal the relationships and closeness of different types of settlements which have emerged and the social cultural factors within the society.

3.6 Why these Space domains?

Sudan is a large African country (one million square miles) composed of different rural areas with diverse cultures and social issues. The Gezira area is one of the rural parts, which is characterized by its mixed cultural ethics, social activities and economical value to the whole country. Our space domains, the two selected villages, are located in an area supposed to be connected socially and economically, as they are located in the same context or the same agricultural block. As one of the themes of this research has a comparative nature, the Gezira area represents a good example for the existence of two types of village that have the following characteristics:

a. First, El Sereiha village has developed organically
b. Second, the Farmhouses village was a result of governmental programming, as the headquarters of an agricultural block.
c. Furthermore El Sereiha village has undergone a re-planning process (planning intervention) while Farmhouses village has not been re-planned since its colonial construction and has been adapted subsequently by its Sudanese official inhabitants.
d. The two villages were related to the same administrative and political area, "Rural Council."

It is crucial to this research to investigate how the people of these villages live and respond to internal and external actions and how social, cultural, economic and environmental factors have changed the development process in the area.

3.7 The Fieldwork

The method used to obtain information and to achieve the purpose of the fieldwork should be looked at in the following terms:

- The method of the work should be appropriate to the research objectives.
- It should be representative or generally applicable to the wider population.
- It should be of explanatory power to answer what? And why? Questions.
- It should be administratively convenient, involving consideration of cost, speed and organizational complexity.

Selecting the data collecting method depends on the type of the study, the determinant sample size, cost, time and accessibility between the researcher and the respondents. Prescott-Clarke, Atkins and Clemens (1993) discuss the three most commonly used methods in tenant surveys.

- Self-completion survey form; mainly as postal surveys,
- Telephone surveys, or
- Face-to-face interview; this might include structured interviews (questionnaire), semi-structured interviews or open-ended interviews.

In regard to this study it was decided that the third method (face to face method) and in particular the schedule interview questionnaire is the most appropriate for the data collection for the following reasons:

- The postal survey is considered to be an expensive method and allows time for the respondents to think about their answers, however the study deals with an area which does not have the postal facilities and the time for the research is limited.
- The shortage of telephone services and the low literacy standard make it difficult to do a telephone survey. Prescott-Clarke, Atkins and Clemens state that: *"Telephone surveys of tenant satisfaction are not advisable as they would give a substantial proportion of tenants no chance to express their view."*
- The study involves a wide range of household aspects and space configurations to be examined, which will be better examined by direct interviewing than by other methods.
- The interviews offer more control over the participation of the required sample survey than the other data collection approaches. Prescott-Clarke, Atkins and Clemens identify,

  "The appropriate person can be more easily identified, and the interviewer can ensure that it is this person who gives the responses."
- The face-to-face interviews allow a higher response rate than the other types; they, therefore, allow more generalisation. Generally (but not always) a higher response rate is achieved with face-to-face interviews than any other method, and there is thus less risk of bias.

3.8 Data Collection and Preparation

Documentation and data collection has been undertaken (2001) as follows:

a. Surveys and interviews.
b. Observations and photographs.
c. Data from governmental surveys and official documents - for instance Sudan Gezira Board documents (S.G.B).

3.8.1 Sample Size

The sample survey is based on the standards for the type of sample, the degree of accuracy necessary for validity and the amount of variation within a community. Thus, as the sample size increases, the efficiency of results increases. The sample survey of this study was determined by adapting a method developed by Krejcie and Morgan (1970), which was based on a formula that had been approved by the National Education Association, USA.

Based on this formula Krejcie and Morgan constructed a table (Appendix F) and a diagram that show the required sample size that the researcher should consider in a certain representative population (appendix D).

Applying the above formula to this study, based on the existing population of the villages, (El Sereiha and the Farmhouses Village), 200 families were chosen from El Sereiha village and 100 families were chosen from the Farmhouses village. These families could be extended families or nuclear ones. A cluster sampling method was used. This is appropriate for the division of the villages' morphology; the villages are divided into quarters (see following chapters). The communities are divided into geographical clusters then a sub-sample of each cluster is made to produce a/the total sample size.

The questionnaire covered 300 dwellings, 200 for El Sereiha and the responses were 100% while 100 dwellings for the other village with the responses 87%. The sample survey helped in reducing the number of refused questionnaires as other households replaced the missing ones. Such percentages are considered very reliable.

3.8.2 The Interviews

There are three types of interview that have been followed in this research:

- Structured interviews.
- Semi-structured interviews.
- Open-ended interviews.

3.8.3 The Structured Interview "The Questionnaire"

Although a sample survey was sufficient based on undertaking questionnaires in the Gezira context, it is important to understand the nature of the social structure of the local inhabitants. For the purpose of the sample survey to be effective, certain factors are essential to enable the survey to go smoothly; the following steps were taken to achieve good support from the inhabitants before starting the questionnaire.

At first a team of consultants including teachers and officials was appointed to help in the survey. Secondly, we discussed the purposes of the research with the key community figures and then explained these to the people in the mosque during the Friday prayers. This worked as a forum for awareness. The author's Gezira origins helped him in understanding and anticipating the reactions of the inhabitants. The local inhabitants were very helpful when they knew that the research was for the benefit of a scholar from their area.

The local authority officials were very enthusiastic about the research and asked for the results for their locality, while the other officials, especially the farm inspectors and irrigation personnel were very reluctant and some of them even refused to answer certain questions like those about income and ownership of other properties because they are government officials; they are not willing to give their exact income. From the answered questions, it was revealed that they receive money from other sources related to agricultural activities and husbandry. Another reason for their refusal was that they didn't know where the information might go. The reasons for not answering these questions are very clear because of their sensitivity and what they will lead to if they are carrying out illegal deeds to possess properties or earn more money.

3.8.4 The Semi-structured Interviews

The semi-structured interviews were run parallel to the questionnaire. Ten questions were put to investigate the chronological development of the villages in particular and the Gezira area as a whole. The semi-structured interviews covered officials and key figures and local inhabitants living in the particular space domain. The main figures were the local authority officials in the village, fields' inspectors; Faki (Qura'ặn teacher), Village sheikh, schools' headmasters, and other services officials.

The interviews were designed to provide background information from key community leaders to cover the missing information in the questionnaire and to fill the gaps created by the refusal to answer certain questions. This would balance the bias towards specific issues of the built environment in traditional society.

3.8.5 Open-ended Interviews

Sometimes an informal open discussion might guide the research to useful information for the study. During the research many conversations were carried out with local inhabitants and officials. These open interviews reveal the strong relationships between the families living in each quarter in particular, and within the whole village in terms of cultural values, such as women's relationship with space and privacy. The quarter represents the home of the large family dominated by women. This type of interview was usually run without structured questions. The information was gathered from the discussion at the time. Sometimes focus groups were arranged to enrich the discussion. It decreases the degree of bias that may be raised using formal interviews.

3.8.6 Other Data Sources

3.8.6.1 Observations

Observation to record people's activities and movements and a photographic technique with a physical survey were used to explain the physical meaning of the space and the environmental effects on built forms.

The social domains are as important as the economic and physical. The designer needs detailed information about the living patterns of people whose culture and lifestyles are reflected by their physical space domains. Analysing the 'latent social structure' and living patterns as they relate to the built environment can provide this information about the functional requirements of rural cultures. Then this can be translated into a form useful in designs and planning interventions.

In order to find out what patterns the physical forms allows we translate an observation of the existing physical built environment into the requirement it seems to fulfil. The field observer could apply the method as described in the following ways:

Looking at behaviour, one can notice the activities of local inhabitants and visitors. He can notice the boys playing in the space domains and other significant factors in the situation.

Looking at the built environment: the relation of spaces, private or public; what functions do they play in daily life? What are the conflicts between behavioural and physical domains?

3.8.6.2 Photographs

This observation alone would, of course, not be enough to make a final judgment. Both repeated observations and use of other techniques, surveying attitudes, informal interviewing, counting how often people do things and photographs are necessary to validate findings of all types of

research method used to collect data. Combinations of seeing and recording skills are required for space exploration and people movement. So, photographs were used to record issues that might not be covered by other methods of the research. This covers the following:

- Some domestic activities, which take place inside the houses, on roads, public spaces and other facilities.
- The basic, visual qualities of things related to the built environment, such as shape, form pattern, line, texture and colour.

3.8.6.3 Physical Survey

Although the official documents might provide sets of maps and plans for the existing conditions of the villages, there is still a need to measure many physical features of the space inside and outside the dwellings, such as the layout of the traditional houses and roads that have been altered by the inhabitants to suit their way of living. In this research, many surveys were carried out to understand the scale and morphology of traditional housing and the planning alterations within and adjoining the re-planned villages.

3.9 Criteria of Evaluation and Appraisal

Once the data is received and before it is submitted to analysis, it is often useful to perform some preliminary operations. These may include:

- Removal of data which is erroneous or irrelevant.
- Elimination of uninteresting factors to reduce or normalize the data means.

The empirical results will be analysed in the following way:

- Arrangement of the results according to their importance to the criteria of the research evaluation methods discussed in chapter two.
- Then consideration of how the frame suits the data, in other words the data is applied in a relevant place within the research.

As mentioned before, quantitative and qualitative methods were used to analyse and evaluate the collected data. There is a growing recognition of the benefits to be gained from combining quantitative and qualitative methods in development research. A number of areas have been identified in which World Development Agencies are making use of integrated quantitative and qualitative approaches (Bamberger 2000). These methods were used to analyse the data collected from the fieldwork.

3.10 Reflections on the Fieldwork process

Some difficulties confronted the fieldwork procedure in the Gezira area:

- The climatic conditions caused some delay in the programme of the research; rain was more than expected in the last few years. Rain and the type of the soil in the area hindered the movement of transport to get into the area.
- It took a lot of time to formulate a meeting with the local inhabitants, but we took the opportunity of Friday prayers for explaining the idea of the research.
- As most interviewers were women, the timing of the survey was limited to the daytime because girls are not allowed to work at night. Also, the daytime was not very suitable for the farmers who work all mornings and evenings on their farms.
- In the Farmhouses village an important observation was recorded. The inhabitants were very reluctant to have photographs taken inside their houses, but it was possible outside.

Bulmer and Warwick (1983) concluded that villages in the developing countries don't trust outsiders and that to the knowledge of the author is true, but to overcome such attitudes in any survey in rural areas the following considerations should be taken.

- Interviewers need some awareness about the village life, forms of social organization, behavioural patterns and leadership in the village, before undertaking data collection.
- A prepared entry plan with a planned procedure for entering each rural community is of important advantage to carrying out a social survey.
- Explaining the purposes of the research to the native people is very important to obtain satisfactory data.
- Sensitivity towards the officials is always a dominant factor in rural areas; it is important to know the leaders within the location before beginning the questionnaire. Local authority officials, field inspectors, school headmasters and medical doctors are the key local leaders. So to know the key figures is vital to know both the local inhabitants and officials in the area.

All these points were noticed and worked out in a successful manner, but there are other important points that should be mentioned; the Gezira area has experienced many social surveys and censuses, which also helped in the fieldwork of the research. Local people consider any questionnaire or gathering of information is connected to the government. To overcome a degree of suspicion the following steps were taken:

- The interviewers were chosen very carefully from students of the same area to build confidence between the interviewers and respondents; there is a great respect for educated people in the area.

- Explaining the aim of the questionnaire to the interviewers, respondents, officials and key figures introduced the idea of the research and helped greatly in undertaking the survey in a reasonable time and efficiently.
- There was an important point of a significant effect; acquaintance of rural people with the author and his work encouraged them to give all the information as much as possible.

3.11 Respondents' Demographic Data

The survey focused on the configuration of living, private and public space; how do the rural inhabitants use their place, what do ways of using space represent in terms of the lifestyles and consequently what meanings are attached to the design of the home? In order to answer these questions the questionnaire survey was structured to address the following general fields of interest:

A) HOUSEHOLD STRUCTURE

a. Number of households in the house;

b. Number of persons per household;

c. The marital status;

d. The social aspects of the household; Sex; Age; Education and Work;

B) HOUSING TYPOLOGY

a. Types of accommodation;

b. Types of dwelling;

c. Ownership;

C) FORM AND SIZE OF A DWELLING

a. Areas;

b. Number of rooms;

c. Open spaces and courtyards;

d. 'Diwan' as reception space;

D) DWELLING CONSTRUCTION

a. Materials;

b. Skills;

c. Quantity and quality;

E) LIFE STYLE

a. Attitudes;

b. Satisfaction;

c. Adaptation;

F) SERVICES AND AMENITIES:

a. Water;

b. Electricity;

c. Sewage;

d. Drainage;

e. Health and education;

As mentioned before factual information (e.g. demographic data) was also required. Open answers and comments were recorded, and all these answers were subjected to statistical tests, using the SPSS program for analysis. As noted before, the total number questioned in El Sereiha village was 100% of the 200 families which were surveyed, while in the other village, the Farmhouses village, it was 78% out of 100 families questioned.

3.12 Characteristics of the Respondents

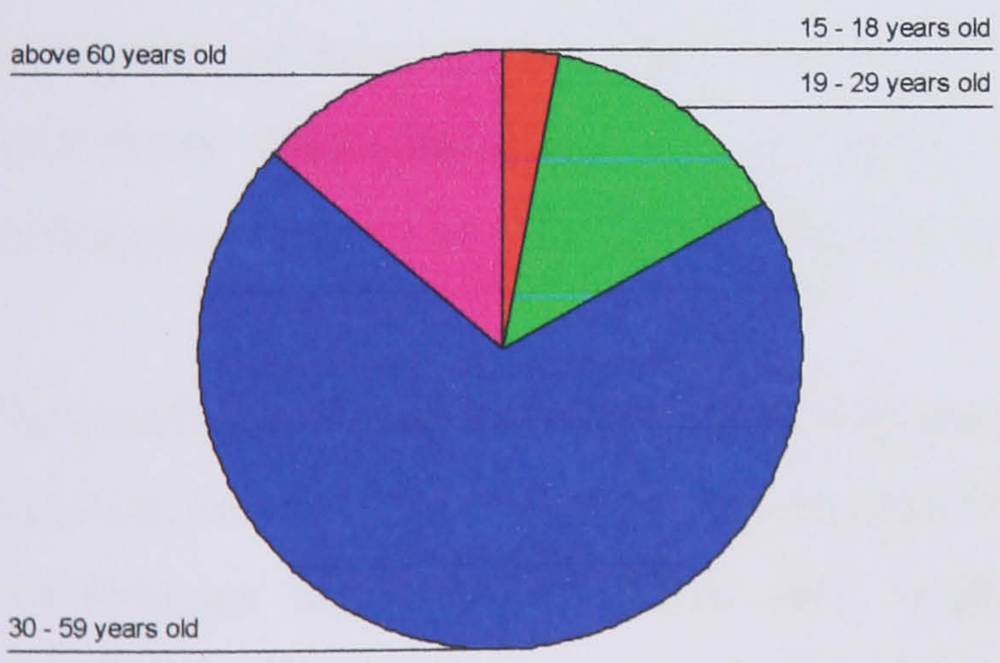
Respondents in El Sereiha village are firstly farmers or are related to farm working. Of the respondents, 67.5% are aged between 30 and 59 and the rest are aged as shown in the chart (Figure 3, A). In the 'Farm Houses Complex' most of the respondents are government officials. Of the respondents, 67.5% are aged between 30 and 59 and the rest are aged as shown in the chart (Figure 3, B).

Frequency & Percent Table

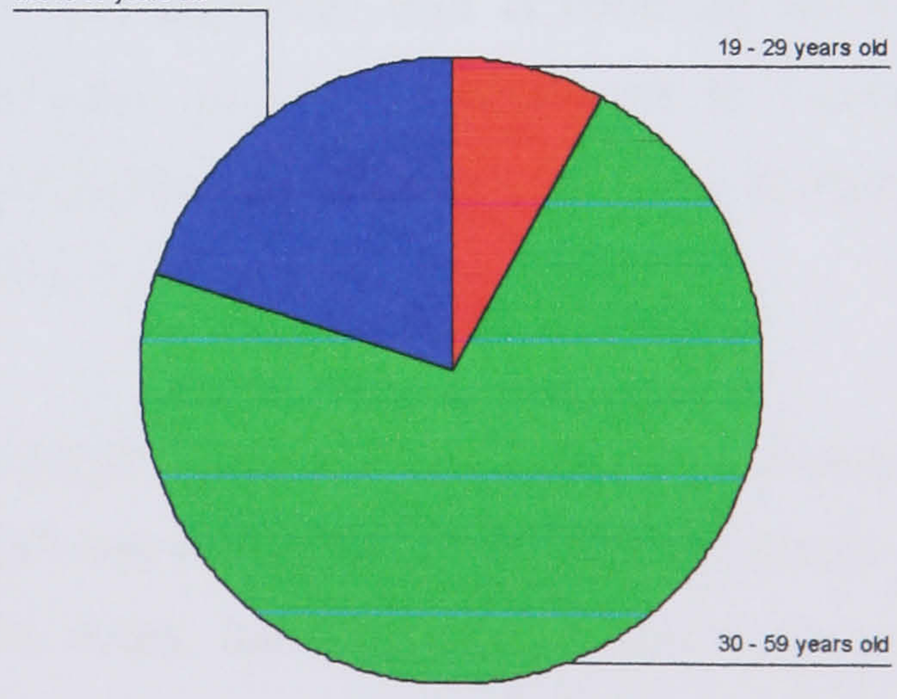
El Sereiha Village	Frequency	Percent
15 - 18 years old	6	3.0
19 - 29 years old	28	14.0
30 - 59 years old	139	69.5
above 60 years old	27	13.5
Total	200	100.0

Frequency & Percent Table

Farmhouses Village	Frequency	Percent
19 - 29 years old	8	8.0
30 - 59 years old	72	72.0
above 60 years old	20	20.0
Total	100	100.0



A



B

Figure 3. 4: The analysis of respondents in El Sereiha and Farmhouses Village

3.13 Conclusion

The strategy employed in this research was designed to understand the evolution of the Gezira settlements and to examine the socio-cultural behaviour in the traditional vernacular architecture rather than designed to test and produce results that could be generalized and applied elsewhere.

The approach adopted was partly chronological and partly systematic, and the aim has been to discuss particular cases within which a series of generalized situations can be studied. Adopting a case study in hierarchical sequences starting from macro-level (regional settlement) to micro-level (dwelling unit), as a methodological and analytical approach, provided a holistic view and in-depth investigation about the factors that have created and maintained the continuity of the development of residential areas and housing provision in the traditional vernacular settlements.

The strength of using two case studies was transformed into offering flexible and integrated comparative frameworks (on matters of data collection methods and procedures) for holistic investigation. However, in the qualitative scope of the analysis, the objective was to enhance, strengthen and support the explanations, descriptions, explorations and interpretation of findings obtained from quantitative approaches. This increased the possibility of crosschecking the validity of the research findings. The combination of quantitative and qualitative approaches facilitated a holistic understanding of the housing variables in the research settings.

One of the potential results of the study, in which a variety of methods of data collection was employed, is that a large amount of data was generated. This is a challenge for the researcher during the analysis; it means a rich source of data. The statistical data is collected for the description of housing situations and social, cultural and economical conditions in various settlements. These have been drawn together to provide comparisons both between different settlements, and between the same settlements at different points in time.

The questionnaire was focused on core data generated variables that were useful for providing the statistical base (appendices) on which to support explanations of behaviour and housing situations and linkages from the qualitative data: largely field notes, transcriptions of interviews and discussions, measured drawings and photographs. Nevertheless, the process of data collection and analysis was not without difficulties and limitations. Indeed the reasons were due to the sensitivity of the nature of the issue of study, the special socio-cultural circumstances in the area and the environmental conditions.

CHAPTER FOUR: SETTLEMENT EVOLUTION ON THE GEZIRA PLAIN

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4.1 Introduction

The culture of the local Gezira people may have had a significant role in developing the organic settlements, but the establishment of the agricultural scheme with its partially mechanized system has modified people's settlements and ways of living or in other words. ways of living and settlements have adapted to the newly-planned built environment. Taha (1974) and Danby (1975) have recognised that:

> *"The irrigation system and the socio-cultural organization have influenced the distribution and layout of villages within the context of the Gezira scheme."*

The history of the evolution of settlements in the area may be discussed under three main periods of development: before the establishment of the Gezira agricultural scheme, after the inauguration of the scheme during the colonial regime or Condominium Government and after the independence of the Sudan in 1956. These periods coincide with the changes that have happened to the social and housing policies and the development of settlements.

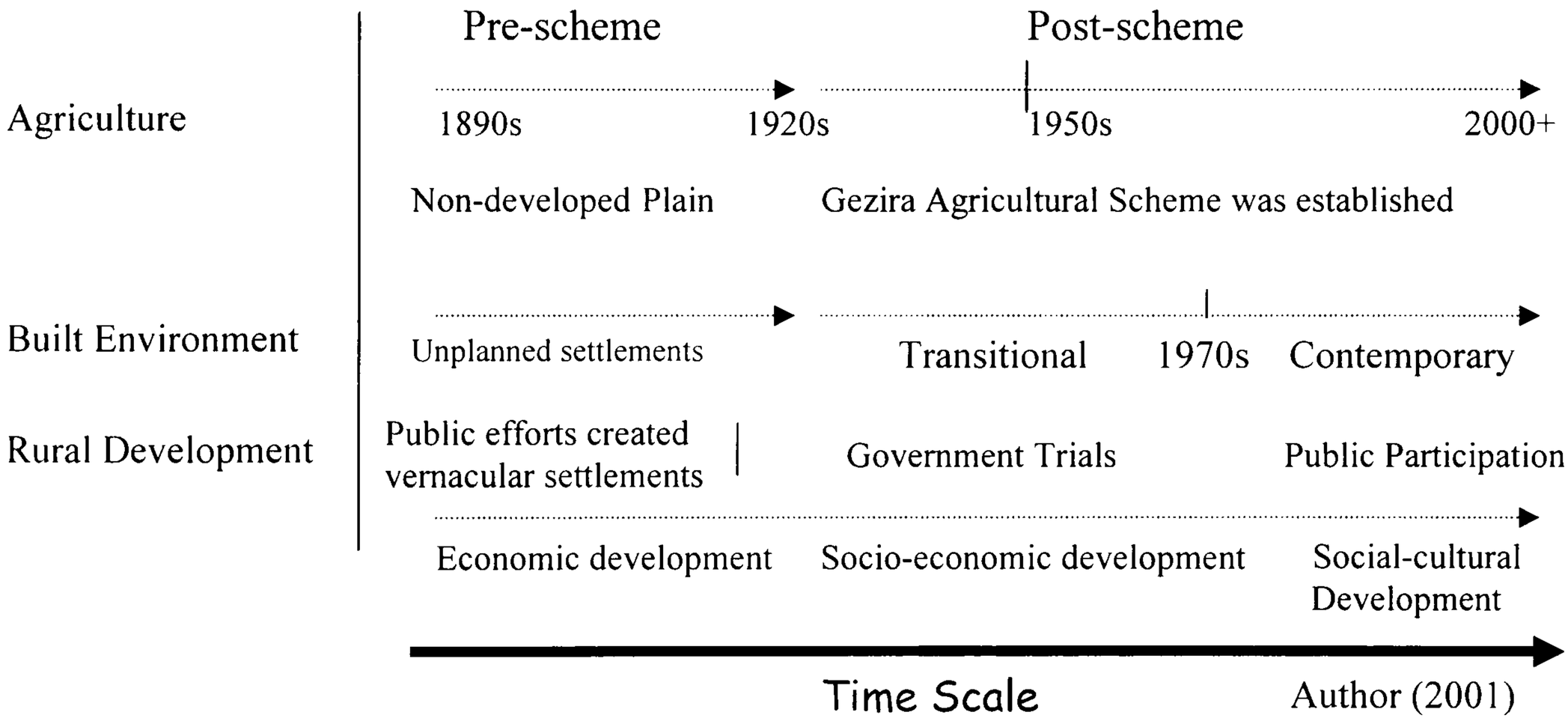


Figure 4. 1: Development and social change processes on time scale in the Gezira;

The development covered three aspects; agriculture, built environment and rural socio-economic development. Changes within these aspects seem to integrate with each other, in other words the formation of the built environment at any stage follows the changes in the other aspects; they have been reciprocal to each other. Thus, the interaction between these forces, social, cultural, economic and physical aspects, influenced the way of life and has its effect on the formation of the built environment. Each stage has its distinct built environment or architectural characteristics. There has been continuity and adaptation in the development of settlements in spite of prudent changes that happened.

4.2 Pre-Inauguration of the Scheme

4.2.1 Historical Background

After the Arab penetration into the area in the 11th century, life began to take some distinctive trends in the central area of the Sudan, known as the Gezira plain. Perhaps most important of all was a popular tendency to settle down around a source of water. The two Rivers Nile (Blue Nile and White Nile), and the fertile soil encouraged people to settle in the Gezira plain on the banks of the rivers and move within the plain during the rainy season to cultivate sorghum for food. The Arabs intermingled with the indigenous people. The Islamic values and cultural norms of those Arabs dominated the African communities' culture in the context of housing.

Pre-inauguration of the Gezira Agricultural Scheme most of the Arab population lived along the river banks and the following diagram (Figure, 4.2) explains the situation of the settlements of the population of the area just before the inauguration of the Gezira Scheme. The population is more dense along the rivers rather than in the inner plain. The Rivers have given the population opportunities to develop agricultural facilities. Irrigation is carried out by indigenous means called 'Shadoof' and 'Sagia' (Figure 4.3).

The settlements that emerged on the Rivers Nile were composed of simple houses built from the available building materials. The residents made their houses from mud walls and wood and thatch flat roofs. They made their houses of compact manner with twisting lanes connecting the houses to the peripheral areas.

During the rainy season, the population used to move to the inner plain to cultivate Sorghum, known as 'Dura'. It is the basic ingredient for people's food; while there were other populations that led the arduous life of Arab Nomads within the plain, a life, perhaps, inherited by the Arabs from their original homeland in the Arab peninsula. They used to move within the plain following the rain and availability of indigenous surface bore-wells that some tribes dug for them, where some temporary settlements existed.

This life of moving people from permanent settlements to temporary settlement and then back make the research in the history of settlement and its development of interest to many researchers to follow the patterns of development before and after the inauguration of the Gezira Agricultural Scheme. This situation also created symptoms of permanent life such as agricultural trade and markets. Agriculture and animal husbandry flourished in the area though the population was always moving around.

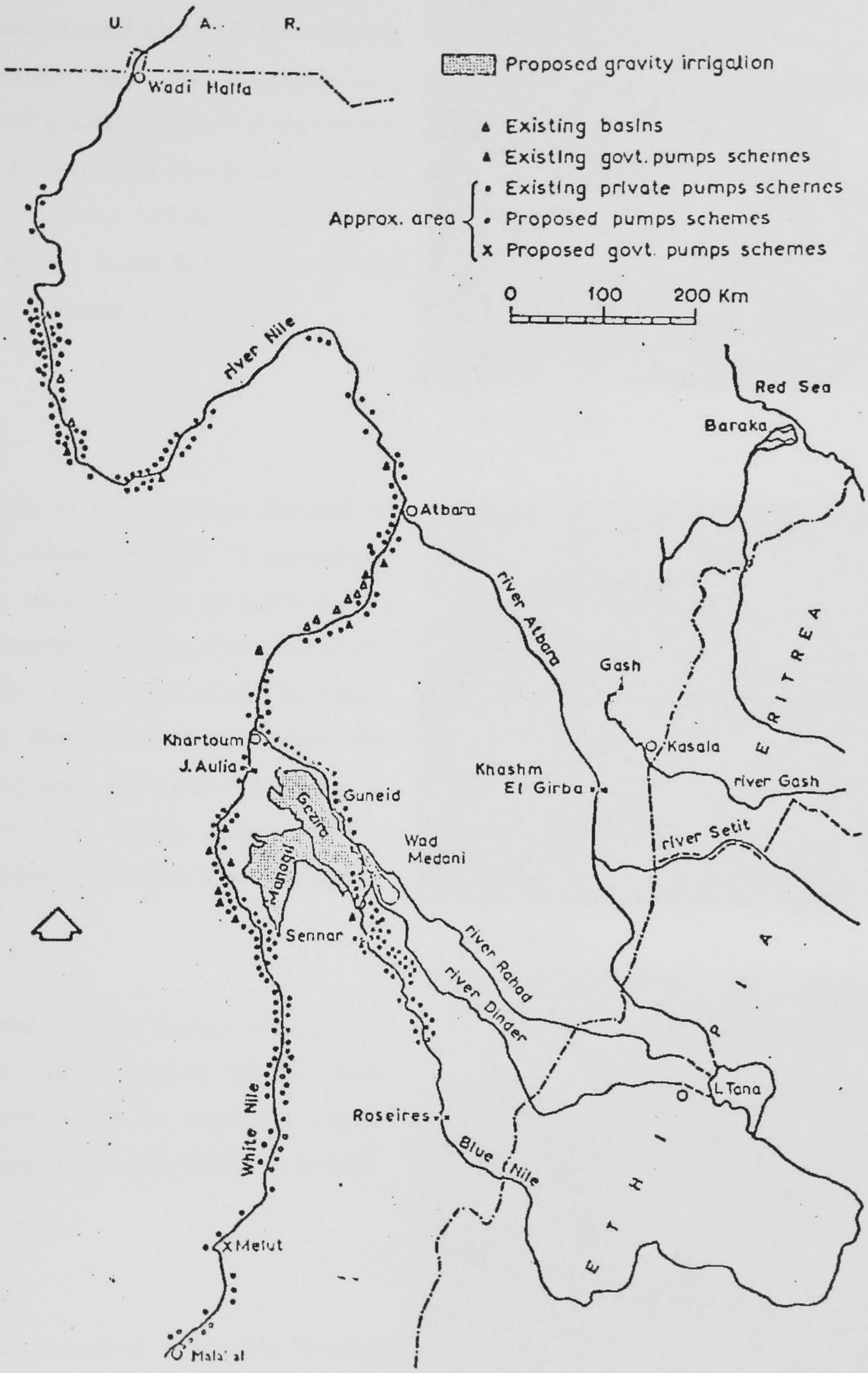


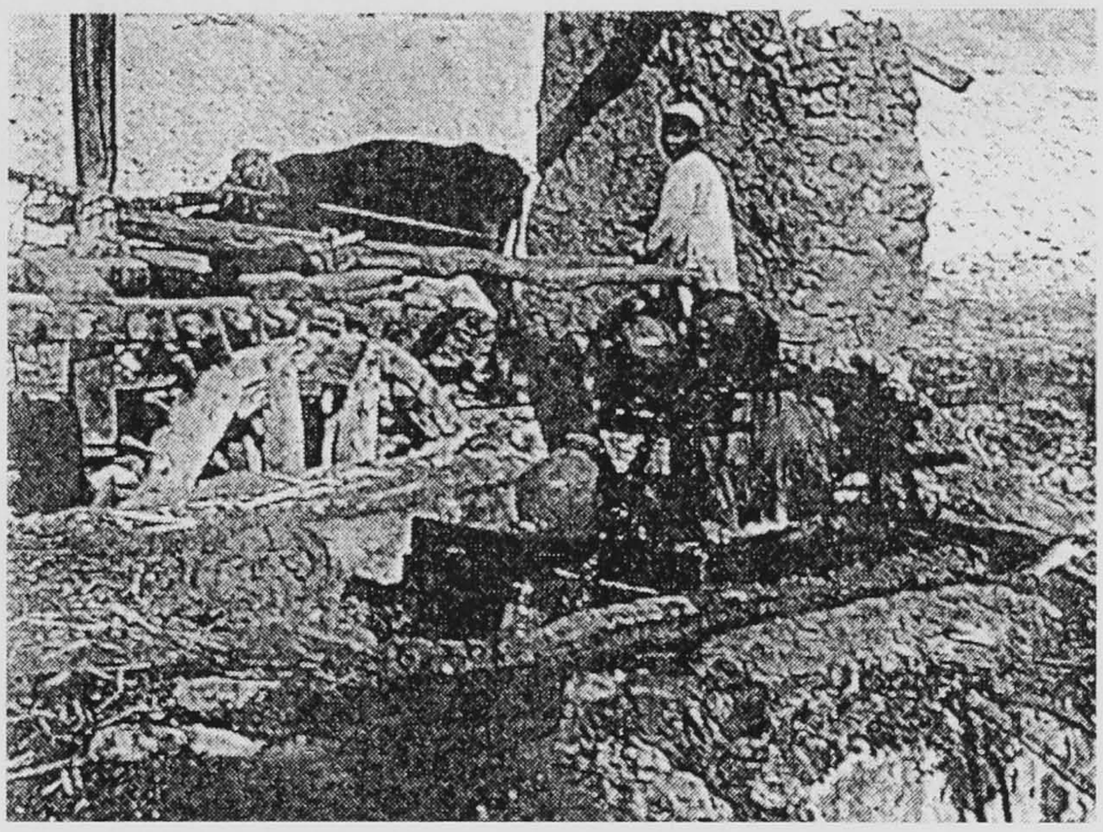
Figure 4. 2: Settlements before the inauguration of the Gezira Agricultural Scheme

Source, Gezira archives

The Shadoof is a mechanical device to raise water and is used above all for irrigating farms on the Nile. A long stick hangs on a horizontal wooden joist laid on two wooden supports. On one end there is a heavy stone which serves as a counter weight. At the other end is a bucket at the end of a long rope that is dipped in river water.

The Shadoof

The Sagia is a water pump powered by animals instead of hand. A horizontally rotating wheel is driven by a cow and by means of gearing turns a wheel that moves vertically. This in turn drives in parallel another wheel fitted with buckets that scoops up water and raises it to fields up to a height of 10 meters. Today automatic pumps have replaced this laborious work.



The Sagia

The water is driven through a channel of recycled materials such as the iron plates from used barrels or sometimes carved from wood. This is known as 'Archimedes Screw'.

Source is the book of 'Egypt- The World of the Pharaohs' Published by Könemann p378

The channel through which water is being carried to farms from Shadoof or Sagia

Figure 4. 3: The Shadoof, Sagia and the channel to feed the fields with water

There were known developed open markets stocked with local and foreign goods which satisfied the daily needs of the population which used to move to these centres. The development of such agricultural trade encouraged some tribes to develop permanent settlements and so very limited villages grew up in the area around these sources of water (Figure 4.4) and marketing places. People built villages from thatch and wood in a form of Guttia (to be discussed later).

Figure 4. 4: People lived and built their Guttias near sources of water before 1925; Source: Ministry of Information Sudan Government

Settlers in the area who used to follow this nomadic way of life were responding to the patterns of the rain and settled where a source of water was available. Climate had a significant effect on their movement and settlement. A savannah type of climate characterizes the area. The climatic conditions of the area differ from one zone to another. The annual average rainfall is approximately 400-500mm in the South and this average drops gradually to the North, where there is an annual average of 200-250mm. This rainfall, practically, is limited to the months of the rainy season, July, August September and October. The amount of rainfall is scanty and inadequate. There are also differences in the temperature of the region. It varies from North to South. The highest degree of temperature in the summer is about 46.2˚C mean average, (Yousif, 1997).

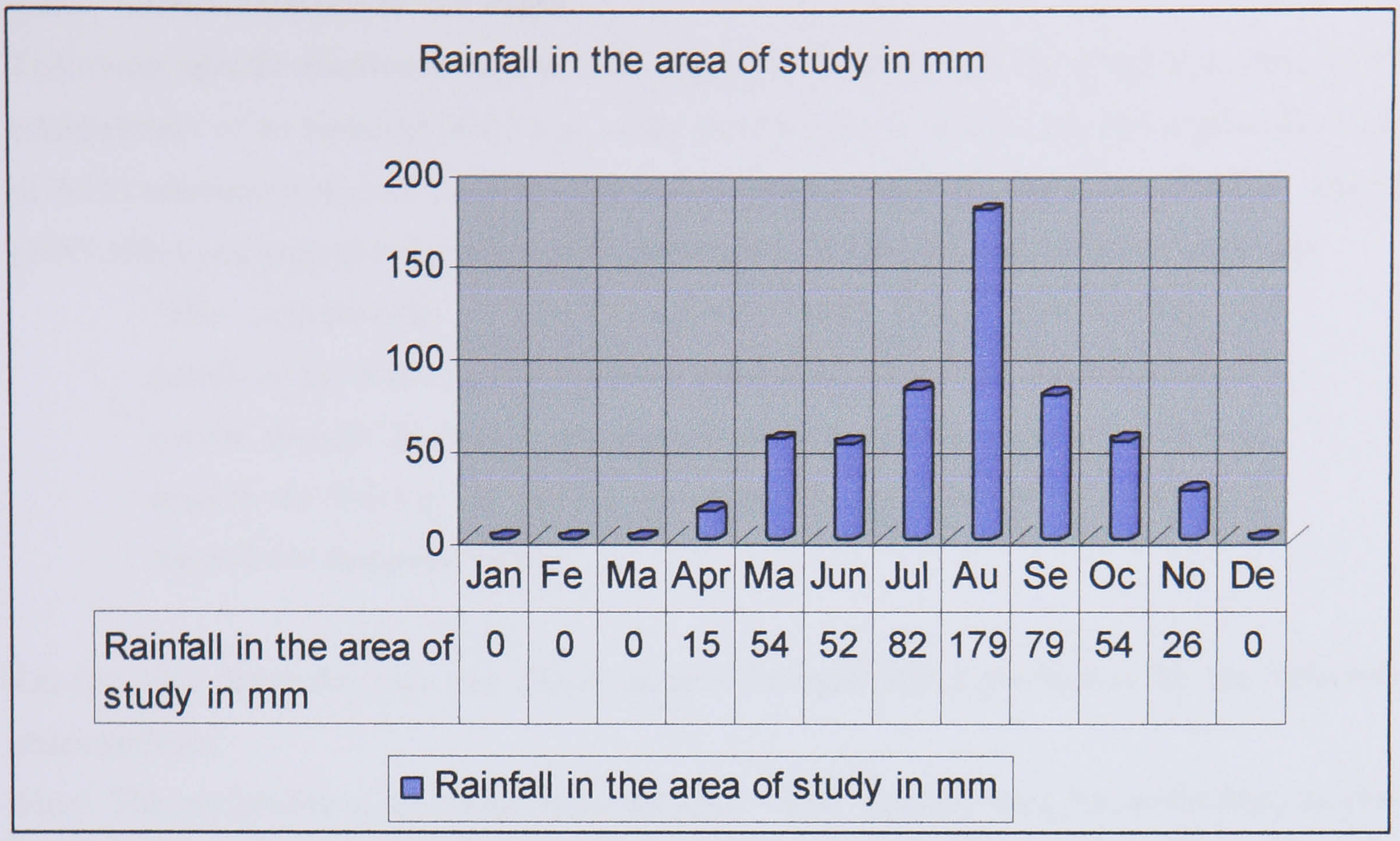


Figure 4. 5: Rainfall in the Gezira area: Source the author and Meteorology Department, the Sudan

During the rainy seasons vegetation covered the plain, while in the other months the area was empty of vegetation and it was mostly subject to dust storms and hot air. To what extent do houses and settlements respond to such severe climate conditions? More details will be seen when discussing the responses of housing to the climatic conditions in chapters six and seven.

This situation of settlements in the plain continued as described above until the inauguration of the Agricultural Scheme (1925). The inauguration of the Gezira Agricultural Scheme became a fact after many studies were carried out to examine the suitability of the Gezira plain. The key question is: Why was this part of the Sudan been chosen for such an important Agricultural Scheme in the Sudan or even in Africa at the time?

The importance stemmed out after investigating suitability of the Gezira plain from different angles of development, political, geographical and social. It was found compatible to the objectives first established to inaugurate the agricultural scheme. The following section may highlight some of the factors that encouraged Authorities and investors to start a big scheme that needed high investment, skills and equipment to erect.

4.2.2 Characteristics of the Plain

There were specific characteristics that encouraged the Condominium Government to plan for the establishment of an agricultural scheme on the Gezira plain to achieve the two urgent objectives of the Condominium Government, to settle the people who came to support the Mahdia[10] regime, (1885-1898) and to grow cotton for textile industries in Britain; Yousif (1997:15) states that:

> *"The establishment of an agricultural scheme would help settling the rebellions in an area easy to be controlled (near Khartoum and the transport system through Railway Lines running from the North of Sudan to Sennar town in the South of the Gezira) and reflect the good face of the government towards the Sudanese people".*

On the other hand the area was found suitable for agricultural production for the following characteristics:

First: The availability of an empty fertile flat land, which was only used during the rainy season, July, August, September and October, for harvesting sorghum, which was the only crop grown in the area. Gaitskell (1959:26) who lived in the area between 1923 and 1953 described it in these terms:

> *"It would be difficult to imagine anything flatter than the Gezira plain, two hundred miles long and eighty miles across. The eye searched in vain for some eminence or dell to break the monotony, and when on the far southern end sighted the blue outline of the hills of Gebel Moya. It was a hard land with a few thorny trees".*

The Gezira plain is almost flat with a gentle slope from South to North and from East to West, which is important for gravity irrigation. It is limited in the southern part by series of hills called 'Gebel Moya.'[11] There were widely dispersed thorny trees as Gaitskell (1959) described. The Gezira plain was a thorny flat land as seen in the photos below (Figures 4.6 & 4.7).

This character and nature of the land was the driving force for developing an agricultural scheme if other supporting factors were available. The researchers were enthusiastic to investigate the suitability of such a huge land (almost equal to England in Britain), (Gaitskell 1959) to grow cotton. They found other essential factors were important for developing such empty land.

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[10] Mahdia is called after Mohamed Ahmed El Mahadi who guided the Sudanese people in a revolution against the British regime in 1885 and killed Gordon and ruled Sudan until 1890 when Kitchener avenged the British people with the help of the Egyptians and took over the regime again.

[11] Jebel is an Arabic word means a hill or mountain

Figure 4. 6: The Gezira plain before 1925, with its empty land,

Source: Ministry of Information, Sudan

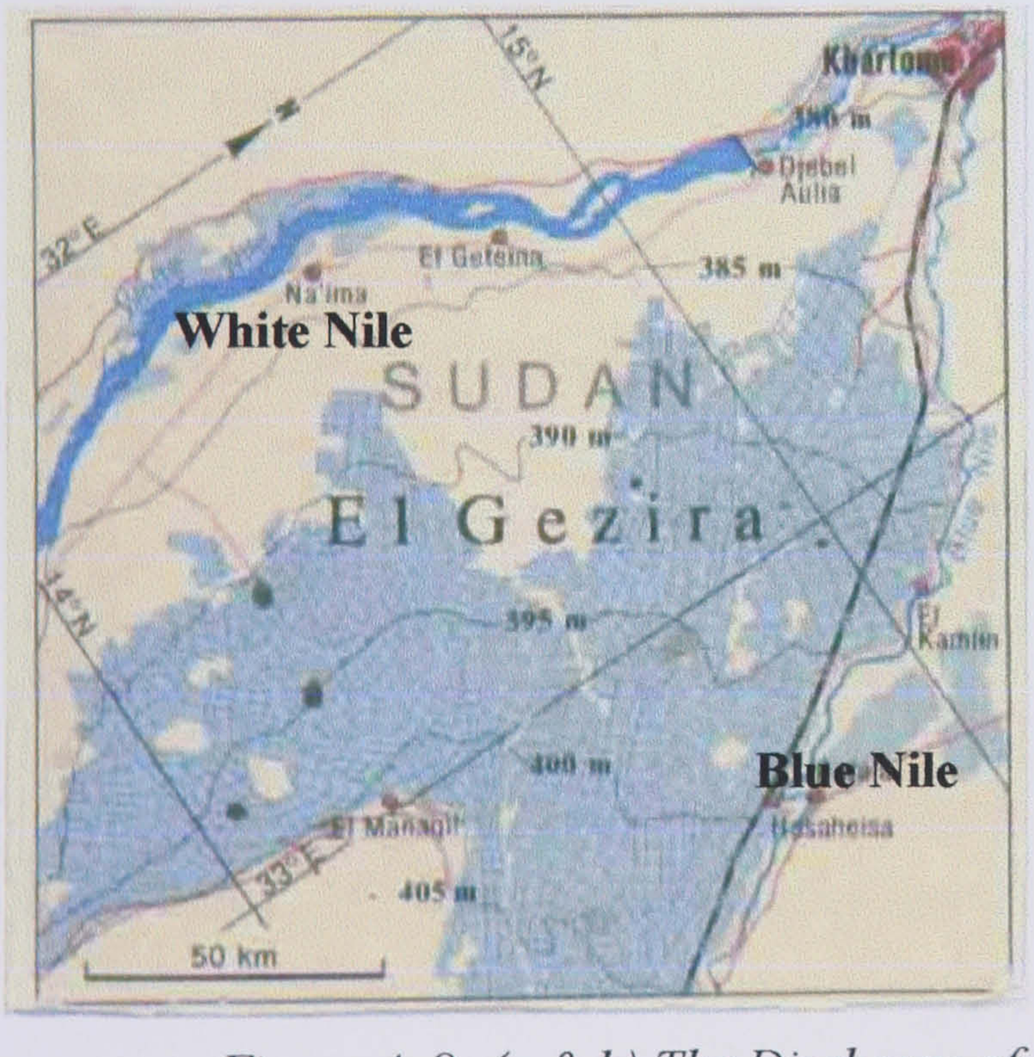
Figure 4. 7: The Gezira plain before 1925, with its thorny trees.

Source: Ministry of Information, Sudan

Secondly: The other key factor was the availability of water, which increased the possibility of developing the land. There are two rivers running within the area, the White Nile and the Blue Nile with their confluence at Khartoum. They have a high discharge of water (Figure 4.8 a, & 4.8 b). As noted before there are four months of rainy season, July, August, September and October, and the average amount of rain is between 200-250 mm. The two Niles, the White Nile and the Blue Nile give two different discharges. The Blue Nile gives the higher because of its nature. It comes from the highlands of Ethiopia while the White Nile comes from Victoria Lake in the lowlands of Uganda and through flat lowlands in the Sudan as well. The nature of the Blue Nile River encouraged the consultants at that time to advise the Condominium Government to build the proposed dam at Sennar on the Blue Nile River. The high flow of water would also help in generating power for development use.

The Diagram (Figure 4.8 b) shows the volumes of water discharged at Khartoum town in 1922-3. The two rivers' discharges are extremely different and reflect the high flow of water from the Blue Nile. Also, another dam was suggested to be built on the White Nile to regulate the water for the use of Egyptian Government.

a. The Two Niles surrounding The Gezira



b. Water Discharge at Khartoum (1922-3)

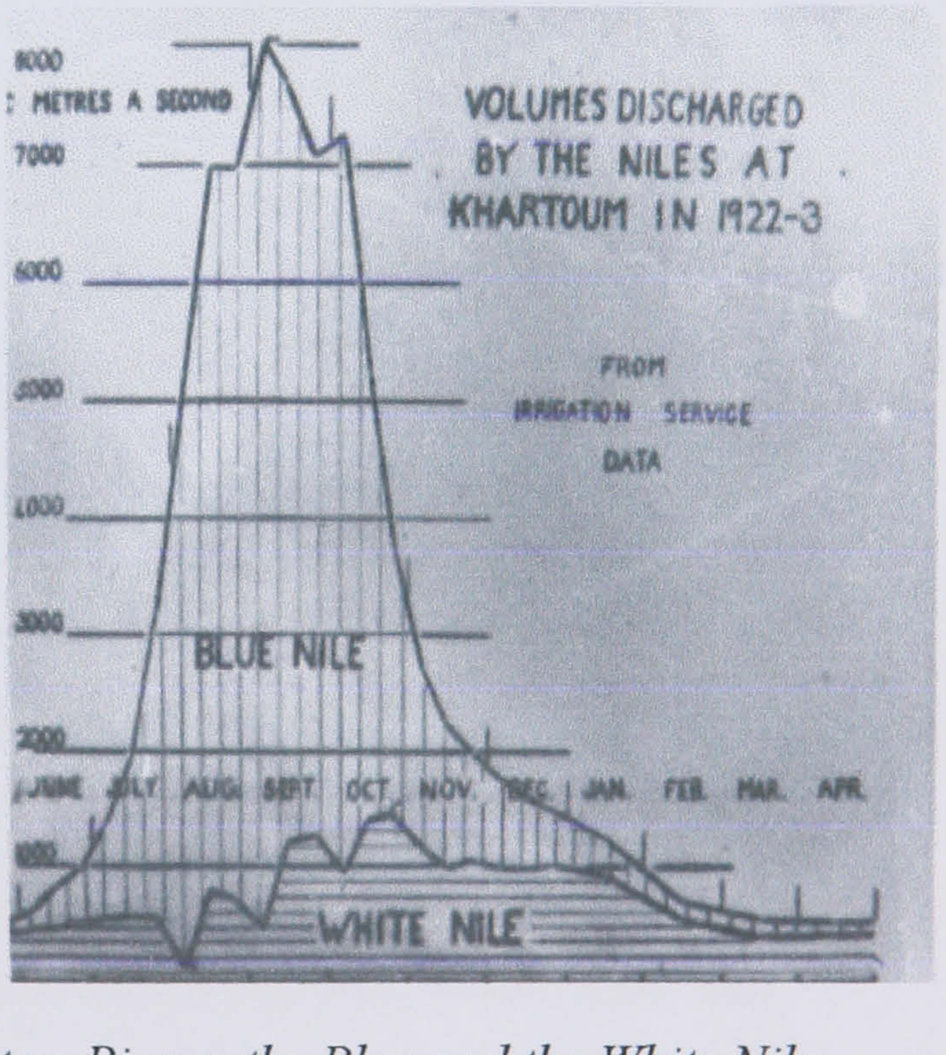


Figure 4. 8: (a & b) The Discharge of the two Rivers, the Blue and the White Nile

Source: Ministry of Information, Sudan

Third: In addition to those two factors was another factor, which was landownership. The landowner was the State, according to the land ordinances that had been enforced earlier in the 1900s (this will be discussed later), but to the local people's or tribes' perception, this seemed of

little importance, as they were unaware of the formal legal position. Yousif (1997:5) remarked that:

> *"The whole land being, as extensive as it was, used to be a traditional popular utility where the individual could cultivate as much land as he would without being questioned or charged by the acknowledged owners."*

So, law long established upheld land ownership; but what brought this about? In human terms it is suggested that the need to establish and defend territory is one of mankind's animal instincts; that attachment to territory, be it permanent or temporary, is embedded in most of us and those with no territory wander forlorn (Miles 1995). The land ownership on the plain was more important than actual occupation for members of the tribe unlike nowadays, where occupation is the critical factor. Any person could exploit the territorial imperative but ownership gave the right to the owner to take over at anytime (Islamic View). In the traditional societies the sheer wealth have largely taken over as the yardstick of collective social esteem; if a kinship group have more land for their members or even others to exploit, it is evidence of respect and wealth that can be hidden without land.

There were two issues that helped in solving this delicate issue of landownership. First the British Authority considered the area was not suitable for the settlement of Europeans and so they avoided the occupation of land without the consent of the owners. Secondly, the local people had the priority in owning farms instead of their old rain-fed farms in the same place. Lord Edward Cecil (1867-1918) made an interesting analysis of the issues at variance and a suggestion to reconcile them. He says in his report:

> *"I think it is as well to emphasize one general proposition, that an essential difference in our land policy should be maintained with regard to what may be termed the pioneer stage of land development as distinct from the permanent land settlement of the country. The Sudan is not, and never will be, a country suitable for permanent European habitation, and it is therefore the interest of the government to encourage as far as possible native land owner-ships. But, in order to bring under cultivation the vast tracts of land which only need water to make them fertile, it is necessary to provide a considerable amount of capital."* (Gaitskell 1959)

However the case, these characteristics and phenomena of the Gezira plain encouraged the British Authority and condominium Government to seriously consider development of the Gezira plain.

4.2.3 Rethinking the Gezira Plain

As mentioned before in the early chapters, there are many information resources covering the Gezira but few researchers have been attracted by rural settlements and traditional vernacular forms. This unique developed area in Africa, which was established in 1925 as an agricultural land for producing cotton and other crops, attracted researchers from different fields. The area has attracted politicians, scientists and social researchers ever since the eminent British irrigation engineer from the Egyptian service, Sir William Garstin, explored (between 1899 and 1903) the future irrigation possibilities of the whole Nile system. Sir William Garstin[12] wrote his report in 1904. Gaitskell (1959:96) states that:

> *"Those to whom the privileges shall be granted of assisting towards this consummation will have a chance given to them such as seldom falls to the lot of man".*

This report was considered the trigger for researchers, but still the research into rural settlements is far behind the potentiality of the area. The report concerned the availability and provision of water to the area and as a benefit to the British textile companies. However it was the starting point for the Condominium Government (Egyptian and British) to think further about developing the Gezira plain. After William Garstin gave his report about the rivers Nile, the Condominium Government (1896-1956) started to consider the Gezira land as a potential area of agricultural development to satisfy the needs of textile industries and to settle the Mahdist rebellions in the plain. After the British textile companies agreed to invest in the project, the government immediately thought of the landownership, as it was a delicate issue for people already cultivating the land. There were certain steps taken to keep the land under the state control. A proclamation in July 1905 brought the transfer of land under stiffer control to stop land selling and transaction. Gaitskell (1959) argued:

Figure 4. 9: William Garstin

> *"It decreed that no native might sell, mortgage or otherwise dispose of any land without the consent of the governor of the province."*

[12] Sir William Garstin (1849-1925) G. C. M. G, G. B. E. Entered Indian Public Works Department, 1872: sent to Egypt, 1885: Inspector-General of Irrigation, Egypt, 1892: Under-Secretary of State for Public Works, Egypt, 1904-8. In Lord Cromer's words he 'raised himself to the rank of the greatest hydraulic engineer of this or any country'.

The difficulties in land ownership were referred to an advisory committee of officials in Cairo at which Lord Edward Cecil (1867-1918) made his report and raised two issues; the first one was the issue of water and type of irrigation necessary to make use of the plain land[13]. The second issue was the land and how it was to be owned by the local people, as it was considered not suitable for Europeans to live in the area (see above). The first question then was about the investment. Thus the Condominium Government thought to bring the capital from 'Cotton Industrial Companies' in Britain, so from the inception of the idea to establish the scheme in the area, the type of investment and the policy of land were put down. Sir Reginald Wingate[14] (cited in Gaitskell 1959-81) mentioned in his report

> *"There can be no doubt of the desirability of eventually bringing in foreign capital to assist in land development of Sudan, but in the first instance the conditions under which concessions of land should be made and have to be carefully considered."*

The report says the need of investment to run the project would help the Government to survive, because,

> *"The Government has fallen in for some criticism as being dilatory and unsympathetic towards schemes of exploitation."*

Figure 4. 10: Sir Reginald Wingate

The need for investment was also reflected in the report of the Trade Section of the Governor General in 1910 (Gezira Board Archives). It seems every official in the Sudan was eager to finish the scheme as quickly as possible to achieve the objectives of the Khartoum Government. The scheme started with a policy of construction that was dependent on certain parameters:

- First the cost of canalisation, which was partly at the expense of the syndicate (formed from the Investors) and the other part to be recovered from the tenant, (more information can be obtained from the archives of the Gezira Board).
- The second parameter was the cost of farmhouses and other buildings (not including local people settlements) and heavy farm machinery; the Government agreed to take these

[13] The syndicate was to get nothing back from the government for clearing and levelling the land, or for subsidiary canalisation, and would therefore have to add the amortization of this capital expenditure to its annual running costs. Provision was made for the cost of a certain part of the subsidiary canalisation (the field channel abutting on his individual tenancy) to be recovered from each tenant, Gaitskell, (1959).
[14] The 'Sudan Agent in Cairo, (1904-1906) and the financial adviser to the Egyptian government, (1912-1918),

structures over at the end of the concession period at a valuation, provided that the former had been erected with the consent of the Government and the latter had been in regular use within a period of two years, and that both were in a good state of repair (Gaitskell 1959).

When the scheme was first thought of, there were certain other issues to be considered:

- Socially it would be inadvisable to allow any investment in the area unless provisions for a very close measure of cultural understanding was well maintained particularly with land ownership, Lord Hailey (1957) related the cause of the strict ownership to Islamic values and laws, before the construction of the scheme and changing the land ownership laws.
- Physically, the topography of the land is suitable for gravity irrigation; later canals bisected the plain carrying water through the gravity irrigation system and shaped the path of local people's settlements.
- Lord Kitchener (Governor of the Sudan from 1998 to 1910) considered that in political terms that the Condominium Government would show good face to the 'Mahdist' rebels and settle them in the area.

Thus we can summarise that the major figures such as Kitchener and Wingate in the early 1990s and their consultant engineers like Garstin (1904), who studied the irrigation phenomenon along the Nile valley, made use of the opportunity because of need of many textile companies in Lancashire to grow cotton in such a suitable place in Africa. Lord Kitchener, the Governor of the Sudan, started to invite the investors from England to invest in growing cotton, which was needed by the textile industry. At the same time, many experiments or pilot schemes were carried out, last of which was the Tayba Pilot Project, which led to the establishment of the biggest agricultural scheme in Africa, the Gezira Agricultural Scheme in the Sudan. Also it can be said that after the Condominium Government put their policy towards the Gezira of the Sudan in the late 19th and early 20th centuries, they opened up the country and its economy for development and the interaction with the outside world has increased enormously with the inauguration of the Gezira agricultural scheme. The Gezira gravity irrigation scheme was projected to develop a rural area to improve the economical situation of residents and hence the social and cultural issues as they saw it. The Condominium Government and the British textile companies, which were interested in cotton production for their factories, undertook the project jointly.[15]

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[15] The main information used to address the research is extracted from files in the Sudan Government archives in Khartoum, referred to under the symbol (S.G.) and files in the Sudan Plantation Syndicate in the Gezira Board's archives in Barakat, referred to under the symbol (S.P.S). Also, it extracted from reports, balance sheets, minutes, etc. of the Sudan Plantation Syndicate at the School of Oriental Studies, Durham University, referred to under the symbol S.P.S. The Governor General's contemporary reports are particularly full of comment on the land policy and water availability and the type of investment needed. Apart from the Governor General's reports, the important documents are the Gezira Board's minute book. The two reports of Sir William Garstin, report as to Irrigation Projects on the Upper Nile, (1901) and a report upon the basin of the Upper Nile, (1904), give all the flavour of an unexplored area. Interesting information is also available in the reports and memoranda of British Cotton Growing Association. The

4.3 Post-Inauguration of the Scheme

In the following section we will discuss the importance of the Agricultural Scheme and how it supported peoples that came from different origins and have different cultures and ways of life. Then we shall examine the type of settlements that evolved and how people settled in the plain. The canals crossing the plain and running in the direction of the slope of the land formed limitations for settlement development and the circulation of local people; which will be discussed in detail in the following chapters. A typical canal is shown in the photo (Figure 4.12). The scheme started in 1925 when the Sennar Dam[16] (Figure 4.11) was established to regulate water on the Blue Nile and feed these canals with water. Then another dam, called El Rosaries, was established on the Blue Nile.

Figure 4. 11: Sennar Dam located at Sennar town in the South border of the Scheme.

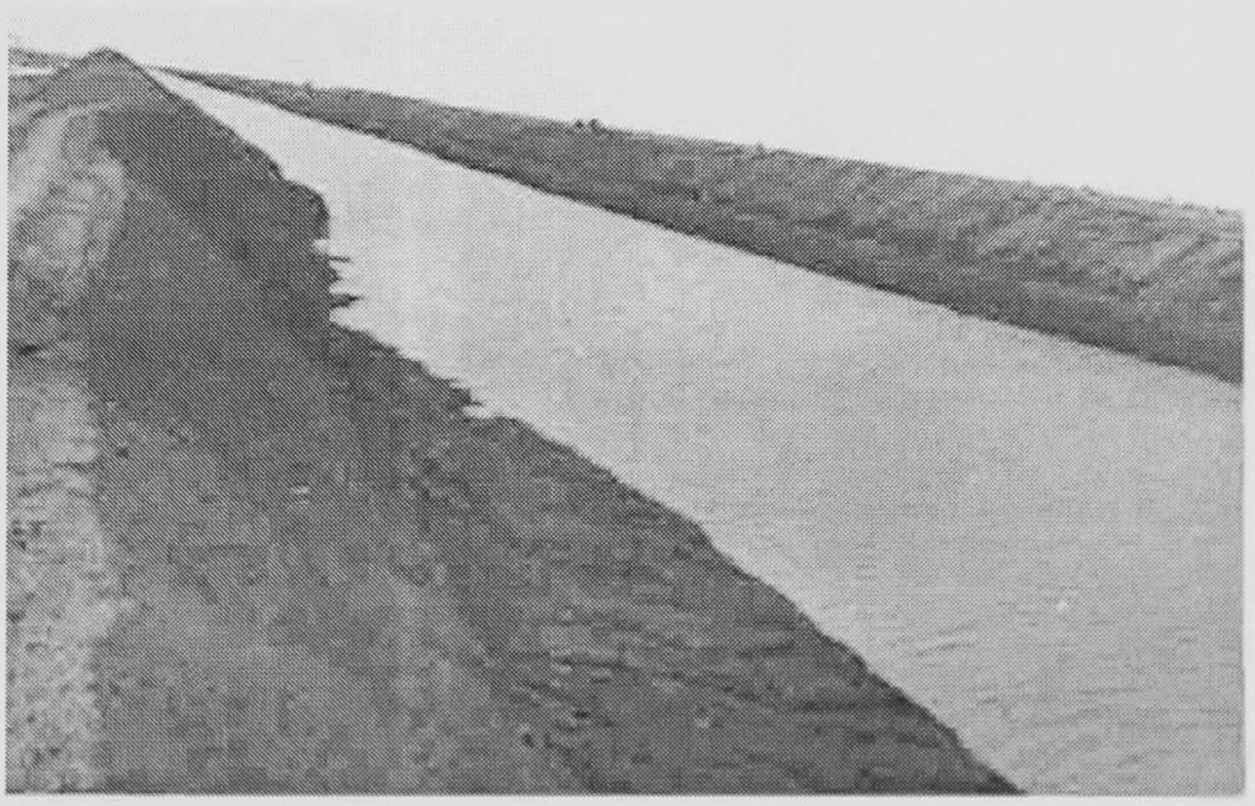

Figure 4. 12: A typical canal in the Gezira Scheme. Thousands of kilometres of canals running through the plain

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Report of 1945 contains its own appreciation of achievements in the Gezira area of the Sudan. Also see the story of the Gezira by Gaitskell (1959).

[16] That is a dam established (1922-23) just before the Inauguration of the Scheme (1925).

The following diagram (Figure 4.13) illustrates the original Agricultural Scheme and an extension called El Managil that was added in 1962 to the original part with similar administration and physical conditions (Figure 4.13).

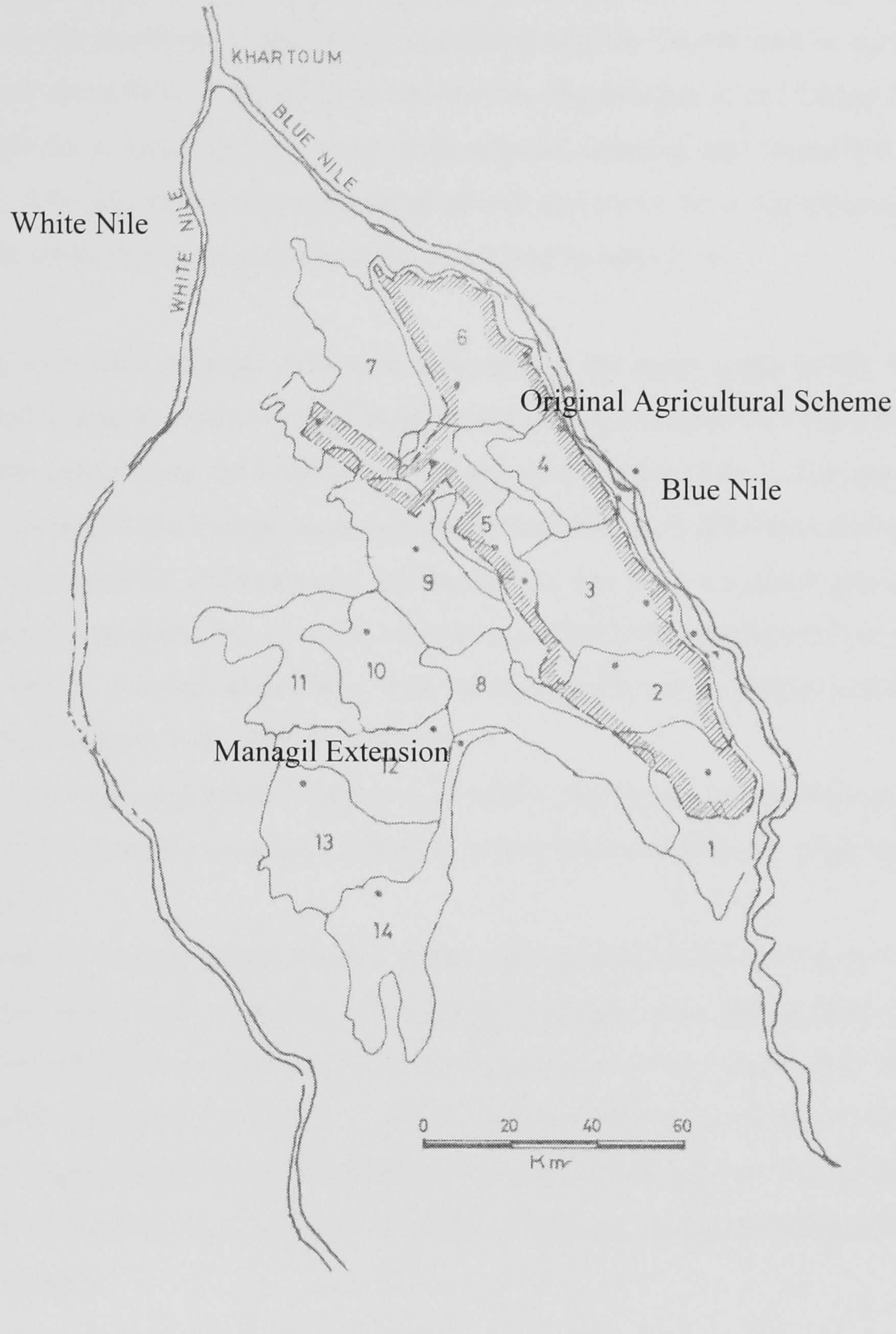

Figure 4. 13: Illustration to show the divisions of the two parts of the Gezira Scheme, El Managil Extension built 1957 and the Gezira main part built 1925.

4.3.1 Importance of the Scheme

Researchers, such as Lord Hailey (1957), Gaitskell (1959) and El Agraa, (1985) declared that the scheme provided an illustration of successful development. The importance of the scheme emerged from many factors but the most telling one was the economic interest, such as cash crops, cotton and wheat, and food crops. It is eighty years since the area was farmed (generated) into an agricultural scheme (1925) as an independent economic institute, which has played a significant role in the economy of the Sudan in general and the Gezira area in particular. The scheme generated about 95% of the national income into the revenue of the Sudan for decades, but now other similar schemes and resources, such as petrol industry, and animal breeding, have been developed. The scheme has supported the economic and social life of the tenants, permanent labourers and the temporary labourers who come every year to work in it.

The Gezira and its related Managil extension still produce the main crops of the Sudan, high quality cotton and wheat, as well as several food crops for local consumption. The irrigated lands of the Gezira now extend from the Blue Nile westwards to the White Nile, occupying the greater part of the land surface in the triangle bordered by the two Niles with Khartoum at the apex. The scheme has been successful economically, but because it has been extended gradually it has gained little international publicity; its success has however attracted population from other parts of the Sudan as well as itinerant labour from West Africa and elsewhere. Barnett and Abdelkarim (1991:6) stated the situation in the following terms:

> *"At its peak of geographical influence, in 1930s, the Gezira attracted people up to 3000 miles from across the Sahalian belt in Northern Nigeria, Chad and Senegal."*

The scheme, with its gravity irrigation and regular geometrical farms, not only transformed agriculture but also had a most profound impact on the physical, social and economic conditions of every settlement within its boundaries. The inhabitants proved able to hold on to their cultural integrity and social conventions, even in the face of changes which occurred due to the economic development and later professional attacks through planning interventions as seen in the evolution and development of the building forms in El Sereiha village and the Farmhouses village as case studies for this research.

The new farming and irrigation network made possible a new flexible system of land use which in turn demanded a new agricultural routine. Instead of four months' fieldwork a year, a new timetable over eleven months of the year was necessary (Gaitskell 1959). This led people to settle permanently in the area. The work starts in June when the tenants prepare the land for cultivation. First they start the process of ploughing, then seeding, and watering the crops and finally

harvesting, which starts in November and finishes in May, when they take off the stems of the cotton and clean the land for the next season.

Despite recent reforms to enhance the social and cultural benefits of the scheme, the area is still the seat of economic power and political influence. There are very strong links between economic and political power, which in the Gezira are based on complex tiers of patron-client inter-linkages that run through all levels of society. For example the provision of services is often promoted by the politicians to help them build up a political power base, whereby political parties and governments organise or even promise provision of services in exchange for political support. This was the case in the 1960s, 1970s and 1980s in Sudan where the known parties and General Governments supported services provision in rural areas in order to gain electoral advantage and support. Frequently there will also be economic interests, such as introducing new technical packages for improving the quality of serving the farming system. This process of piecemeal development has not been helpful.

Pearce, (1995:5) describes the situation in the Developing Countries in the following terms:

> *"The state became a mediator through which members of the ruling élite distributed power and privileges among themselves. Social order was maintained by client list loyalties based on political manipulation and administrative corruption and by repression"*

Whatever the political intentions, there were main bases for the evolution of settlements developed by the erection of the scheme. The most significant bases are the agricultural and economic bases that formed the foundations for the evolution of the settlements in the Gezira area of the Sudan. The following sections discuss these bases with social and cultural changes. Then finally the chapter focuses on settlement evolution and shapes of development.

4.3.2 The Agricultural Base

Agriculture is the backbone of economic and social development in the Sudan. 78% of the population is dependent on agriculture. It contributes to about 33% of the gross national product and 95% of all earnings of the Sudan (Yousif 1997). It was the major source of the hard currency that was needed for the control of the balance of payments in the country's budget (this situation has changed since the discovery of oil in Sudan in the 1990s), as well as the major raw materials for local industries such as textile, cooking oil and animal product industries. The agricultural sector is divided into two main parts:

- Rain-fed Sector: the estimated area of this sector is about 27.5 million feddans (1.034 acres). It comprises the areas of Western Sudan, North and South Gedarif, South of the

Blue Nile and most of the central plains. Crops cultivated in this sector are sesame, sorghum, groundnuts, gum Arabic, sunflower, and millet.

- Irrigated Sector: The sector covers land of an area about 4.5 million feddans. It comprises the Gezira area, El Rahad, New Halfa, the Blue and White Nile Schemes, as well as the Northern States and Toker and Gash projects. More than 95% of the exported cotton is grown in this sector. The cotton irrigated in the Gezira accounts for 59% of its exports. Other crops cultivated include wheat, sorghum, groundnuts, sunflower, vegetables, fruits, sugar cane, fodder crops (leguminous and cereals). The Gezira area, also, has the lead in producing most of these crops.

The Gezira irrigated scheme is well known as one of the largest irrigated agricultural schemes in Africa. The scheme introduced unknown technology to the people and created a new economic base for the inhabitants. In the Gezira a standard system of agricultural land allocation has been adopted, each holding consisting of 40 feddans (a Feddan is nearly 1.034 acres or 4230 square meters) made up of a number of agricultural plots (hawasha), which may or may not be adjacent to one another. This is decided by the agricultural rotation system applied in the scheme. On receiving the tenancy, each tenant becomes a participant in the scheme with the Government of the Sudan and the Sudan Gezira Board, his rights and responsibilities being defined by law. The ownership of the land is vested in the Government; every occupier is a tenant of the Government. The relationship of the production system between the Government, the Gezira Board and the tenant has been changed many times. Important developments during the history of the scheme included a shift from an interest in mere productivity before the 1950s to include tenant welfare. Since the late 1960s, the government has adopted a policy of intensification and diversification of crops and the introduction of the Land and Water Charge System (LWCS) in the 1980s in place of the Joint Account System (JAS). It is to be remembered that the tenant, the Gezira Board and the Government have always constituted the three partners in the scheme. By the JAS they originally received 40%, 20% and 40% respectively, of cotton sales proceeds. These were repeatedly revised. Recently the LWCS was introduced instead in the hope that an individual account system will inject an incentive crucial to better tenant productivity. By the LWCS, the Gezira Board deducts the costs of inputs and services from the sales values accruing to the tenant, who individually pays charges for land and water for every irrigable Feddan.

In the past, the size of a holding was too large for the tenant and his family to perform all agricultural operations themselves. This particularly applies to weeding and harvesting. Therefore from the very beginning of the scheme there has been a need for a hired labour force. Labourers migrated to the area from different parts of Africa and were encouraged to settle in small villages scattered throughout the irrigated areas to provide readily available labour. Most of the labour villages have emerged as small quarters close to some villages.

In the recent past, the 40-Feddan holdings have been subjected to subdivision according to the Islamic law of inheritance, though the Gezira Board has limited the minimum plot to 10 feddans only (a quarter of a farm). Today, people in the area carry out various agricultural tasks, build or rebuild the houses and trade in agricultural produce. The growth of the three towns, Khartoum, Omdurman and Khartoum North in the northern part of the area and Wad Madani, the capital of the region in the south of it, provided urban markets for agricultural produce. The construction of the railway and the asphalt road from Khartoum to Wad Madani in turn made possible further economic development. The scheme has introduced diversity in agricultural production. Now, the farmer cultivates cotton, wheat, groundnuts, dura (sorghum) and vegetables. Table 4.14 reflects the diversity of crops grown and harvested in the Gezira through five years.

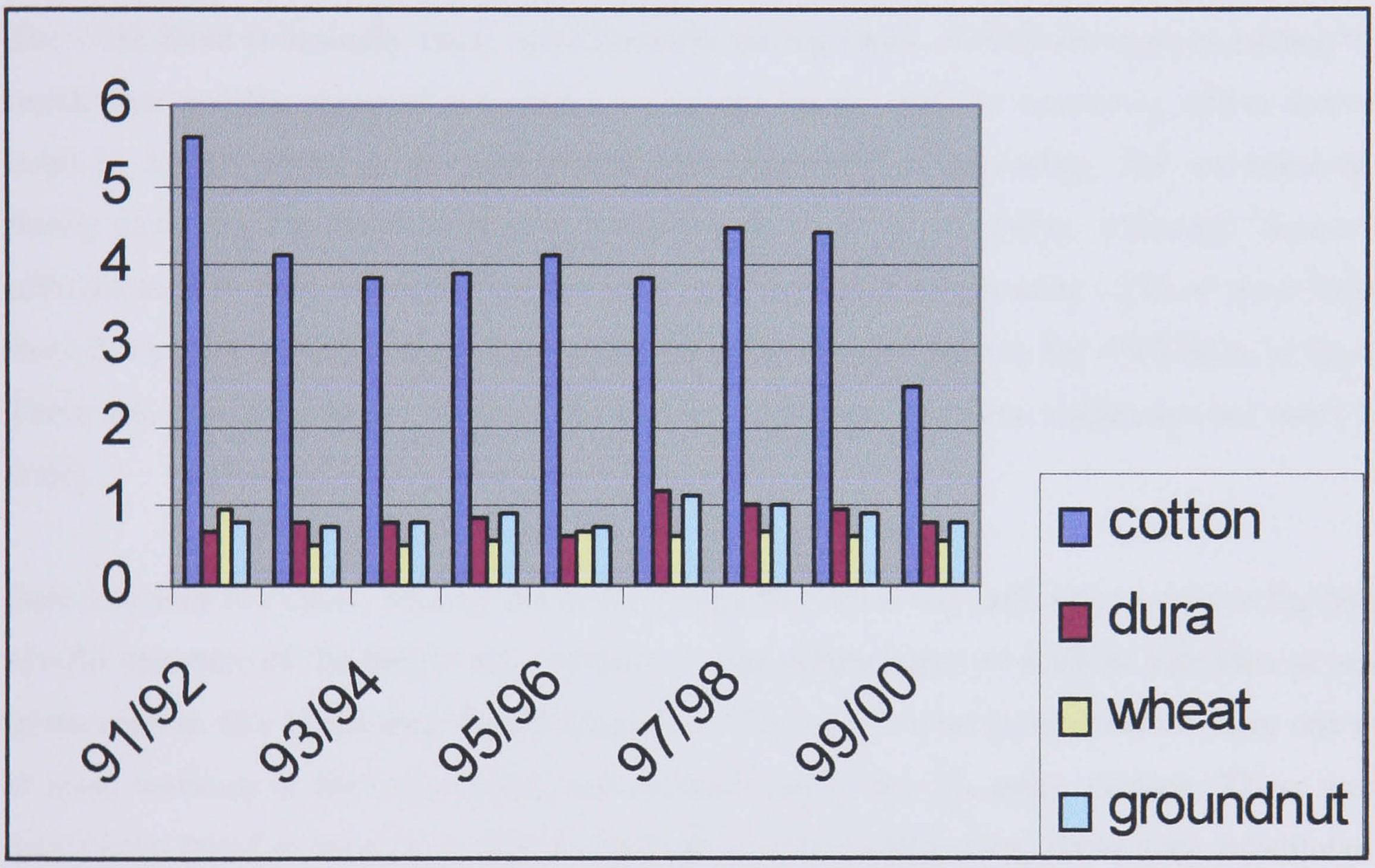

Figure 4. 14: Diversity of crops and yearly production, Source: Gezira Board Archives,

The scheme has financially supported 100000 tenants and their families, kinship and labourers that came from different parts of Africa in addition to the casual labour force that comes for harvesting the crops, especially the picking of cotton. These groups of people started to form their settlements according to the nature and social and cultural behaviour of their original lifestyle. It seems that all people of African origin have settled permanently with the tenants, while the move casual labourers have temporary housing and go back to their normal nomadic life in other parts of the Sudan because they usually make use of harvesting periods to make some money and feed their herds of cows and sheep.

4.3.3 The Economic Base

The agricultural base has created an economic base for the tenants and people of the area. There are three categories of people in the economic fields; merchants, farmers and farm labour force. The merchants and rich farmers became, of course, more powerful than the third category that continued to follow the agricultural pursuits, to work in the farms or build houses for tenants. Wealth permitted some people to buy some farms or the produce of other farms and establish their power locally, as elsewhere. Fortunately, these riches cannot buy more than two farms because the Gezira Board law forbids the ownership of more than two farms (the farm area is 40 feddans) and at the same time the families seldom get rid of their farms. People work elsewhere to support themselves to keep their plot.

The work force is basically made up of peasants having farms of different sizes according to the regulations and the status of inheritance within the family, and the temporary labour force that helps in certain stages of the agricultural cycle especially in harvesting. The members of the family constitute the main convenient group for the work on the farms, while the Government officials such as field inspectors, municipality staff and teachers are other types of work force. If there is a public service in the village, other officials may be added to the work force in the area. There are, also, other types of work like trading in produce, builders, carpenters and other local crafts.

Save in a very few cases, because the income from the land is not sufficient to support the family, several members of the family will combine to take employment or work in activities in nearby urban centres, like Khartoum, Wad Madani, etc. There are several families which have one man, at least, working in the urban areas, and comes home every Thursday evening. These weekly migrations, found in so many countries between rural and urban areas, have been substituted for those who have no chance to join the great and far-reaching migrations to the Gulf area. If we look into the table (4.14) above it shows the decreasing and unstable production of crops since the season of 1993/1994. Season 1999/2000 showed lower production than the season before. Also, the high service costs of the farms and government taxation decreased the income of the farmer and his family.

Then, as women do not participate in the farming work, and they are considered as consumers more than producers, they put a big burden on the economical situation of the family. On the other hand a woman has a great role in the household decisions, (see later in chapter five the role of women in the society). There is also an exception that some women, in the absence of men, managed their farms successfully, (as we were told in the 2001 survey).

In the recent past, the difficult conditions of agriculture in developing countries (see chapter two) obliged some of the youths to emigrate, especially from the Gezira; they would join the mass of the Sudanese immigrants in the Gulf area. In fact, the limited opportunities for work encouraged migration to the Gulf countries. They can find work hoping to put enough money aside after some time in order to return to the area to improve or build a new house for the family or buy a farm if they do not have one to support the family. An emigrant said in the interview (2001),

> *"I went to the Gulf area because our farm is not like before; it doesn't support the family nowadays. I have family of 5 persons and two brothers, I want to support their education plus my father and mother and other children. How can I support all that number? I hope to save some money to maintain the expenses of the farm and increase its produce. This will help the family members to make use of the farm. If I get more money I repair our house or even build a separate house for my own nuclear family."*

It seems that the economical base background and agricultural system was built on the kinship system in the social life of the tenants. So to understand the nature of such important aspects that are a base for continuity of development especially in housing, we have to explain the social, cultural and physical changes. Assessing the socio-cultural setting in the Gezira area we have to perceive that the socio-cultural cores are related to two values, the spiritual and the economic. The spiritual value of the tribal practices and ethics have developed within a context that reflects their cosmology and value systems, in the same way that the discipline of economics reflects the value system and world view of its Anglo-Egyptian roots. The economic-based culture held the environment of secondary importance as the local settlements were left to grow haphazardly. The spiritual-based socio-cultural structure embraces the whole environment; inhabitants created their environment and tried to cope with the condition of the surroundings. These aspects and changes have interacted to form a system of settlements that enabled the inhabitants to create forms originating from their own traditions and customs to suit the environment in which they live. Thus new organic settlements grew up in the Gezira of the Sudan. Then the question is: what are the physical and socio-cultural changes that shaped settlements and housing forms in the area?

4.4 Patterns of Physical Change

We saw that the inauguration of the Gezira Agricultural Scheme formed a watershed for life and human settlements of the region. Previous patchy, rain-fed, agricultural plots were replaced by an irrigated farming system, which covers two million feddans. Previous small, temporary, inland settlements were gradually transformed into permanent ones. By 1980, the population had reached 2.05 million people including 100.000 tenants of the agricultural scheme. By 1995, the population

had reached 2.716 million people including the same number of tenants. The average annual, natural growth rate amounts to 2.84% while the average size of household works out to 6.2 persons per household according to the 1995 population census of Sudan. Figure (4.15) shows the population and its structure by sex within the evolved villages.

Population	Males	Females	Households	Villages
2261553	1027164	1234389	322886	1124

Source: 1995 Sudan Census,

Figure 4. 15: populations by sex and households

Two types of settlement emerged to accommodate these populations, the colonial housing system for officials and clerics and the organic settlements created by the local people all over the plain, matching the existing new development of irrigation and farming system. The pattern of organic settlement is partly a reflection of the physical structure of the scheme. The regular straight canals and geometric farms with the distributed Farmhouses villages and empty lands for local people settlements, including the existing villages, defined and sized the organic settlements that emerged in the area. Indeed the land extension limitations caused by the canals and farms have been identified as key factors working against the implementation of more fundamental and progressive policies. The bridges designed to regulate water flow do not help much to allow direct communication between settlements and their original populations.

The colonial formal planning of the scheme as a whole has unintentionally allowed the creation of haphazard organic settlements all over the plain besides the official housing planned in parallel with the structure of the scheme. After the inauguration of the scheme, many thousands of settlements grew (local people's villages) or have been created (labourers' camps) to house the

farming communities, (Danby 1975). 1300 settlements grew in a haphazard way on land not allocated to agriculture (Figure, 4.16). They were not included in the scheme development plan (El Agraa, 1985). Most of the researchers have argued that such an important scheme should have acknowledged from the start the importance of stable settlements to support the way of life, to sustain built environments and to promote people's cultural values. The negligence of the need for local people's settlements has created a complete separation between the evolved organic villages which developed and the Farmhouses villages, from the beginning, while over the decades many social and cultural reforms have managed to integrate relationships between the two communities. This will be seen in the next chapters.

The creation of the scheme has enforced major changes on the topography of the land, the nature of the built environment and the way of living. The system of irrigation has radically changed land use, land ownership, land distribution and has enforced certain patterns of life for the people. Instead of the thorny flat land, new patterns evolved on the plain, thousands of kilometres of canals have lined the plain. Water canals now run through and the regular farms replaced the thorny trees. Settlements and farmhouses can now be seen breaking the monotony which was the characteristic of the old land. The new patterns can be seen in the photographs (Figures, 4.16 & 4.17). Such changes have supported both animals (Figure 4.18) and people; fertile agricultural land characterizes the whole area (Figure 4.19). Instead of the monsoon cultivation of land people settled in the area to continue the processes of agriculture that occupy eleven months of the year. New life styles in all aspects have emerged to replace both the arduous life of nomads and the semi-settled life of monsoon farmers. The following characteristics have followed these changes:

- Rigid farm and canal layouts have given the land certain fixed characteristics that have had a great effect on the settlements which have emerged in general and particularly organic settlements.
- Canals and farms surround the villages on all sides. Villages are situated in flat low lands between canals; 2 kilometres apart. The general slope of the land of the Gezira is about 5° from the South to the North. Regular planned farms and straight canals surround the settlements forming a green collar for each village. The impact of this situation will be discussed in chapter five.
- As we mentioned before thousands of villages were created or developed haphazardly all over the plain to support and be supported by the agricultural development (Figure 4.16). No policy was drawn to connect any of these villages except that based on agricultural and economic purposes.

There was no record for the ground levels of the villages. According to many surveyors' reports the levels of Gezira villages are lower than the farms and canals. One of the surveyors who worked in the area described the level of the villages to be about 50cm less than the lowest level of farms and about 150cm below the lowest level of the canals. Therefore, any damage to, or failure of the canals to store water, causes a big problem for the village because there is no means of drainage. This might be worse during the rainy season.

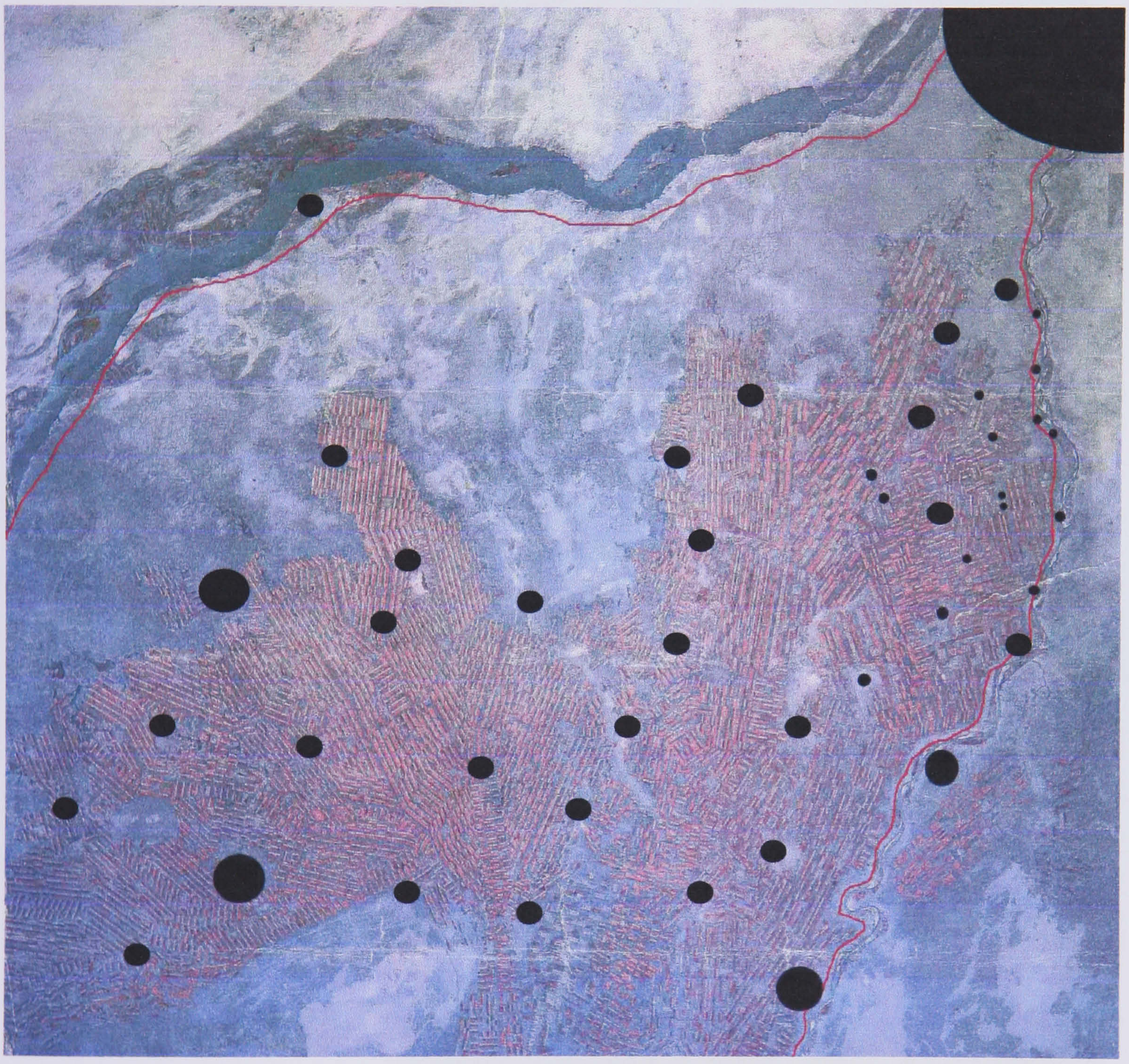

Figure 4. 16: The Gezira Area and settlements; villages were diagrammatically drawn

Source: Survey Department Sudan. (See appendix 4)

To summaries: the Gezira area of the Sudan, which presents one of the best examples of a spontaneous rural pattern of settlements in a set of inter-linked infra-structural facilities, has grown organically with characteristic features. Most settlements have grown in a haphazard way, and created distinguished types of settlement patterns through time. A total of hundreds of rural settlements and hamlets emerged in the area in empty spaces in between the well-organized

regular canals and farms. As noted more than 1,300 rural settlements (villages), of different sizes, which have emerged in the main part of the Gezira area (El Agraa, O. 1985:289).

Figure 4. 17: Canals, Farms and settlements seen on the horizon stand as witness for change

Figure 4. 18: Water canals provide enough water for animals

Figure 4. 19: People plough land for cultivation. It is real life support

4.5 Patterns of Socio-Cultural Change

Although those decades have produced economic growth and some significant economical and physical development from the diversification of the agricultural base, can the same be said with equal conviction about the social and cultural aspects? Since a few years after the First World War, when the Gezira Agricultural Scheme first got under way as the result of the construction of the Sennar Dam, on the Blue Nile 1925, the area has experienced many changes, not only in economic and physical development but in social and cultural aspects as well. The effect of those changes is nowhere more clearly evident than in the built environment (the following chapters focus more on this aspect). In the Gezira area of the Sudan, which can be considered as a container of a changing process of development, social cultural forces have played a major role in the creation of its habitats through prudent use of local resources.

Though a lot of research was carried out on the area's changes, there has been little investigation of the social and cultural aspects and housing development. The early research concentrated on physical, demographical and environmental conditions of the Gezira area. They covered anthropology, flora and fauna studies in the area. We can conclude that all studies, carried out to establish the scheme, have concentrated on the following:

- Topography of land and its suitability to a high yield of cotton production.
- Environmental conditions and the effect of climate on the feasibility of the project.
- Type of irrigation efficient for watering the agricultural lands with suitable soil structure.
- Distribution of agricultural land, taking into consideration the existing land ownership in the area.

These researches discussed geographical aspects and people in the area, but not settlement patterns or related social and cultural issues. However, the project has had an enormous effect on people and their settlements. The ways of life in all aspects have changed tremendously and even the thinking of government has changed towards the tenants and population in the area. In the following chapters we will examine the social and cultural changes but here we will firstly discuss the change of thinking towards people's socio-cultural behaviour and how people have adapted to this change.

In 1952, the administration of the Gezira agricultural project at Barakat decided to establish a 'Social Development Unit' to support and enhance the socio-cultural needs of the tenants. Its principles and functions were stated in the Formation Committee Report of the (Social Development unit, 1950-1951:3, the Gezira Board Archives), as follows:

- *"The promotion of social development services by any means having as main object the benefit of the tenants and other persons living within the scheme area, the assistance of local government authorities and other bodies in providing such services, and where it thinks fit the provision of such services by the Board",*
- *"The conduct of the social research",*
- *"The preparation and submission to the Board for annual budget on social development activities," and*
- *"The submission to the Board of an annual report on the exercise by the committee of its proceeding functions".*

In carrying out its main functions, the Social Department Unit concentrated on promoting the following:

- Social development activities through piecemeal work; but this has not satisfied the needs of the people in the area, as many small villages were not served with piped water in addition to the absence of health facilities and education and the absence of any regional planning system.
- Social research, which has recorded social and traditional issues, such as family structure, festivals etc. the Department started to carry out research to cover the services and settlements, such as the research carried out in the 1970s in collaboration with the Ministry of Housing. This has helped in the participation of tenants in planning processes' decision-making.
- Creation of a budget for researches and services for all people interested in such fields. Financing services in a piecemeal way has created an unbalanced distribution of social services because services were concentrated in the villages of influential persons.

However, the formation of such a Unit, later developed to "Social Development Department" within a remarkable administrative body of the biggest economical project in the Sudan has been the source of many social changes within the evolved settlements and people's structure. Nowhere are the changes more apparent than in the relationships of the tenants' social structure and built environment.

4.5.1 Tenants' Structure

As we noted before the tenants of the area comprise a multitude of different ethnic groups and tribes coming from different regions of the Sudan and nearby African countries. Historically, the indigenous tribes which lived since the 11th century and earlier in the area were Nubian and Nilotic origin (African). This was before the Arab migratory hordes swept into the country to implant their own ethnic entity beside the Nubians and Africans. They intermarried

with the local Nubian and African tribes and settled on the banks of the Rivers Nile. After the establishment of the agricultural scheme the Arabs have gradually maintained a social cultural pre-dominance in the Gezira. Yousif, (1997:4) states the result in the following terms

> *"This Arab intermingling had led to intermarriages with the Arab emerging as weighing social ethnic strata able to impose its cultural heritage in the fields of religion, mode of life and others."*

The results of such history are clearly evident in the built forms and people's way of life that is typical of the Arab groups. In the following chapters this will be clarified when the research turns to the formation of housing systems. As Islam is the main religion of these groups, Islamic values have impacted on the communities' lifestyle in the area, since the people are a mixture of Muslim African and Arabs. Those mixed people migrated to the area, where the economy of the country was centralized, bringing with them their own cultural, social and building habits. The mixture of social, cultural and natural conditions is reflected in the built environment and architecture. This may confirm that culture cannot be separated from the process of the continuation of settlement development.

Most of the population depends on agriculture and there are 100,000 tenants, most of whom are men. Table 4.20, shows the sex structure of those tenants. The table reflects the fact that some women and children, also, own farms. The law gives women and children the right to inherit farms on condition that an adult man should look after it; he is called "Wakeel".[17] In practice women have proved that they can deal with their farms successfully. A woman from El Sereiha village interviewed by the author (2001) says that,

> *"I work to support my family. I have the youngest to look after. This year I managed to have reasonable production. It is not enough but it could help. I am keeping the land for my children".*

This means women have their role in the process of the development. The old men also have the same intention to keep the land for further generations even though they sometimes find it difficult to continue managing the agricultural land in their old age. But the tribal system provides solutions for such cases either through the help of relatives or wakeels. In other words the old men will be helped by their relatives to do certain agricultural jobs such as looking after watering the farm, bringing some labourers to do different activities in the farm and even communicating to the authorities about what needs to be done.

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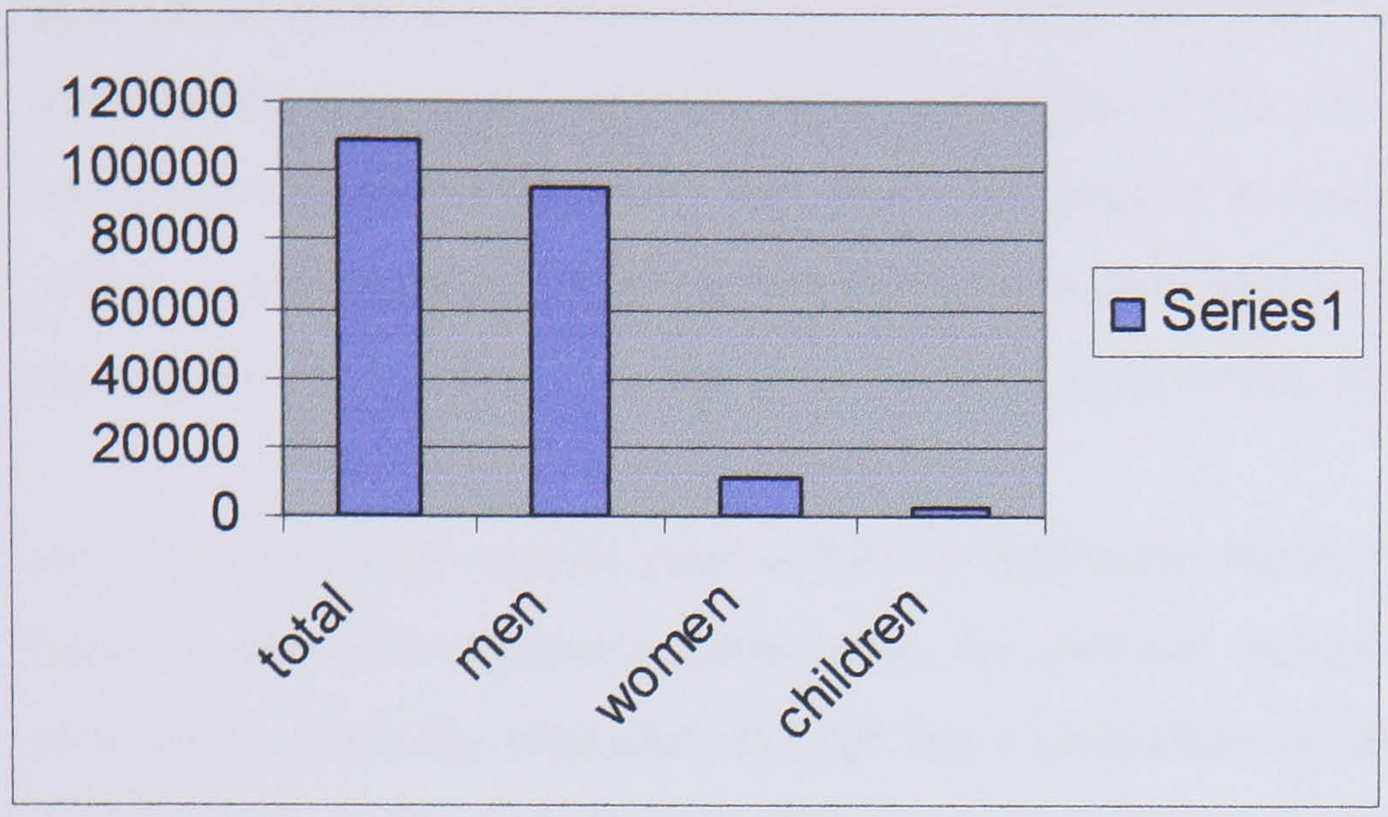
[17] A man who carries out the farm work on behalf of its owner is called 'Wakeel". He takes care of the farm, keeps an eye on the watering system and deals with the authorities in everything concerning the farm. Usually, the Wakeel is from the family or related somehow to it and the authorities know of him.

Total	Men	Women	Children
109094	95832	10874	2388



Source: 1995 Sudan Census,

Figure 4. 20: show the number of tenant farmers by sex,

4.5.2 The Kinship System

Historically, the social structure that dominated the fragmented Gezira settlements was the tribal system. The presence of agriculture then as the main economic base of the society for the population was based on a tribal kinship system. The family tribal system represented the strong political power and established an effective organization to protect the benefit of society. After the establishment of the Gezira agricultural scheme, many changes occurred in the social lifestyles of the tenants in the area through the changes of the agricultural system, which introduced a new setting of physical development and a new ownership system. Through time the canalisations and geometric farms acted as limiting factors for extensions. The farms and canals, strictly girded the free or empty land that was left to the family kinship group to be distributed among its members to live in.

The tribal system still operates but it is restricted nowadays to a limited range of socio-cultural activities. This has happened for two reasons. The new system of development took the political and economical decision-making from the tribes and gave it to the local authority. The other reason is that those people no longer look to the main figures of the tribe as a source of law but still after to them as a symbol of respect and dignity of the society. The tribal leaders still have the respect of the people in deciding the socio-cultural values to be followed. So we can conclude that even though the political and economical decision-making has been shifted to the local government, tribal structure is still an important factor in socio-cultural life.

The Gezira is associated with many tribes and ethnic groups from all parts of the Sudan and even West Africa. Those people came to the area and built their settlements beside each other near their farms. From the beginning of the scheme, the Gezira Board distributed the agricultural plots to the locals according to where the locals lived or cultivated the land. In other words they distributed the farms according to the old ownership and utilization of agricultural lands. So the tribes kept their own land or at least part of it to comply with the policy, which gives the right for every person to own only two farms in his name. This has secured the tribal norms of living close together. It is considered a success of the scheme.

An extended family system grew within the haphazard settlement that developed organically between the well-organized farms near the planned colonial Farmhouses villages. The settlements gradually expanded through the construction of residential housings for kinship groups, with their supporting facilities, such as mosques, Qura'ặn schools (Khalwa) and Majlis (that is a common meeting place for all the people of the village). The extended families created their own system of traditional planning. Though the land allocated for residential uses was very limited, the families were able to distribute the land in the form of hoshes for each extended family to expand. Hoshes are court clusters to accommodate extended families, and named after the first family's leader. This typology of hoshes characterised the way of organic planning system followed in all the villages that have emerged on the plain (the following chapters will discuss the system in more detail).

The farming system was oriented to give each person at most two farms of 40 feddans, but the socio-economical set-up of the families considered the farm to be the property of the whole family. All the family participate in cultivating the farm. The family, men and women, adults and children, carry out cultivation. Men plough, hoe and do other agricultural activities, some women participate in planting the seeds and harvesting, especially the cotton because picking the cotton must be harvested in a very short time, while the tractors for ploughing the farms at the beginning of the cultivating period (Figure 4.19). As mentioned before women have no major role in farming work but sometimes help on the farm and play a major role in the work within the house. They have a pervasive influence on the shape of the interior of the house. They do the decoration of their houses and participate in a wide range of the household decision-making concerning the house's arrangement. Women consider the house as their kingdom while the man is seeks way to increase the farm produce and the family's income.

Women used to work (sometimes in groups) as interior designers of the houses where they prepared the plaster and paint from local materials usually made from animal dung and fire ashes mixed together with 'Gum Arabic' to give elasticity. Nowadays these activities and

building materials have been affected by the new technology, skills and building materials introduced by the more financially able households. Therefore, women in most houses are no longer doing the job of interior design. Then we can conclude that the agricultural scheme has had many changes on the way of life and cultural behaviour. The main changes can be summarized as follows:

- It changes the system of the agricultural ownership from Al-Nawzil[18] where people cultivate the land they want within the area of the tribe via a system in which every person has its definite plot though the whole family participates and feels that they own the land collectively. This feeling is reflected when the family members inherit the farm.
- The nuclear families started to grow extensively in the area. Now the extended family is, practically, not related to the distant ancestors of the family but they are related to at most to the third grand father.
- People's aspirations and the need for new services have increased. The need to organise the settlements becomes important. Re-planning interventions have, already, started to enable the authorities to supply the villages with the required facilities. Has this intervention within the traditional built environment been successful? This can be evaluated later.
- The tribal system has been greatly affected as well. The political and economical decision-making was shifted from the tribal system to the local government system, which was established with the creation of the scheme. But the tribal system seems to be still a very strong factor in the socio-cultural behaviour. That was reflected in the socio-cultural ties that to some extent affected the economical and political system created in the area.
- The role of women in society has been affected greatly. Women can now work in farms and offices and have freedom to move but they have to consider the family socio-cultural system and respect the ethics of the society. Most of the young women have some education or training and they can help the family financially. Also the new way of living and new technology has replaced the collective work of the family in farms and housing construction.

Thus we conclude that there are two types of settlement that have emerged in the area. The Gezira organic built environments are viewed as a direct product of tribalism and their religious and customary laws. Sharie'ą (Islamic law) and customary laws provided the basis for the planning guidelines for settlements and were practised by the community members

[18] Al Nawzil means that people come in groups to certain agricultural areas and live for a while to cultivate land and feed their animals and then leave the place for their permanent home land on the river bank.

until 1970. Muslim 'Faki' was the one who teaches the law while village sheikhs and old people with wisdom as known in villages were the persons who usually enforced the law. Those prominent figures used to apply the Islamic and customary laws to emerging planning problems which emerged such as those seen in the Gezira context where several vernacular institutions were developed. These institutions formulated the decision making process pertinent to the user and the built environment.

In contrast the Farmhouses settlements were developed by the government in a hierarchical planning system and continued to be under the responsibility of the government until now. These settlements form the colonial or formal side of the development parallel to the organic settlements in the area. Those formal settlements consist of high and medium ranks' farmhouses, labour camps and other houses for officials of lower ranks. The settlements are characterised by the essence of Western-style planning; more discussion will be follow in this chapter. After establishing the Social Development Department the government has tried the promotion of planning organic settlements and supplying social services, essentially a water supply, as a way to stimulate the economy, as well as enhancing the social amenities in the area. The history of state intervention in organic settlements and related social issues can best be interpreted as reflecting the wider economical and political agenda of those in power, and hence an understanding of the nature and motivations of the state is vital.

The Gezira area has a relatively long history of state intervention in organic settlements. In the 1960s the Government and the UN started the process of re-planning the organic villages. Prior to 1970 its results and impact were minimal, but in 1970 a Planning Office was created to debate the problem. The resulting progress had an impact on housing and community action policies throughout the Gezira with the introduction of reforms aimed at replacing the old traditional vernacular architecture. There was a perception of the need for social stability for the sustainability of the scheme production. Chapter Five will discuss the planning intervention and its impact on the organic settlements. Here in the following section we will discuss the processes of settlement evolution and development and how the social and cultural values interacted with other factors to produce a form or system of planning. Also, we will see that the uniformity of the elements of the regional patterns that emerged after the amalgamation of two different systems (social and cultural factors are the catalysts) could be an order of planning development.

4.6 Settlements Evolution Process

4.6.1 Regional Planning Forms

The agricultural improvement of the Gezira area of the Sudan has had its greatest impact on the settlements, the so-called traditional vernacular villages, lying between the farms and the central administrative Farmhouses villages. Important questions are raised by the experience of the evolution of settlements, especially in the context of planning in places like Farmhouse villages and traditional vernacular villages. The area demonstrates the important influence pressure groups have upon planning decisions. Of course any physical planning decisions have long term, cumulative and direct influences on places and people (Herington 1989).

Hayder (1994:134) stated three types of theory, the Scattered Settlement Theory, the Gathered Settlement Theory and Semi-Gathered Settlement Theory. The following diagram (Figure 4.21) help to explain these theories. Here we can consider that there were two types of planning system produced for the area at the beginning of the scheme. Therefore we conclude that there have been planning systems brought to the area.

The British people brought a style known in Sudan as 'European style', when they first came to the Gezira area at the beginning of the 19th century and established the agricultural scheme in 1925. The Farmhouses villages and single farmsteads are scattered all over the plain to serve agricultural purposes in an order that may be characterised by its 'Scattered Settlement Planning' features (Hayder 1994:134). The diagram (Figure 4.21) explains the theoretical background of the planning system introduced in the area. The area was divided into regions, each region into divisions, each division into blocks and each block into 4-5 farmsteads of a single house. This set of development may be considered (Hayder 1994) as a scattered settlement theory if considered alone, but another form of settlement was added to the area when the tenants from different cultures came to the area and formed another set of haphazard settlements that could be categorised by its semi-scattered settlement nature. In other words villages were haphazardly grouped in the empty places between the regular farms and the geometric straight canals, the diagrammatic drawing (Figure 4.22) indicates the system formed after the two systems were amalgamated together in terms of social and cultural amenities.

These general ideas or theories could provide guidance for evaluation of the emerged planning system that has emerged and has an impact on the regional development thinking to develop a hierarchy in the region for the sake of both the productivity of the scheme and the social amenity of the tenants and other interested parties.

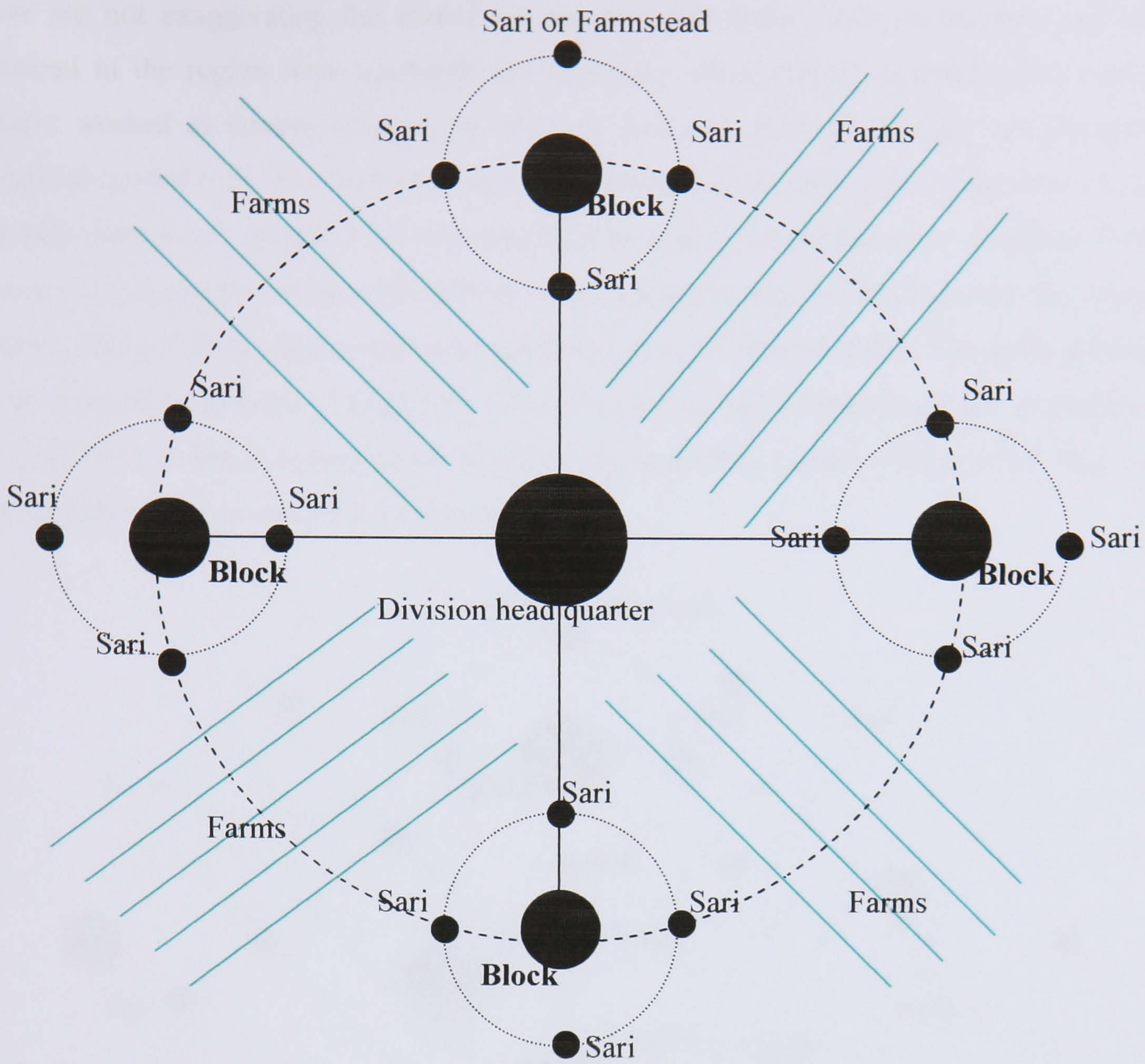


Figure 4. 21: Schematic colonial regional planning for the Gezira, which reflects the scattered settlement system.

We saw that between these systems another set of organic planning has emerged. At the very beginning of the scheme the Farmhouses settlements worked irrespectively of these organic developments. Though there is no theoretical framework found for the planning introduced in the area by using the discussion of Hayder (1994:134) a framework can be developed for the type of hierarchy used for developing the regional plan. This shows a scattered settlement planning system. The 'Head Quarters' work as sub-region service centre, while the blocks as service villages and the farmsteads (known in the area as a sari) come at the base of the system. The diagram (Figure 4.23) explains the new system formed due to socio-cultural and economic relations in the area. Through time the organic system has integrated with these planning systems and formed another system. A further aspect of the application of these simple models from reality to theories was identified by many planners when they examined the spacing and relations of villages in the area and this work must be considered in more detail, for the results have a direct bearing on the precise definition of the actual extent of the economic area around these settlements.

If we are not exaggerating the matter we can say that these forms of planning systems produced in the region were gradually changed into semi-gathered planning when certain villages worked as central villages, or what we know as primary villages, and the other centres integrated with them to form a lattice of semi-gathered settlements. Therefore, we can conclude that the two forms of development have created a form that may be of interest to the planners and designers on the regional level to consider and may be developed to suit current theories. Hayder states the positive and negative issues of these theories. The semi-gathered theory is based on gathering the positive characteristics of both of the other types of planning, the small villages are in an easy reach of their farms and of the central villages where they can find the services required in the primary villages.

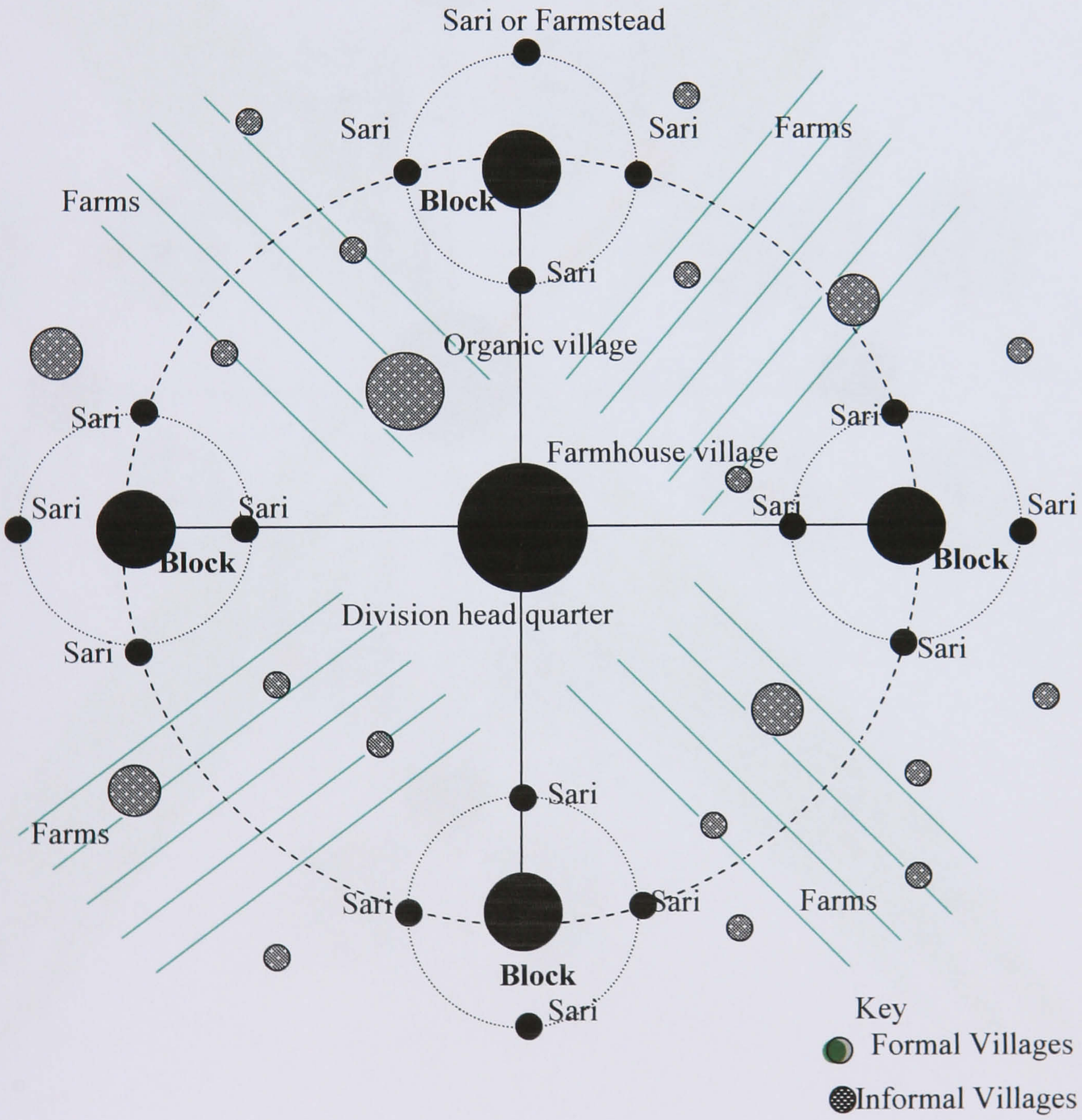


Figure 4. 22: Schematic diagram showing the scattered organic settlements between the planned colonial fabric and farms

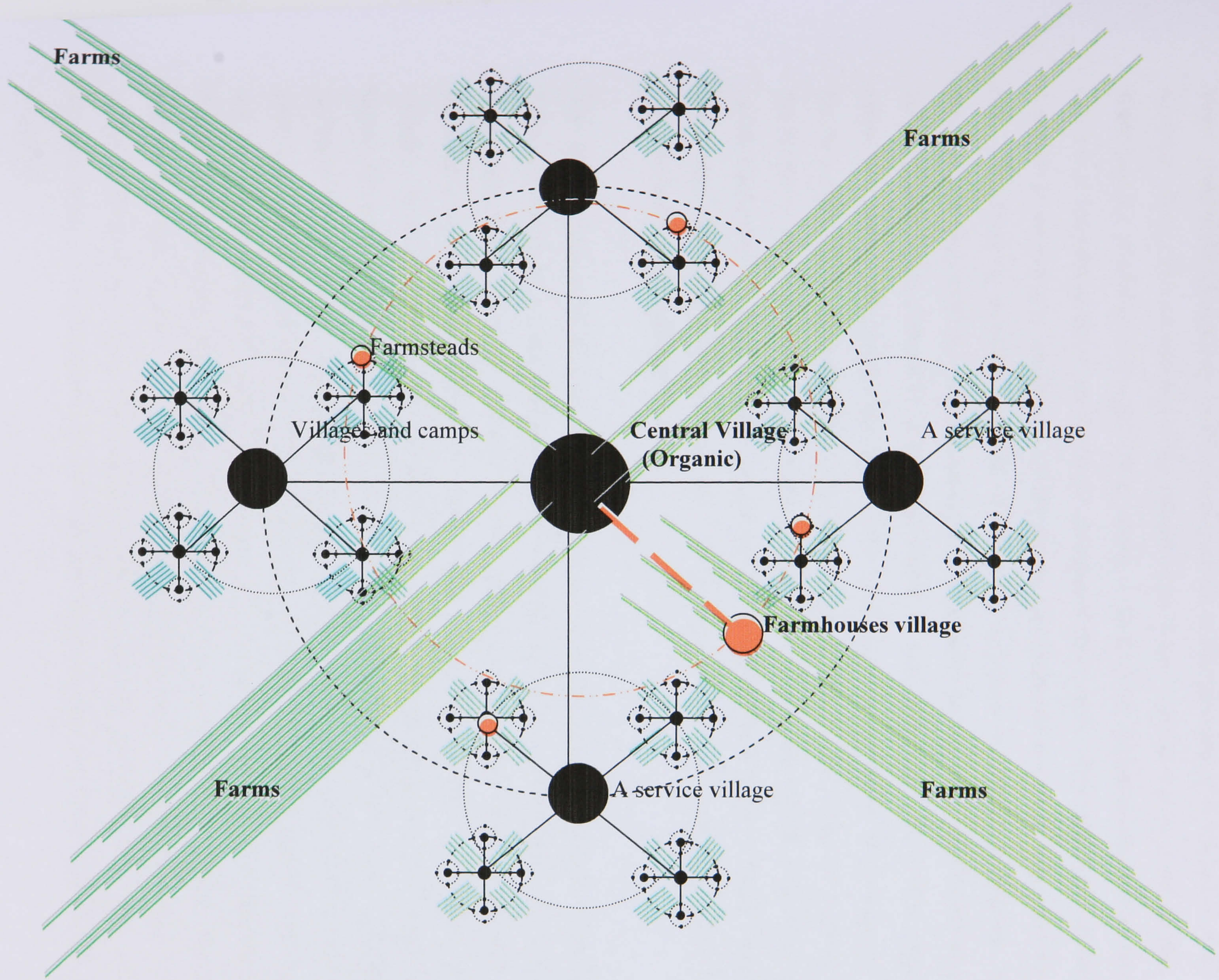


Figure 4. 23: An existing relationship between the two types of settlements in the form of semi-scattered settlement planning

The remarkable variety of village forms and relationships seen in reality is a reflection of the long period of time involved in their development, and it is this characteristic above all others which gives to the Gezira rural nucleation a diversity and fortuitousness in which lies much of its visual charm. The appearance of the village, often simple, always varied, is the product of many decades of historical change. The evidence of researchers' studies points to more than a century of continuous existence for many settlements that crossed with other cultural forms, while if we consider the settlements on the Rivers Nile evidence can easily add centuries to this. The types of evidence relevant to historical appraisal of village settlements are: documentary and morphological or landscape. The evidence derived from the documents has for many years been a mainstay of historical studies of rural settlements, but in this category maps, as a source of accuracy, were unavailable for all types of settlement which emerged in the area even for the formal villages. One further source remains available, the evidence of the landscape itself, and although a recent authority has written that 'the joys of fields and canals connecting the simple villages are more likely to benefit the economy's health than the knowledge' (El Agraa 1985), the evidence provided by the settlement morphology itself is a valuable and virtually untapped source.

The first obvious signs of settlements in the Gezira rural scene are the movement patterns from one village to another and between the dwelling and associated buildings which make up villages, hamlets and farms. The movement patterns assured the hierarchical patterns of these settlements as people move with their produce and students travel to school in other villages. In other words, certain informal villages developed themselves as main centres for others. If we borrow the analysis of El Agraa (1984) concerning the primacy of these villages we can conclude that the informal villages have developed to give another shape of settlement planning. The above schematic diagram (Figure 4.23) explains that the evolved settlements can be arranged into the system of semi-gathered settlement planning. The morphology depends on the existing situation of service provision and size of population. It seems that the Farmhouses and its derivatives as an economic hierarchy and as important centres have declined allowing the organic development to have the primacy in providing services and at the same time to have intimate relations with the economic fabric (shown in red lines in the diagram)

4.6.2 Village Forms

Generally one key objective of village planning must be an integration of a village with the farming system and its services to the economic base so as to enhance the process of crop production. For the special connection between the village and people on one side and on the other side people and their animals and agricultural equipment, the study of the quality of

settlement arrangements and spaces is vital. Having studied the system of planning as it emerged at the regional level it should be followed by a study of the settlement or village space organisation. The two systems brought to the area different types of development that interacted with each other. As we have seen the social and cultural behaviour has had a great effect on these developments, as will be discussed in detail in the case studies in the following chapters. Here we will draw attention to the general village formation brought by the British and different peoples with different cultures that settled in the area.

- The British introduced what is known in the Sudan as a Western-legacy Planning with its wider roads and green areas and houses of rectangular shapes with straight lines built of red bricks and roofed with slate or corrugated zinc (Figure 4.24).
- The African style with its thatched houses concentrated in groups separated from each other in a cluster form (Figure 4.25). The same African planning system was used in the area but it was changed into crowded thatched houses. Figure 4.26 shows the settlement of Azraq settlements, which forms part of El Sereiha Village at the time.
- The Arab and Nubian architecture with its crowded mud houses, which result from the extended family structure and privacy orientation known in Islamic values and culture (Figure, 4.28).

The processes of the above different styles of planning have impacted on the area in two different ways. As analysis over the last hundred years or so, has shown the development of building layout in the region evolved in a series of overlapping stages based on both traditional and professional solutions. These are two separate but parallel approaches that have developed over time in the Gezira area of the Sudan. The building materials used in the building construction affect the two approaches. The culture of the Arab, the dominant group, has also had a major effect on the planning legacy of the traditional solutions. Physical conditions in terms of new structures of irrigation system controlled the shape of settlements. The two types of planning can be named as a western-style system, which in this research is referred to as "conscious planning" and a traditional planning system that will be referred to as the "traditional vernacular system". There are the two space domains of our study. The following figures analyse the shape of regional development and the location of the space domains.

The Western-legacy Planning formed the source for the colonial regime to plan the Farmhouses and Saris or farmsteads in its formal shape. This planning has a great effect on the élites in the field of planning. The following diagram shows this impact of the Western-legacy planning on the planning for the Sudanese. The designer at the Gezira Board designed

the following village project (Figure 4.24) for labourers and lower rank clerics. More detail will be focussed on when discussing the Farmhouses village form.

Figure 4. 24: The European planning legacy designed by Sudanese Planners. Source Barakat Archives

Figure 4. 25: Settlements originating from the West of Africa, using thatch Guttias, Source Ministry of Information (1948) Sudan

Figure 4. 26: Cluster system produced by the African Style; Source the Author (2002)

Figure 4. 27: Settlements developed by an Arab tribe after the establishment of the 1925 scheme in (1933): Source Ministry of housing Sudan

Figure 4. 28: Another view of settlements developed by an Arab tribe after the establishment of the scheme (1925) in (1933): Source Ministry of housing Sudan

Both categories of building habit (Arab and African) brought to the area are logical in their original regions but they became very problematic in the Gezira. The technology of the North is based on mud as the major building material and is not suitable for this area, which has four months of rain.

On the other hand the technology of West Africa, based on thatched buildings, proved not to be practical for different reasons, mainly because it catches fire, people in the area tend to live close together, and thatch material has also become very scarce.

The majority of people abandoned the thatch Guttia 'cottage' because of the problems already mentioned in addition to the improved income situation and replaced them by mud buildings. Later they used redbrick walls and imported building material as will be shown in the following chapter. The figure (4.29) represents the existing layout after all planning processes have been carried out and many changes in socio-cultural structures have occurred within the society of El Sereiha village. On the other hand there have been few changes on the level of settlement planning in the Farmhouses village.

Figure 4. 29: Illustrate the existing settlement layout, Source Ministry of housing Sudan

4.6.3 Dwelling Forms

The most obvious signs of settlement in the rural scene are the dwellings which make up villages, hamlets, farmhouses and farmsteads, but important as these are, and large as is the literature dealing with them, it is not the purpose of this chapter to dwell in detail on domestic architecture, and a brief view of some of the issues and questions suffice before we turn to the context in which these structures occur. Many researchers have argued that in the rural landscape the traditional house is an important element providing evidence of the complex relations between man and his environment. House-types and building materials adopted do undoubtedly illustrate some of the interactions between physical and human factors, while the plan of the house and the layout of the buildings are valuable visual clues to the functional aspects of settlements. The evidence available for the Gezira house-forms in the post-1925 context is derived primarily from the documents and the existing simple structures. A careful study of documentary material can greatly illuminate social and economic contexts for these. There is an increasing volume of evidence to show that throughout the history of the scheme the traditional house formed an important, if not a dominant, house-form at the peasant level, although it underwent substantial modifications. The capacity of a building to survive is a reflection of two principal factors; its position on the social scale and the changing fortunes of the owners, the settlement and the whole region. Thus the higher up the social scale a building is, the more chance there is of it surviving, so that houses from as early as 1930 still exist.

The history of the Gezira Plain revealed that communities build their settlements whenever they find sources that sustain their living, such as water and income resources. But at the same time they stick to certain rules and values that might prudently be changed to suit the environmental context. Also it proved the possibility of socio-cultural interaction between different groups of different cultures, and this is very clear in the built environment created through time, and at the same time the socio-cultural factors interact freely with other factors of sustainability in these settlements. In other words they interplay with the environment and economic condition to support the living within these settlements. Sharma (1980) assured that the four factors interact freely to sustain settlements' formation (See chapter two). It is true that such studies reveal the accumulation of experience of previous generations, but these experiences were the product of an entire society which had different standards, norms, values and technical capabilities. The study of societal process that produced the traditional environment could be of significance to planners rather than analysing the end product only. Thus we can understand the extreme complexity of the built environment, and consequently deal with it rather than just assume that we are capable of understanding the structure of the built environment and thus can intervene to improve it.

4.7 Conclusion

Apart from the political impacts and effects on the Gezira context, the contextual analysis shows the prudent evolution of the informal organic order that dominated the economic formal order. This reflects the effectiveness of the socio-cultural behaviour within the built environment. The slow emergence of the organic order in the informal settlements assured the adaptation and adjustment that regulates the stream of the individual acts put forward by the users. This system ensured another fact that all decisions about what to plan and what to build and how to build were in the hands of the users. It also confirmed that a process, which allowed settlements to emerge gradually from local acts, guided the planning and construction of the built environment.

Most of the built environments today lack natural order, an order that presents itself strongly in places that were built by local people prudently through decades. His natural or organic order emerges when there is perfect balance between the needs of the individual parts of the environment, and the need of the whole community. As we saw in the organic built environment every place is unique and cooperative with others to form a fabric of common interest and function. And it is certainly true that nowadays communities do need planning and planning intervention because without a plan, the gradual accumulation of piecemeal acts will create mistakes of organisation, as the built environment parts today are complex and not

simple or humble as seen in the old organic order and the socio-cultural values have changed and new expectations emerged. The central question can the planning principles formulated in the traditional vernacular work of people generate guidance for rural development processes rather than western-styles patterns? In the chapters which follow these principles will be defined in much greater detail. We believe that these issues or principles adopted the bottom up theory and decentralisation in the contemporary planning ideas. Thus any planning processes that conform to a community's adopted patterns and order with clear understanding of the socio-cultural images will be built on solid foundations for any future resilient and robust acts in the built environment. The criteria for the judgement of the effectiveness of planning processes are the community language and the current analysis of a physical context. The appearance of the village is the product of many decades of historical and social cultural changes. The evidence of Gaitskell (1959) points to nearly 100 years of continuous existence for many settlements of both types, formal and informal forms that interrelate with each other to bring about a regional order, which secured the continuity of identity of these settlements. As noted before, two types of evidence are relevant to the historical appraisal of villages in this research: documentary, which we discussed in this chapter and morphology as will be discussed in the following chapters.

CHAPTER FIVE: SOCIO-CULTURAL ORGANISATIONS

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5.1 Introduction

The process of the formation and development of the Gezira villages that was discussed in the previous chapter has been continuously based upon the interrelationship of the physical and socio-cultural environments. The morphology and spatial patterns of these villages have gradually developed to satisfy the social and cultural needs of their populations and, at the same time, to respond to their surrounding environment.

Frequently evoked in discussions of urban (rural) design, the public realm and the related and overlapping concept of public life require further consideration. Public must be understood vis-à-vis private. Public life involves relatively open and universal social contexts, in contrast to private life, which is intimate, familiar, shielded, controlled by the individual, and shared only with family and friends (Carmona 2003).

The public realm has physical (space) and social (activity) dimensions. The physical public realm is understood here to mean the spaces and settings – publicly or privately owned – that support or facilitate public life and social interaction. The activities and events occurring in those spaces and settings can be termed the socio-cultural public realm (Chapter Two).

Anthropologists have noted how in tribal or traditional societies, all aspects of daily life - from the religious to the economic - fit together to form a unified whole. With regard to tribal settlement patterns, for example, it has long been observed that the arrangement of houses is not random: rather it reflects a tribe's social structure and – in some cases – its cosmology. Those same concerns also influence the design of houses in traditional societies. Rare – if not known – it is the house whose design is purely functional. In some cases, the tribe itself acknowledges the connection between a tribe's settlement pattern and its social structure.

The two main cultural subgroups in El Sereiha and the Farmhouses villages were radically different in terms of core cultural values, particularly in relation to the role and image women and men and the consequent household structure, which made their societies. How do these cultural values translate into housing behaviour? Household is the machine for translating cultural values into housing behaviour (Rapoport 1969). For EL Sereiha the family unit is cohesive and intended to be long term, hence a man's commitment to his family is likely to be reflected in his effort and investment in creating a dwelling. Such order and clarity is in clear contrast to the formal and unstable household circumstances of the Farmhouses village illustrated by the situation of the inspectors and other staff whose jobs change with time.

In this chapter we return our attention to the behavioural processes involved in people's relations with the environment. The chapter focuses on the following issues:

- The first issue will briefly sketch the key aspects of the socio-cultural groupings of the people who have both created and populated these settlements.
- The second issue will discuss the structures and profiles of the population of the settlements, the traditional settlement in El Sereiha village and the formal Government housing as seen in the Farmhouses village.
- The third issue discusses the family (usra) structure and its relationship with the environment and its role within the community.
- The fourth issue will cover the accessibility to these settlements.
- The fifth is the issue that concerns the sustainable rural settlements. Socio-cultural factors are important in the process of sustainable development (Chapter Two).

The examples of various types of social relationship provide evidence compatible with certain frameworks of behavioural regulation as a cultural universal. However, cultures are unique in that they have a variety of mechanisms for regulating interaction between strangers, acquaintances, and family members (Altman 1989). Thus the relationships within families, kinship and communities could reflect on socio-culture/environment relations.

5.2. Socio-Cultural Groupings

The National Sudan Statistics (Sudan Census 1995) revealed that the residents of the Gezira area came from different parts of the Sudan and from the Western African countries, in particular Chad, Nigeria, Senegal and others, since the establishment of the Gezira Agricultural Scheme in 1925. The cultures of the incoming population had a great effect on the organisation of social life and space at the beginning of the Scheme. It is difficult to trace cultural values through questionnaires or interviews but here we can use the origin of household head or the respondent as indicators for cultural groupings on the understanding that those born in a particular region or country are likely to adopt the key cultural characteristics and values of that region. This is in line with the position of Kellett (1995) who links cultural values and place of origin.

The questionnaire carried out by the author (2001) showed that El Sereiha village is dominated by Arab groupings who came from nearby villages lining the banks of the Blue Nile River and there are some residents of Nigerian origin who live in the village and form a quarter, which grew as a labour camp but has now been amalgamated within the new extension of the village. Almost more than 95% of the household heads are from the same origin in both the old village and the extension, while about 3.5% are Nigerians and the rest

(1.5%) from other Eastern and Northern parts of the Sudan. The inhabitants of the Farmhouses village are usually from the Gezira Board staff. They represent the educated people from different parts of the Sudan, but recently the Government tended to appoint the local people into these posts. Before independence in 1956, all the staffs were British and the houses were built to suit their behavioural conditions.

5.3 Families and Households

While there are several meanings in the development processes on the criteria which define a household, the desire here is to generate a definition of a household and family, which may be applicable to rural Sudan, especially for the Gezira area of the Sudan. The most reliable definition for El Sereiha and the Farmhouses villages is a household designated as individuals who live in a compound and who share basic needs and domestic activities with the community in which a family forms a housing unit, social (kinship) or economic unit that helps the individuals to regulate their behaviour and support their lives. In this sense the definition of a household revolves around whether the household should be viewed primarily as a social (kinship) group, an economic or a housing unit. The relative weight of these different emphases varies according to different groups, such as household members, planners and policy–makers, etc. It is of significance to mention here that the household reproduction may not depend entirely or even predominantly on the effort of the household members, but on a wider network of kin, friends and neighbours with whom there may be fundamental and enduring links. Also UNDP (1996:11) defines household as follows:

> *"The household is a fundamental social unit. Households are more than groups of dyadic pairs. They have an emergent character that makes them more than the sum of their parts. They are a primary arena for the expression of age and sex roles, kinship socialisation and economic cooperation where the very stuff of culture is mediated and transformed into action."*

Therefore the following brief description of the social structure and kinship organisation of those groups living in a same space domain is necessary in order to introduce the discussion of the mode of kinship organisation in rural areas, and particularly among the people covered by the survey of this study.

All tribes in the area, whether African or Arab, are agnatic and segmented in character. Thus each tribe (gabila in Arabic) is divided into several clans. Each of these clans is again segmented into a number of sub-clans, which in turn are further divided into agnatic or

paternal linkages. At this level of segmentation, the group usually refers to a widely known male ancestor, the lineage founder, who may be three or five generations earlier than the oldest living member. All lineages are further divided into several paternal extended families (usra in Arabic), which, for example, may consist of a compound (hosh) head's family, together with the families of his married son/s, their descendents and/or collateral agnates, and their dependents. While in the traditional vernacular village the paternal extended family (usra) is firmly embedded in the social structure of the larger kinship units, in the Farmhouses village its affiliation to wider kinship groups is less important and it is replaced by the ties of its members to occupational associations or guilds and other socio-economic institutions in the area. As each paternal extended family (usra) occupies a common house or hosh, it is the basic domestic grouping in vernacular context.

In El Sereiha village the dwelling represented by a house or houses, built in an externally surrounded compound 'hosh' itself encloses an agnatic nucleus: the *'Usra'* consisting of one nuclear family or an extended family, in other words, a family of a man, his wife and children or an extended family consisting of more than one family, living in the same compound. Children who marry live with their parents. The sons have their own units in the compound and share the guest room, and continue to work in the family framework; the daughters go to live with their husbands but do not abandon their kin. In fact, the preference for marriage between cousins, traditionally considered desirable, has resulted in keeping women in the family and so in the village. Such types of marriage do not make new links with other groups, but enlarge alliance relationships and the kinship circle. However such types of family supported society within the area for the decades of housing development, especially in the traditional vernacular villages.

As was discussed before in chapters two and four, traditional societies establish an order on their living space and their character is reflected in these spaces. The socio-cultural factors are considered here as design layers that create homes for residents. The society and space are two interrelated design layers; it is difficult to conceive of one of them without the content of the other. In the Farmhouses village, choice in housing is not expressed through design socio-cultural relationships, while in the vernacular village the socio-cultural relations credit the choice of housing. The access to a dwelling in the traditional settlement is mostly secured through social interaction, marriages, inheritance, and relation to kinship (family). Housing affordability was not a critical factor in the provision of land for vernacular houses, although the economic situation greatly affects the status of the family (usra) and the type of design chosen by the usra in constructing the typology of the housing. The social structures and cultural regulations of people in traditional vernacular villages are not abruptly changed by

enforcing professional ideas (planning intervention), but prudent development may alter the everyday details of life, as seen in El Sereiha vernacular development that took a long time to cope with the planners' interventions. It seems intuitively clear that the family and kin groups in the traditional vernacular villages, in general, should be able to co-ordinate their environment best. Then the usra has been able to apply this co-operation to initial construction as in the vernacular settlements, ongoing maintenance and to changes, extensions and personalisation either in vernacular or Government housing. Salama (1995 in Rapoport in Awotona 1999:27) stated that:

> *"Stable communities with similar cultural backgrounds, i.e. people with close relationships and tight social links, co-operate better and are thus more capable of working together."*

Families can also be helpful in accumulating and sharing necessary resources – money, materials, labour or skills – making the continuous housing modifications and transformations more likely and easier, particularly if housing is open ended; they can also be helpful in self-housing. It should be noted that the increasing role of codes, regulations and rules make self-build, building by the family or kin group, and transformations more difficult, as do particular forms of land sub-division, street and service layout etc. (Rapoport 1980). But before discussing the family structure it is of significance to understand the people and their profiles that supported these families.

5.4 The People

People are an important factor in sustaining the usra and the development process on any piece of land. At the same time people cannot sustain themselves without life supporting factors. People create their vernacular architecture depending solely on the resources to suit their culture and adapt the environmental conditions. Here in this section we will focus on the population structures and economic support systems and how the family integrates with the available resources to support their daily life and suit their cultural values.

5.4.1 Population Profile

This pattern is shown by the statistics derived from the 1970 social survey carried out by the Ministry of Housing, the Planning Office at Wad Madani. This covers the wedge of El Turabi division. Here we can derive the following data for the approximate population for the settlements in Kab El Gidad Block, which is within the area of El Turabi Division.

El Sereiha Village	7000 population (in 1970)
The Farmhouse Village (Almost fixed)	1500 population including local people
Other settlements in the Block	150 – 2500 population (1970)

A review of documents and an interview with Sheikh of the vernacular traditional village indicates that the population of El Sereiha has undergone changes since the establishment of the agricultural scheme. The population in the village has tended to grow steadily as a result of the natural increase by 2.84%, (Sudan Census 1995). The provision of some services due to a planning intervention process and improved quality of living in comparison to other villages around has encouraged people to stay in the village. There are no statistical abstracts for either village but the social survey of 1970 indicates that the population of El Sereiha was 7000 people and the Farmhouses village was 1500 people. Analysis of data collected from the Ministry of Housing, the Planning Office in Wad Madani and Gezira Board Archives indicate that the population of El Sereiha reached 13000 people in 2000. There is no population prediction for the villages but from the natural increase and as a result of the interviews with officials and according to the settlement development, an approximate population projection was calculated. The following diagram (Table 5.1) shows that there is a steady increase in the El Sereiha population. In contrast the population in the Farmhouses village has not recorded any significant increase (Table 5.1) and we were told that the increase depends on the sizes of families which move frequently to and from the Farmhouses village and thus it is considered as a fixed population, which fluctuates at around 1500 persons and if there was an increase it was from the local people who come and go for the purpose of trade. However, it is insignificant increase.

Table 5. 1: Estimated Population Projections for El Sereiha Village:

The explanation of the steady population projection in the Farmhouses village and the increase of El Sereiha village can be seen in the reply of the Gezira Board Director of the Engineering Department. He says:

> *"The Farmhouses village was built to segregate the field inspectors from the tenants from the first beginning of the Scheme. And as the farms and canals surround tightly the village and limited any extension, no local people tried to come to the village. Of course there are local people settlements around the village and it showed some increase but at the same time the extensions of these settlements are very limited as well. El Sereiha village has the chance to increase in population for its structure of both types of settlements and population and opportunities of being supplied with the main services for a long period" (Social Survey 2001).*

If we compare the population growth in El Sereiha village to the whole Gezira area we find certain facts. The Sudanese population statistics for the year 1995 indicate that the dominant pattern of the whole Gezira population ages between 0-14 and 75+ is as shown in table (5.2), which shows the age grouping of the Gezira population, is decreasing with age.

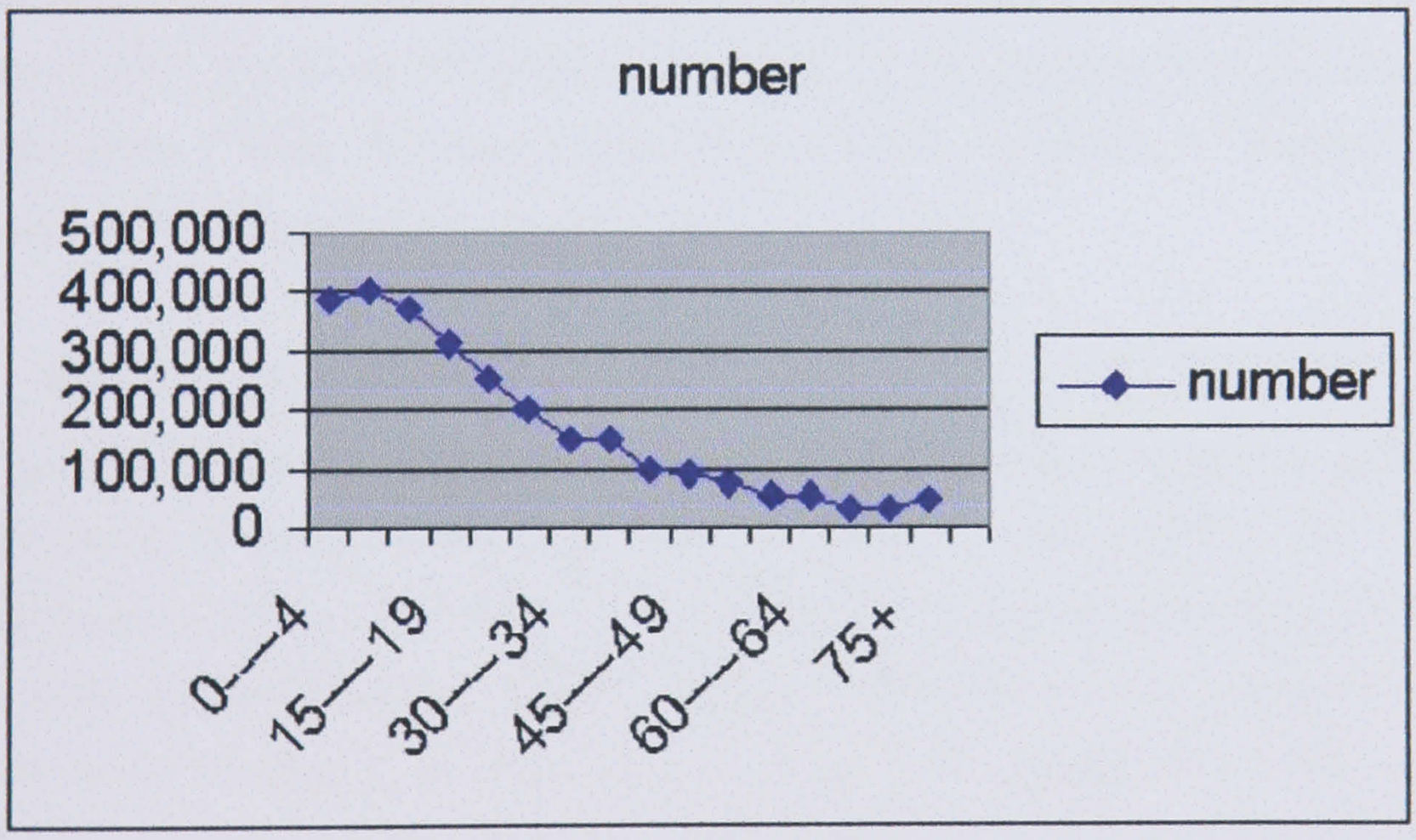


Table 5. 2: Population projection according to age grouping in the Gezira area of the Sudan: Source Sudan Census (1995).

The breakdown of the data shows certain facts. There are a decreasing number of age groups in the whole Gezira. It is said that the reasons for the decrease in age groups is related to the migration to either the urban areas or to the Gulf area searching for work and a better life (Misra 1996). The high percentage of children (34%) reflects the fact that the death rate is low. This means there is a remarkable development in the quality of life.

Population pattern (year)	0-14	15-24	25-34	35-44	45-59	60-74	75+
Percentage %	34%	31%	13%	9%	8%	4%	2%

Table 5. 3: Population Pattern according to Age Grouping, Source: The Sudan census (1995)

When comparing the population increase in El Sereiha village with the decreasing factor in the whole Gezira, two conflicting factors emerge; some villages have the chance to support the living of people while others have failed to do so (El Ariefi 1985). It is noted that the piecemeal provisions of services and planning intervention processes have significant effects on the population persistence of some villages in the Gezira area of the Sudan (El Agraa 1985).

The fieldwork analysis of the population of El Sereiha village showed an increase in the adult people in relation to the young; this reflects the stability in population. Also the percentage of educated people tells us that there are opportunities for jobs provided through public services available in the village. This may confirm the stable and sustainable development at least in the basic health in the area of the space domains of our study.

5.4.2 The Economic Profile

This emigration from the Gezira area happens even though the scheme was established to enhance the social life as well as the economic benefits of beneficiaries. The scheme has provided chances for the farmers to grow diverse crops. The government takes the cotton and wheat crops and sells them on behalf of the tenants and then pays the profit after deducting the expenses of the agricultural services and irrigation. Other produce such as dura (sorghum), groundnuts, and vegetables are not taken or bought by the government but the farmers sell them, whenever financial needs necessitate.

People do not work in commerce, but there are seasonal merchants who come to the area to buy the agricultural products either directly from the farmers or from brokers. This created instability in the prices of products, and therefore affected the income consistency of the tenants. In another sector, the labourers depend on the work on farms in preparing, harvesting and clearing the lands for another rotation. These agricultural activities may oblige the farmers to sell their crops at a low price before harvesting to cover the expenses of the labourers. The fieldwork (2001) revealed that the average annual income of a farm of 10

Feddans owned by a person from El Sereiha village is five million Sudanese pounds, equivalent to $2000[19]. The highest income recorded is 12,000,000 Sudanese pounds equivalent to $4800. Average household income is calculated to give 1,200,000 Sudanese pounds (SP) equivalent to $480. That means the household income is $40 monthly. It seems that the income per household is low in relation to the expenses, which showed the following records:

Money paid for education per annum	600,000 SP
Money paid for health	750,000 SP
Money paid for other services, electricity, etc.	1,200,000 SP
Total	2,550,000 SP

This total amount is equivalent approximately to $1000. It means $85 monthly.

The question here is how do the families cope with the mismatch? One of the farmers told us that:

> *"Some families have financial support from their sons working outside the village, either in urban areas or abroad. In addition to the income from cash crops or others there are crops which may help living, such as dura for bread. Also people make use of breeding animals for milk and meat. If all this is insufficient to support the family, people co-operate to help each other" (Survey 2001).*

Therefore, the above calculations include only the income from the cash crops such as cotton, wheat and vegetables. The other produce such as sorghum supports the living of the family. The sorghum 'dura' is the main component of Sudanese family food; it is ground to make flour for Kisra, which is a popular type of bread. In El Sereiha village, the head of the family is usually the tenant of the farm and runs it. It is thus he who is charged with the fair distribution between his descendents. Otherwise the elder people of the village may intervene to avoid potential conflict. Where the family works together on a farm, the different agricultural tasks and supervision are split up among the sons. The agricultural produce belongs to the family, but it is the head of the family who controls its distribution between the members of the family. The work on these farms is indistinct, neither measured nor measurable. The share of each one, thus, depends on the size of his household and his needs. There is another observation; the father's domination diminishes as the son establishes his own group of productivity, his own authority over those who depend on him. but still he has to share with the family's fortunes. Produce and other resources become part of the community's property if they are surplus. So, even educated men may participate in reinforcing the economy of the family community. Both El Sereiha and Farmhouses

[19] A USA dollar is equivalent to 2500 SP.

communities are extremely integrated societies and in both villages the social structure and the irrigation system shape the use of space. The village autonomy is based on the irrigation and farming system introduced in the area. Thus individuals and their networks and relationships should not be seen as independent of the wider forces or structures, which influence their built environment. The social and economic organization of the village seems to function as a filter: it never gives access to anything harmful to the community. The above points indicate that there is an interaction between use of space, lifestyles and the structural constraints that bear upon interactions. In reply to a question about the share of the men who have salaried jobs one of the officials replied that:

> *"When a member has a salaried job, say in Khartoum or in any part of the world, he gives part of his wage to his father or the oldest son, either to support the family to buy food or to be invested in a shared business. The proportion given differs according to the income of the salaried son. In return he can receive a share of the produce at any time he wants. The father stores food produce as much as he can for domestic use. Of course, the son will not forget that his father has paid or is going to pay for him the 'mahr' or bride-price"* A respondent's view (Social Survey, 2001).

Therefore, the usra here works collectively as an economic unit to sustain living and increase the quality of life through socio-cultural networks. Thus the usra has socio-cultural and economic dimensions that interact freely together to sustain settlements. This consolidates the idea of freely interacted factors within the process of sustainable development (chapter two).

5.4.3 The Adaptation Profile

Throughout the Gezira area of the Sudan the process of adaptation takes many and varied forms. The mutations between traditional rural values and colonial and urban values produce a wide array of adaptations. The old vernacular village and its new extension reflect the coexistence of a peculiar situation when a comparison is made between the two types. Toon in Murison (1979:63) discusses that in the following terms:

> *"Traditional and modern values coexist in peculiar, often humorous and certainly asymmetrical arrangements. Some like transistor radio are obvious, whereas others, such as modified belief system, are difficult to identify with accuracy."*

However the vernacular village's people adapted to the new situation and built their system in the new plots without changing the socio-cultural behaviour although the spaces have been modified. This can be explained and detailed in the morphology of the housing forms in the following chapters. The Gezira village in the form of El Sereiha village is thus caught

between a variety of ideologies and struggles. At its very essence it represents is a struggle for modernity and trying to achieve a place in the globalised world. Yet is this a phenomenon inherited from the colonial village or should this be understood in the wider context of globalisation? This will be understood when discussing the impact of the élite intervention in the traditional vernacular village. If we could understand planning processes for the future and constructive networking rather than piecemeal working in addressing the social facilities through the integration of households and families we could affirm the connectivity among traditional vernacular villages and the fragmentary nature of the new extension's structures. Thus this connectivity may lead to decreasing the struggle for modernity and adaptation to the impact of globalisation.

5.5 The Family (Usra) Structure

The two hundred compounds (hoshes) surveyed in El Sereiha village contained a total of 600 households that fall into three categories. First, there is the compound head's household; second; there are all other related households, which are dependent or semi-dependent; and third, there are the staff households in the Government houses. While the Farmhouses village contained a total of one hundred households in one hundred farm plots and fall into one category which is the staff household living in a Government house. Before 1970, there was no data about the structure of the families but most of the people in the interview (2001) described a way of living which shows the domination of the extended families. A report produced by the Ministry of Housing in 1970 mentioned the crowded-ness in the village and many nuclear families in one plot and Danby (1975) mentioned the domination of the extended families in the Gezira area. Also, the shape of space organization, the system of hoshes indicates the extended family system. The structures of the usras in El Sereiha village society have undergone changes since the 1970s. Most of the extended families (usras) that were recorded in 1970 have changed into the nuclear family system. The Farmhouses village has no changes as the families that come to the village are nuclear families due to the nature of the structure of the families who occupy the houses in the Farmhouses village. The family structure for both villages can be seen in the diagram (Table 5.3 and Figure 5.1). A review of the respondents in both villages shows an increase of nuclear families and a decrease in extended families. The fall in extended family structure has reduced the number of the average extended families in a plot. It has also brought about a rise in the proportion of nuclear families. The social survey carried out by the author (2001) showed that the nuclear families now dominate in both the traditional village and the Government village though the extended families' socio-economic structures persisted in spite of these changes, 71% in the traditional village and 76% in the Farmhouses village.

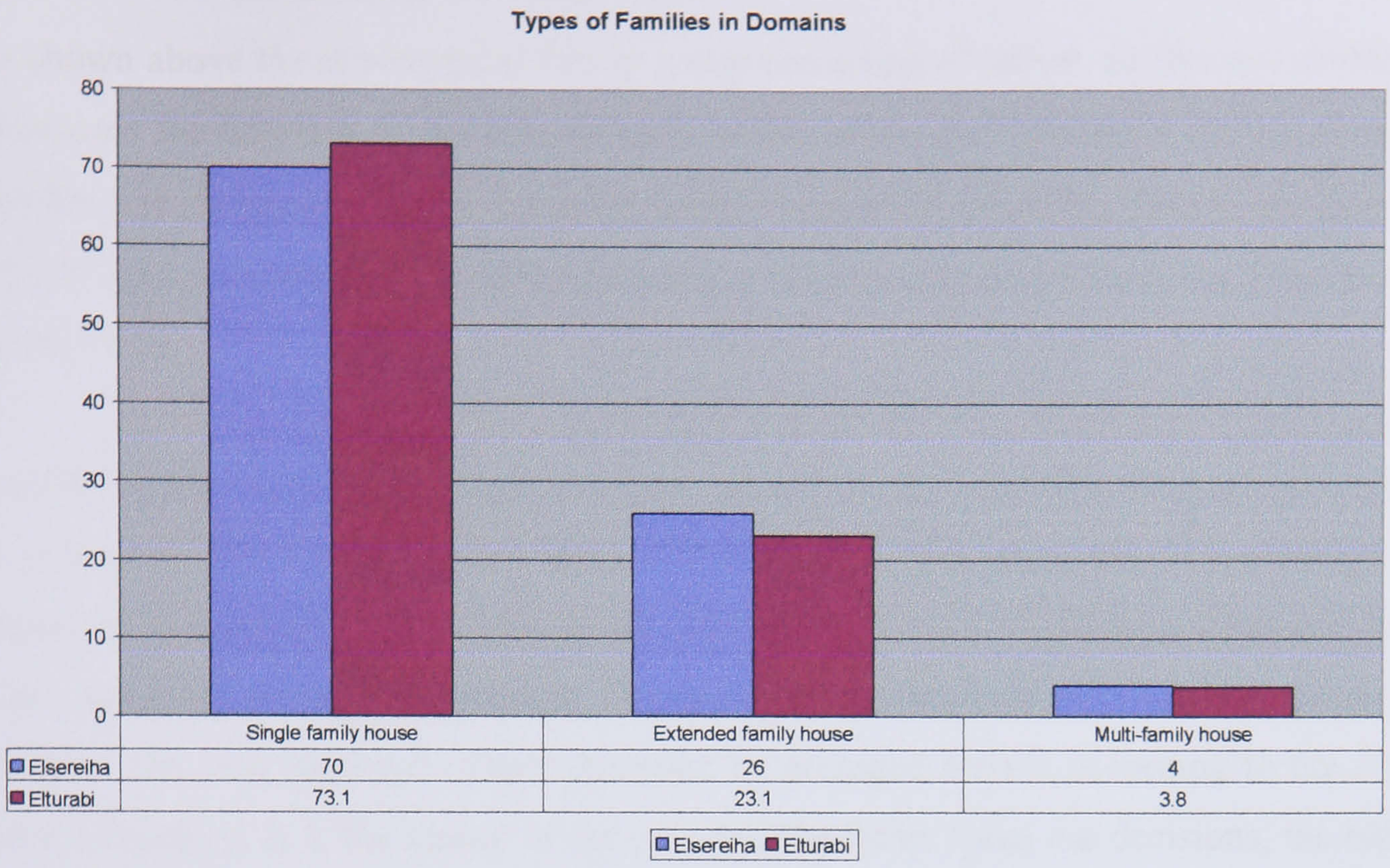


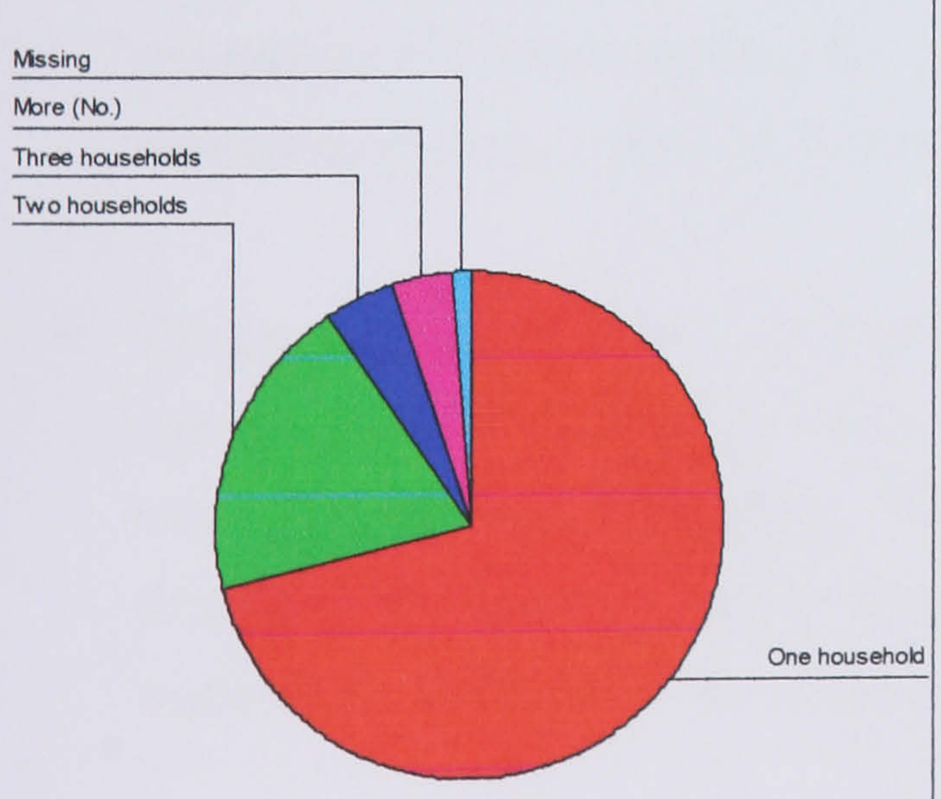
Table 5. 4: The typology of families in the two villages of the study (2001)

How many households live with you in the same unit?

El Sereiha Village

Frequency & Percent Table

	Frequency	Percent
One household	142	71.0
Two households	39	19.5
Three households	9	4.5
More (No.)	8	4.0
Total	198	99.0
System	2	1.0
	200	100.0



Farmhouses Village

Frequency & Percent Table

	Frequency	Percent
One household	76	76.0
Two households	16	16.0
Three households	8	8.0
Total	100	100.0

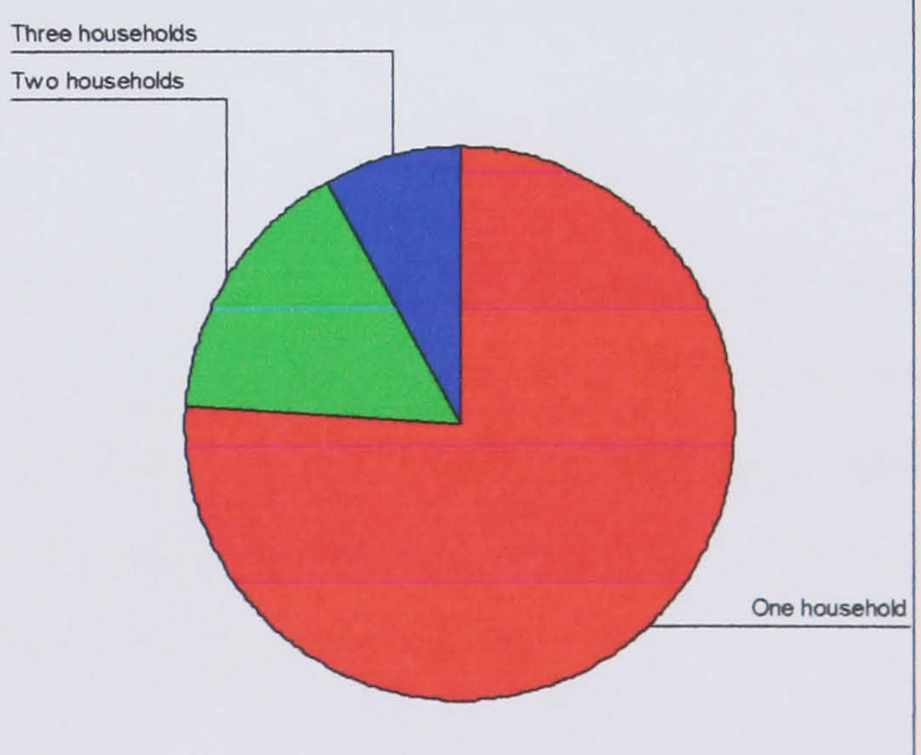


Figure 5. 1: Number of household in El Sereiha village and in a farm plot in the Farmhouses village (2001).

5.6 Households and Family Ties

As shown above the stereotypical family group consisting of father, mother and children now dominates the lifestyle of the two villages, while in the past before 1970, for example, El Sereiha was dominated by the extended family type while the other village, the Farmhouses village, was dominated by the phenomenon of nuclear stereotype from the beginning of its construction.

Usually, in the traditional villages, the elder son is the most important person after his father; he is the one who determines the status of the family in the future. His first marriage is very important to build the status of the family, of it are born the first children of the new lines, the future heads of coming generations. Therefore the matrimonial rules are rigorously applied for him. The first marriage cannot therefore be arranged merely according to the choice of those concerned; it is the choice of the usra and the father takes the decisions, the eldest son of the family may make the decisions on behalf of his father or in his absence. Later, other marriages are less important for the family and consequently less controlled in general. This shows the importance of women within the family cocoon; women from other tribes will not be taken as a first wife but as a second, third or fourth one according to Islamic values which allowed a person to marry four wives. Even though these types of marriages still exist, case studies indicate the following remarks on marriages are dominant (Mustafa 1992):

- Endogamous marriages are frequent. Youth are reluctant to marry young as their fathers used to do, because of the high cost of the ceremonies, celebrations and preparation of a home. Sometimes a wedding within the family may cost less; it is not necessarily the most common practice.

- Polygamous marriages are not widespread among the educated youngest; men aged between 20 and 35 years-old, while most of the older people have more than one wife. Most of these marriages are characterized by the need for interaction with other tribes or a recognizable family. This has no effect on the physical structure of the hoshes because the new wife will have her sector within the hosh.

Marriages between the inhabitants of El Sereiha and other communities are characterized by the following as we observed and were told:

a. Most of the people who are interested in marrying outside the village marry from the place of their origin, which is on the bank of the Blue Nile River.

b. Most of the older educated men moved to their relatives in the nearby urban areas, especially Khartoum, where they can find educated wives.

c. As women's education has improved in El Sereiha village, the percentage of the marriages of educated people increased.

d. Most of the people of the Station Farm Houses come either as officials or as merchants from different parts of the country and they do not practice their marriages in the vicinity. Observations and discussion with the inhabitants recorded no marriages happening within the last few years.

e. There are no records of intermarriages between the residents of the vernacular village or the Farmhouses village's residents.

Such marriages have an impact on the housing space. The space occupied by a family group composed of a man and his sons revolves around the paternal home according to the Islamic law, 'Sharie'ã Law'. If households are reduced to a nuclear family, that is one family occupying the house and the other families moving to other plots, still the family remains the focus and the base of the social and production group.

In El Sereiha society, the head of the family is the one who usually possesses the farm(s) and the rights to run it/them; it is thus he who is in charge of the fair distribution between his descendents or otherwise the older people of the village may intervene to avoid potential conflicts. The following figures 5.2 & 5.3 show clearly the structure of the households. The structure reflects that most of the population are married. Single people are very few (less than 10%) among the respondents.

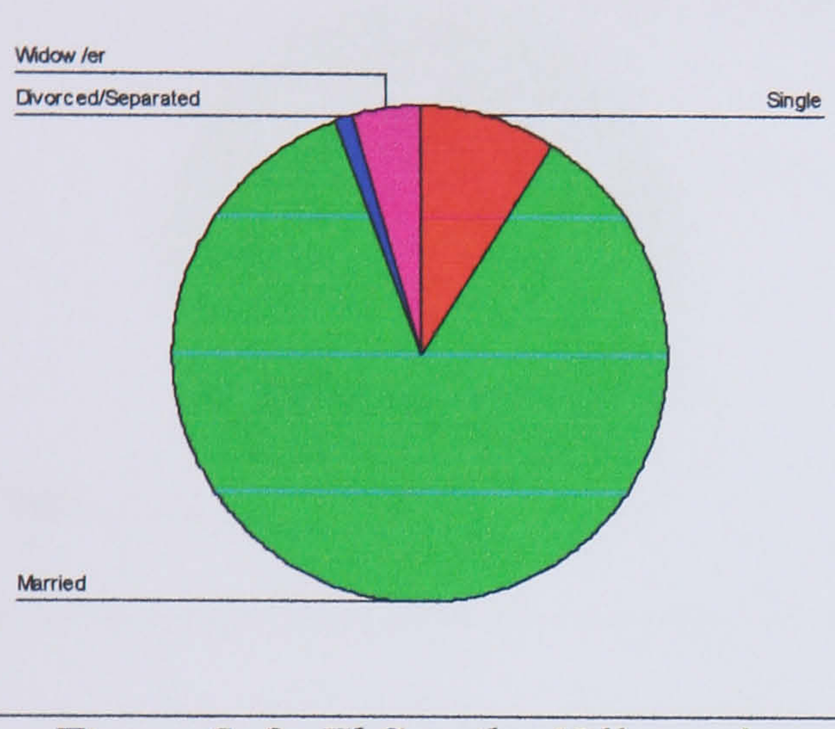
The diagram (Figure 5.4) shows that men dominate the heads of the usra in both villages. And the diagram Figure 5.5 reveals that all people live in their villages. This indicates very few people live in other places but they have a house in the traditional village, while no one in the Farmhouses village is living elsewhere.

Marital status:

El Sereiha Village

Frequency & Percent Table

		Frequency	Percent
Valid	Single	18	9.0
	Married	171	85.5
	Divorced/Separated	2	1.0
	Widow/er	9	4.5
	Total	200	100.0



Farmhouses Village

Frequency & Percent Table

		Frequency	Percent
Valid	Married	76	76.0
	Divorced/Separated	8	8.0
	Widow/er	16	16.0
	Total	100	100.0

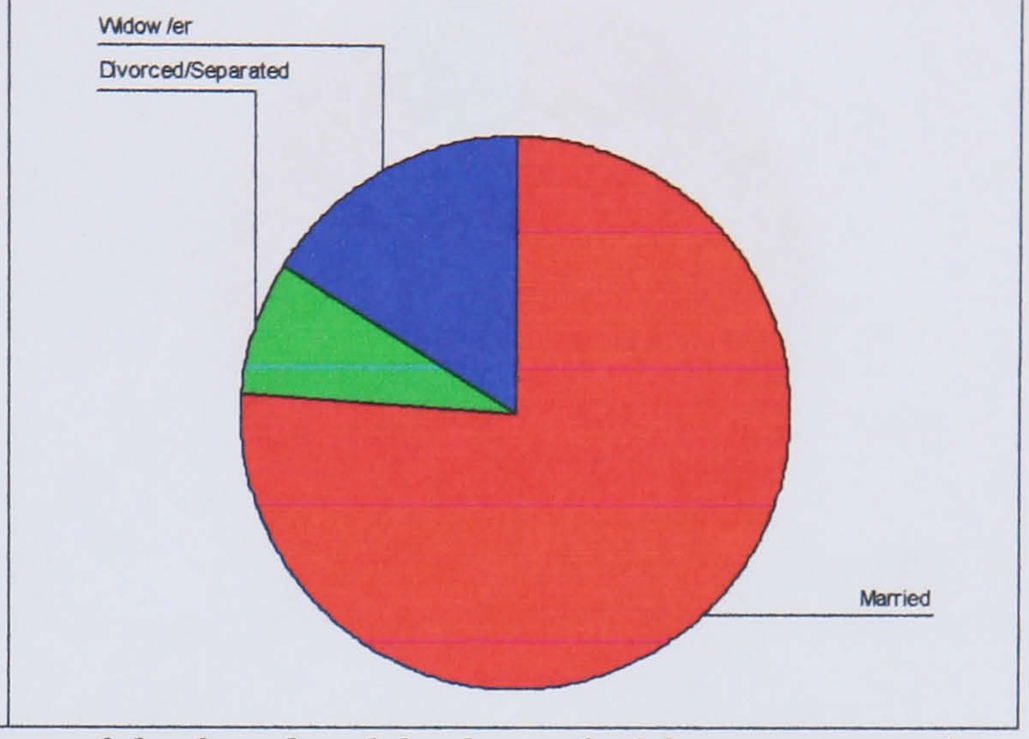


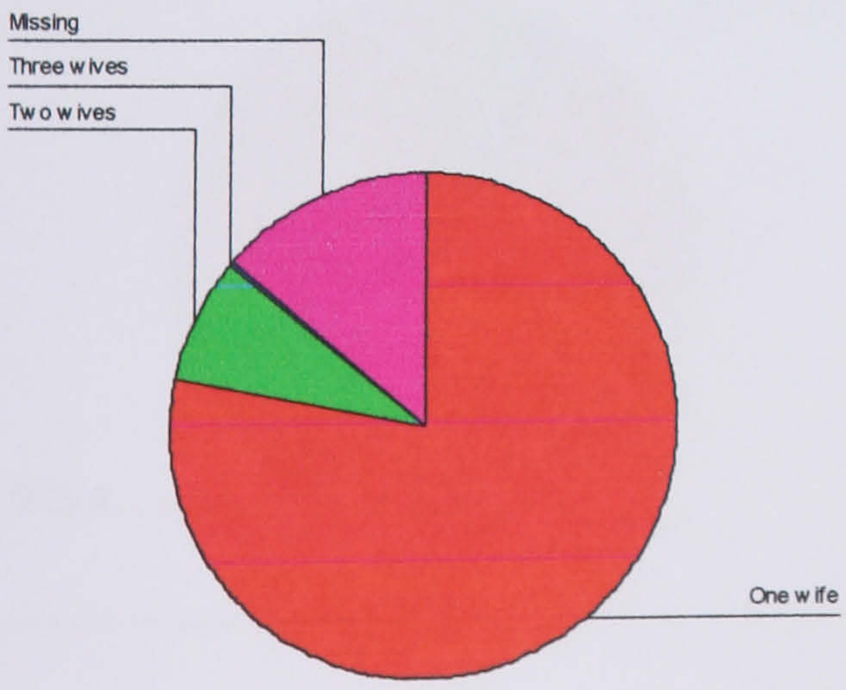
Figure 5. 2: El Sereiha Village shows most of the heads of the households are married reflecting the importance of marriage: Source the author's questionnaire survey (2001)

Number of wives in each house:

El Sereiha Village

Frequency & Percent Table

	Frequency	Percent
One wife	156	78.0
Two wives	16	8.0
Three wives	1	.5
Total	173	86.5
System	27	13.5
	200	100.0



Farmhouses Village

Frequency & Percent Table

	Frequency	Percent
none	10	10.0
One wife	90	90.0
Total	100	100.0

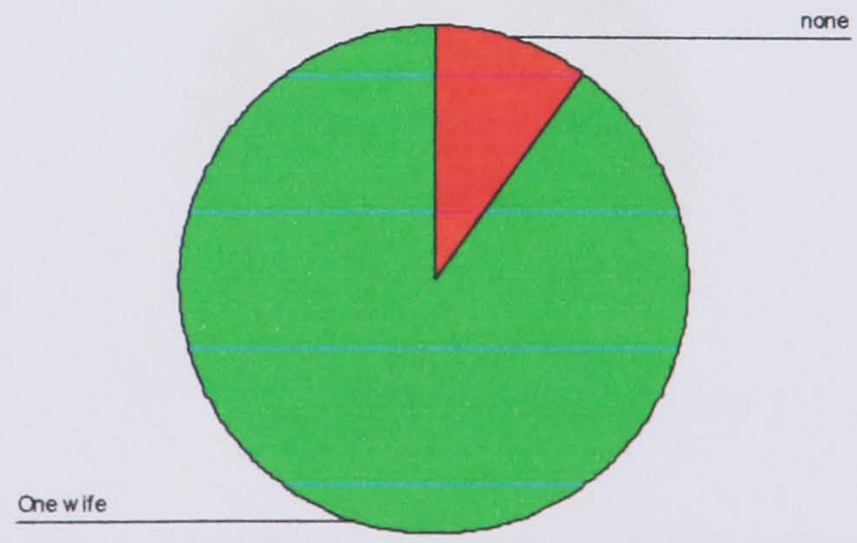


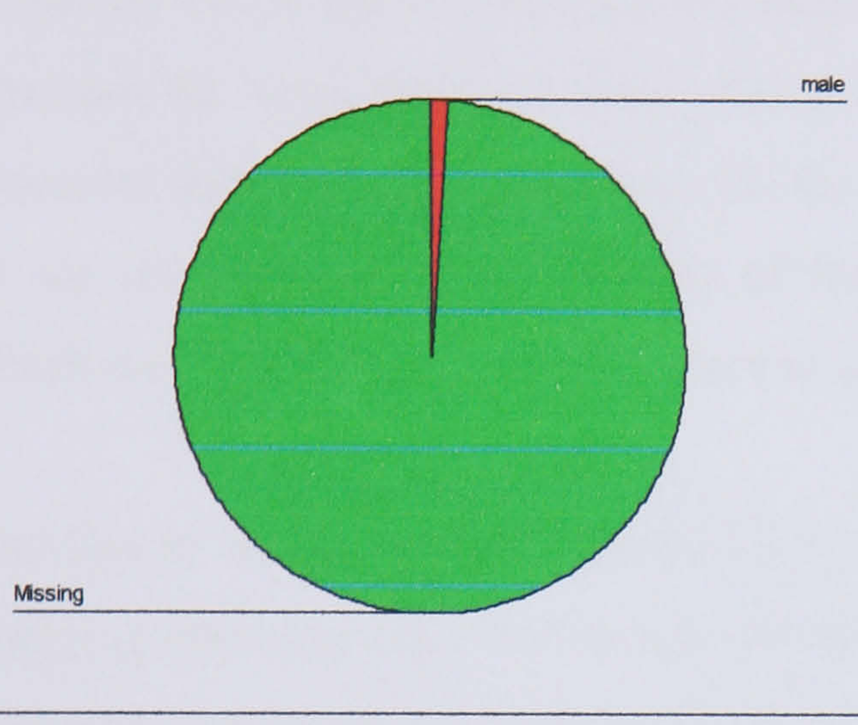
Figure 5. 3: Number of wives for each hosh head in both villages.

Male/Female

El Sereiha Village

Frequency & Percent Table

	Frequency	Percent
1- male	198	99.0
2- female	2	1.0
	200	100.0



Farmhouses Village

Frequency & Percent Table

	Frequency	Percent
1- male	92	92.0
2- female	8	8.0
Total	100	100.0

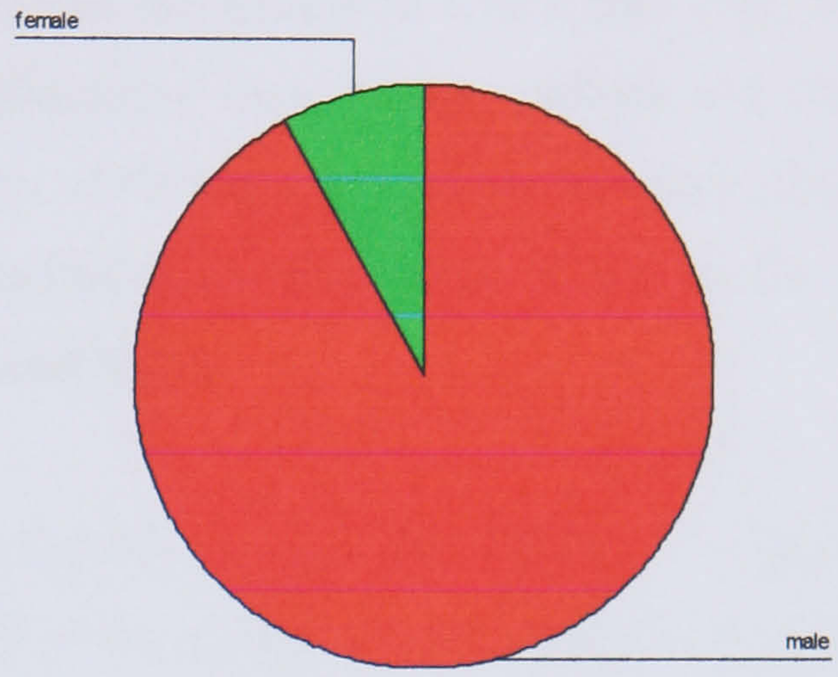


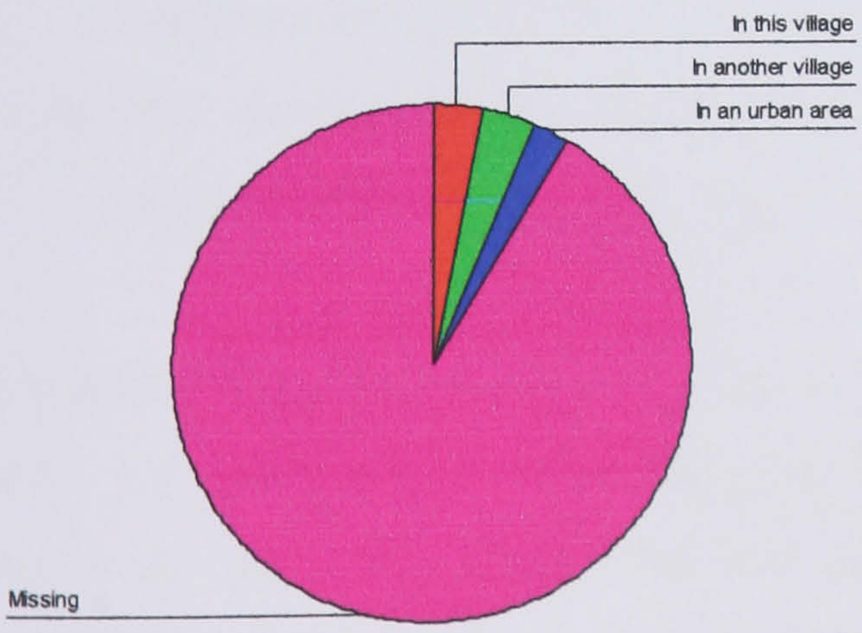
Figure 5. 4: number of males and females who answer the questionnaire

Place of Living

El Sereiha Village

Frequency & Percent Table

	Frequency	Percent
1-In this village	189	94.5
2-In another village	7	3.5
3 In an urban area	4	2.0
Total	200	100.0



Farmhouses Village

Frequency & Percent Table

	Frequency	Percent
In this village	100	100.0

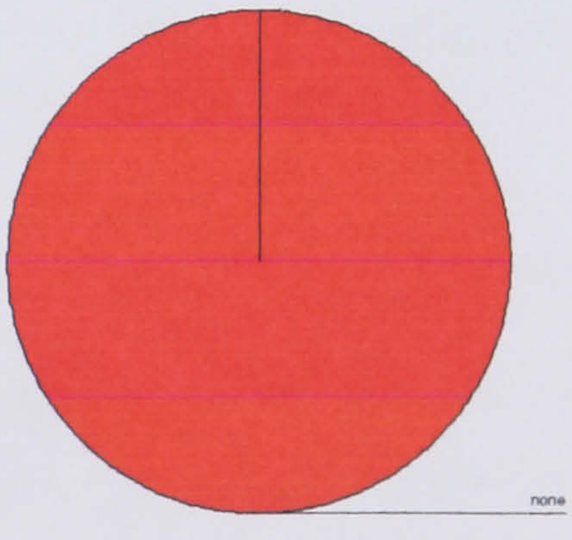


Figure 5. 5: the place where people originally live

5.7 The Roles of Families within the Rural Built Environment

Families, as was said at the beginning of this chapter, are a power-base. They are like other social groups growing in responsibility and the community encourages and helps families to take their own responsibilities or, instead, offers convenient ways of shedding them. But there is also another more controversial issue about the right of families to make their own decisions where these contradict the main ideology of the society in which they live, and to maintain the continuity of their choices by transmitting their values, culture and marital resources to the future generations. So the anatomy of the Family 'usra' in the space domains of our study shows the importance of the understanding the role of the family or the usra, which was defined earlier as a nuclear or an extended family.

The power of the nuclear family has grown considerably since the 1970s, as a result of applying planning intervention and design of space. This planning intervention in an organic settlement recognised that the family obviously has different dimensions:

- Family (usra) is a social cultural unit of values and ethics to be transmitted to the future generations and to govern the behaviour of the whole society.
- Family is a demographic unit; it has a spatial dimension, and needs in terms of housing, community design, transport and communications.
- The family is, also, an economic unit whose composition and functioning affects the distribution of incomes, expenditure patterns, the supply of workers to the labour force for agriculture and other facilities for life use and support. It is an accumulation and transfer between the generations of economic assets, such as the home, farms, capital, know-how and networks of opportunities for the farming system and agricultural enterprises.
- The time and energy of family members are limited resources like any other resource to be used to the best advantage.

Men and women are pillars of the family in the traditional vernacular villages in the area of study. Although men have the responsibility of the usra affairs with the community, women control the behaviour within the household and its spatial organisation. Women help in decorating the house, bringing up the children, control the privacy of the family, in a sense that mothers have the final say if their daughters want to socialise with other friends. This tradition is still dominant in certain families within the area. Women are now claiming equal access to the labour market and other outside interests as education has been increased. Most of the educated girls joined the boys in urban work.

5.7.1 Women's Rôle in the Society

Women's mobility is strictly regulated in public spaces; women do not use public space except during festivals, while men are accustomed to use it for daily entertainment; a woman who wants to go outside her home to visit relatives or friends should dress in a modest way wearing a traditional dress known as Thoob 'sari'. It is not important to have permission from her husband to go outside, as the villagers know each other and they have very close relationships and originated from the same kinship. The role of women in El Sereiha village is characterised by the following dimensions in the way of life:

- Women carry out all domestic work within the house; they grind dura to flour for making kisra 'the main food' and they prepare all the domestic needs of the family.
- Women play the most important role in the development and interior design of the houses; we see later how women participate in decorating the interior. They help in methods of construction; they decorate the houses and wash clothes in a cooperative way.
- Some women have their own home-enterprises (Figure 5.6) such as mat knitting and weaving. Some women work in the two-day market and make use of these activities to increase the income of the family.
- Women participate in the various stages of many agricultural activities. Women work on the farms to help their families at critical times, especially, during the time of cotton picking or tomato harvest.
- Some women own farms and control the work on it.
- Today educated women share confidently in the way of life like any man and they work in salaried jobs even away in the urban areas.

Though the women's role has its effect on these communities, in sustaining the way of living it is still lagging behind the wishes of the wider community. The social survey revealed that most women in both cases of the study have no proper work other than the domestic work, and even nowadays the women's work on the farms is decreasing because of the increasing complexity of life, the decrease of profits of the farms and women interests that show more interest in enhancing their appearance. Also the increase of opportunity of education for women created the need for other types of work in addition to the traditional farming and domestic work. These changes that have occurred in the socio-cultural behaviour and socio-economic situations caused changes in residential thinking and access to work. This socio-cultural change, also, encourages the authorities to intervene in injecting services hoping, besides its direct social benefits, to accommodate certain jobs.

A woman picking cotton

Women knitting mats

Figure 5. 6: Women Access to Work 'increases the usra Economic Potentiality'

Source, Gezira Board Archives (1970).

5.7.2 Collective Organisations

In the traditional village the scale and size of open spaces and hoshes are impressive, and in fact their arrangement and organisation is a clear echo of the socio-cultural relationships with the physical form. From the outset it is clear that as well as attempting to resolve individual shelter needs the settlers were also laying the foundations for a fully functioning community. Hence the shared conception about settlement forms being more than a shelter. Undoubtedly such shared values that formed the settlement are a considerable asset to those who took on leadership responsibilities within the settlement. Let us briefly examine aspects of the organisation within the community through the accounts of residents themselves. Sheikh Siddeeg, an old farmer who came to the area with the first groups said:

> *"When we first came here, I came with my family and relatives. I remember we collectively built our houses in the form of groups of huts. One family occupied each house. Then the house was developed to form a hosh with no walls around but there were demarcations for its limits. We built houses around the core residential unit for the increased number of the family. Bit by bit we developed those hoshes and a mud wall might be established to accommodate the scattered mudrooms that replaced the thatch huts. However this development continues as the family income and life complexity increased. Until the 1960s we had no electricity and pit-latrines and we used the outskirts land and farms. Water supply was secured through two sources, the well in the village and the irrigation canals. Each family had its Zariba (animal yard) for animals and we had enough milk and meat in addition to the kisra (local bread) and vegetables from our farms"* (The author, social survey 2001).

In the Farmhouse village the case is different in the way that the Government built the houses for the use of officials to run the fieldworks efficiently. To discover the way of residential development the Head of the Engineering Department at Barakat described the process in the following terms,

> *"At first the condominium Government built the houses for the British inspectors. They built houses in large plots surrounded by hedges. The department of engineering at Barakat was and still is responsible for these houses and their maintenance. No additions were thought of because the house was built to accommodate a certain economic group for a limited time and these houses had nothing to do with its household structure. Some modifications such as walls instead of hedges were carried out to suit the Sudanese traditions and privacy. In houses built after the*

independence these walls were added to the design before construction"
(the author, social survey 2001).

Thus, we shall argue that the individual acts in the El Sereiha village cooperate to form an organic order that guided the planning and construction processes to produce, gradually, a built environment which met the needs of the users. Of course, we must understand the contrast in quality between the forms produced in the two different kinds of culture and the two form-making processes need to be sharply distinguished before we can map out a new approach to design and identify our principles. It is far more important that we should understand the particular contrast the study is trying to bring about than that the facts about any given culture should be accurate or telling. In the next chapter we will discuss the idea of the organic order, which presents itself very strongly in El Sereiha village that was prudently built by the users. This natural or organic order emerges when there is a perfect balance between the needs of the individual parts of the environment, and the needs of the community, which can be identified by everyone who is a part of it (Alexander 1975). In the next chapter we will discuss the Sudanese additions and modifications to the colonial models or plans to suit their traditions and concept of privacy.

5.7.3 Community Leadership

Within the organic village there are clan groups, whose affairs were regulated by El Sheikh, usually an elder person nominated by the Government with the consent of the villagers, as the head of a village to solve local problems and to help the Government in tax collection. He was responsible among other things for settling land demarcation problems. This local people administration was working with until 1970 when the 'Local People Administration Law' was stopped working with in the Sudan since then. But still the clan elders hold specific responsibilities in community life, derived from the traditional socio-cultural organization. Within each clan group there is a varying number of domestic groups of which the smallest number consists of a headman of household and his wife and children of both sexes. In the extended family system the members of the family act together to form a coherent team. The main advantages of this team are that it:

- Allows full control of activities permitting reasonable flexibility, robust, a more rapid response and direct quality control.
- Should ensure a good standard of facilities and family development as seen by the family members who enjoy the continuity of a quality of life they understand.

The breakdown of any family is very rare. The family member's solidarity injects a strong internal family cohesion into the life of the family in the community, which has an effect on all aspects of life; to the extent that the head of the extended family could even enforce his

will into the political arena. Such power may be consolidated by religious power. Islamic organizations for teaching 'Qura'ặn' and the 'Faki' (Qura'ặn teacher) consolidate this religious power. So in the case of El Sereiha village as an organic vernacular village our understanding of such family units has special characteristics bearing in mind that the village autonomy is based on the irrigation and farming system developed in the area. To summarise:

- The family units of which the quarter or cluster is composed are agnatic cells organized as production groups around the head of the extended family. Even though the family structure has increasingly changed to nuclear structure since 1970, the family preserves its economic base.

- The various communities form extremely integrated societies. The social structure and the irrigation system shape the use of space and give this way of life its personality. Thus, individuals and their networks and relationships should not be seen as independent of the wider forces or structures, which influence their built environment.

- The socio-economic organization of the village seems to function as a filter: it never gives access to anything harmful to the community.

- Kinship relationships and social reality make the village a great family cell. In this cell there are invisible relations through which people's everyday lives are conducted.

Therefore, thinking relationally allows exploration of the per-formative interplays between the diverse networks of socio-cultural and socio-economic relations, which conceptualise planning practice and contextualise housing forms. Different actors respond to their situations variously to face the constraints, to make use of the resources available for them and to confront the forces which push and pull them, continuously, from one direction to another. Thus the family secures behind its walls shelter for each member of the family, agricultural estates and income support for the different generations. All this interacts with other families' efforts to establish a larger community to form a cocoon of kinship or clan to support the settlement in form of a village such as 'El Sereiha', which has its own spatial organization. Therefore we can conclude that the usra system is important in the production and supply of shelter to the community in the rural Sudan and we can ask how these clans and the members of the community participated within the settlements, and what the level of participation is.

5.7.4 Community Participation

Community participation in El Sereiha is very high, especially as there is a greater need for collective activity to address basic issues such as infrastructure. An explanation for the higher number of residents who expressed willingness to be actively involved in community issues may lie in the socio-culturally motivated spirit towards succeeding in carrying out many things collectively and having more services in the village.

Households or partners: two settlements (percentage)

	El Sereiha village	Farmhouse village
	N = 200	N = 100
Never	5.7	95. 5
Sometimes	6.8	4.5
Frequently	87.5	00

Source: the author, (questionnaire 2001)

Table 5. 5: Participation in community Activities

It seems that the traditional village people participate frequently in community activities, while the other people in the Farmhouses village do not (Table 5.5). This reflects the responsibility towards both housing and community development in the vernacular village and not in the formal village. We also noticed the participation in the process of building construction; this can be seen in the photographs (Figure 5.7) where we see people constructing their own houses and doing the maintenance by themselves to secure the continuity of their dwellings. We saw in the sustainability discussion in chapter two that participation is one of the components of sustainable development and continuity in the process of construction is important as a way of sustaining the vernacular architecture.

In the other development 'the Farmhouses village' people do not participate in the process of construction or maintenance. This leads us to question the responsibility effect on sustainable settlements and dwellings. This is not the concern of this research but could be an issue of further research.

Father and sons constructing their house

One of the suns mixing sand for the work

Father and son building a parapet wall

A son mixing mortar for construction

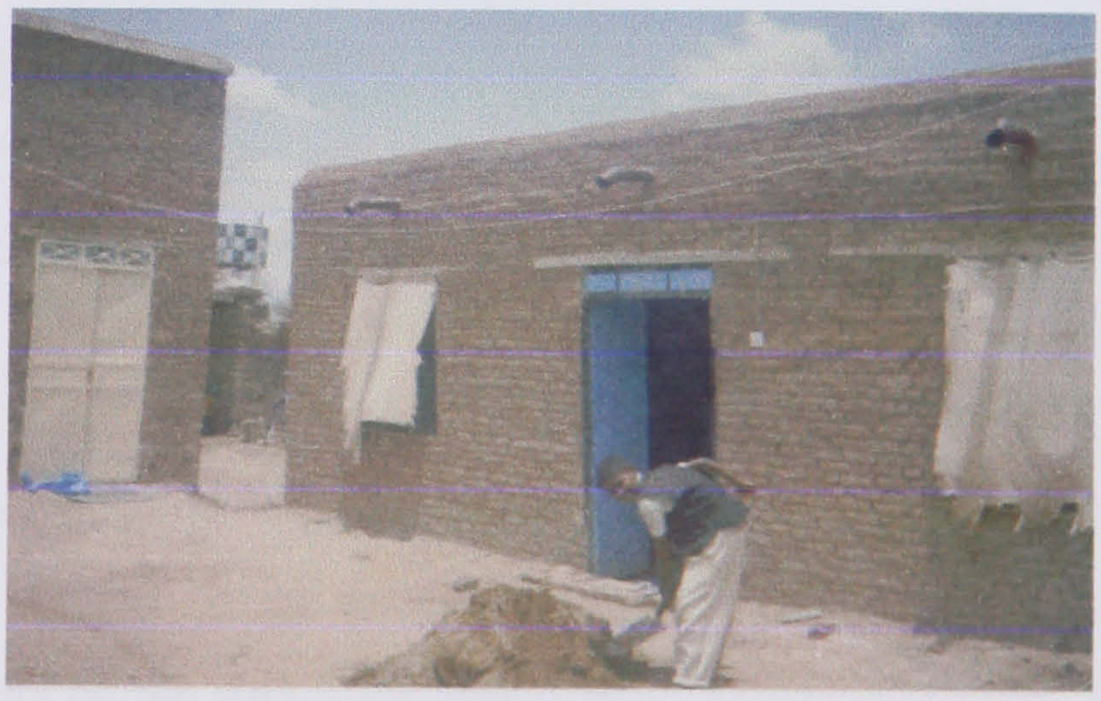


Figure 5. 7: the usra do most of the construction and maintenance stages for their houses: Source Fieldwork (2001)

5.8 Social Behaviour versus Spatial Organisation

All societies design and organise domestic and public space to house specific activities and related objects in accordance with underlying social ideas about where, how and who should conduct such activities (Kellett 1995). This means there is a connection between the spatial form and the socio-cultural values. Without a detailed understanding of such values any spatial analysis would remain superficial. Many researchers have proposed methodologies for measuring spatial/social relationships but here we will use ethnographic approach similar to those used by Lawrence (1987) and Stea (1990). In analysis of housing forms in two different cultures Lawrence (1987:7) demonstrates how a series of binary constructs can illuminate and explain why certain forms are selected in preference to others. Thus activities and spaces are classified according to whether they are regarded as public/private, day/night, front/back, and sacred/secular.

Where possible we will use these binary constructs in the analysis of this study, as well as introducing others, in particular the constructs of indoor/outdoor and female/male which appearing to be helpful in explaining the forms and activities of people in relation to a culture of privacy originated from the meaning of Muharam and Non-Muharam, the well known Islamic norms. Muharam refers to a specific category of people of the other sex with whom marriage is explicitly forbidden. Non-Muharams are those of the opposite sex, whose kinship does not represent any impediment for marriage. What constitutes domestic space is predicted largely on Islamic notions, Muharam and non-Muharam and as mentioned in the previous chapters, the dwelling spaces are manifested by the physical interaction with the concept of the 'usra'; in other words the location of the household's members inside the 'hoshes' and social interaction within the public space.

Generally, privacy is sometimes needed for the family in any society but in the Muslim world privacy is a vital factor in traditional society. Islam has put certain limitations between males and females according to the rule of 'Muharam and Non-Muharam'. So privacy comes from the point of view that Islamic ethical values have created a fundamental relationship between Muslim families and strangers from both sexes. This has a great effect on the environment. The effect arose from the usage and organisation of internal spaces within the dwelling of the traditional village. These rules have impacts on the village as a whole and the dwelling in particular. In broad terms, the anatomy of the traditional and formal villages includes three types of space:

- Public space: Pieces of land that lie between private holdings, in rural areas the central open space 'hara[20]' as known in the traditional village within the village and outside open lots including public institutions, such as schools, health centres, etc. (Chapter four). The public space includes all spaces accessible to and used by the public.
- Semi-public space: This includes part of the house (diwan) and zugags in the traditional village and only roads in the formal village (chapter seven).
- Private space: this the main parts occupied by the family and strangers are not allowed in.

The above categorisations are designed into layers of meaning and physical space. Of most interest in rural traditional design is informal public life, which occurs beyond the realm of formal institutions and entails choice. Many parts of the public place are discretionary environments, which inhabitants choose whether or not to use: for example, there are often alternative routes for getting from one point to another, with choice made on interrelated grounds of convenience, interest, delight, safety, etc. Also, in construction, people are different in their choice. People in the vernacular village are producers and consumers at the same time while those in the formal village are not. People in traditional vernacular dwellings gain the space through socio-cultural interaction, marriages, inheritance, and kinship relationships (usra). Typology and morphology of housing will be discussed later in the dwelling chapter.

Using the analysis criterion described above we can consider that the dwelling should be built according to the socio-cultural needs of the usra or, in other words, the socio-cultural needs are one of the design layers that create a home for the residents. Thus the dwelling can be divided into three different parts, which were built to suit the lifestyle of people and reflect their cultural norms, particularly the privacy:

- The very private part 'The women's part'
- The semi-private part. This is the family's common part.
- The semi-public part. This is the guests' reception part 'diwan'.

The private and semi-private parts are the parts that accommodate the members of the family 'usra'. In these parts no stranger is allowed. The private part is where women and especially girls lead their domestic life while the head of the household occupies the semi-private part

[20] 'Hara' means a space inside a village usually surrounded by shops or houses where the people hold some private festivals and entertainment. Also it is used as a playing area for children. Most of the famous football players start to play in these haras. These functions take place at different times of the day. From the observations made in the questionnaire in 2001 by the author, these haras are connected by two undertaken axes representing the largest alleys in the area and that is clear in the plan of the traditional part of El Sereiha.

and it is allowed to be used by extended-family members and sometimes the closest neighbours. It is the main part where all members of the family meet together for normal converse. The semi-public part is where the diwan is established. Boys may use this part in the absence of guests and sometimes with them. Therefore, each hosh is formed of compartments. The number of compartments depends on the family requirements. It depends on the number of married sons and the size of the household. These spaces could easily be rearranged to accommodate more private and semi-public areas.

We saw in the previous chapters that after planning intervention in the 1970s a new system of plots for single nuclear families was introduced to replace the extended families' hoshes. Although changes have occurred to social spatial arrangement (hoshes) the socio-cultural domains still dominate the structure of the arrangement of the vernacular traditional housing.

In contrast the dwellings in the Farmhouse village can be categorised into three different types classified according to the different ranks of the officials.

- The first Group is the third class category, which is composed of the dwellings for labourers and lower rank officials.
- Then the second group of the middle class dwellings, which are accommodation for clerks and lower ranks personnel.
- The third group is the high ranking officials' dwellings, first class houses for directors of divisions and agricultural field inspectors.

An important point to be mentioned here is that each colonial group of these above are also divided into different types of houses, but the differences are only in the number of rooms and sizes of the houses, not in quality. The colonial régime provided these classes of elites, which were fostered to serve the colonial power, with a standard of living that was far in advance of that available to the masses of the people in the vernacular traditional housing areas. These classes continued in existence up to now. This has had a great effect on the thoughts of the westernised élite, as we will see later in considering the design of the extension of the traditional village.

The public space found in the old village is greatly related to the social interaction of the inhabitants. The main central space of the traditional vernacular village reflects the public social use and their freedom in choice, while the absence of the inner public space within the formal village and the use of private institutions reflect the disengagement from public space and public facilities to private or semi-private institutions such as clubs, etc. This also appears

in the new extension of the old vernacular village. In the extension as in the Farmhouses the public space has been affected by many intrusive activities:

- Activities that were once only available in collective and public forms have increasingly become available in individualised and private forms,
- Mobilisation of cars and use of various developments and changes to the public spaces. The social interaction today is affected by conflict within public space and those of mechanised movement. Cars facilitate an essentially private control over public space.

Thus the social, political and economic factors leading to the privatisation of people's lives and the end of public culture will lead to decline in meaningful space, or to its privatisation, in other words it prohibits the connectivity of both societies and spatial organisation.

5.9 Reflections on Socio-cultural Organisation

In the emergence of the housing in the Gezira villages one finds two parallel and interrelated organisation trends over time: a more restricted socio-cultural network for sharing activities and the concomitant development of more formal institutions for integrating the community and its built environment. Therefore a question can be raised; how far have physical and household changes affected the social behaviour and cultural background? Studying households, kinship and relationship revealed the main changes, if any, which occurred within the villages of the study:

- First in terms of decreasing the gross and net density of population per plot; it means that densities are now lower rather than the high density of the crowded character of the El Sereiha village before 1970.
- Secondly, it changed the social use of certain spaces, such as the inner space of the village 'open space in the middle of the village', called 'Hara' and the public space within the housing plots, the 'Diwan', which is the main part of the house for strange guests and it is used at ease by these visitors without interfering with the family members.
- The Third effect is the end of social privacy at the level of El Sereiha village as a whole giving it similar social characteristics to the Farmhouses Village. This is because mixed families from other origins are now living in the physical settings previously occupied by related extended families only. The village layout therefore no longer provides the privacy for inhabitants collectively. Everybody has to provide his family privacy within his dwelling. So we can say the single-family houses have replaced the extended family hoshes.

- The fourth is the introduction of new types of housing, which has its impact on the households and their social activities. It has brought with it the urban style of spatial organization, social activities and technology but still takes into account the social cultural needs (see social housing needs later).

Thus we can also conclude that the needs of people, as individuals or in small groups or whole communities, fairly directly influence built form, from single cells to whole cities. People cannot survive without shelter, and they need protection from the elements of nature and from each other. Beyond the basic needs for survival, however, there are extremely complex societal patterns, which generate needs for facilities of all kinds.

5.10 Conclusion

The socio-cultural behaviour may be a forceful factor within a community establishing its foundation for better life and sustainability in housing development as social and cultural factors are two critical factors of the sustainable development model (chapter Two). We found that people in vernacular dwellings are both producers and consumers while in the Government houses the inhabitants are not. Thus we conclude that in traditional vernacular buildings the socio-cultural choice is related to the type of houses provided. This necessitates putting the vernacular buildings at the heart of governments' housing policies.

The socio-cultural organisation is the fundamental force in establishing spaces within a dwelling. Changes to the land definitely lead to changes in social organisation as happened to the changes to households in the Gezira household structure. Thus, the decline of household structure from extended family to nuclear family leads to the fall of the hoshes system which was adopted by the vernacular architecture for decades.

The socio-economic factors are the backbone for solidity of the society, particularly the family, to be equipped to monitor and evaluate their own environmental performance. This means developing a systematic adaptation that allows both the socio-cultural and environmental consequences of individual and collective actions and interventions to be better understood and accounted for in decision making.

The socio-cultural organisation is nowhere more clearly manifested than in the dwellings. This chapter clearly indicates that the space organisation in a dwelling is related to the socio-cultural behaviour.

CHAPTER SIX: PEOPLE AND PLACES: SETTLEMENT PATTERNS

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6.1 Introduction

As described in chapter four, the traditional vernacular and colonial built environments which form the focus of this research were both developed at the beginning of the Gezira Agricultural Scheme in 1925. The traditional vernacular built environments in El Sereiha village and its vicinity were created and occupied by the local people. The government at the time built the other type of built environment in the Farmhouses village and other similar villages, and Government officials occupy these houses.

The task of this chapter is to investigate the traditional vernacular architecture in El Sereiha village and provide an understanding of the key stages and components of the place which the local people have developed and to understand how the inhabitants plan, organise and build, as well as to identify the main external impacts which are exerted by the other planned villages, such as the colonial housing and the government interventions in the area, leading to a broad understanding of the phenomenon of development. The chapter begins by examining how the two settlements were formed and then moves into a discussion of the morphological dimension of traditional vernacular settlement development before and after 1970. This is followed by an analysis of the formal and informal planning processes carried out on the Gezira Plain. Then the effect of planning intervention is discussed to evaluate the changes that occurred in the two settlements.

6.2 Location

The location of the case study settlements, El Sereiha and the Farmhouses villages, were shown in figure 1.3 in their general context; here the two settlements are particularly located in Kab El Gidad Block (Figure 6.1), which is a part of El Turabi Division (Figure 6.2). The two villages are 12 kilometres apart. The Farmhouses village lies on the railway line connecting Khartoum and Wad Madani, the capitals of the Sudan and the capital of the Gezira State respectively while El Sereiha is not far from the railway line; about 5 kilometres away. The block is subdivided into agricultural plots (Howashas, each 150m by 280m) which are allocated to individual tenants. A farmer is authorised to own only two howashas at most. The Gezira Scheme geometric fields are divided into 90-feddan fields (each field is a rectangular block of 9 farms (hawashes) and each field is 1350m by 280m) and there are regular parallel canals (approximately 1400m apart from each other) surrounding the two villages. Both settlements were formed within this built environment, which dictates some limitations on their development and expansion.

Key:

Organic Villages

Farmhouses Villages

A Single Farmhouse 'Sarai'

B Block Headquarter

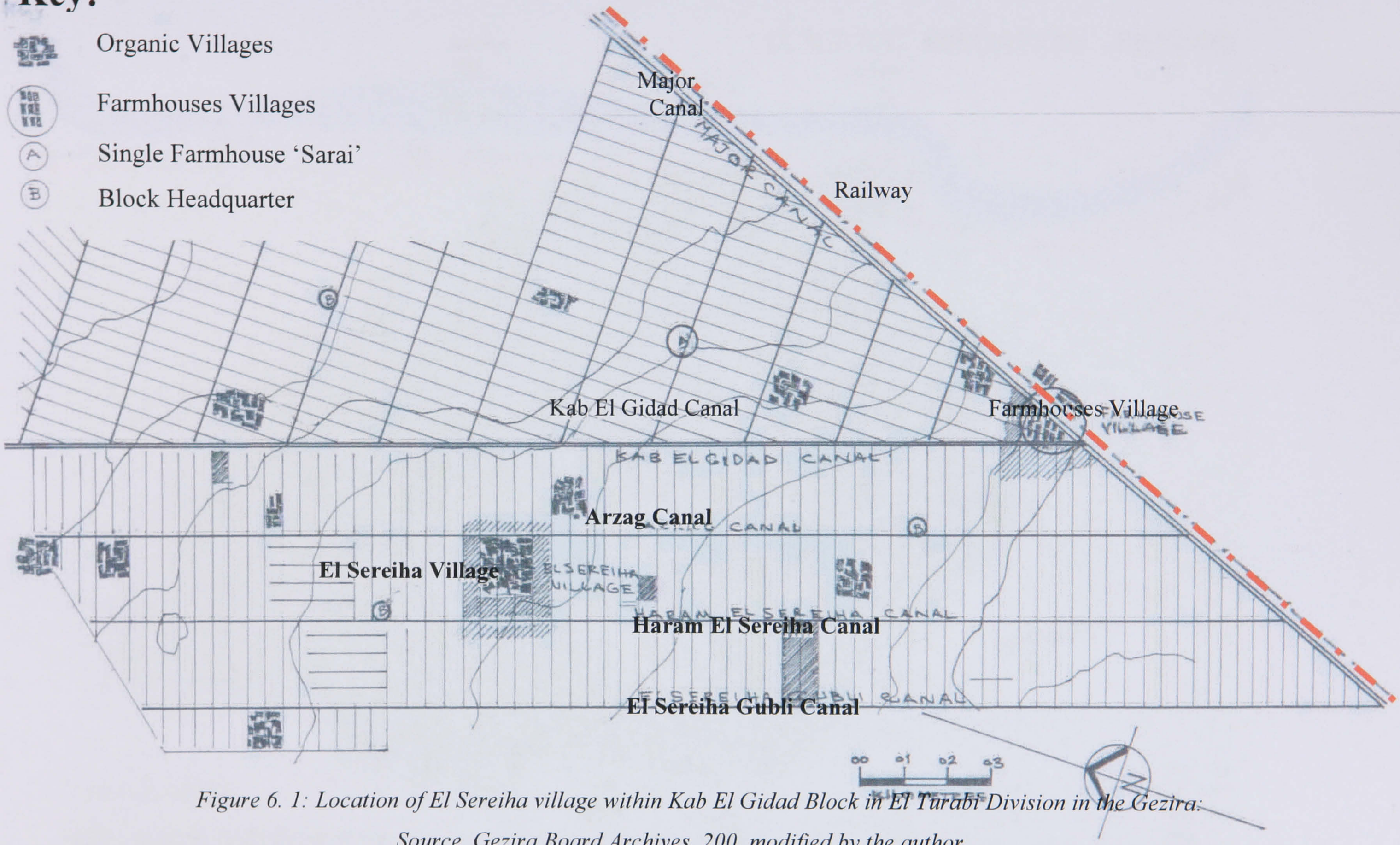


Figure 6. 1: Location of El Sereiha village within Kab El Gidad Block in El Turabi Division in the Gezira: Source, Gezira Board Archives, 200, modified by the author

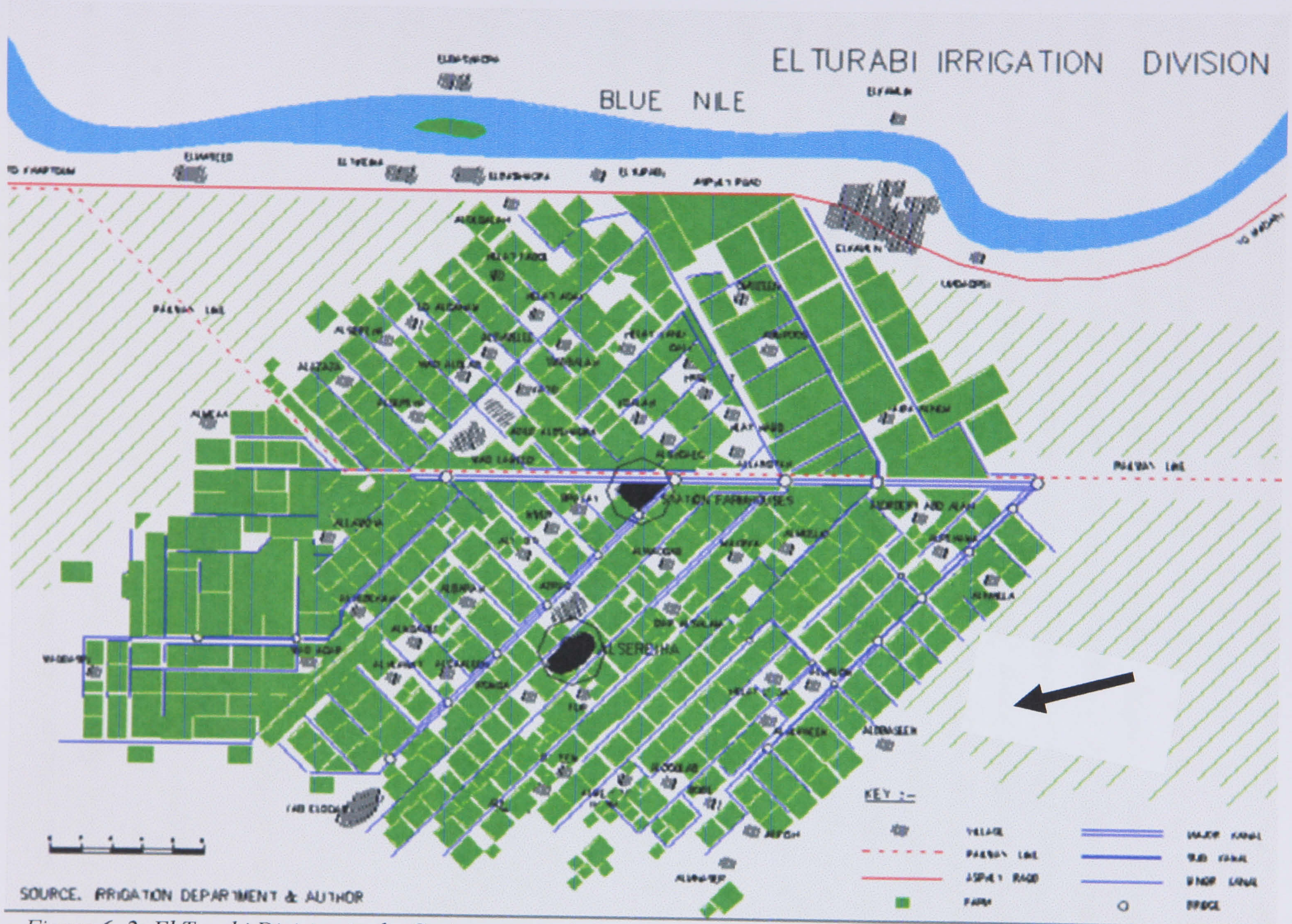


Figure 6. 2: El Turabi Division in the Gezira area in the Northern Part: Source, Gezira Board Archives, 2001 modified by the author

6.3 Settlement Forms

This section examines the earliest stages of the settlement processes, beginning with the establishment of the Gezira Agricultural Scheme with the occupation of land through two different ways of planning, to expand on what has been discussed in the previous chapters. The main planning structures of canalisation, staff settlements and the administrative centres were designed in a hierarchical system according to the function and purpose of each settlement. The structural plan of the settlements and centres starts from the main head quarters in Barakat as a capital of the scheme to Farmhouses villages to single Farmsteads known as 'Sarais' (chapter four). This hierarchy follows the line of the different stages of cotton production, which moves from the farm to the head quarters in Barakat. The hierarchy of the canals starts from the Sennar Dam to the Major Canal, Minor Canals and then to the channels, which feed the farms with water. The whole area was divided into regions, which contain divisions that are composed of many blocks (Figure 6.3). Each division had a hierarchical structure of services, from the hospital to the health unit and high secondary schools to the sub-grade schools, but now a new hierarchical structure of services has been created. The discussion of this change will be included when we illustrate how informal planning dominated the formal planning in terms of services development.

However, this structure has been constructed and has accommodated millions of cultivated feddans run by thousands of farmers from both sexes (table 6.1).

Zones	Date of Construction	Area in Feddans	Number of Farmers	Women Farmers
The Gezira	Between 1925-1953	1.16 Million	114000	13000
El Managil Extension	Between 1960-1964	0.78 Million	-	-

Table 6. 1: Some statistics about the Gezira and its extension Development

The Gezira total area includes El Genaid Project, which is 2.12 Million Feddans, (0.9 Million Hectares). The number of divisions is 18 and the number of blocks is 113. Crops grown are cotton, wheat, sorghum, groundnuts, vegetables, and other food crops. The irrigation system is a gravity system from the Sennar Dam and El Rosé iris Dam running through canals: Source Sudan Gezira Board (2001).

The following diagram (Figure 6.3) explains the physical layout of the divisions and blocks and how the scattered settlements theoretical diagram (shown on figure 4.23; chapter four) can be imposed on the plan to show the relationships of the system introduced.

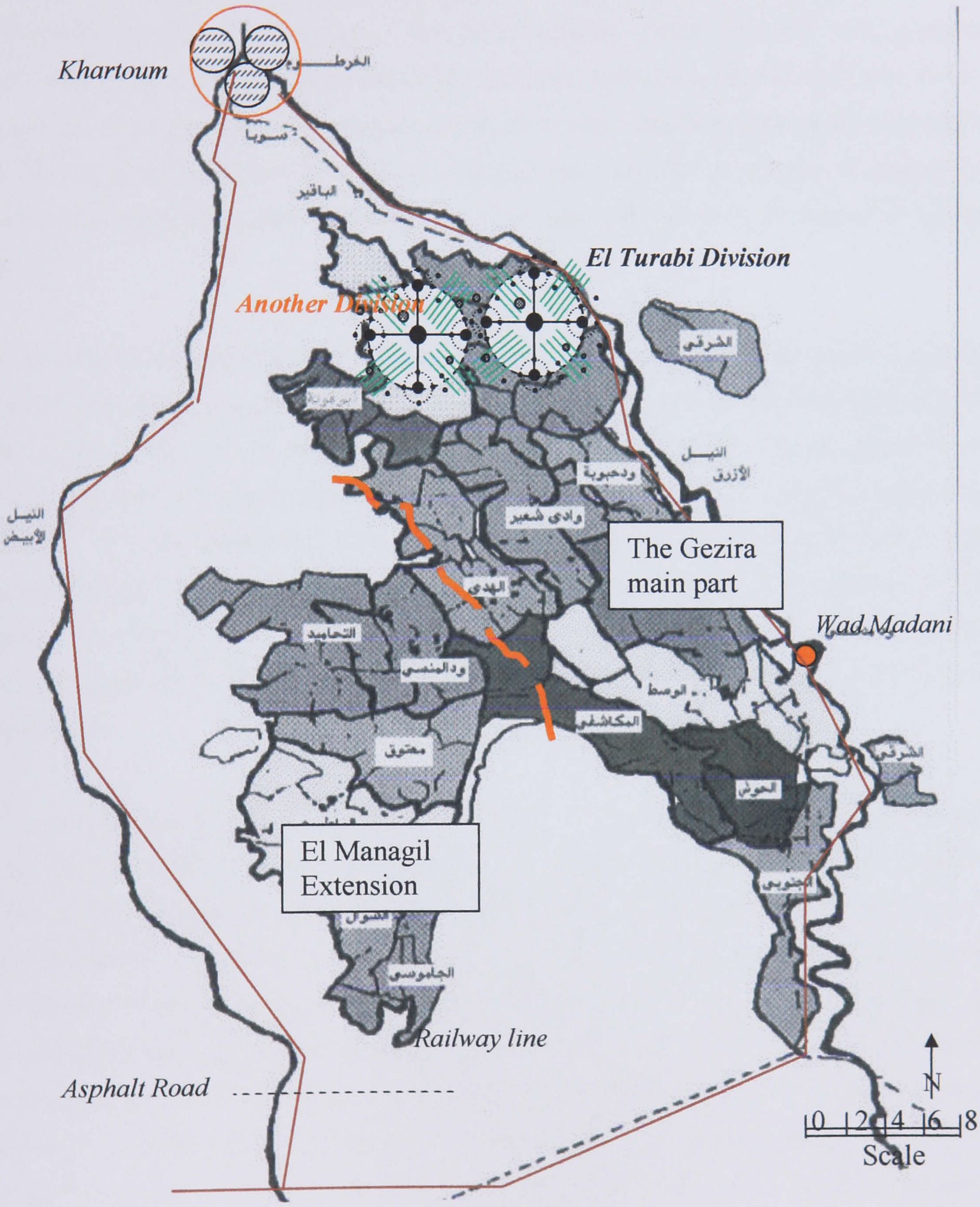


Figure 6. 3: Gezira area of the Sudan is divided into districts, divisions and blocks:

Source, Gezira Board Archives, 2001

As discussed in the previous chapters, the Gezira Plain was planned to fulfil economic development initiatives. These economic planning decisions have had an important effect upon settlement formation in the Gezira area. Although the development did not consider the local people's settlements from the beginning, the Gezira scheme planning has had a significant effect upon their morphology and social structure. Most of these effects have come about from the cumulative impact of the partial planning introduced in the area at regional and local levels. Ironically, what appeared once to be planning solutions have now become problems. This is certainly true because of the continuous trials of rethinking the hierarchy of traditional settlements and Government planning interventions carried out to improve the haphazard villages that grew organically as vernacular settlements in the Gezira area of the Sudan.

As a result of the movements of people from their original villages there is now a crowded pattern of permanent organic settlements scattered 1-3 miles apart on the empty land between the regular farms. At the beginning of the scheme these settlements were augmented by smaller hamlets and labour camps of immigrant families employed as 'cotton-pickers' by the farmers. It is not known how the organic built environment began to develop and it is not clear how this process will continue or where it will end, but through comparison of both types of development, formal and informal, we can investigate the fact of the physical and multicultural effects that shaped these settlements and how they sustain the life of their inhabitants.

This organic development can be seen in the plan of El Sereiha village before 1970 (Figure 6.4). Government regional policy and settlement organisation has been a significant driving force for the development of the area, but it is important not to forget government investment in infrastructure, much of which was directly related to the agriculture, its administrative centres and canalisations. By neglecting the settlements of local people, this policy forgot the social reality that is an ensemble of often invisible relations through which people's everyday lives are conducted. Exploration of the interplay between the diverse networks of social, economic, cultural and political relations permits contextualised-planning practice, in other words sustainable settlements. In this sense the reality of economic planning decisions is often disappointing.

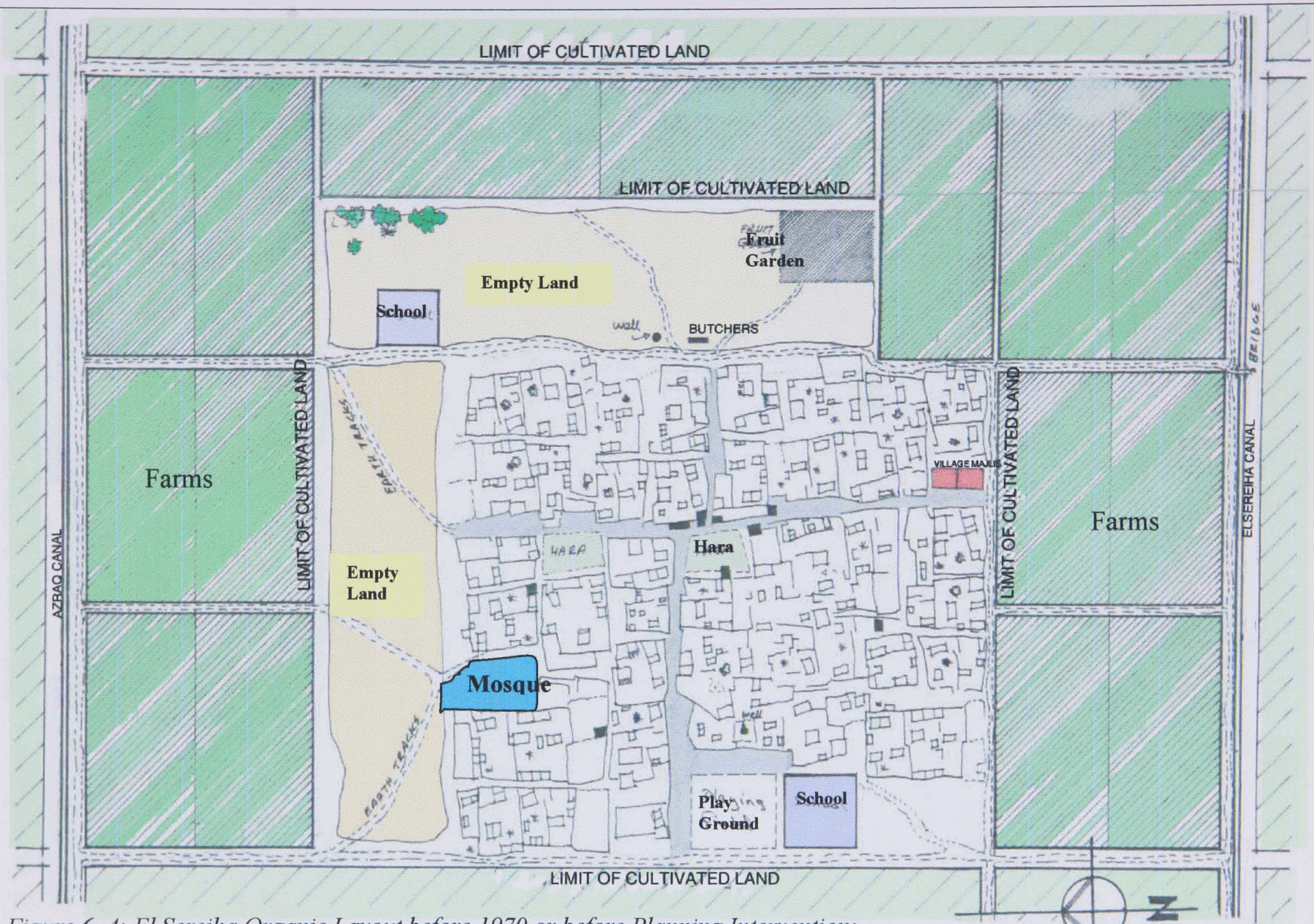


Figure 6. 4: El Sereiha Organic Layout before 1970 or before Planning Intervention:

Source, Gezira Planning Office, 1970, modified by the author

The Government is responsible for the houses in the Farmhouses village. The Gezira Board authorities have directed the houses in all stages of development; design, construction, distribution and preservation (maintenance) in the Farmhouses villages. These houses are characterised by their different sizes. The plan of the Farmhouses village is in the form of meshed-grid shape that is characterised by its straight lines, wide roads (15–25m) and regular plots with limited amenities. Although the houses are of different sizes, the plots of the middle and higher officials are of the same size, about ½ feddan (Feddan = 1.035 acre). Houses for lower income classes fluctuate between 100m² to 200 m².

The responsibility of the Government towards these houses and the mobilisation of the settlers have not enabled the inhabitants to make any major physical modifications. The changes in the use patterns showed minor physical changes to the houses but not the layout plan of the village. There are additions, such as a boundary wall to secure some privacy for the dwellers. This consolidates the thoughts of Akbar (1988) that the pattern of responsibility is very important in shaping the dwelling or otherwise it should be changed to cope with the changes in the environment.

In addition to the Government houses there are the irrigation department houses and the railway staff houses. The local people who came to the area for trade built their houses near this settlement as a separate quarter (Figure 6.5). The dominant characteristic of the layout of this quarter is the formal planning even though it was not formally planned. It was noticed that the quarter of the local traders was in a ruined residential area. The explanation for that came from one of the residents interviewed, who stated that this part started to diminish after the construction of the asphalt road in 1962 away from the area, near the Blue Nile River. The railway ceased to be of such importance to the inhabitants, as it was before the road construction, because passengers prefer to use buses. Therefore those people who came for trade started to leave the place for other areas with more potential. Some of them built their shops in El Sereiha village and this reflects the significance of its growing importance. However, the Farmhouses village pattern forms adjoining large plots and wide streets, creating a pattern different from the traditional settlement (Figure 6.5). The settlement has taken on the appearance of a typical western legacy structure. The houses are surrounded by many trees and farming areas. In this type of pattern, the hierarchical order of spaces from public to private displays an abrupt sequence from 'Public Street' to dwelling plot to veranda to dwelling. In the traditional pattern, the hierarchical order of spaces from public to semi-public to private, in other words from principal lane to zugag (narrow twisting alley) to dwelling, is much more differentiated in the sequence from public to private.

In order to understand the present inadequacies in the sphere of rural land use, and to be in a good position to articulate the future, it is important to explore both types of pattern; the traditional pattern and colonial pattern that was occupied by the British civil servants, who had run the agricultural system within the area, and has been taken over by the Sudanese civil servants who occupied the Farmhouses settlement. The understanding of the present land use situation is partly dependent on an appreciation of the dynamics that led to the evolution and pattern of land uses in the past.

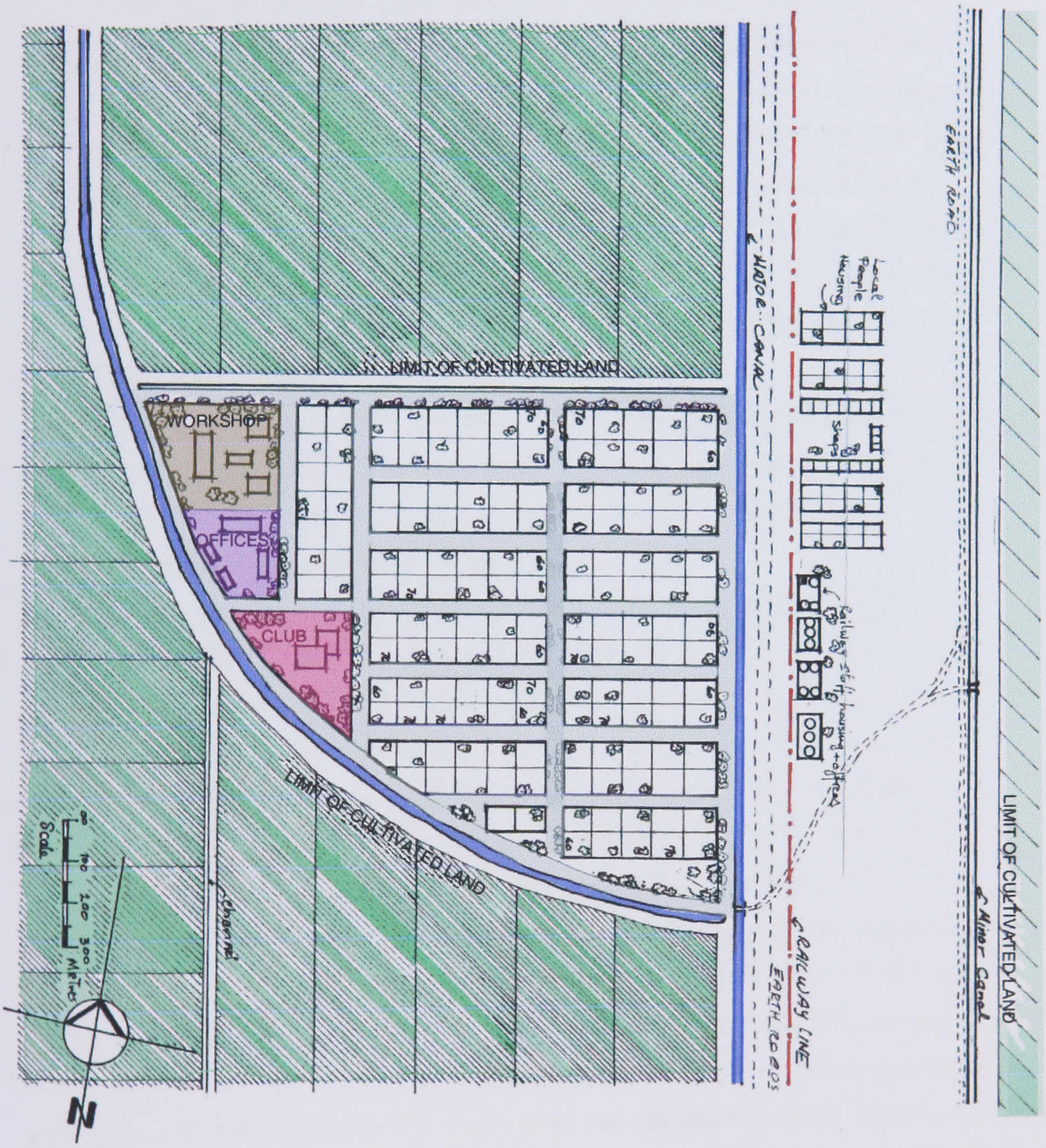


Figure 6. 5: The Farmhouse Layout since the erection of the Gezira Scheme:

Source, Gezira Planning Office, 1970, modified by the author

6.3 Site Selection

These issues will be examined in more depth to explore the response of the dwellers. Many of the key issues such as site selection, organisation and relationship with the scheme authorities will be introduced using extracts from first hand accounts by the tenants themselves. The first account is by an old man called Haj Ahmed who came from his original settlement to live in the organic El Sereiha settlement.

> *"Before the beginning of the scheme our predecessors used to come to the site to grow sorghum 'dura' during the rainy seasons. The dura is very important for our bread, which is known as Kisra. Women grind it and make kisra out of it. This site was well known to our grandfathers because they dug a well in it and used to build temporary huts from the stem of sorghum. After the beginning of the scheme we moved from our village on the river and came to the site with other relatives and we built our homes. Each usra built its house in a compound 'hoshes'. Many changes have happened to the shapes of our houses, from the hut to the large rooms built out of red-bricks"* (Social survey 2001).

Another account from Sayed 'Mr.' Abu Galib, who was a field inspector and lived in the area for twenty years, and who described the Farmhouses village formation in the following terms:

> *"I came here with my family and we lived in the smallest house in the complex, but we moved to a bigger house whenever I had been promoted. The Government built the houses and we have no responsibility towards them. The Gezira board-engineering department prepares everything, the construction, distribution and maintenance. These houses were built at the beginning of the scheme for the British field inspectors and after independence Sudanese officials occupied the houses. In comparison to other places, these houses are very big and durable. The area of the average plot is about half an acre (2100m²)," (Fieldwork 2001).*

It seems that Abu Galib preferred to be in the area for long time and he was lucky to find what he wanted from the Gezira principals. Usually, the inspectors move from one division to another according to the necessity of the job, but sometimes the desire of the tenants parallels that of the inspectors and may determine the continuity of the service of the inspector in the same area. This happened with Abu Galib, who was supported by the tenants to stay for a long period. This shows the social interaction between people living in the area. We were told that had happened with some of the British people who worked in the area; people still mention their names.

6.4 Expansion of the Settlements

6.4.1 Limiting Factors

El Sereiha village development has been more severely restricted by the scheme components than the Farmhouses village. The irrigation and farms system in conjunction with the land policy (land within the Scheme should remain for the distant future for agricultural use) have restricted the development of El Sereiha village. The Farmhouses village is restricted by the same factors of the constructed built environment but there has been no need for extension. The rigidity of the planning of the canals and farms with the strict ownership make it difficult to acquire land for extensions for El Sereiha to meet the natural growth of the population (2.84% 1995 Sudan Census).

The canals and farms surrounding El Sereiha village have been a means of shaping spatial patterns of rural growth. In 'Kab El Gidad Agricultural Block' (containing El Sereiha village) over 98% of the land remained predominantly rural farmland until 1970 when a very limited portion, possibly 0.2-0.5% at most, was taken for the overspill for El Sereiha village (information taken from the Block Head Office). The overall rate of land taken for settlements' extensions was quite low: one estimate suggests that between the beginning of the scheme and 1970 the extensions of villages and small groups of houses may have risen by 50 acres or less than 0.1%. However, even with this apparently rigid belt of farms and canals, planners found it difficult to ignore the pressure to supply services to the villages and secure plots for the natural increase in population, and therefore they rethought the development of the organic development in many settlements, including El Sereiha village.

These limitations also had their impact on the pattern of housing at the different levels of settlement development; regional level, local level 'village' and unit level 'dwelling'. Forming an order of settlements (previous chapter) reflects that inhabitants have adapted themselves to these changes and stresses as well as to the severe hot weather. Therefore we can summarise these limitations, which are considered the main stresses on settlements, (especially the traditional organic forms) as three major factors of great significance for their direct effect on the layout and expansion of the village:

- The factor of irrigation canalisations and farm system forms physical obstacles for the settlements' development. The straight canals with the geometric farms have limited the shapes and expansions of the grown settlements.

- The strict ownership of these farms and the continuous surveillance by the field inspectors and the owner make it impossible to expand, illegally, on these farms.

- The hot dry climate and dusty wind obliged the inhabitants to follow the Arabic style of layout; crowded houses with narrow alleys and dead ends to prevent bad weather penetrating the village.

The normal expansion was carried out within the plots of the two villages. Local people built extensions within their hoshes. The Government built a very limited number of houses within the existing residential Farmhouses area but it carried out continuous maintenance. One of the engineers interviewed mentioned that only two houses were built in the Farmhouses village during the history of the scheme.

6.4. 2 Re-planning Intervention

In fact there was no need to re-plan the Farmhouses Village as it was designed to accommodate a limited number of people for the life of the scheme. A special engineering department of the Gezira board maintains the houses for the use of the officials, though most of them are not very happy about the maintenance because there is no fixed programme for the maintenance of these large houses. Also applications for maintenance pass a complicated routine. The social survey (2001) revealed that most of the officials in the Farmhouses village found it difficult to run the farm or the agricultural land attached to the house because the facilities that had been given to the British inspectors for running these farms were not given to the Sudanese inspectors to keep the same standard of their maintenance. They did not have assistant workers with them and no gardeners to look after the greenery and no finance to help them to do the job themselves. The local people's houses attached to the Farmhouses village seemed to follow the system of planning of the Farmhouses village. However, the village has undergone no land changes in size and shape since first established.

In contrast the nature of the development of El Sereiha village, its population growth, the need for re-thinking the organic order and other political reasons made it necessary to re-plan it. The Gezira Board, with the collaboration of the UN development program and the Survey Department in the Sudan, started rethinking the planning process in the organic villages that developed haphazardly in the whole Gezira in the 1960s. One of the surveyors, who worked in the area for two decades, describes the first processes as follows:

> *"We usually had no plans or any aerial photos for these villages. We used to draw the perimeter of the village and then we divided the village into blocks to have back-to-back houses forgetting the old fabric. We faced a lot of problems in executing the re-planning; though the inhabitants got*

> *the compensation allotted to them according to the damage that occurred to their dwellings. Another problem was because the most of the households share one house plot 'extended family' it was difficult to divide and distribute the old plots. Also we found difficulty in acquiring land for spill-over."* Mr Gunaim, a surveyor, worked from 1960 until he was retired in 1970, (Author Interview 2001).

That means a complete change of the crowd organic order into back-to-back plots and wide roads had been introduced in some villages of the Gezira area. This type of new planning development forced the socio-cultural activities to work within a new systematic order. All the answers of many officials (2001 interview) revealed that there were only four villages that underwent this type of re-planning policy during the 1960s and it cost a lot to implement and in most cases it failed to be applied.

In the 1970s, new planning ideas were put forward by the newly established Ministry of Housing to carry on the job of planning the Gezira villages. Why was the first work of the Central Ministry re-planning the organic Gezira villages? When the Ministry of Housing was first established in 1970, the first task thought of was the re-planning of the Gezira area of the Sudan because of its economical importance and the migration phenomenon recorded in the censuses of the area. The farms and canals make the extension of the villages impossible and there is no land for new settlements to extend. There were other reasons for rethinking the planning processes in the Gezira. The 'Revolutionary Government' that came to power in 1969 was interested in developing the rural areas and agriculture rather than the urban areas. So it directed all planning bodies to look at rural development including re-planning villages, in particular the Gezira villages. As the Gezira area was well-known and its settlements were being injected with the facilities given by the Sudan Gezira Board, the Ministry of Housing at Khartoum found it a good opportunity to intervene in planning the traditional villages, making use of the enthusiasm of the Government, the existing infrastructure and many studies carried out for the area. Also the Ministry was looking to achieve an objective of stopping immigration to the nearby urban areas like Khartoum, which was populated by squatters, and to provide these villages with some amenities such as electricity, which was put in as an incentive for villagers to accept the planning intervention without compensation.

The Ministry of Housing immediately established a 'Planning Office' in Wad Madani to organise the planning intervention, which had already been running in the area through the survey department with the collaboration of the Gezira Board and UN technical assistance. The new planning office was established with the assistance of different government departments. The Ministry of Housing in Khartoum provided a team of planners, guided by an

architect planner (the author of this research), and continued to give technical support to the office, which was administered by the State (Wilaya) and funded by the Gezira Board authorities.

The office started the work after the Ministry of Housing had passed a new planning law that gave the state the right to facilitate regional planning regulations to enable the regional offices to take decisions in planning procedures. Immediately the Planning Office decided to carry out the following steps before starting the processes of re-planning the old traditional villages:

- The policy of the Ministry of Housing was to start with four villages of different sizes and the method of selection depended on acceptance of planning interventions without compensation by the inhabitants of the village; the village would have the opportunity to acquire some services, such as electricity provision. El Sereiha village had been chosen to be a model for this policy of re-planning processes against services,. Usually, there were revenues that had been allocated for each village in the Gezira to compensate the inhabitants for the damage to their premises. The Planning Office thought of using this revenue to supply villages with essential services.
- The Planning Office stopped the planning interventions processes that had been going on for a while until a social survey and aerial photographs, to be provided by the Social Department of the Gezira Board and Survey Department of the Central Government respectively were available.
- The Planning Office with the collaboration with the Social Department of the Gezira Board carried out a social survey, while the Survey Department carried out building surveys and aerial photographs to help the planners to reduce the damage when doing the structural plan.
- The Ministry of Housing policy, also, concluded that it was essential for the inhabitants to participate in the planning decision-making. The first agreement with villagers to achieve this policy was as follows:

a. First a committee was established to mediate between the planners and the inhabitants consolidated with officials in the area.
b. Secondly, to rethink the planning processes according to the culture and the way of living of the inhabitants.
c. Thirdly, to follow the existing zugags and widen them in such a way as to not damage the habitable rooms.

The planners started the planning process in these four selected traditional villages. El Sereiha village was the largest settlement to accept the planning intervention process, as the

inhabitants were eager to be supplied with electricity. The Planning Office sent a building survey team and a social survey team to carry out a questionnaire prepared by the Planning Office and Social Department 'Gezira Board'. According to that survey (1970) the calculation of the housing needs in El Sereiha village, based on the number of households, showed that there was an undesirable crowded situation. Therefore an overview into El Sereiha situation of housing needs may give an idea of how El Sereiha's organic development had met the housing demands of the inhabitants.

6.4.3 El Sereiha Housing Needs

The housing needs appeared when the numbers of local people showed a remarkable growth and the rural-urban emigration increased to a clear level (Misra 1992). The increasing number will be discussed in detail later in this chapter. The author as an architect/planner in the Ministry of Housing (1970) reported about El Sereiha village before starting the process of evaluating the housing needs, describing the situation in the following terms:

> *"In between the agricultural fields, tightly clustered houses connected by narrow alleys characterize the traditional built environment. This traditional built environment is characterized by elements of continually renewed interest and surprise arising from the changing patterns and sizes of roads and open spaces and the fact that one constantly faces a closed vista and can rarely see too far ahead. In the village designed for maximum exposure and close surveillance the exact opposite was sought. These lanes always lead to a central place. The main open space was located in the centre of the village. Shops projecting from the nearby dwellings surrounded it. It serves the social and commercial activities. There is segregation between kinship groups, men and women, public and private, in both physical and physiological aspects. Houses or hoshes were built on the basis of multi purpose usage. They are built of mud structure, which is gradually being changed to new building materials. They accommodate all the activities of the nuclear or extended families."*
>
> *(Ministry of Housing Records 1970: Planning the Gezira Villages)*

The natural growth has a great effect on the housing patterns in the traditional organic setting. Immigration to the village was hardly seen or recorded, but after re-planning intervention few households came to the village from other nearby villages and bought plots in the extension part. The land was very precious because it was difficult to confiscate farms for a village extension. There were two constraints to acquiring land for spill over:

- The Gezira board administration should agree to give up the farms which were in the vicinity of the village.

- The acceptance of the tenants to give up agricultural land was important as well as the agreement of the Gezira Board Administration.

It was found that 90 Feddans were needed to cover the shortage of housing, taking into account reducing the housing density of the village. The size of the plots in the new extension was planned to be 20x25=500sq.m while the plots in the traditional part were left to be controlled by the minimum size of plots of 200m² with minimum frontage of 10m as stated in the planning regulations. After calculating the housing needs of El Sereiha village, 90 feddans (acres) were added to the site to make 210 feddans in total to accommodate about 13000 inhabitants. This gives an approximate density of 62 persons per acre. These feddans were taken from the nearby farms after an agreement with the owners and the Gezira Board on one side and the planning office on the other. One feddan was taken from the total of each farm's area allocated for the yearly rotation (chapter four).

However it was considered that the planning office has succeeded in putting a policy of provision extensions for all villages under re-planning processes by reducing from farms of every 10 farmers living in the village by one acre to compensate those farms taken to be overspill for inhabitants. Most of the limitations to the village development were eased by this policy and land was available for the new extension:

- The difficulty of confiscating farms to be added to villages for the development of new extensions was overcome by that policy.

- Not moving farmers to places distant from their village satisfied the residents so that they accepted the planning interventions, even without compensation for the damage.

- Taking one feddan from each farmer was considered participation by the villagers in their village development.

The following diagram (Figure 6.6) shows the old village and the land acquired for the overspill and it explains the scale of the new extension compared to the old site of the traditional village.

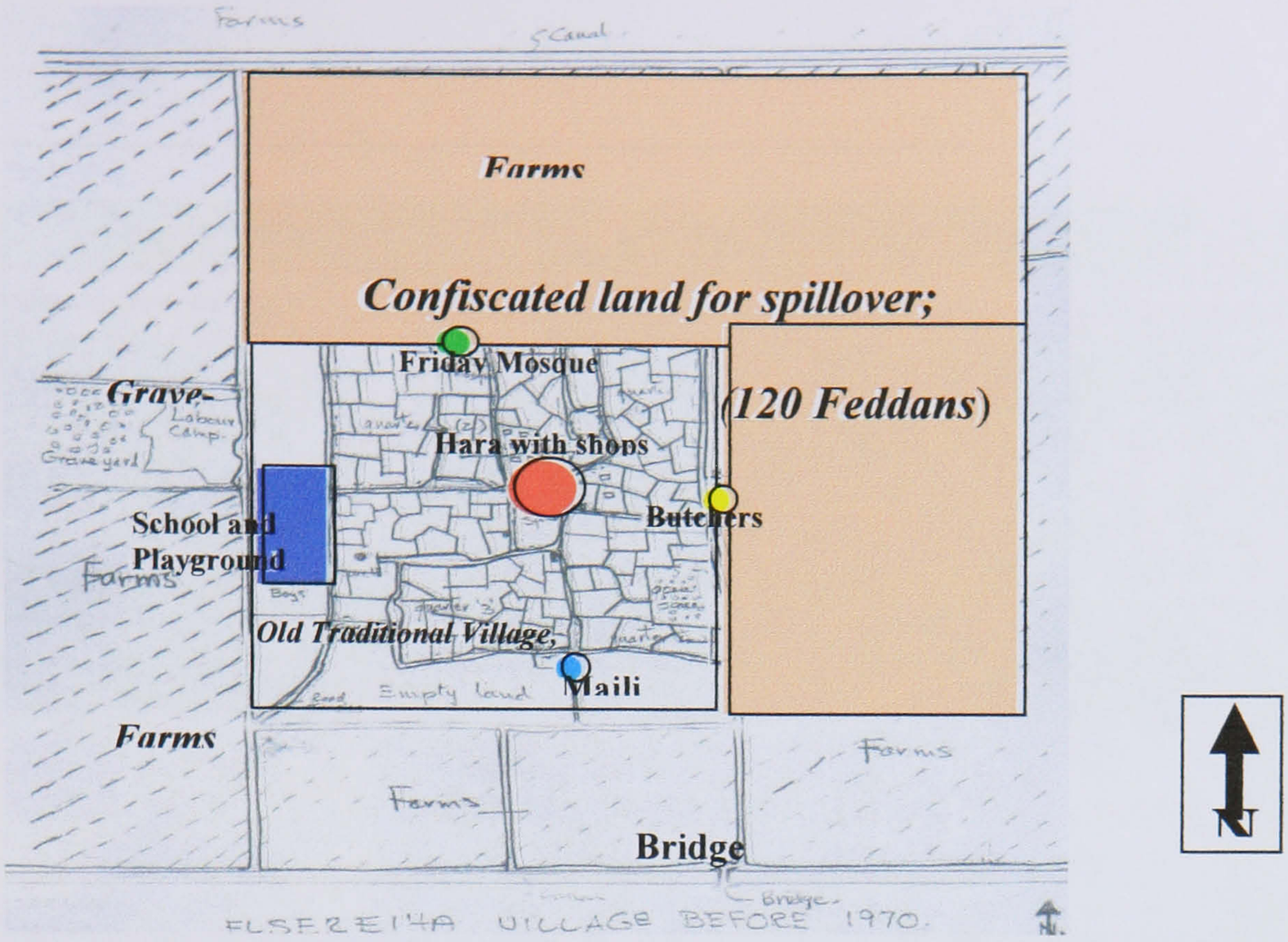


Figure 6. 6: shows the old layout of El Sereiha, before (1970) and land added for the extension of the traditional village.

The new extension was evolved as a result of planning intervention as will be explained later. The plan followed was of a grid-erosion structure. Unfortunately, in spite of all these conditions the plan extended and imposed on the traditional village has created a new system, not only for the extension but also on the main accesses to the old village. The system is simply a copy of the contemporary, diffused European style. For the sake of this research the new system is called the hybrid system. The village seems to be more tightly constrained by the irrigation canals and farms than before; there are no empty spaces surrounding the village. The plan for housing covered all the area added to the village including the empty lots that were used by the inhabitants for their festivals and domestic occasions.

The physical changes affected the twisting streets and alleys. It covered also the open spaces and the system of hoshes known to the people for decades. The plan imposed on the traditional village (Figure 6.7) shows two different residential parts; a new extension of large streets, many open areas, and regularised plots, of rectangular shapes. The old part represents the old fabric with new straight roads and alleys cutting through the hoshes. In the spatial organisation we will go further in detailing the network pattern in both villages.

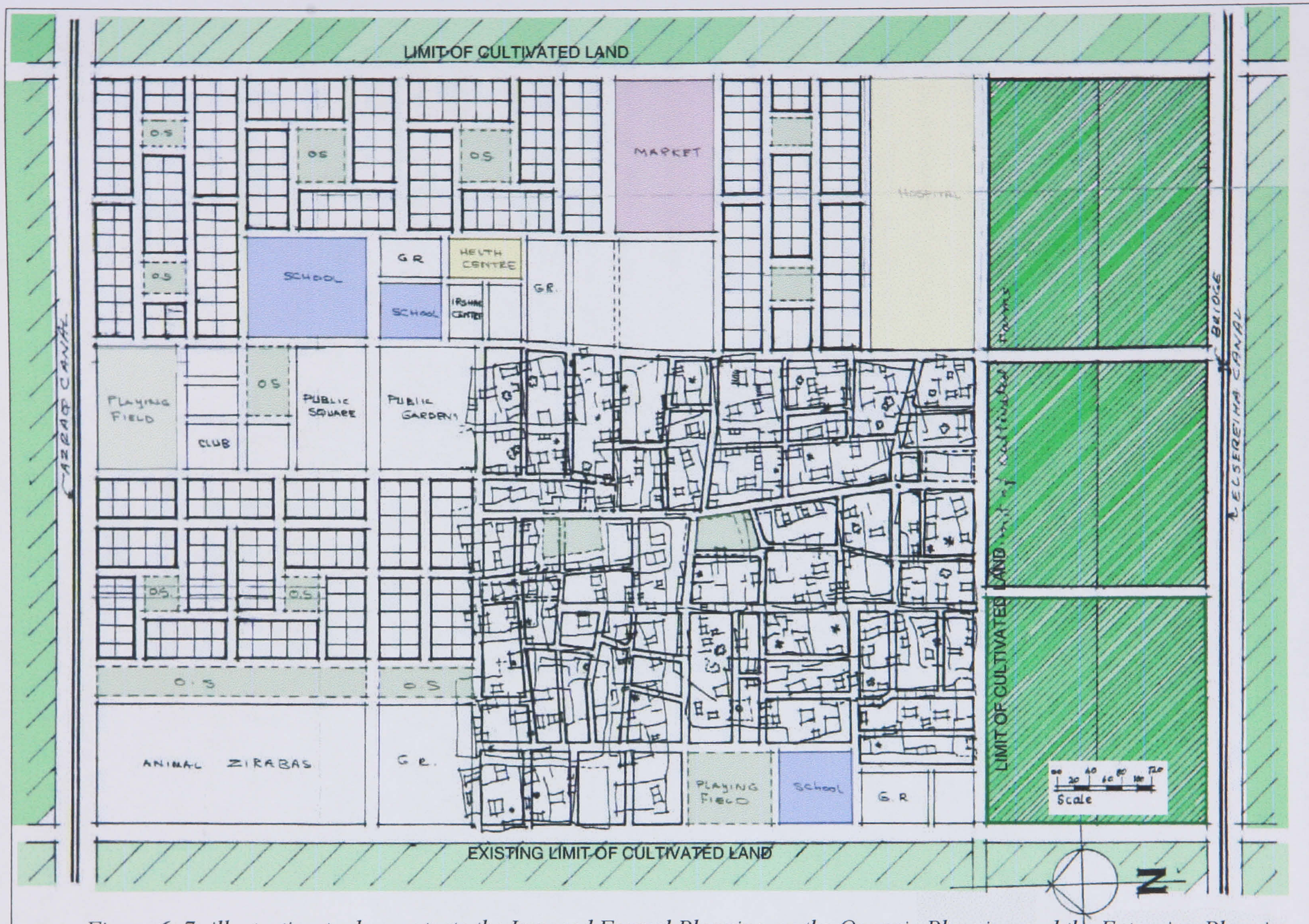


Figure 6. 7: illustration to demonstrate the Imposed Formal Planning on the Organic Planning and the Extension Planning, El Sereiha

6.5 Formal and Informal Planning

6.5.1 Introduction

The dominant characteristic of the layout of El Sereiha village is one of the informal planning (organic) systems that is fascinating and originates from the system of kinship of the people who came to settle on the site. The settlement, which is a form of hoshes, can be traced back directly to the Arab people who settled on the Nile River for centuries and the Africans who came to the area after the scheme's construction (see chapter four).

The organic village form can be clearly seen in the plan as it evolved from the beginning of the twentieth century to 1970 (Figure 6.4), immediately prior to the planned extensions. However the inherent flexibility and absence of hierarchy in the form have also been linked to the democratic principles of egalitarianism within the structure of the kinship at the time (Ahmed 1992). Interestingly the few variations in the traditional village layout were the government housing built for teachers and other Government officials. They were built in rows of straight lines and regular forms in the empty land around the village near the public buildings, such as schools, health centre or local Government buildings.

Although the Farmhouses plan and El Sereiha extension layouts offer considerable practical advantages when surveying and setting out, the concept of multiple plots of equal sizes was of no significance to the local people. It is clear from the inhabitants' views that, from their perspective, the most important factor is to establish a framework in accordance with the traditional conventions and kinship rules. In the traditional planning the subdivision and the allocation were done by the main figures of the kinship group. How were such layouts achieved in practice? Some respondents speak of the way that was followed to make the system:

> *"When our predecessors came first to the site in groups, the families of the same kinship allocated hoshes according to the descendants' relationship, the father and his sons and then his brother, uncles, aunts and so on. The existing situation still tells us that people built their houses in relation to the Muharam and Non-Muharam of Islam"* (Sheikh Ahmed's perception, the author's interview 2001).

The traditional settlement system produced an environment of significant features to secure privacy and at the same time provided possibilities of social interaction with other relatives and strangers. The traditional system is more than simple twisted lines that indicated streets, open spaces or plots (hoshes), there were homes and a system of life adapting itself to the existing environment; but it is of great significance to study some of these physical planning features differentiating both types of settlement.

6.5.2 The Compact Rural Form: the Climatic Factor

The physical morphology of the traditional village is, to a great extent, a cultural-historical response to the environment, especially to the built-scheme and natural environment, in particular the climatic condition of the region. In contrast to the colonial and contemporary planning system of the extension of El Sereiha village, diffused from the European systems, the traditional planning is concentrated and homogeneous in its buildings, combining diverse land uses in a tight relationship with each other. The primary reasons for the development of the compact village may have been necessities of social cohesiveness, land conservation for public realm social interaction, and optimal size. Also the compact system as the dominant rural form in hot-dry zones has probably been maintained as a result of its climatic advantages. The climatic advantages of a compact rural form can be summarised as follows:

- Reduces direct radiation and evaporation;
- Minimizes heat gain during the day and heat loss at night;
- Provides shade and cool air;
- Makes human movement easier within the settlement;
- Breaks both strong hot day winds and cold night winds; and
- Reduces the harmful effects of dusty storms.

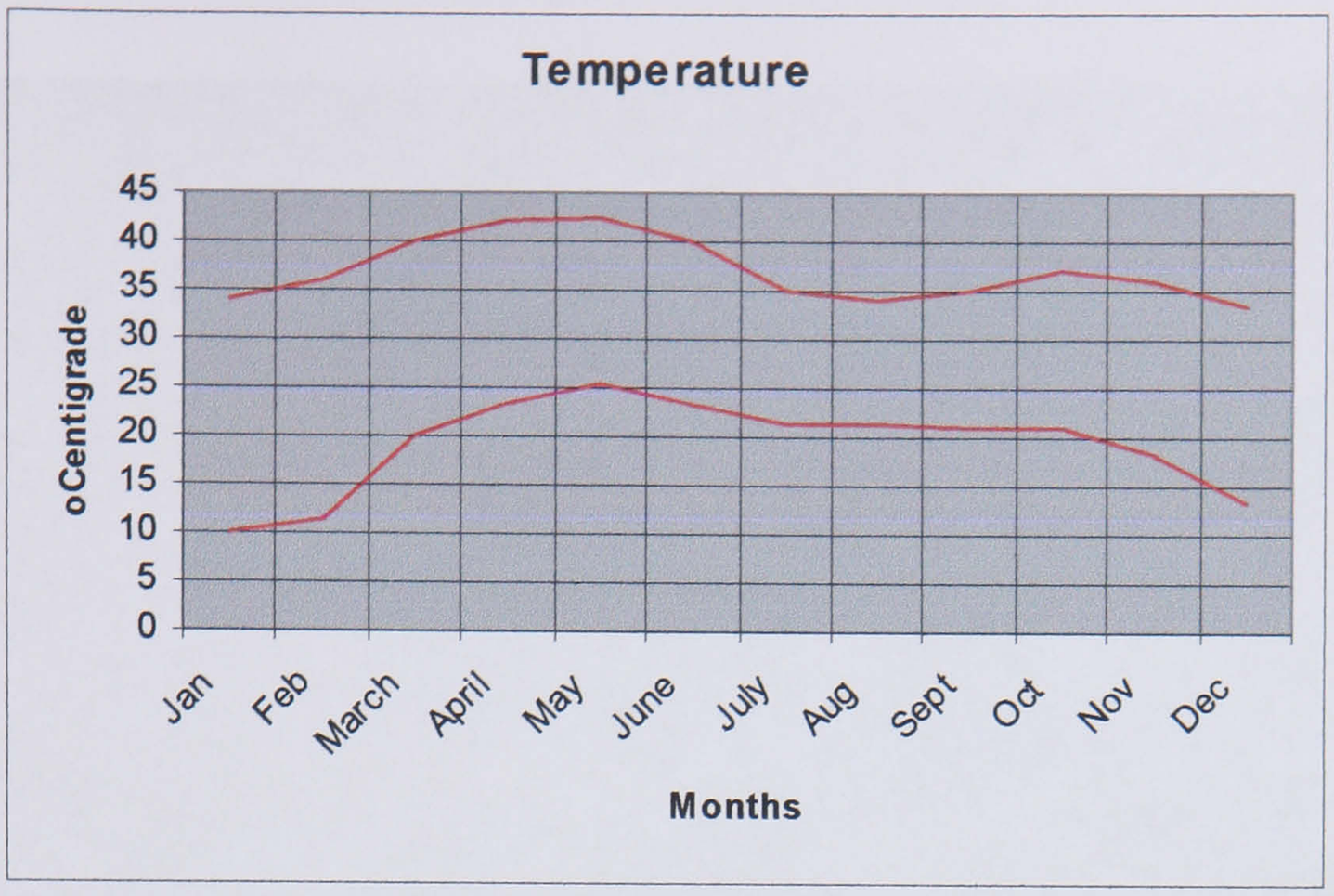
The advantages of the traditional compact patterns can be summarised as follows:

- Twisting narrow streets and alleys reduce daily temperature;
- They protects inhabitants against harmful winds and are open to pleasant winds; and
- Are shaded and cool during the day and warm at night.

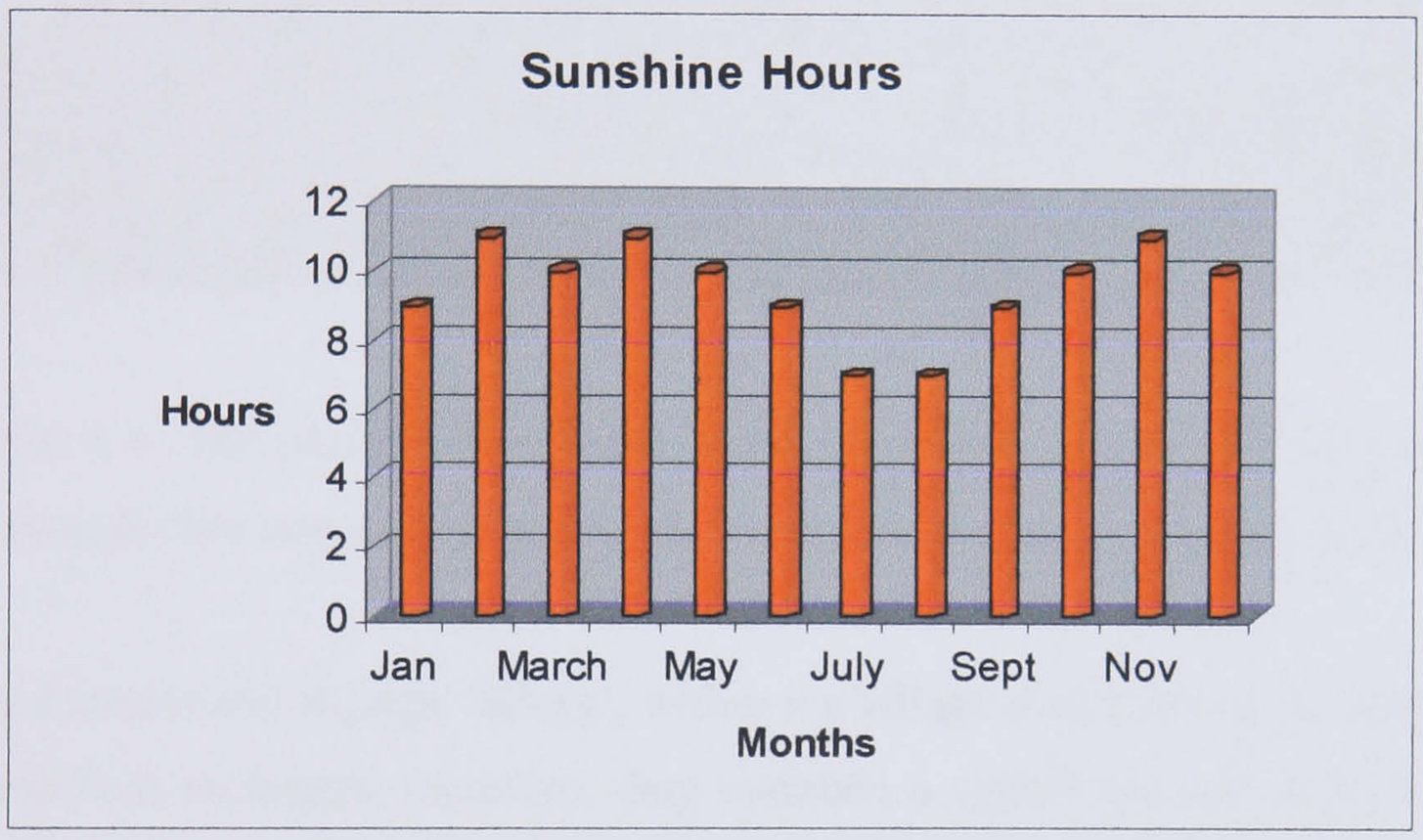
In addition to responding to climatic conditions, a compact system offers many other advantages:

- Minimizes the walking distances;
- Provides easy accessibility;
- Minimizes energy consumption by employing the forces of nature, such as a passive cooling system
- Conserves the environment by using the passive cooling system.

The traditional vernacular village minimized empty space, had buildings of uniform single storey height, and contained narrow twisting alleys. The traditional village also recognized the importance of orientation to mitigate the effects of the wind and sun; temperatures may reach 46.2° C, (Table 6.2 & Figure 6.8).



The maximum and minimum temperate mean



The sunshine hours during the day in each month

Figure 6. 8: Illustrations show different aspects of climate prevailing in the Gezira

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Hours	9	11	10	11	10	09	7	7	9	10	11	10

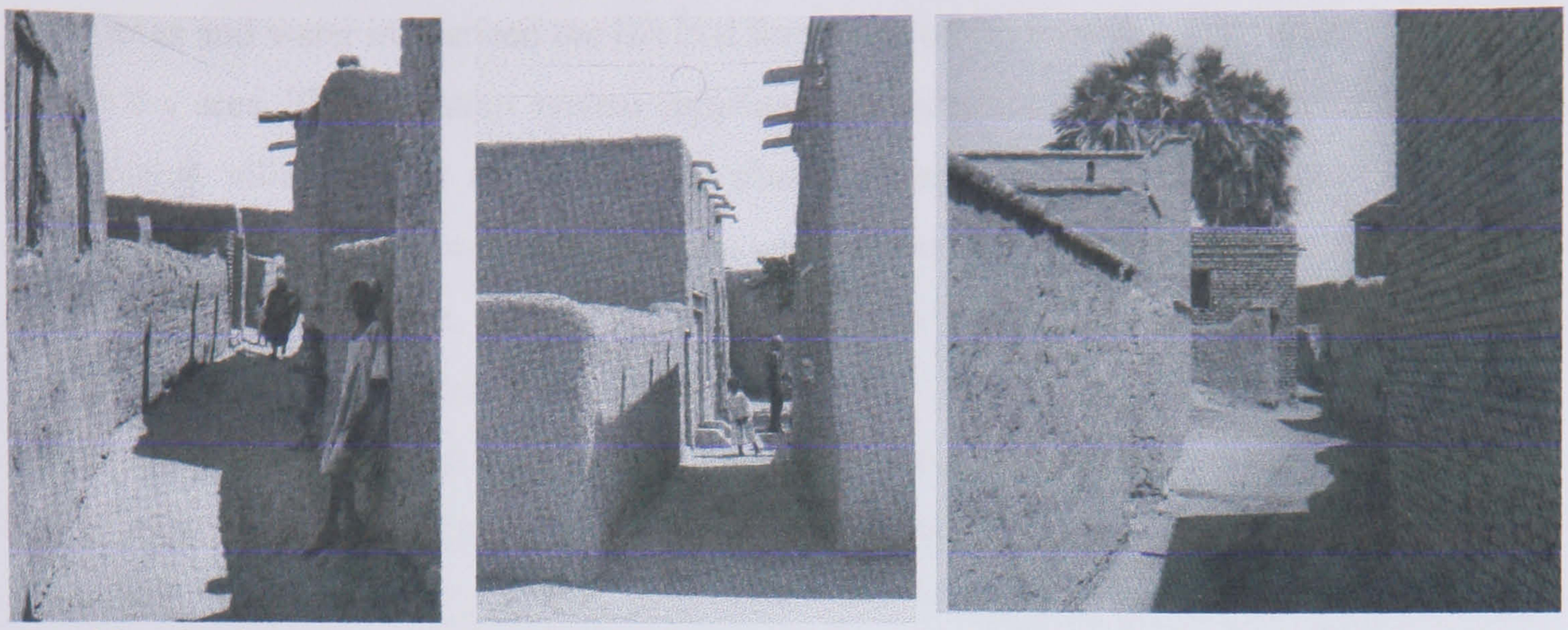
Table 6. 2: Climatic condition; source Meteorological Department Sudan (2001)

The traditional village contains relatively few open spaces. This is due to the fact that in hot dry conditions any large empty space, because of its direct exposure to the sun, generates heated air during the day and cold air at night. An open space, therefore, accelerates the climatic stress, unless it is shaded by trees or contains a body of water. As can be seen in the following photograph, the height of the buildings, with exception of a mosque or a minaret, is uniform throughout the village (Figure 6.9).

Figure 6. 9: The traditional village is easily distinguished from the contemporary planning for the new extension and the Farmhouses village (see chapter four).

The traditional streets and zugags, 'alleys', within the village also function as channels for air movement and heat exchange; therefore, they maintain a significant role in establishing the village's climate, whereas in the hot dry area, the modern wide, straight streets function as channels for hot dusty winds. The twisting streets and zugags reduce the effect of such strong dusty winds.

A dust-storm blowing over the village flows easily through the newly-planned straight streets and alleys creating problems for the residents. The disadvantage of wide, straight streets is more visible during hot summer days when the dusty air near the surface is heated and rises in funnel-shaped dust currents that blow around the village within the large open spaces. Narrow streets and alleys, surrounded by tall walls oriented toward fresh winds, are shaded during the hot summer. The following diagram (Figure 6.10) illustrates the traditional compact layout and the small zugags shaded by the walls.



Outside a hosh | Inside a hosh | Outside a hosh

Figure 6. 10: Photographs illustrate typical zugags 'alleys' in the traditional village.

In addition to the above climatic factors there are the dusty winds which blow all over the north part of the Sudan and which people give different names; for example in the eastern part of the Sudan it is known 'Hababay' and in the central Sudan they call it 'Haboob' (Figure 6.11). This habboob has great effect on the size and shape of windows. People prefer small windows. Also it affects the size of courtyards and the location of rooms within the hoshes.

Figure 6. 11: The famous dusty wind known in the Gezira Plain as 'Haboob'

On the other hand the Farmhouses village is characterised by its many/closely-planted trees on the wide roads and these help in reducing the heat of the sun and protect the houses from the dusty winds but they create other disturbing factors such as mosquitoes. A respondent from the Farmhouses Village mentioned that the increased amount of trees has a great effect on the air movement and the surface area. The weather is fine within the complex but there is the problem of the mosquitoes and other insects, which have annoyed the residents.

These trees and water influenced the life and formation of the houses in the colonial village in the hot dry area. The irrigation system supplies the residential farms with water channels. In the colonial village, trees and water are also used as cooling elements, the trees often appearing in the form of rows running along wide streets. These also add to the visual appeal of the village. Everywhere, streets are lined with trees, receiving their water through water channels coming from the main canals. But here a question might be raised about affordability of running and maintaining this system. The cost of those houses is far from the reach of the Sudanese who occupied these houses, let alone the simple farmer who is after a decent home at a standard matching his society's ability. The village was not equipped with such a watering system, and if it had been, what will cater for the consequences of such development? In the area, trees and water, usually, increase the possibility of breeding mosquitoes and other harmful insects. The following photographs (Figure 6.12) illustrate the intensive woodland and water channels in the colonial village.

Figure 6. 12: Trees and water channel surrounding the houses in the colonial village

It seems that most people prefer to live in the old houses within the old village. The reason was explained by one of the inhabitants who said:

> *"We prefer to live in the old part for two reasons, first we live with our family and then we feel very cool inside the mud houses rather than in that exposed house though it is built from the same materials. The wide roads bring dust and dirt from all directions and heat passes to your body directly"* (Fieldwork 2001)

People also reflect their desire to have more trees as in the Farmhouses village but on the condition that they have the water and facilities for maintaining these trees. Thus it is clear that any facility that mitigates the hot weather is preferable to the inhabitants. This shows the (cognitive) knowledge of people about their environment.

6.6 Spatial Organisation

The spatial organisation of dwellings may be quite different in different periods, regions, cultures and societies. Societies establish an order on their living spaces and reflect their characters in these spaces (see chapter four). There is a relation between the space and human relations (chapter five). The differences in social systems show morphological variety in dwelling layouts. The family contains the socio-economical structure of society within itself. Even though it is a small element, it forms the core, which makes up the future of the society (see the usra system in chapter five). The family needs a certain space, namely the dwelling, to achieve this function. The purpose of this chapter is to investigate the relationship between housing morphology and the social cultural relationships. In practice, it is important to examine which plan layouts are satisfactory to which level and in what ways they are unsuccessful in meeting the needs of the residents. It is argued here that the understanding of the spatial structure of the organic settlements is essential in the design process of the future housing layouts.

The ability to plan, organise and mobilise is a vital ingredient in informal settlement development at different levels of settlement formation. In the informal settlement the design and construction are limited by the ability of the tenant, or the builders who build for the residents, and so in El Sereiha traditional organic village people have developed their own houses. We have already discussed the evolution of the settlements and the cross-cultural dimension to the process (chapter four and five) and it was particularly noticeable how, during the layout and plotting process, specific areas and plots are allocated for future collective use. In the formal planning the ability is limited to the designer and the body initiating the project and so the Farmhouses settlement symbolises the modern system of planning known to the planner at the time.

Rural informal settlement is more than simple twisted lines that indicated plots (hoshes). streets or open spaces, they represent homes and a system of life adapting itself to the existing environment. Thus the spatial organisation of this informal settlement can be identified with several key elements, of which we consider housing patterns (hoshes), street patterns and land uses. Then we discuss the effect of planning intervention on these settlements. The settlements' order which has been formed through time and socio-cultural processes (chapter four), has also formed a network pattern that could be studied against the new ideas of planning to investigate to what extent it could be of use to modern planning. The network systems discussed by Carmona (2003) can be a base for the discussion of the movement pattern.

6.6.1 Movement Patterns

Carmona (2003) has identified three systems of street layout: laddered-street, meshed-grid and eroded-grid pattern. The laddered-grid street layout (Figure 6.13) involves a system of small lanes (alleys) where every destination has an exclusive entrance or exit to the main axes that connect the public space to the peripheries. As each lane termination or residential closed lane becomes an exclusive destination, it becomes only a place to go to rather than a place that might also be passed through. It is believed that the traditional laddered-grid street layout would support broader desires for privacy and selectiveness creating a system of enclosures which may be justified by the argument that defining discrete areas of territory helps to generate a sense of identity, a sense of community and a sense of safety and security for those living in the village, their ultimate development is the gated community. A ladder system only allows movement from one place to another and vice versa.

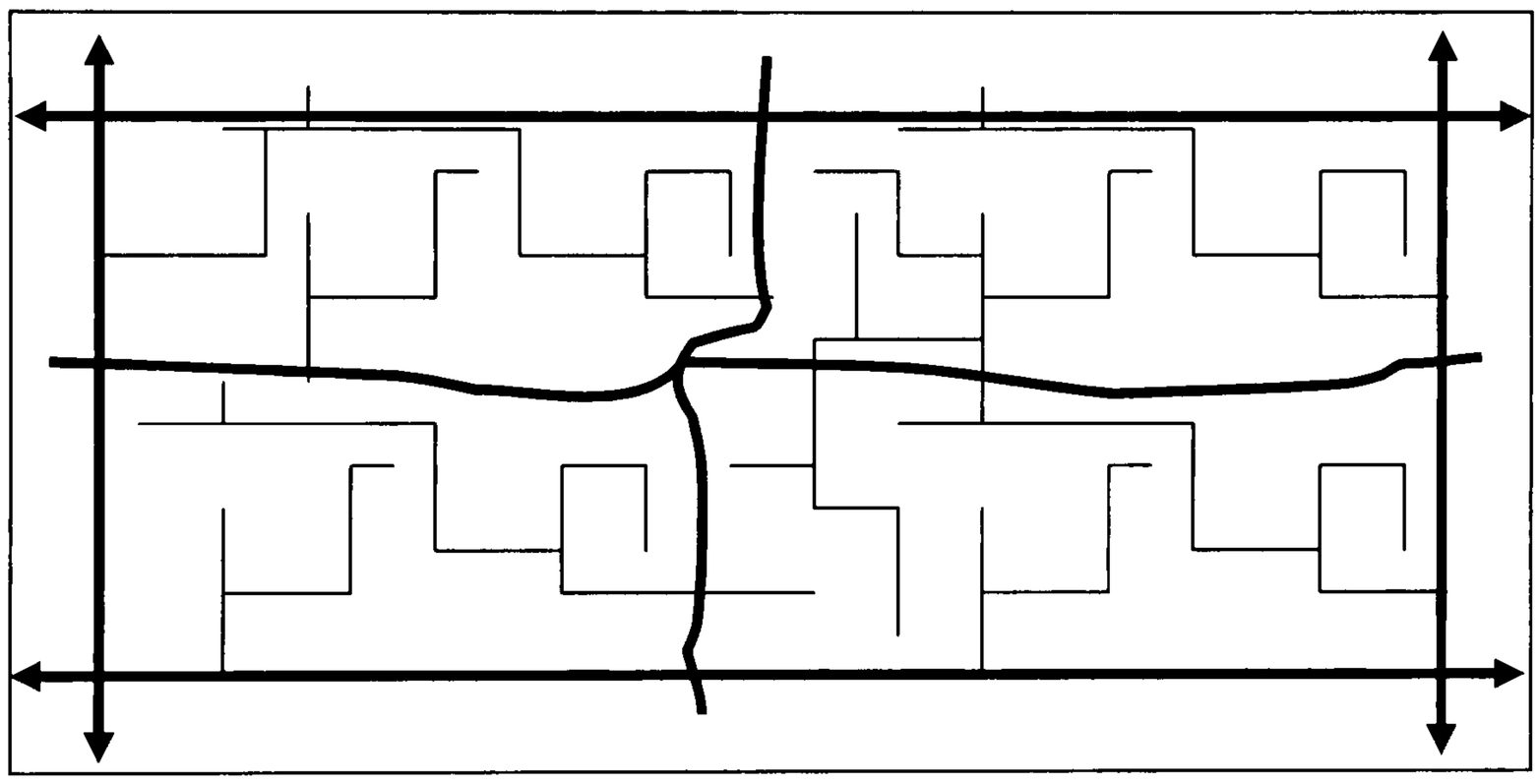


Figure 6. 13: A diagrammatic sketch to illustrate the Laddered-Street System

Architects today sometimes tend to include dead-end streets in their designs. Norberg-Schulz (1980), states that traditional small lanes are related to the scale of pedestrians and donkeys which were the main form of personal transport at the time. The dead-end street cannot successfully be used in contemporary environments without regard to socio-cultural behaviour in the society. A society can improve the quality of life by changing the patterns of social behaviour that operate within it. Akbar (1988) argues that the change of responsibility towards the environment is a critical factor in changing the socio-cultural behaviour. He discusses this in the following terms:

> *"As a result, the contemporary dead-end street is, for the residents, the same as the through street. They are therefore unlikely to maintain it, and the burden of its maintenance falls on the municipality, thus increasing the percentage of public spaces and affecting the social and economic situation" (Akbar 1988:14).*

Thus introducing a lane in a new plan does not mean replacing a zugag in a traditional plan. Who is responsible for these lanes is important for the sustainability of such lanes. Therefore. the issue is not simple. We have to understand the socio-cultural behaviour in a society and its consequences to take on the changes in our new planning systems.

The meshed-grid system (Figure 6.14) allows movement in a variety of directions and through a variety of paths. The emergence and rapid popularization of the automobile as personal transportation made virtually all the urban periphery equally accessible, dissolving the traditional planning constraint of walking distance. At the same time, the automobile introduced new constraints: noise, fumes, and pedestrian safety. In addition, automobiles required streets designed for speed and driving safety, attributes that were lacking in the traditional pedestrian street.

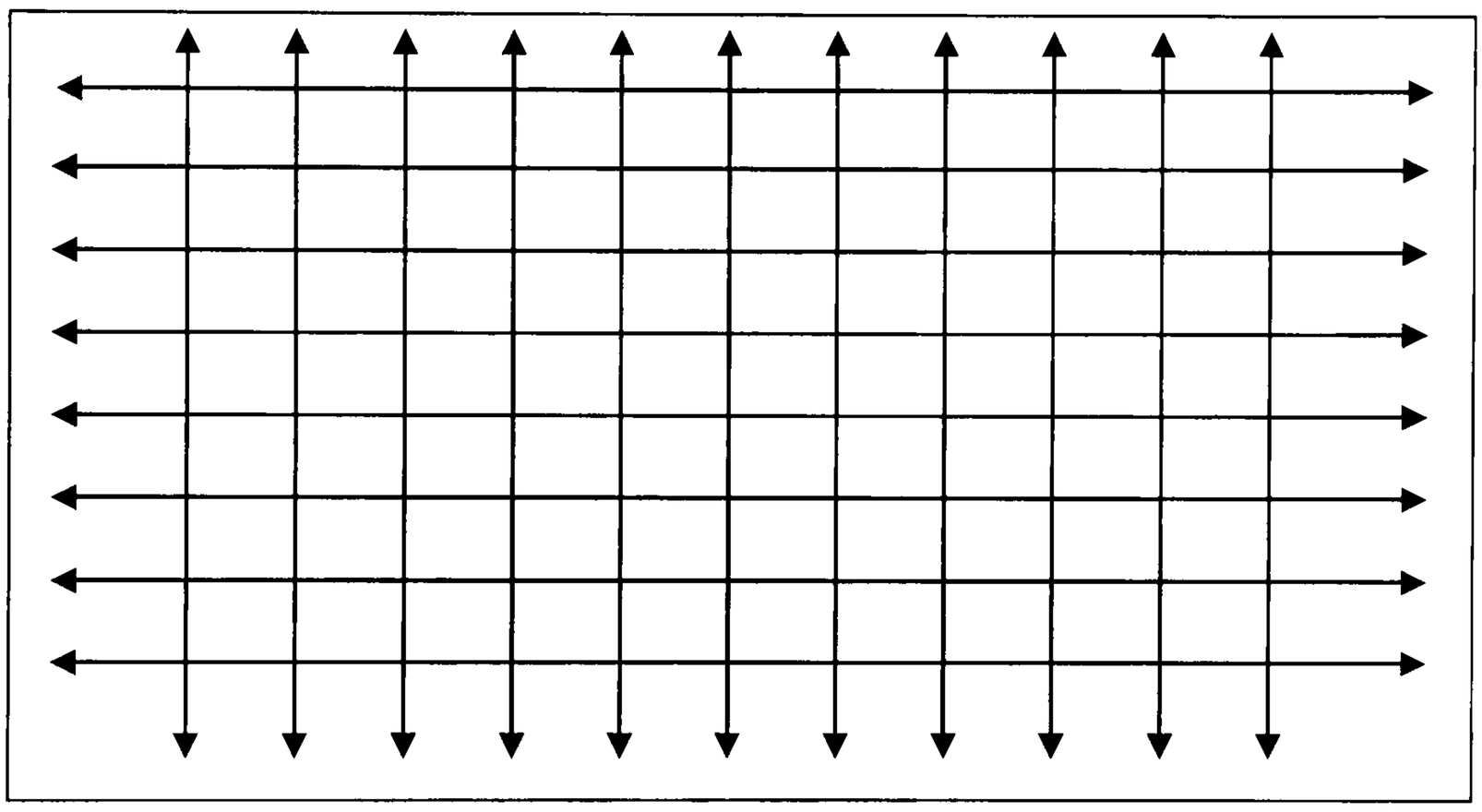


Figure 6. 14: Meshed-Grid System

These new requirements found their clearest expression in the Radburn model, named after the pioneering suburb of Radburn, N.J., begun in 1928. Radburn replaced the meshed-grid with "super-blocks" that excluded through car traffic by grouping houses around cul-de-sacs, served by collector streets, and separated by common open spaces. Traffic was directed to wide collectors or divided arterials on the perimeter and incorporates a "spine" of open space in the middle of the super-block. This new model of circulation (known as the eroded-grid pattern Carmona 2003: 72-73) retained the key ideas of rural setting and foot accessibility, but people walked on landscaped footpaths while streets were given over to the automobile. Later suburban subdivisions followed the Radburn model, although over the years' pragmatic adaptations, such as decreasing the width of streets, the elimination of the footpaths and the open spaces, increased socio-cultural efficiencies while reducing the overall attractiveness of the original model.

In response to the introduction of planning intervention by the elite, who are greatly affected by the meshed-grid system, the new extension of El Sereiha village was designed to form a hierarchical system which consists of access points from main roads surrounding clusters with open space in between (Figure 6.15).

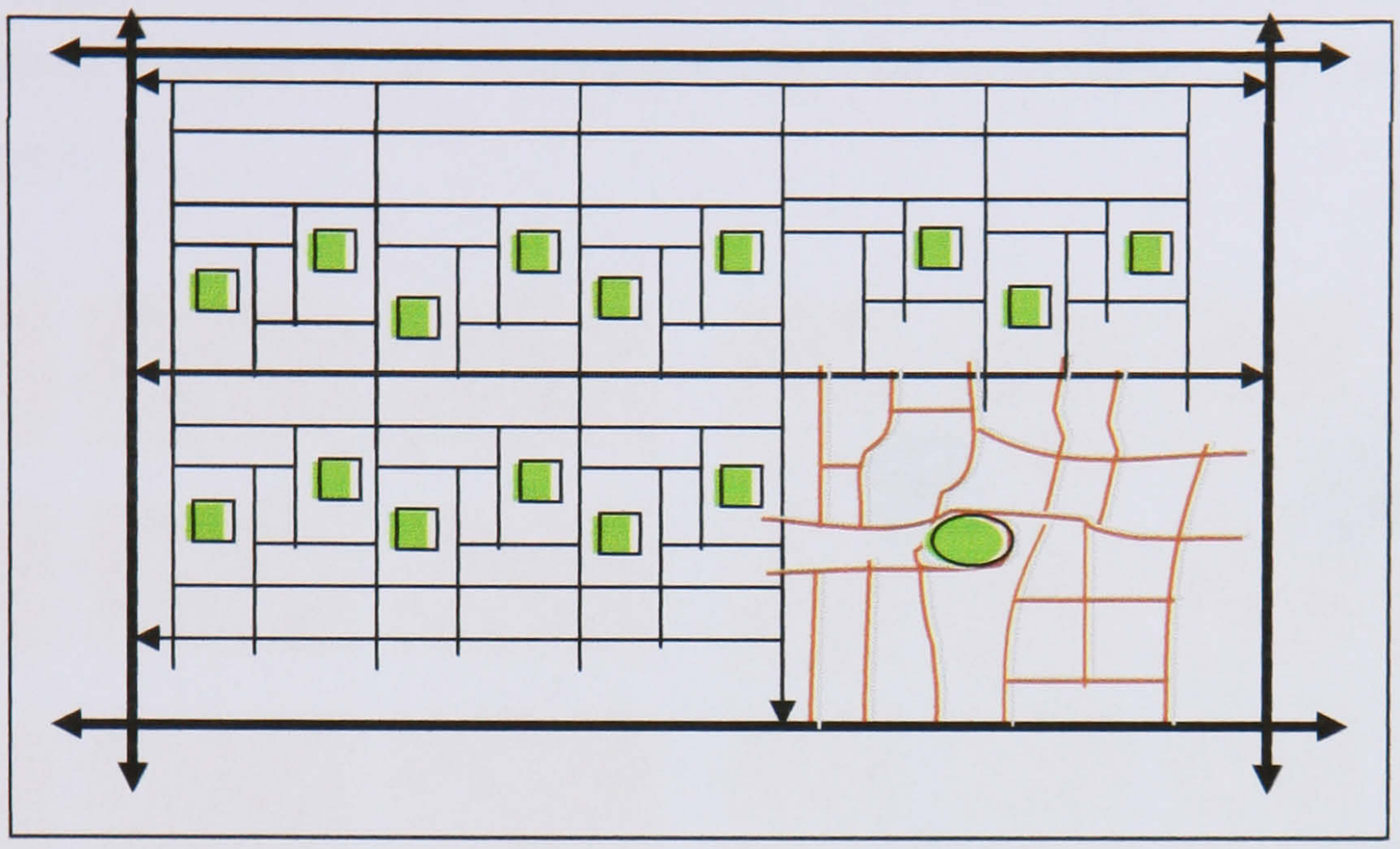


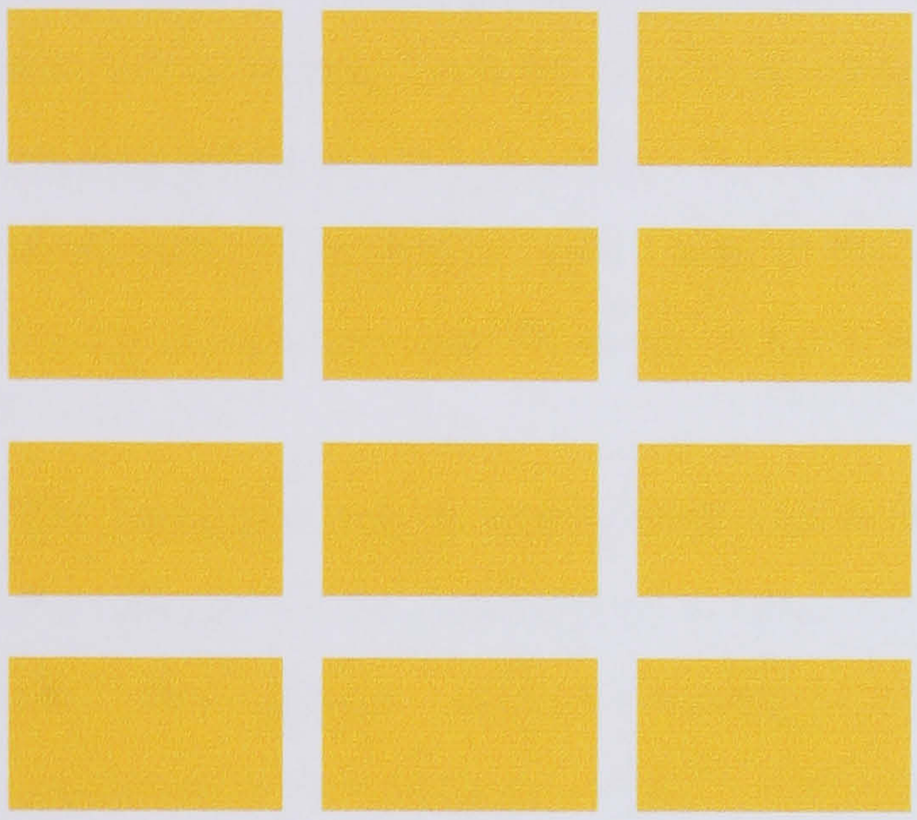
Figure 6. 15: illustrates both the eroded-grid and hybrid system

6.6.2 Street and Zugag Pattern

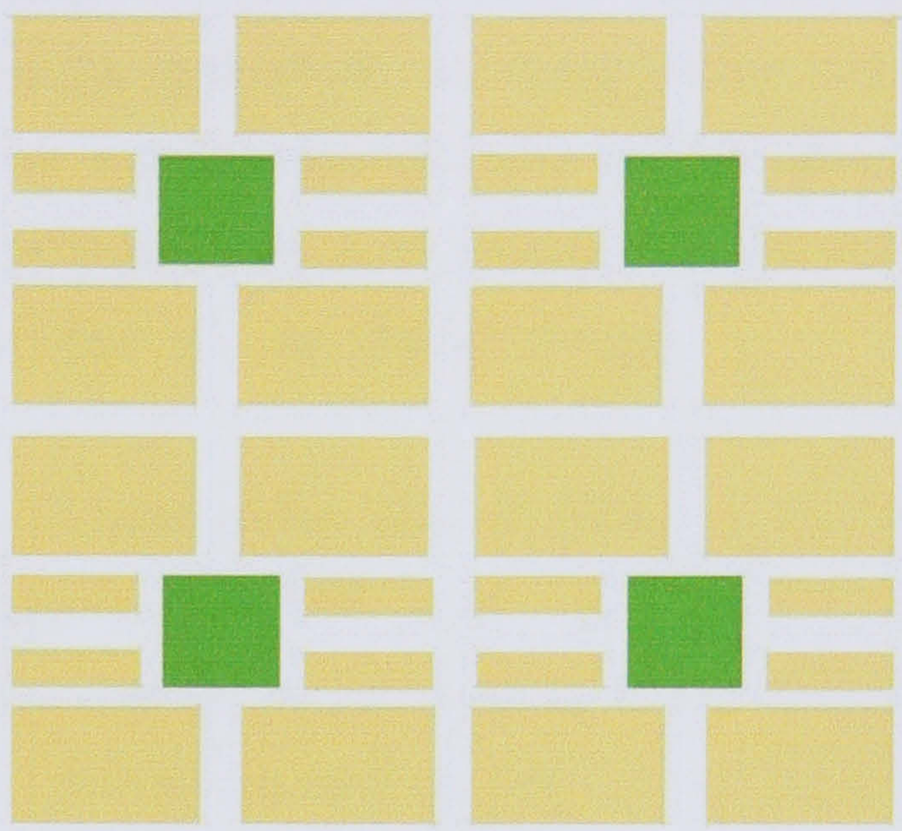
The Zugag is always integral to the Arabic housing pattern. It connects the private and semi-public realmsto public streets. Streets connect the zugags and sometimes the private space with the public domain and also link different parts of a settlement. These linkages support social interaction and exchange, both vital functions. Street design contributes significantly to the quality and character of a community since appropriately designed streets create safe, quiet and healthy environments, particularly for children.

Old thinking on zugag and street patterns appears to be for the provision of reinforced privacy at two levels; the dwelling level and the whole community or settlement. Current thinking on street pattern design appears to be divided between concern for the efficiencies of infrastructure and traffic, and a consideration of aesthetics. This generally translates into a battle between grid and conventional models. The first approach typifies smart growth, while the other represents the Traditional Settlement Development. Thus, can we modify street patterns that balance efficiency and quality, and reconcile functionality and aesthetics? This requires identification of the positive attributes of conventional settlement development while utilizing current technology and satisfying new social demands.

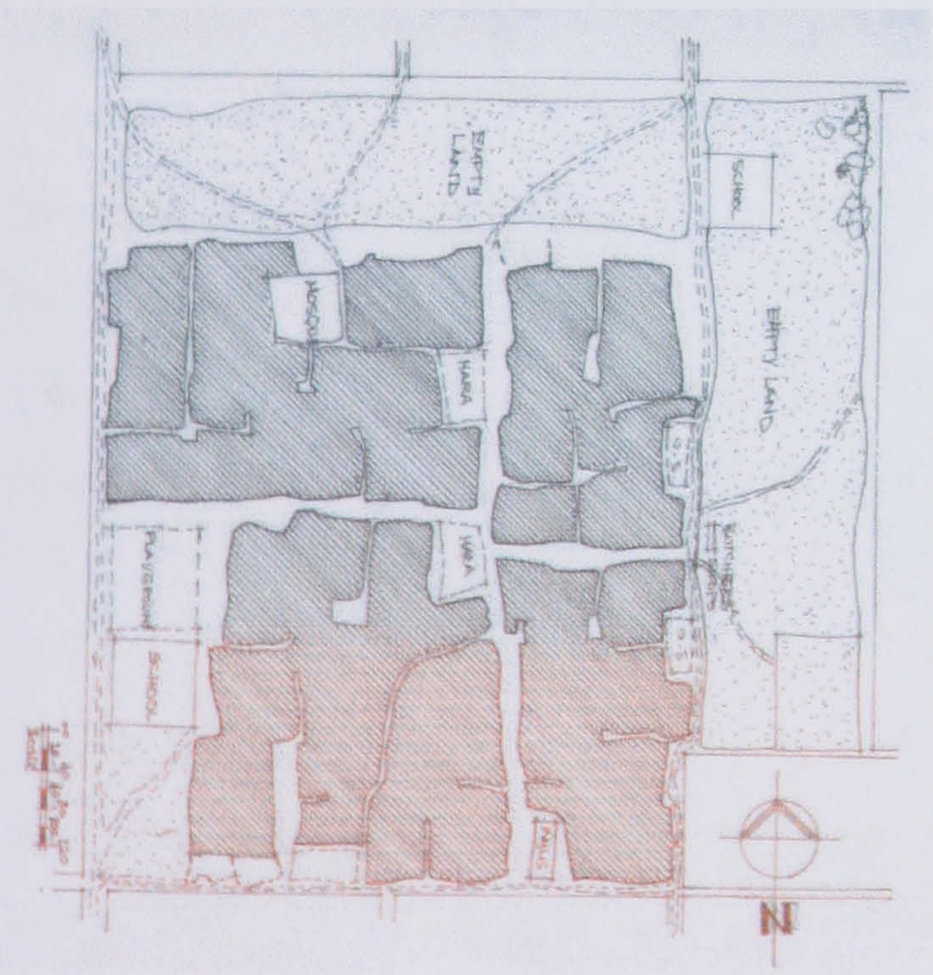
The first type of pattern to emerge at the Gezira rural fringe was the meshed-grid pattern in the Farmhouses villages. The traditional laddered-grid pattern evolved from plans of early Gezira traditional villages and settlements, in particular before the 1970s. These plans were replaced by: the mode of transportation of the day; the current models of village planning; and the recent explosion of population growth. Due to planning intervention, two types of planning system emerged in the traditional village; the eroded-grid street and the hybrid layout (Figure 6.16).

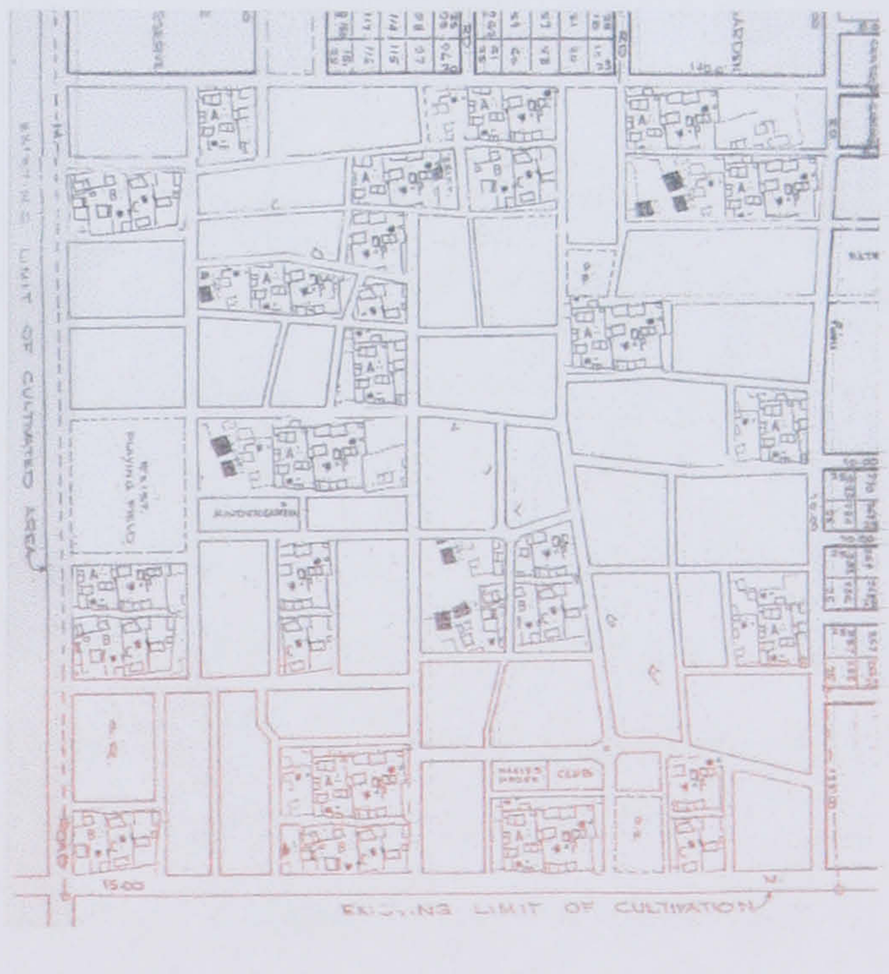


Mesh-grid street layout



Eroded-grid street layout





A: The Traditional Laddered-street layout

B: Hybrid street layout

Figure 6.16 illustrates the four types of street patterns that have emerged in the Gezira area.

6.6.3 Street and Zugag Functions

In El Sereiha village the function of the zugag is as a semi-public space related mostly to the hoshes system. It serves many functions, for example it serves as a safe place for children to play. Also it provides security for people who usually sleep in the outdoor space within the hosh. During the day it allows women to move easily between hoshes without the intrusion of strangers, when the men are on their farms. It has a significant importance for ventilation, prevention of dusty winds and it gives shade to the passers-by. Some of the respondents mentioned that it drains rainwater easily. This seems to be so, as most of the zugags are found to be clean during the rainy season. If we look at the figure (6.10), the zugag is clean and well drained while the new roads are full of rainwater that was not efficiently drained, bearing in mind both photographs were taken at the same time, in the rainy season. It seems that the zugags drain water into the main accesses which drain it to the villages' fringes.

The dead-end zugag symbolises a pattern of responsibility that prevailed in traditional environments. The residents of a dead-end zugag controlled the zugag. Also, nothing which affected the zugag – such as opening a new door into the zugag – could be done without the consent of all residents or planning authorities. It was part of their property. On the other hand the planning imposed on the traditional village created straight roads bisecting the village from east-west and northeast. This system released the inhabitants from the shared responsibility of the streets. The government took over the responsibility.

The traditional residential accesses ultimately tended to funnel into the hara[21], which then served as the main street, 'shari'a', for the village. The shari'a also provided access to areas outside the village. To find a house in the traditional village a visitor would walk through the main shari'a to the hara and then be directed to the house through twisting streets. Usually the shari'a is more than 6m in width and is irregular while the zugag is less than 3m wide. Very rarely were there alternative routes through the village. Thus a distinct hierarchy of street size and function formed the movement network of the traditional village. El Sereiha traditional ladder systems are transformed into hosh systems connected by ways with restricted access which disrupted continuity and reinforced privacy and defined choice by enforcing a strict hierarchical movement. The zugags that were evolved in the design of the traditional village can be summarized as follows:

- Narrow twisting zugags connecting twisting streets and open spaces. Entrances to semi-private and semi-public places open on to these zugags.

[21] Hara is an open space in the middle of the old village

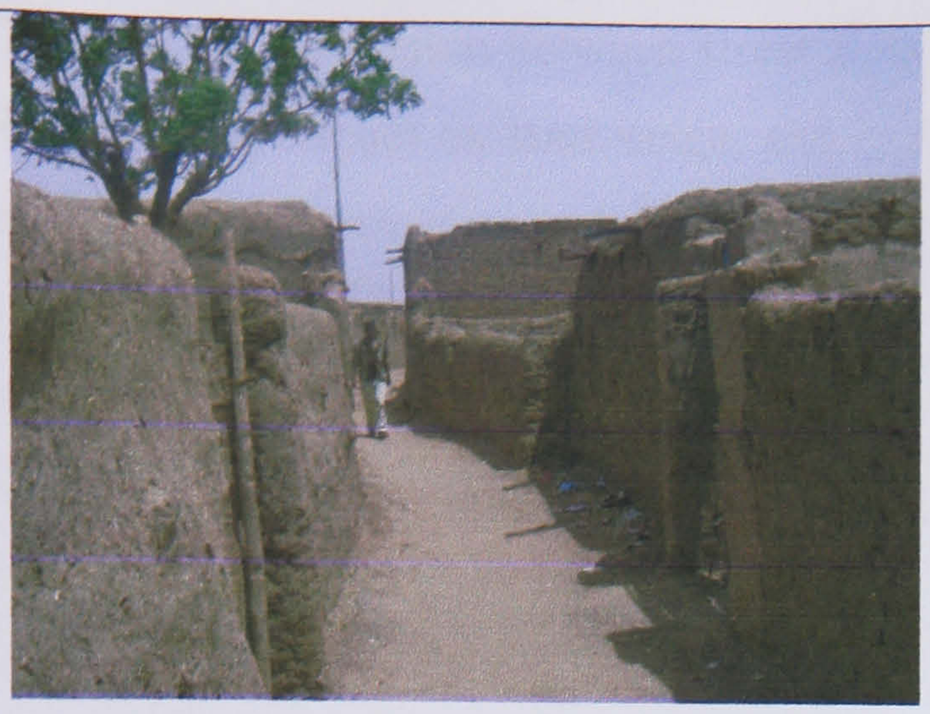
- Dead-end zugag: this leads to a hosh and usually ends with a gate leading to internal zugags connecting different household compartments within the hosh.
- Zugags end at small open spaces. They can be identified as (cul-de-sac) accesses.
- The internal zugags, which are very private alleys within the boundary of the hosh.

Although the new plan was executed in 1970, the observer can see some changes in the straight lines and wide streets. A surveyor described the development in El Sereiha village after 1970. He says (2001):

> *"We implemented the development plan (Figure 6.9) on the ground in 1971 and we left the village. After 10 years, problems of land ownership especially in the new extension forced us to go back to resurvey and demarcate the roads and we discovered that these problems were created because of the absence of planning control, which was supposed to have been taken by the Local Council and most people added parts of the streets, open spaces and parts of neighbouring land to their plots."*

The photographs (Figure 6.17) illustrate different types of zugags, the twisting and dead end ones and then the new narrow streets (maximum 6m wide) and wide roads in the extension. The new plan of El Sereiha village shows that the planners tried to widen these zugags to accommodate vehicles and this has changed all the characteristics of these twisting lanes (zugags), as straight lines replaced the narrow twisting lanes (zugags). So the old organic village was regulated with small streets imposed on the existing zugags. The superimposed plan divided the hoshes into formal plots as known in urban Sudan or the Farmhouses village. The formal planning embraced the village on two sides and formed another limitation to the traditional organic village. The layout form can be seen in the plan in 1970 (Figure 6.7 bottom) which shows how the old traditional organic development has been changed into a new system of planning characterised by its regular single plots separated by straight roads (the hybrid contemporary setting). The extension shows the eroded-grid layout and roads not less than (20m) in width, and this is considered very wide in comparison to the 2-3m lanes.

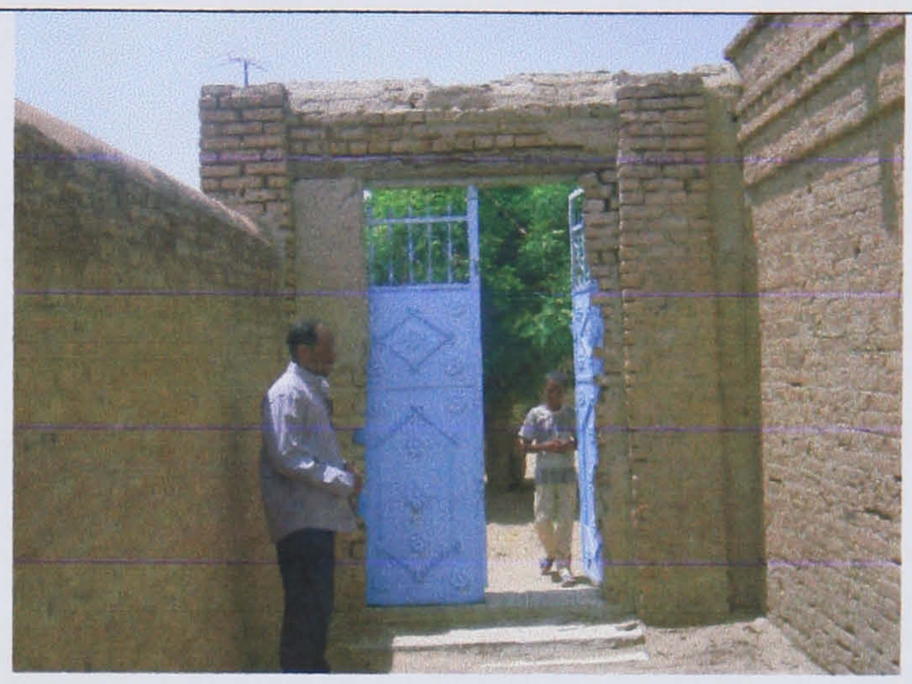
In the formal Farmhouses village the modes of travel were the vehicle and horses and so the network's morphological structure was dominated by what is known in planning as the fine meshed-grid system. Although, there were relatively few cars in comparison to nowadays (almost every house in the Farmhouses village has a car), the movement was limited to modes of travel to the fields. Thus movement could be one of the factors which shaped the wide streets within the colonial village.



Zugag in the old village

Another zugag in the old village

A zugag leading to a door of a hosh

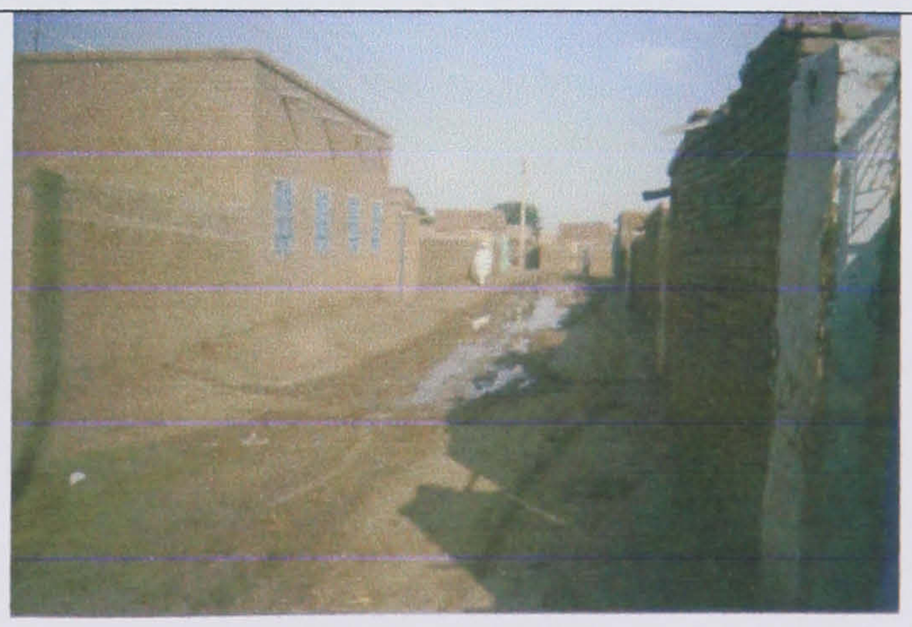


Another one leading to a hosh

New imposed street

Another street

A third street



A fourth one

Figure 6. 17 illustrates a comparison between the old zugags 'laddered street layout and the straight lanes 'hybrid grid'.

There is no correlation between street pattern type and residential density, although density has a strong impact on land usage, and is also related to the presence of amenities within a division. The strongest predictor of residential density is land price, with higher densities occurring where land prices are high. Household affluence is the primary indicator of land consumption, followed by a household's stage in the life cycle. The higher the income of a household, the higher the likelihood, that it occupies a redbrick house and a diwan. Similarly, the presence of children is closely linked with the consumption of such house. Street patterns have never been associated with a specific residential density. In fact, for comparable residential densities, ladder street patterns are more efficient than traditional gridiron geometry (which is why they are preferred by most dwellers). According to the technical literature on street planning, traditional street layouts consume approximately 16-25 percent less land than the grids advocated by New Planning (Figure 6.17).

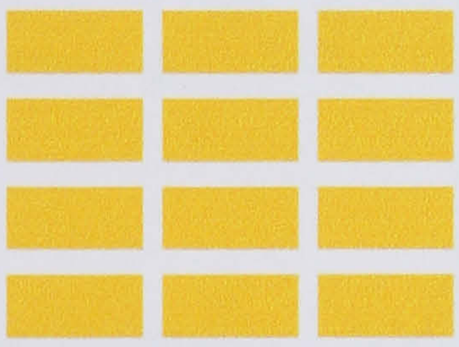
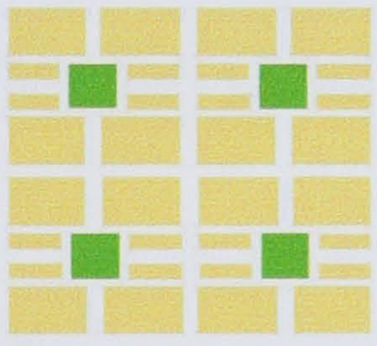
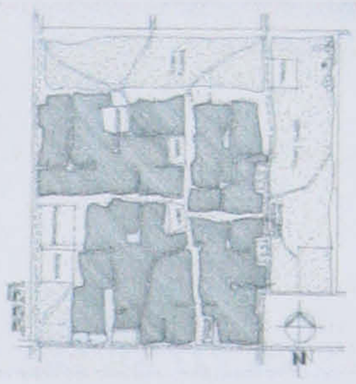
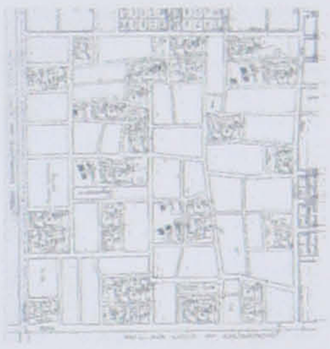
Type of street patterns	Mesh grid	Eroded grid	Ladder grid	Hybrid
				
Percent of area for streets	45%	33%	17%	23%
Percent of built up area	55%	67%	83%	77%

Table 6. 3 Comparison of area used for streets, among four typical patterns: source the Ministry of Housing/ Sudan 2001

This study draws lessons from recent subdivision street pattern designs and from street patterns of traditional villages. It examines how they function, how they fulfil residents' needs and expectations, and how they accommodate environmental concerns. In developing an alternative pattern that integrates the most important and desirable attributes of each approach, the study concludes: first, that it is possible to maintain the efficiency and quality of Khartoum conventional suburb while adopting the geometry of the grid; and second, that it is feasible and desirable to combine the tradition of the main street and the meshed-grid street layout. By fusing the street patterns of conventional suburbs with those of the traditional

laddered-grid, and by recasting the arterial street in the light of its activity generation potential, it is possible to create communities that are efficient, viable, liveable, healthy and highly marketable.

6.6.4 Hoshes' Patterns

The hosh is traditionally a dwelling house, which has historically enabled the continuity of interdependent relationships between an usra (chapter five) and the community. The hosh is a tradition and production of significance to those inhabiting it as the framework for, and embodiment of, specific and ritual culture. In the Gezira area, the hosh and its cycles of construction, inhabitation and renewal are intricately bound with places and particular aspects of life of the inhabitants as understood from an underlying Islamic framework also linked to local beliefs. The cycle of the hosh dwelling house relates to a family's life cycle as well as to key family relationships and arrangements. The hosh patterns maximise use of space for interaction through the 'diwan' (diwan is a separate section of the dwelling specially built for stranger guests and will be discussed in detail in the next chapter. The hosh also contains specifically allocated individual space for different sexes accepting and embodying dialogue with the potential for capacity renewal. The hoshes generally become well established over time.

In fact the hosh system embodies more clearly some essential philosophies and relationships that result in uniform dwelling production according to the need of the usra that occupies it. Patterns of hoshes in the old traditional El Sereiha village were different from those today that affect aspects of the built environment. The hoshes were traditionally characterised by their irregular varied sizes. The area of a hosh, as recorded in El Sereiha village varies from 1000m^2 to 1500m^2 and the medium area is about 1200 m^2. It is, however, argued that the hosh is more than a simple version of a house. The hoshes consolidate the patterns of responsibility in the environment. The hoshes system shows some traditional practices to be almost antithetical to the maximum production and consumption equations of the West, now appropriated or adopted by the Government planning intervention policies. The negligence of study of the Gezira domestic dwellings and perceptions of the vernacular, in particular the hoshes system as being 'backward', make the situation unaccepted into the extension context without some degree of progressive change as this is the still prevalent attitude. Is the portrayal of hoshes as backward a highly subjective political view that does not reflect a more complex reality?

In contrast the Farmhouse village consists of rectangular plots with large equal sizes and wide roads leading to all directions of the complex. There are offices and workshops to serve

agricultural purposes, such as maintenance of agricultural equipment and inspectors' cars. There are no open spaces and services are found in the meshed-grid patterns of the Farmhouses village. The inspectors speak of services that have moved to the traditional village such as a health centre, a sub-grade school and a kindergarten; this is another significantly important characteristic of the organic village. Other services, such as higher schools, hospitals are still found in larger Farmhouses villages in other parts of the Gezira area. The main characteristic of this village was the intensive greenery, many trees were grown around these houses but now in some Farmhouses villages only the trees that resist drought are found (Figure 6.18). There are areas within the plots that were allocated for farming but they are seldom used by the existing inspectors. Expansion happened very rarely and when it should happen, the Gizera Board is responsible for that as well as the maintenance and any changes to the houses. There are no amenities such as schools, health facilities, a mosque or any type of haras in the complex and there are limited services such as asphalt roads, electricity and water. There is also a social club that was built for, and was limited to, the officials only.

When the Sudanese officials occupied these dwellings, they used to go to other villages for shopping, education, health treatment and praying, especially the Friday prayer, which is a must to be practised in a mosque, or in other words in a group 'Jama'a'. The main characteristics of the Farmhouses village that differentiate it from El Sereiha organic village are the availability of cars, as the Gezira board provides every inspector with a car, and the sewage services, as the houses were provided with a bucket sewage system which has been changed into a soak-away system. People in the organic village use the pit-latrine system. Before that they had used the open outskirts or farms, as the old tenants told us. Most of the houses built for labourers have either disappeared or are now in ruins. Some inhabitants of the Farmhouses village changed, with a concession from the authority, the hedges into brick walls or zinc sheet boundaries, as we will see in detail in chapter seven. But still most of the boundaries are either hedges or metal fences. The hedges are not well looked after and this caused the disappearance of the boundary or created bushy hedges (figure 6.18).

Thus the hosh is a system of housing enabling different kinship groups to help each other. The socio-cultural behaviour provided the local people with the land, as the kinship groups secure the land for housing their generations. Also these kinship groups help in constructing the houses to accommodate the households related to them. Therefore people utilise the space to practice their socio-cultural activities, while the socio-cultural factors sustain these activities, as people cooperate to provide housing to individuals of the community.

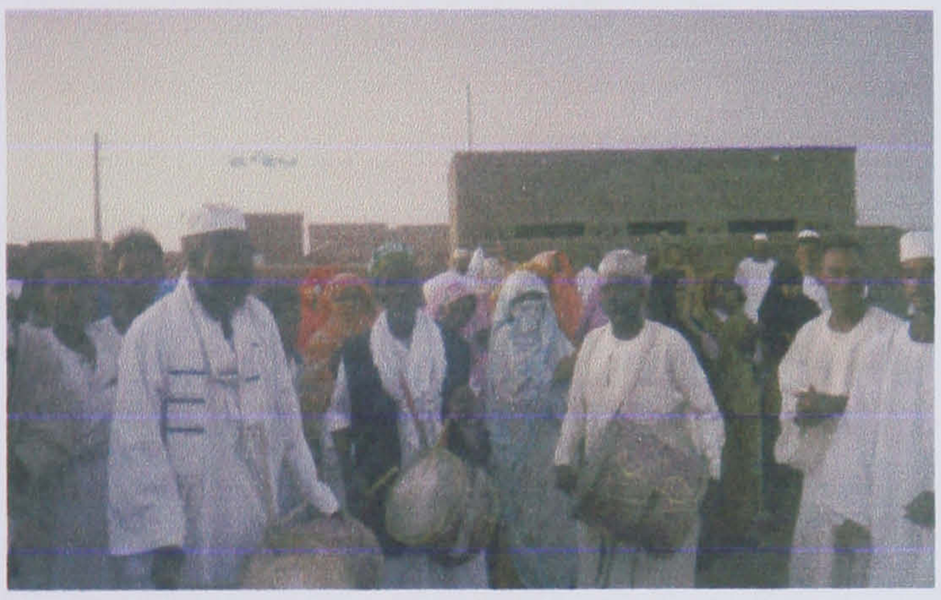
A: View shows the earth roads and intensive trees within the Farmhous es village.

B: Private earth road lead to a house.

Figure 6. 18: Illustration shows houses in the Farmhouses village A shows the Asphalt road surrounded by the bushy fences and trees, B Earth road through bushy boundaries and a road within a Farmhouse through the field allocated for farming.

6.6.5 Public Space Patterns and Amenities

In the organic village there are two main open spaces; one forms the peripheral lots around two sides of the village while the other forms the centre of the village. The peripheral space (lot) was, largely, left empty; nothing was built there except the Friday Mosque and the primary schools with houses for the staff and the playground. The location of these facilities shows the segregation of the strangers (teachers and officials may not be from the village) while still keeping an intimate relationship with them through these axes. The lots were usually used for festivals and celebrations, the two 'Eids' of Muslims and marriages. People of El Sereiha village used to go out, men and women, old and young, in their best clothes; this reflects another cultural attitude towards privacy, in a way that women can see strangers in social events if they are well-dressed, ' putting on their 'Thoobs', which are like Indian saris.



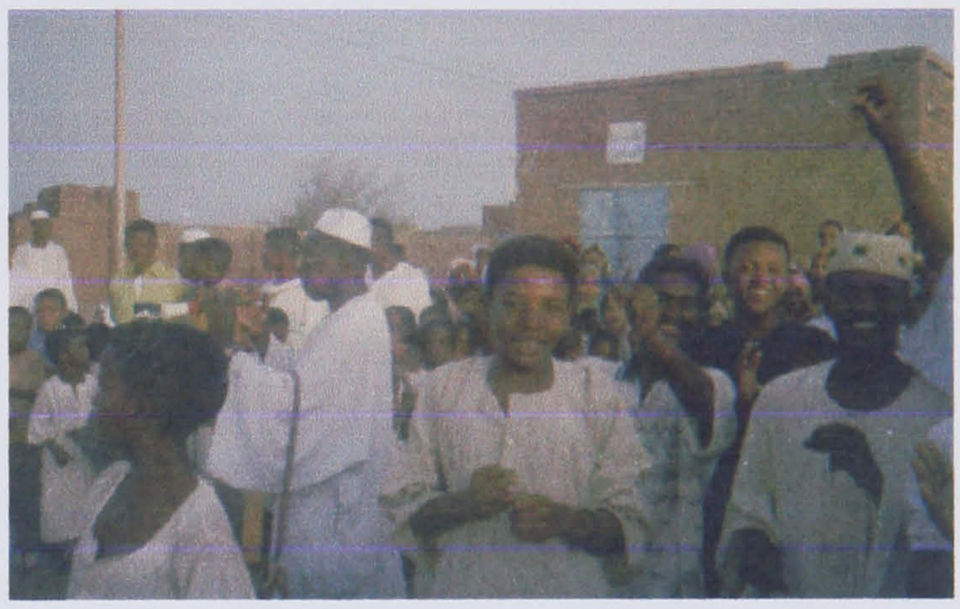


Figure 6. 19: shows a celebration event in open spaces within the old village, shops shown behind the crowd.

Government, semi-government and community buildings like schools, health centres and houses for officials and teachers are usually sited on the periphery of the village, as is the butcher's shop and the bore-hole stand pipe for fresh water that most Gezira villages possess. The mosque is placed on a prominent site, often near the house of El Faki, 'Islamic Teacher', or in the middle of the village, but mostly on the periphery, as in El Sereiha village, to keep people coming to the mosque from other villages away from the sight of the houses. before establishing a two-day market in El Sereiha village, the shops, however, were fairly evenly distributed throughout the village and around the hara 'inner open space'.

The old traditional fabric contained a few small-scale inner open spaces, which were used as social spaces and usually used for many activities of entertainment; children's play area, adults' amusement places (playing cards, Dominoes etc, especially at night) and corner shops especially for women during the day when the adults are on the farm and children at school. Open spaces are also used for celebrations during marriages or Eids' days.

Public space and semi-public space finishes at the entrance door to the walled courtyard of the house; this will be discussed in detail when we draw a picture of the internal dwelling use of space. As described before public space is in the form of a network of narrow twisting lanes (zugags) between the hosh walls, occasionally opening into irregular spaces, with a tree now and again to give shade. This network is informal and never involves the use of the surveyor's straight lines. The streets (El Shari'a), hara, 'inner space' and hoshes are collectively true interior places, and public services, suk (market) and the main mosque are a focus of social life where the individual may experience participation and belonging, socialisation and recreation.

6.7 Factors Involved in Shaping settlement Patterns

As discussed before, the policy of the Government for the agricultural scheme at the very beginning divided the area into three settings; the agricultural setting, the local government setting and with the aid of empty zones (empty spaces or lots between the farms), turns the interior of the village into a land-locked zone of balanced human existence, which may be called a vernacular traditional setting of organic order (Ahmed 1992). For the sake of discussion let us consider three types of development that were created in the area: the traditional colonial patterns, the traditional organic patterns and the hybrid pattern. The agricultural and cultivated area, as well as the human physical geography resulting from such a presence, of course, necessitated housing and settlements to support the process of agricultural development.

6.7.1 Family Composition

As discussed in chapter five, in El Sereiha village society, the main characteristic of the family was the tradition of the extended family (that is to say, a family consisting of several generations) living together in the same dwelling, which is still quite commonly occupied by parents, children and grandparents, together, in some cases, with other relatives, such as brothers and sisters of the parents or their aunts and uncles. The tradition is continued as the family grows up, by the sons marrying and bringing their wives to live with them. Most heads of the households are farmers working separately or collectively. The type of work is changing with time. Households, their growth and the income generated from work have their direct impact on the development of the pattern of hoshes and the alleys connecting them. For more information, refer to chapter five.

6.7.2 Land Ownership

As mentioned before in chapter three, the Government has put in place a very strict ownership system for farming but until 1970 there was ambiguity surrounding the legal position of the owners of the housing sites. In the Farmhouse the government owns the village site and houses as well, while in El Sereiha village people thought the sites were their's, but when the government intervened in the planning system of the village in 1970, the ownership of the extension was totally posited in the hands of the Government, the houses were registered in the system of leasehold ownership. The housing ownership system in the Sudan is either freehold or leasehold according to the land rules laid down by the Condominium Government. When we look into the ownerships, all plots in the village extension are registered leasehold but the old village is left without registration because the planners think it is government land that developed over a long time and it may be registered as freehold plots. The following table (Table 5.3) shows the situation of the ownership in El Sereiha village.

Land in Feddans (Feddan =1.034 acres) (N=Number)

	Area		Ownership Status		
Sites	Total Land Feddans	Total plots (N)	Leasehold (N)	Freehold or Government	Ambiguous (N)
El Sereiha old village	**120**	**213**	**-**	**-**	**213**
El Sereiha +extension	**210**	**502**	**289**	**-**	**213**
Farmhouse village	**151**	**146**	**-**	**146**	**40 'Local'**

Table 6. 4: The Land Ownership: Source the author, questionnaire 2001

The land, in all cases, is occupied by the owners of the hoshes or plots who developed their houses on it, but in the present situation the development is controlled by the planning authorities and no construction is to be built without concession from the planning and building authorities. The settlers themselves, as their predecessors, used to come to cultivate sorghum for their food, previously owned the land now forming El Sereiha village. So they insist that the farmland and housing sites are theirs. The people explain that the land of the whole Gezira is rented from the families who were living in the area. We asked one of the inspectors about the situation, he says,

> *"It is true the land was rented by the Condominium Government and leased again to the tenants in the form of farms but the housing sites were not considered in the planning at the time. However the case, there is a system of purchasing transaction of land that incorporates both parties, the tenant and the government represented by the Gezira Board"* (the author, interview 2001).

Land ownership type seems to be of no significance to the tenants since they have the right to sell and buy their properties without any obstruction from the authorities or any other force. It was recorded that there was no high percentage of land purchase especially in the old village. There are some plots in the extension that were sold during the last decades, forming not more than 10% of the total of the new plots in the extension, and they were sold to relatives. The reasons for selling these plots are identified by a tenant who sold his land.

> *"I sold my plot because I needed some money to improve the farm production and make some maintenance and improvement in my family's old house considering that it is difficult to build a new house in it"* The author (Fieldwork 2001).

The freedom and sense of attachment to land created the feeling of freedom in shaping the housing patterns that suit the way of life of the traditional inhabitants. This freedom gives the identity of the place (Norberg-Schulz 1980). People constructed buildings "freely" within hoshes. Streets, zugags and open spaces developed to maintain certain activities and fulfil the needs of the residents. The rural tissues were "closed up", the continuity of the rural walls was not interrupted and the coherence of open spaces was secured. The colonial buildings were built for a certain culture and they have their identity but do they suit other cultures?

The changes considered to the already existing village and the new extension, which is the product of the elites who were affected by the culture of the colonial planning and western styles, do not possess enclosure and density. The rural tissue was "opened up", the continuity was interrupted and the coherence was damaged. Zugags, streets and hoshes lose their identity, and the village as a whole its image.

Together with the loss of the traditional structure, the landscape is deprived of its meaning as comprehensive extension, and reduced to remnants within the complex network of man-made elements. The character of the extension is usually distinguished by monotony. If any variety is found, it is usually due to elements left over from the past. Lack of character implies poverty of stimuli. Though buildings are very humble, the building is a meaningful sub-place where man may simultaneously experience individuality and belonging. Lost also is the relationship with the society and nature that should collaborate to withstand residential change made by human beings.

6.8 Sustaining Factors

Although the majority of the organic settlements have started a process of sustainability and it is the wish of all communities to enhance sustainable quality of living, not all settlements are able to do so, and this may continue for years to come. In the regional planning theories a village can be categorised by the services or social forms and size of population to give it its primacy and place in the regional development hierarchy (El Agra, 1985). However, the provision of services, access to work and cultural stability are the main aspects that proved to sustain the housing system in the organic development of rural Sudan, or, in other words, continuity of these settlements. So we will now discuss the settlement-sustaining aspects in the form of provision of services, access to work, communications, labour force and methods of construction.

6.8.1 Access to Work

The main aim of settling in the scheme was to secure work for individuals and their usras and the scheme has provided the base for economic development for many households although the income is low, as we will see later in this chapter. We consider the negligence of integrating the tenants' settlement within the plan of the Agricultural Scheme from the beginning was not a successful economic task and the shifting of services from the agricultural centres to the traditional organic villages is evidence of the importance of the socio-cultural factors within the process of development. The socio-cultural behaviour is believed to support the economic processes and work freely with the other factors of sustainability. However, the economic factor has played a role in enabling the inhabitants to participate in the process of settlement development. It affects both the quality of settlement and usra status, which create a good impression for encouraging the government to supply services.

The apparently stable El Sereiha society created economic bases for its development during the decades that followed the establishment of the Gezira Scheme (1925). The social structure of El Sereiha community has increased the possibility of making use of these bases and developing its economic circumstances, as we will see. Here we will discuss the main economic aspects that have a great effect on the social behaviour of the tenants, the farming production, and home-based enterprises and produce trade.

The apex of life as well has its effect on the access to work. The apex of life is the rainy seasons when the farmers start to sow seed and grow their plants, cultivate, clear and then prepare the land for another rotation. But does all that support long-term sustainable survival?

This may be reflected in the quality of living, built environment and housing standard. An agricultural inspector who lived in the area, in which El Sereiha village is located in the 1970s, described these conditions and tenor of life as follows:

> *"During the summer, which is very hot, the temperature may reach 46°C, the land is flat and most of the canals are empty of water. Eyes see only the mirage. At other seasons of the year the plain changes to a green carpet with colourful flowers dispersed on it and the sound of water breaks the silence of the vast land. Everything is moving, the land, the water, the plants and the people. Generally, the Qura'ặn described the situation in Sura xxii, verse 5 as: "thou seest the Earth barren and lifeless, but We pour down rain on it, it is stirred (to life) it swells, and it puts forth every kind of beautiful growth (in pairs)". The tenor of life goes with climatic conditions and finishes when the plant gives its product and then the land is cleared from the roots for another rotation. The effort of the farmer and his family is the keystone for his living and improving the quality of life and condition of housing" (*The author, social survey 2001).

6.8.1.1 Farming Production

The Scheme offered income opportunities to different peoples coming from all parts of the country. There are tenants and civil servants, with labourers who support the tenants to succeed their economic activities. Extending over more than 2 million feddans, employing over 100,000 tenants and constituting the source of living for around 40% of all heads of households in the Gezira, agriculture is the predominant occupation in the region (chapter four).

However, the Scheme has almost reached its limit and can no longer be relied upon for the generation of further tenancies, intensified cultivation and related employment. Moreover, even those already involved in existing tenancies have been showing increasing dissatisfaction with agriculture, since declining yields and prices of crops, at a time of increasing costs of labour and inputs, are resulting in serious deterioration of their earnings (Table 5.4). This has led to the abandonment of agriculture, increasing dependence on non-family labour and a pronounced resort to additional jobs by about two thirds of the tenants. The saturation of tenancies combines with the prevalent dissatisfaction with agriculture to pose serious obstacles on the path to employment and income. This is especially so in the numerous villages where alternatives to agriculture are virtually non-existent. Tenants are continually moving in search of ways of improving their farms' production and finding the

best ways to sell their produce, though the government takes cotton and wheat to be sold on their behalf. Other men (non-farmers) are always in search of casual daily employment. Those men are farm-workers, builders, carpenters or any other skilled people.

	Annual Income	
	$	**% Of Tenancies**
1. Account Gezira Tenancy (1991-2001 average)	**500**	**100%**
2. Sudan Gezira Board Staff (2001)		
Unskilled Labour	**1200**	**230%**
Skilled Labour	**3250**	**630%**
Clerks, Storekeepers	**4140**	**800%**
Field Staff	**5336**	**1030%**
3. Traditional Agriculture in other regions		
Western Sudan	**252**	**45%**
Northern Sudan	**456**	**90%**

Table 6. 5: Tenant's income as compared to average incomes of various levels of SGB staff and to that from traditional agriculture in Northern and Western Sudan: Source Sudan Gezira Board (2001)

In El Sereiha village the percentage of income generated through farms is comparatively higher than in other villages in the vicinity and that means the agricultural production is higher as well. We asked a field inspector about the income in Kab El Gidad Block, where El Sereiha village is located, and his answer revealed that:

> *"The production of all crops recorded very high production rates in Harum El Sereiha, the area watered from Harum El Sereiha Canal (Figure 6.1) and there is a prize for the best farmer which is mostly taken by a farmer from El Sereiha"* (the author, interview 2001).

When we look to the reasons behind such income increase in El Sereiha village we found people describe the feeling that the land is theirs and they have to keep it for their coming generations and make use of it. The socio-cultural networks of El Sereiha proved that the whole village is descended from one father, who is related to a known tribe, which consider the land they cultivate is theirs, while people of the other villages around came from other parts of the country or Africa and lived with them. Therefore we conclude that the attachment to land was important for its development and this is available in most villages in the Gezira area. Although the farming income is comparatively higher in the traditional context of the

area, it is still is very low in accordance with the Sudan Gezira Board (SGB) staff and international individual per capita. However the increase of this income seems promising if the social cultural development is considered as a significant factor for enhancing the integration of this income for the benefits of both the quality of life and the farming system, which has been paralysed for many decades. We saw that a Social Development Department was established for the purpose and showed good work especially in El Sereiha village, where people were enthusiastic and the relationships between the inspectors and the farmers proved to be good not only in the fields but also at the level of social activities. We noticed that people speak about the importance of the inspector in any social organisation. Through the efforts of many women a social unit was established to enhance home-based enterprises and improve health and nutrition facilities.

6.8.1.2 Home-based Enterprises

It is important to mention that these activities are always connected with the rural women rather than men. The Social Development Department in the Gezira Board from its establishment in 1952 started to develop the skills of women to do some beneficial works, such as knitting, training in health and child care and diversification of food. If we look at the profile of workingwomen in El Sereiha village the importance of the social development programmes is clear and it is proving to be a very effective way of targeting resources: there were immediate benefits for the nursery children in terms of a better environment in which to play and learn, but also the women and their families gained from improved housing conditions and there are benefits from knitting and dress-making to maximise their earning potential. The generation of home-based employment is particularly important for women from cultural groups where it is not considered appropriate for a woman to work independently of her partner or 'Muharam' outside the home or farm: this was found to be the case amongst certain groups in both El Sereiha village and the Farmhouse village. Those home-based activities, with many others such as men's sales transactions in their diwans and women's preparation of food to sell in the two-day market have added another meaning to the settlement social and cultural interaction.

Although most spaces are clearly defined and identified for specific purposes, there is considerable flexibility about space usage and a willingness to experiment with new ideas. even if these lead to apparently severe disruption, for example sleeping arrangements in the diwan (men's area). The diwan is used, in addition to its main function, for produce transactions, especially at night. It is also impossible to extricate income-generating activities from other aspects of life in the settlements. Sometimes, needs and knowledge lead to greater expectations, so inhabitants of organic village seem eager to have all basic services within

their villages. This is not the case in the Farmhouses village. Men have fixed jobs and they have to devote themselves to it according to civil servant values and somebody else caters for their dwellings. Women, like those of urban areas, concentrate only on domestic work and bringing up their children.

6.8.1.3 Marketing Facilities

Rural villagers are not very accustomed to marketing systems as known in the urban areas. The tenants used to sell their produce either directly from the place of production, the farms, or store it and make transactions later in their diwans. Since early times, streets, haras and diwans were places where the common marketing facilities took place. The places were the essence of the village morphology; hence villages had always been closely integrated with their economy and environment. In terms of the social activities, buying and selling probably were the activities that occurred in public spaces 'the hara' and the diwan. They were, consecutively, the central open space and reception semi-public space where the market processes of the community were focussed. In urban areas the markets might be a public meeting, while in El Sereiha village it is proved that the public and semi-public spaces where meeting occurs might provide a chance for produce transactions as well.

Figure 6. 20: The two-days market in which women participates by selling commodities

6.9 Evolved Housing Patterns

At the beginning of this chapter we discussed the hoshes pattern of the old traditional village before re-planning intervention in 1970. Now we will move to the pattern which emerged. But first we will discuss the concept of patterns, which will guide our discussion about building design within the process of planning intervention. Alexander, C. (1975:102) defined planning pattern as:

> *"A pattern as any planning principle, which states a clear problem that may occur repeatedly in the environment, states the range of contexts in which this problem may occur, and gives the general features required for buildings and plans that solve the problem. In this sense, then, we may regard a pattern as an empirically grounded imperative, which states the preconditions for healthy individual and social life in the community."*

If we consider the new planning system that has developed, in addition to the three types of theoretical understanding of the planning theories, the laddered-grid, meshed-grid and eroded-grid, with reference to figure 6.21 we can say that there are four types of planning that have emerged in the context of the two space domains; the vernacular traditional village (A), the Farmhouses village planning (B). There are two types that emerged due to Government Planning intervention, the superimposed meshed-grid pattern mixed with the laddered-grid system of the old village's extension to form what it is called the hybrid-grid pattern (C) and the eroded-grid pattern in the new extension (D).

The above descriptions raise significant features of the rural built environment in the vernacular architecture represented in El Sereiha village, taking the hierarchy of street patterns into consideration to a greater extent. The settlement that has emerged through time due to mixture of developments is characterised by the following features:

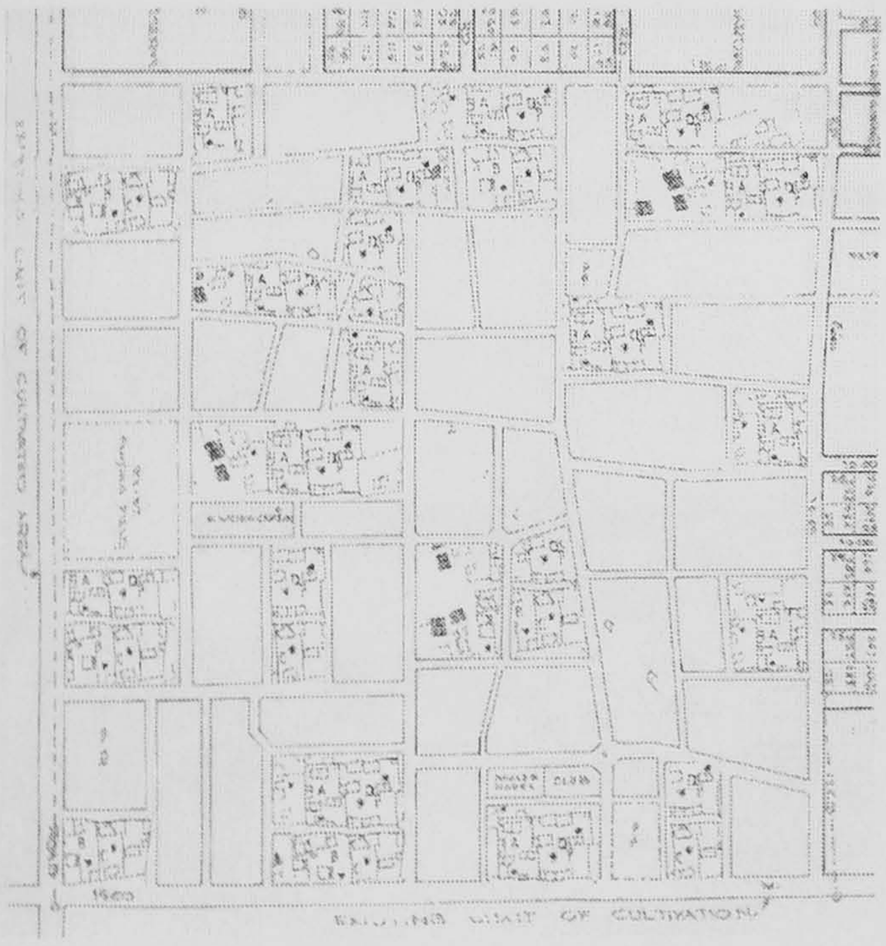
- One of the most significant features of El Sereiha village is the way that the main streets (Shari'a) and the small alleys (Zugags) connect the hoshes. Each hosh is a system of residential courts for the extended family; each hosh has its guest space and an access to the street, either directly or through a zugag.
- The persistence of the 'village axis', two streets running east-west and north-south intersecting at an open space surrounded by corner shops.
- The persistence of hoshes despite the introduction of other forms of housing with the planning intervention in the 1970s.
- The persistence of semi-public spaces within the hoshes, reception areas in the form of diwan (a reception area for stranger guests, see chapter 7). Now the introduction

of new kinds of space to receive visitors, due to socio-economic changes, is seen in the new houses built in the extension of El Sereiha village.

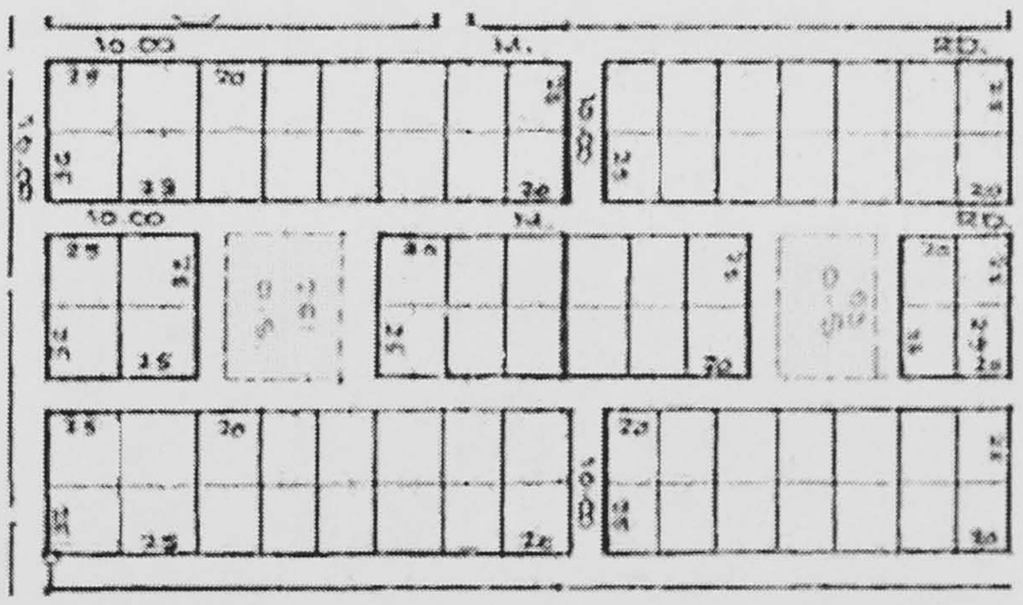
- The emergence of new materials and decorative features to replace the modelling of the mud buildings and women's hand-made plasterwork, when the walls were internally painted cinders[22] and externally zibala[23] rendered. This was a result of hybrid processes that will be discussed in the following chapter.

A The Laddered-grid Traditional Patterns

B The Meshed-grid Colonial Patterns



C The Hybrid Superimposed Patterns



D The Eroded-grid Extension Patterns

Figure 6. 21: A plan of detailed housing patterns and street layout in the three setting of layouts.

[22] It is a material made out of ashes of the sorghum 'Dura' stems after burning them and then it is mixed with clay and gum powder to form a whitewash.
[23] It is a material made out of animal dung fermented for some days, presumably three days.

6.9.1 Colonial Housing Pattern

Most houses in the Farmhouses village are situated within a farming space. This type of farmhouse is well known in the Sudan, particularly in the South and West, where people used to build their houses attached to their farms. The farming plot area fluctuates from ½ acre to 1 acre, depending on whether the house is a farmstead or farmhouse. The houses are single floor houses distributed within these farming plots (Figure 6.22). The type of housing has two interpretations:

- It gives the residents the feeling of integration with farming development in the area. In other words it gives a feeling of attachment to the spirit of the Gezira nature.
- Rural remote areas usually give a feeling of loneliness but spending time in such agricultural fields could heal and create relationships between the residents and the villages.
- One of the inspectors says:

"Shared benefits increase the possibility of interaction between people" (Fieldwork 2001).

Thus the shared economic benefits and socio-cultural similarity of the tenants and field inspectors broke the barriers of educational and economical status and created a social interaction between the farmer and the officials. The phenomenon of the relationship that happened through the history of the Agricultural Scheme included social relationships between the British inspectors and the farmers at the time. The old people speak about the intimate relationships with the British officials. These relationships and social interaction intensified the socio-cultural relationships and enhanced the hybrid intermingling in traditional housing patterns and construction.

Figure 6. 22: Side views of colonial house: Source Gezira Board Archives.

6.9.2 Traditional Organic Housing Patterns

The traditional village's housing, as mentioned before, is characterised by its compact nature, although 6m streets were imposed on its site. Two features emerge to the eyes, the Neem trees that are dispersed within the single floor hoshes; and the tallest element in the village decorating the site with its natural and green colour, which was the symbol of Islamic Emblem, is the minaret of the main mosque. There is mutual relationship between these elements. This gives the villages its significance and natural order. It makes it different from other fabrics of formal housing organisations. In particular, a hosh that has identifiable physical boundaries is the basic operational unit. In the extension the significant operational unit is a cluster. This shows the differences in the spatial development, which has a great effect on the social cultural organisation. This fabric is surrounded by a green carpet forming the regular farms and straight canals. It is lined with earth streets leading in a twisting manner to straight earth roads parallel to these water canals.

6.9.3 Hybrid Housing Patterns

This system is a product of mixing two systems together; the meshed-grid pattern imposed on the laddered-grid pattern. The character of housing patterns ultimately deals with certain planning and design aspects:

- It is clear that routes are very important and they follow the type of transport and are affected by people's culture and social behaviour. Patterns of routes thus recorded the past and help to structure the future. A new route can threaten the social behaviour of the residents and even change the economic opportunities in a place. In El Sereiha village, the imposing of new large lanes changed the pattern of movement and created new economic relations. They changed the shape of the usra from extended to nuclear families. they also changed the system of hoshes from shared plots to single plots
- The shape and type of plots or spaces that are connected by those routes give the shape of a neighbourhood or a village. Houses clustering together in a pattern form the identity of a village. Though similar in their outer appearance, houses do vary in internal design and architecture. Size and internal decoration are the indicators of the owners taste and financial condition.
- The hybrid-grid pattern created a homogeneous layout. Can the planners develop more ideas about this type of development? This type of organisation and design has a feature of sharing ideas between planners and inhabitants.

Figure 6. 23: illustrates the patterns of development of the traditional village.

Figure 6. 24: views of houses and plans that have emerged in the traditional village and its extension: Source Fieldwork (2001).

6.10 Summary of the Morphology of the Settlements

Morphology has a clearer and abstract form of revealing the relations between spaces (Kirşan, 1996):

> *"The most widespread opinion about space is that spatial organisation is a sign of the common attitudes and the hierarchy of their different levels"* (Hillier, and Hanson 1984).

The strong feeling for privacy and tranquillity in residential areas led traditional habitations to evolve into major sections: public, semi-public and private. The peripheral space (lot) was, largely, left empty; nothing was built in it except the Friday Mosque and the primary schools with houses for the staff and the playground. Thus the plan of El Sereiha village came to be a laddered-grid system emphasising the importance of the main axes, zugags, the inner and outer spaces, hoshes and the amenities in the outskirts connected to the other part of the village with the main axes. Could the planners make use of such development to enhance the future rural planning?

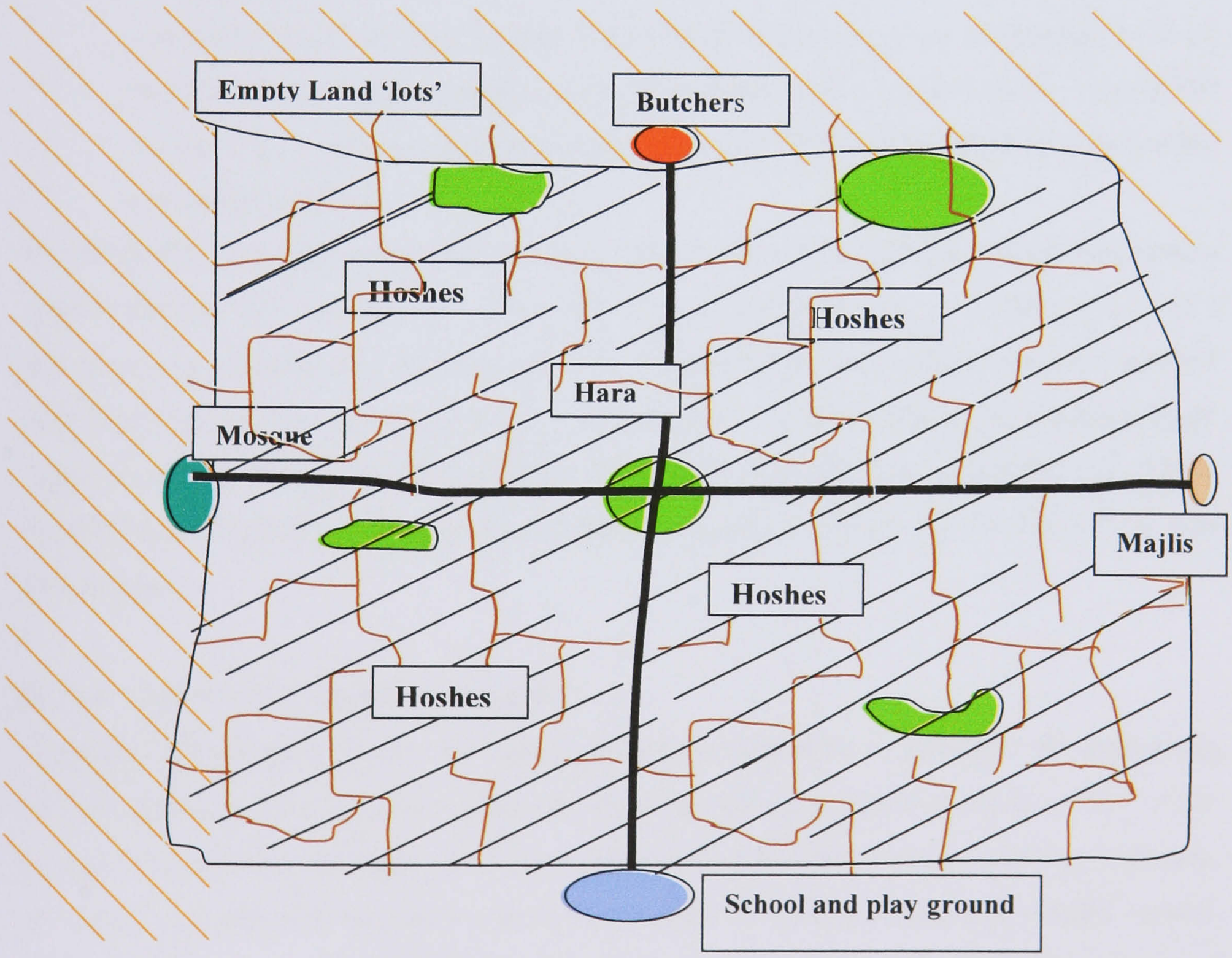


Figure 6. 25: Diagrammatic plans for the vernacular traditional village plan illustrating the poles of development and how people articulate with it. It also illustrates the zugag or twisting lanes (shown in brown colour). Note here the Majlis means the place where agricultural affairs are dealt with.

6.10.1 The Impacts of Planning

El Sereiha village was planned by the Ministry of Housing as part of its policy to intervene in all villages in the Gezira area of the Sudan to organize and re-plan the traditional housing development to fulfil the following objectives. The main aims were:

- To accommodate the natural increase of inhabitants and to relieve the crowded population of villages, and as they were completely surrounded by the canals and farms, it was essential to confiscate some feddans (acres) for the purpose. 90 feddans were released for the extension of El Sereiha village.
- To apply certain services, such as educational and health facilities, drinking water and electricity, and a market and shopping facilities, to serve the increasing population in the village and other settlements in the vicinity.
- To enhance the process of public participation in planning decision-making, which the Ministry of Housing has started to practice since its formation in 1969, because the planning process had failed to achieve its theoretical purposes in the area. A committee from the local people and officials in the area was established to work with the planners and surveyors during preparation and execution of the plans of the village. The committee had the right to reject any re-planning policy not compatible with their traditions.

The Ministry at the time had no programme for how to plan these villages, but let the dwellers choose whether they wanted the re-planning for their village or not. The ministry provided incentives for villagers who accepted the idea of re-planning; their village would be supplied with electricity without paying its share in the cost of the construction of the electrical lines. There was a general policy that people should pay part of the electrical supply cost if they wanted to get electricity. Then planning started in selected villages; El Sereiha village was one of them.

6.10.2 Effects of Containment plans

The plan of El Sereiha village was one of many piecemeal plans to recognise the limitations of farms and canals to land-use planning. The plan neither transcends the boundary of the village of El Sereiha, nor treats the whole area as one functional unit for planning purposes. The piecemeal planning has had a great effect on both El Sereiha village and villages around. That was the remark of a local governor responding to our question about the success of piecemeal planning (2001 social survey). The services were not distributed efficiently. They have increased movement between these villages and so the interaction between people in these villages.

However, the traditional vernacular settlement patterns were re-planned. The planning intervention has caused significant changes in the fabric of the traditional development and so on other aspects of life. Here we take some examples of changes that occurred in the village of our concern, El Sereiha village. The old extended hoshes were changed into plots allocated to single families according to the new act of ownership. The distribution within hoshes was concentrated on the families living inside them and it was considered that a minimum area of 200m with frontage not less than 10m was needed and so crowded families with less than 200m² should move to the new extension. The changes within this crowded plan were reflected by one of the planners:

> *"We tried our best to avoid demolishing the old rooms of traditional houses but it was very difficult to avoid mud boundaries walls and some of the rooms. We introduced roads between 6m to 10m inside the old fabric, while the plan of the extension was following the grid iron development"* (Fieldwork 2001).

The fact that the change in the built environment in general, and housing in particular, reflects changes in society is clearly evident in the development of the housing pattern and design in the traditional housing. This consolidates the idea that housing not only reflects social and cultural change but also leads to it, housing which is inappropriate and hence inhibiting or merely not supportive, may lead to undesirable changes in family structure, behaviour and other aspects of culture (Rapoport, 1978).

6.10.2.1 Physical Changes

The re-planning processes have significant impacts on the physical space and socio-cultural behaviour of the inhabitants. The changes on the physical space are maintained in terms of:

- The 'hoshes or the boundaries of the large families have been rearranged in small plots to ease the way to registration and supplies of electricity and water mains. The registration will be according to the (Sharie'ą) principles, either in the name of the head of the family or in names of many people (Shuyo'), if the plot is small with reference to the planning law. The plot should be 200 sq. m. as a minimum area with a front of 10 m width as a minimum dimension.

- The peripheral surrounding lands, which were owned by the inhabitants of these families, have been distributed to married sons or daughters of the same owners, who had no plots in the village.

- The confiscated land has been planned, developed and distributed between married people. The area of each plot is 500sq m. Instead of the narrow roads and accesses, wide roads were designed in the extension; the width is not less than 15m.

- Some amenities such as schools, health centres and others were located on the periphery of the village according to the wishes of the residents.

- A two-day market was established in the village. It is noticed that the market is moved from its original place; this is due to the objection of the inhabitants to the location of the market near the houses. They thought it would bring strangers who are not acceptable within the privacy zones.

- The alleys have been widened to accommodate vehicles. According to the records of the police in the village, some accidents have occurred; about 3 car accidents happened in the year 2001, which was considered as a new phenomenon not known before. Also, many residents have complained that privacy is no longer preserved unless they have higher boundary walls and that is an additional cost.

The plan (Figure 6.7: P 153) shows how the physical changes impinged on the traditional planning fabrics. Although the hoshes were changed into single plots the hoshes were still shared by extended families. The meshed-grid system was applied in both parts of the village, the old and the extension; the two parts have different grids; the eroded and the hybrid grids (Figure 6.21, D, and C). The local people in the old part then modified the new imposed system and adapted themselves to the new plots that replaced the hoshes. At the same time the inhabitants of the extension modified the regular plots to accommodate some of the extended family households. It was recorded that the inhabitants insisted on moving all the public facilities to the outskirts of the extension, especially the market.

Houses developed within the extension have the same single storey characteristics of the old village's houses. Some of the extension houses have roof terraces which were not known in the old part. This feature is well known in the Farmhouses village. Most of the houses have such roof terraces used for sleeping. They are usually protected from mosquitoes by a wire-mesh structure.

6.10.2.2 Socio-Cultural Changes

Most of the populations of the space domains of the study are Muslims, (appendices showed 94% of the inhabitants are Muslims). Islam to rural inhabitants is more than religion. It is an all-encompassing culture and a way of life. It defines a certain set of interrelationships between the members of a community. It is, therefore, an extremely powerful social force, which interacts with the local, regional, agricultural and economic way of living of the community. Islamic laws provide an essential body of legislation to present tools to organize the built environment. The Gezira area of the Sudan proved the flexibility of Sharie'ą law through its system of agricultural land ownership (Chapter two). The social cultural and economical factors have a strong effect on enhancing space organization and visa versa. The most significant factors are the privacy, (private and public space) the ecological adaptability, (climatic condition, physical barriers) and social activities, (children's playground, adult meeting areas). For example the changing social and economic condition of inner open space has presented the government with a challenging set of planning problems:

- The problem of vacant land within the village has been tackled, although is far from resolved. Redevelopment on a planning intervention scale has been used to tackle the shops around the inner open space and promote commercial retail development in the two-day market. Area improvement in such a manner has not succeeded and the shops are still in their place and the open space is used for socialization.
- The above point reflects the strong social behaviour that could be an obstacle if not carefully considered. People in the area prefer planning to consider the social cultural factors, otherwise planning will be changed accordingly.
- The traditional rural villages of the Gezira area were not made to a plan, but were simply a result of organic growth. The unity of the whole is secured by perfect homogeneity of form of its different elements, which interact with the economic investment and environment conditions to satisfy the residents' needs. The new plan did not provide solution for the affordability or the economic dimension toward the development of houses.

Therefore, we conclude that incorporating the organic system idea within our planning legacy may fulfil people's needs and reduce the gap in thinking between the local people and the planners and designers.

6.11 Conclusion

The organic development is one of the known systems in rural areas in the Sudan that consolidates the process of housing provision and production. It is of great significance to consider its objectives that are the support of the housing policy in any region. In spite of the appreciated advantages, there are disadvantages that lead the planners to intervene to inject new facilities within the old fabrics to enhance the way of life of the modern world. Could the local people adapt to the changes?

The changes affected the household structure and the organic pattern system, in other words space and socio-cultural behaviour, and consolidated the theories that identified the relationship between socio-cultural behaviour and place. Another question was could the new system enable the inhabitants to cope with their environment? The organic development proved to work well with the severe climate. The zugags proved to be a filter for the fresh air and to slow down the dusty winds. The wide roads do not, unless intensive trees are provided to mild the weather. Could the local inhabitants maintain the growing of trees? That has many difficulties and consequences but why should not be discussed.

Thus planning intervention could be of use to the local people and could be of interest to planners if the hybrid isolation that happened on site can happen in the ideas of the two parties. Planners can make use of the experience of such interaction of cultural values of both villages and the new extension that came out of intermingling theories.

CHAPTER SEVEN: THE DWELLING

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7.1 Introduction

In the previous chapters the process of settlement evolution and adjustment to an order was documented and we saw how, through time and interaction of socio-cultural factors with the economic and environmental conditions, in other words sustainability issues, the tenants were able to change their modest settlements into well-built substantial houses, a change from an unserviced dwellings towards larger fully-serviced houses. We saw how these changes were limited and affected by the built development in the area and also how the households extended themselves in the settlement. This chapter will examine in some detail the resulting forms and spaces of both the individual dwellings and more briefly some of the settlement supportive components. The term 'dwelling' means to Norberg-Schulz, (1985:7):

> *"Something more than having a roof overhead and a certain number of square metres at our disposal"*

Researchers identify the meaning of home in three aspects: A place where one can achieve the desire of being oneself, in the sense of having a small chosen world of one's own, to meet others to exchange products and ideas and feelings and to come with an agreement with others, that is, to accept a set of common values (Norberg-Schulz 1985)

> Allsopp (1974) defines the term home as: *"It is one's private station in relation to the rest of the community. It plays a very large part in giving one a place in society and it is linked with other homes through personal relationships".*

And 'certainly, a home is a place in which to eat and sleep and have one's belonging with some degree of privacy and security. It is also the place to which one belongs; where one has one's roots, (Allsopp, 1974).

The dwelling in the Islamic world plays an important part in society. It gives the essential privacy, which is a vital requirement and at the same time keeps the relationship with the other individuals through Muharam space and diwan. However, the terms 'dwelling', 'home' and 'house' are three related meanings but each one is defined to have a degree of interaction with physical and social components. 'House' implies a physical structure or shelter as well as having a socio-cultural meaning as we saw in chapter five. In viewing the house as a physical structure and an ultimate product of a long period of experience incorporating social, cultural, economical and environmental aspects, the designers and planners must be conscious of the vernacular architecture that has been conserved through traditions and lifestyle and manifested in the place perception and image. In this context we can contribute that socio-cultural symbolic values, which are embedded in these places and interact with the economic and environmental values to support the continuity of settlements, are necessarily connected or associated with the physical features of a place, whatever these features are.

7.2 Dwelling Types

In this study the vernacular or traditional process of design is a model of variations and adjustments; there is more individual variability and differentiation than in other standard types of design, of colonial legacy. It is individual requirements that have caused these modifications, not the type. When the tenant builds his home, he knows the type in question, the form or model and even the materials; what remain to be determined are the specifics and family requirements. This is in contrast to the Farmhouses Village where choice is not usually expressed through design but rather through the place of the job. Housing which has already been designed and constructed is chosen from a range that varies within the context and is closely linked to income categories, the status of the dweller depends on his rank in the civil service. The house in El Sereiha village has a long history but the focus will be on the vernacular traditional dwellings that have been affected by the economical and physical changes in the area since the start of the agricultural scheme in 1925.

House types are categorised parallel to the socio-cultural patterns discussed in chapter five: physically we can categorise the different types as colonial, traditional organic and hybrid houses (extension houses). The following table (7.1) shows the respondents' housing types in the villages, the Farmhouses village, El Sereiha village and its extension.

Types of houses

	El Sereiha Village		Farmhouses Village	
Housing Typology	Frequency	Percent	Frequency	Percent
Traditional dwelling (organic)	136	68.0	8	8.0
Extension dwelling (Hybrid)	59	29.5	8	8.0
Colonial dwelling (Government)	5	2.5	84	84.0
Total	200	100.0	100	100.0

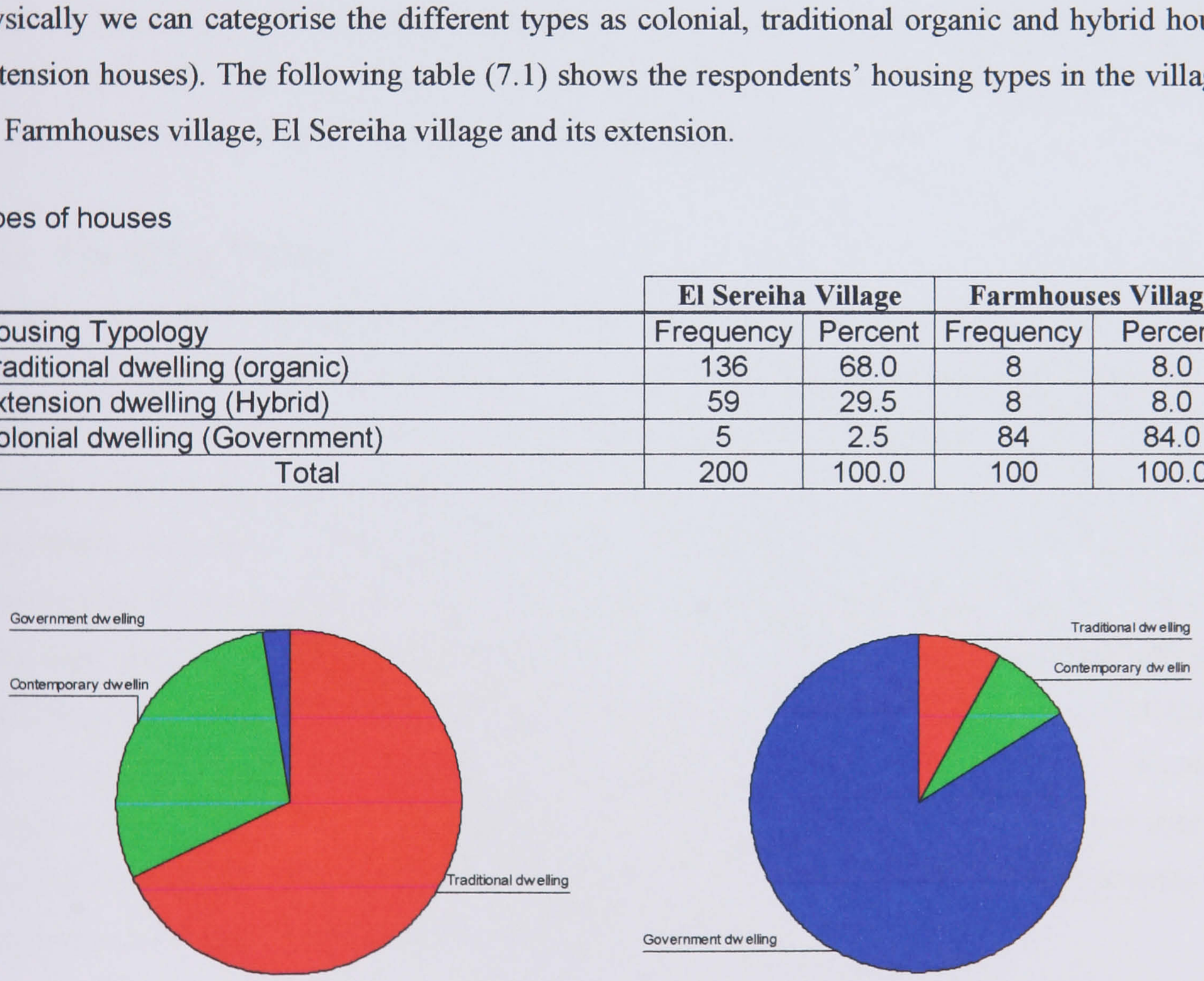

Figure 7. 1: Illustration of the Housing Typology

The results show three main points:

- It seems that traditional houses dominate the locals' settlements (68% of the dwellings of El Sereiha village).
- hybrid housing is new to El Sereiha Village[24](29.5% of the dwellings in El Sereiha village)
- Government housing is the houses built by the colonial system and the national governments carried on the process. They represent 84% of the dwellings in the Farmhouses village and they are very limited in El Sereiha village, only 2.5%. These represent the government houses for teachers and other staff.

The result reflects also the sharp difference between the typology of housing in the two space domains of the study, while we noticed that the houses in the extension are of a hybrid type representing the images of both organic and colonial. The hybridism is manifested in the type of material used, the design layout and to some extent the shape. The hybridism has also been reflected in the design of the labourers' housings. The colonial government built houses for the lower income groups in the form of Guttias that were the houses of the temporary labourers who help the tenants in crop harvesting. The conical-roofed house was built from red-bricks instead of either mud walls with a thatched conical roof or thatch walls with thatched conical roof. These types of houses will be dealt with in more depth in the following sections.

7.3 Dwelling Forms

There is an implicit assumption underlying much academic writing on rural housing that poverty and the struggle for survival will mean that the dwellings of the poor, especially those that they have created for themselves, respond essentially and only to the basics of shelter (Kellett 1995). In fact this poor dwelling is the point of maximum concentration of the power and culture of a community. It is a place where many activities of life take place with both social effectiveness and significance. Here it is clear that such simple places created by the tenants are in fact loaded with meanings and qualities which reflect people both as individuals and members of broader socio-cultural groups. Kellett also argues that understanding the formation processes is critical for anyone who intends to learn from any of these poor houses. That is important because culture has become deeply embedded within it. Academic researchers are led to excel within narrow peer groups of scholarly élite. To get out they have to communicate and value the opinions and judgements of the simplest achievement of humanity. Kingery (1996:1) states that:

> *"Artefacts (dwellings) are tools as well as signals, signs, and symbols. Their use and functions are multiple and intertwined. Much of their meaning is subliminal and unconscious."*

[24] Hybrid housing means here the new houses of new style or using new building materials such as gishra walls (see later building materials section).

At the same time these dwellings and their meaning interact with the available built environment, nature and income opportunities to form ideal homes. Lea (in Murrison 1979:51) maintains that:

> *"Turner extends our perception to include the whole dwelling environment and the way in which society - the householder and decision maker - interacts with it and with each other."*

This section discusses how the vernacular traditional dwelling has developed from the round Guttia[25] form to the square form as core-room units[26] until it reached the existing forms, which have also housed the socio-cultural behaviour and activities of the inhabitants. These forms have responded to the environmental and economical development changes that have occurred in the area since the beginning of the agricultural scheme. Rooms were usually arranged in a courtyard 'hosh' to form a structure following the way of life that conserved the socio-cultural norms (chapter five).

It is noted that the vernacular traditional house in El Sereiha village has different forms within the hoshes, but always construction started with a core unit and the Farmhouses village model has different forms for each economic category of residents. In this chapter we will analyse the forms of the two settlements separately and then draw on the links and their impact on each other. As the vernacular traditional model started with what we call a core-room unit we will analyse this type as a symbol of housing development through the decades and as its history has been affected by the government houses which has been greatly associated with the Europeans. There are changes of spaces due to changes of activities through time, especially after the Sudanese officials occupied the government houses after independence. These planning changes reflect that the physical changes are always reciprocal to the socio-cultural changes that have happened in the village. Here we will draw on the form that has had an impact on the traditional organic form such as the colonial housing and Guttia from east and west and mud houses[27] from the north of the Sudan. Then we will discuss the forms that were first introduced within the area and affected the evolution of the dwelling in the organic settlement, and then we will draw on the organic and hybrid development that resulted, as we think, from the intermarriages between many cultures in housing industry in the area.

7.3.1 Guttia Form

We saw in chapter four that the African Guttias (huts) were introduced extensively as many African people came to the area after the construction of the agricultural scheme. It was stated that before and at the very beginning of the Agricultural Scheme, the known traditional organic houses were

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[25] Any structure with a conical roof is known as Guttia.
[26] People used to start the construction of a house by building one room known as one core-room unit. more rooms added to create the usra home.
[27] Mud house is a house with mud walls and flat roof made of wood, thatch and earth as known in the Sudan.

the Arab or African Guttias 'Huts'. The rooms were commonly built to a circular plan of approximately between three or five meters internal diameter with thatch or mud walls, which supported a conical thatched roof. Also the Guttia might be built to a square plan with a pyramidal thatched roof (Figure 7.2).

People of the Gezira Plain first introduced the Guttia for their temporary settlement when they used to go to the Gezira plain to grow Dura 'Sorghum' and other simple crops for their food. There are three types of Guttia (Figure 7.2) known in the Gezira development. These types are still prevalent in different parts of the Gezira area. The space domains of this study recognised the three types but now only the thatch Guttia prevails to accommodate the temporary labourers who come to harvest the crops, especially cotton-picking and sorghum 'dura' harvesting. This Guttia form is well known for the Arabs in Eastern Sudan. Temporary workers who come for a short time still use this type of Guttia but away from the traditional village and usually within the cultivated farms. The residents used local materials such as wood, and certain crop stems, especially dura stems. Houses of this type are built close together. When we asked who is responsible for making these Guttias, it was explained that the farmer gives the straw and the dwellers build the Guttia.

The Guttia had a very simple form in design and construction. The simple local materials that were used reflect its simplicity and humbleness and it demonstrates the culture of local construction and materials. The thatch Guttia was made of straw in a circular shape without any foundation or threshold. The basic construction consists of a framework of split acacia wood posts set in the ground. The foundation trenches were dug in a simple form, 60cm deep and as wide as necessary for the wood post to fit into it and the rest of the hole is filled with earth. The firmness of the construction was secured through the network of all posts tied together to give a stable structure. Horizontal, and sometimes diagonal, braces are then tied to the vertical pieces, thus creating a very sturdy wall. The posts supporting the roof are placed around the house without regard to symmetry. It appears that their spacing is predominantly functional.

The diagrams (Figure 7.2) illustrate the different features of the Guttia 'hut'. The mud Guttia was made of mud walls and a conical thatched roof. The foundation was also very simple and the trenches were dug 60cm deep with a width of the thickness of the wall which is approximately equal to a brick and half (35cm). The floor of these Guttias was made of earth. The Guttia, usually, has only one door. The square plan form consists of four walls and windows set in the north and south ends to allow ventilation. The form of the Guttia had great effect on the British designers who designed for the Gezira Board low-income labourers as they borrowed this design to form huts using the same shapes with redbrick materials in construction (see the following section).

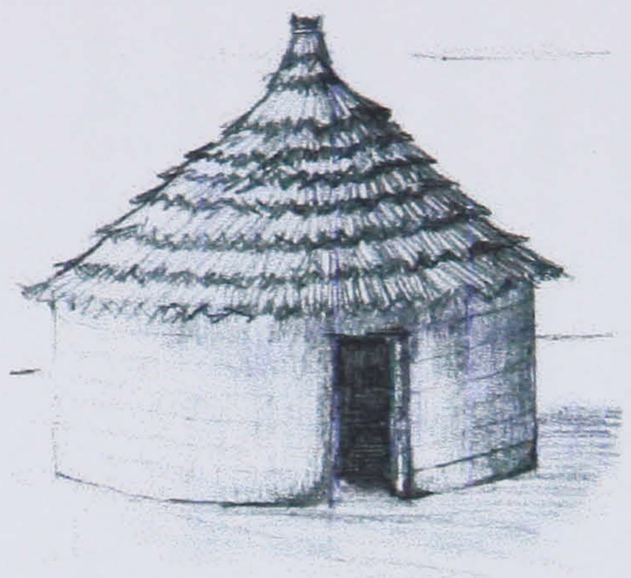
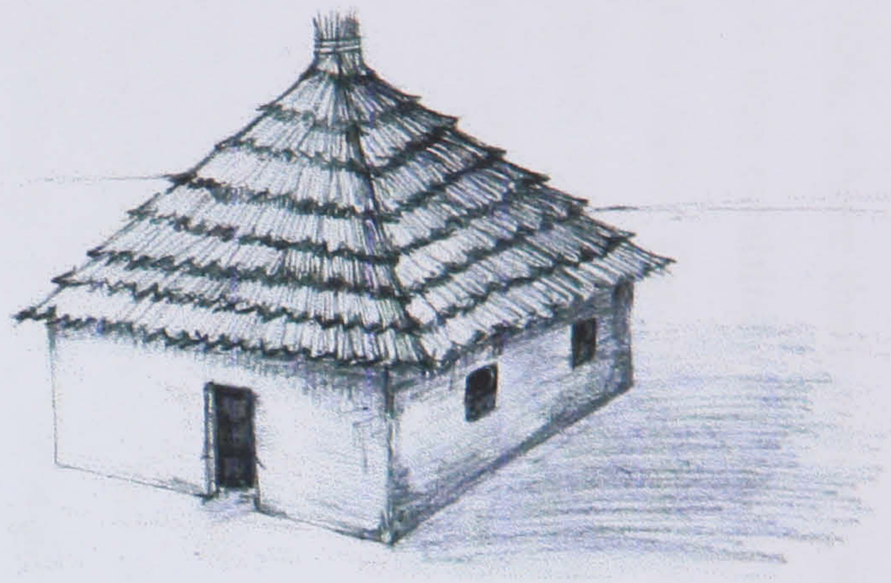
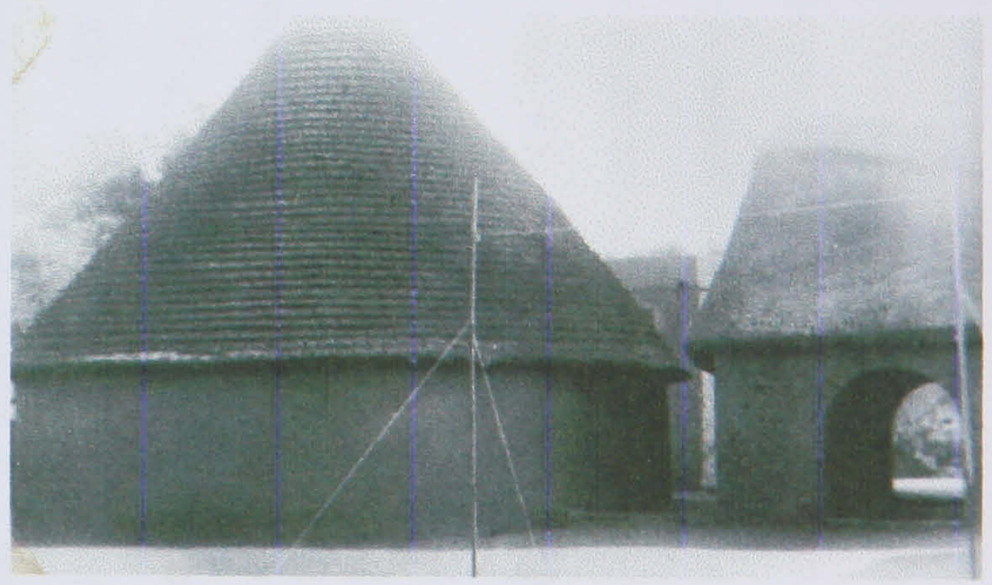
Type I	Type II	Type III
Circular plan thatch Guttia	 Circular plan mud and thatch Guttia	 Square plan Mud Guttia
A Guttia made of thatch from Eastern Sudan	Mud covers the outer surface	 A square-room with conical thatched roof and rounded corners.

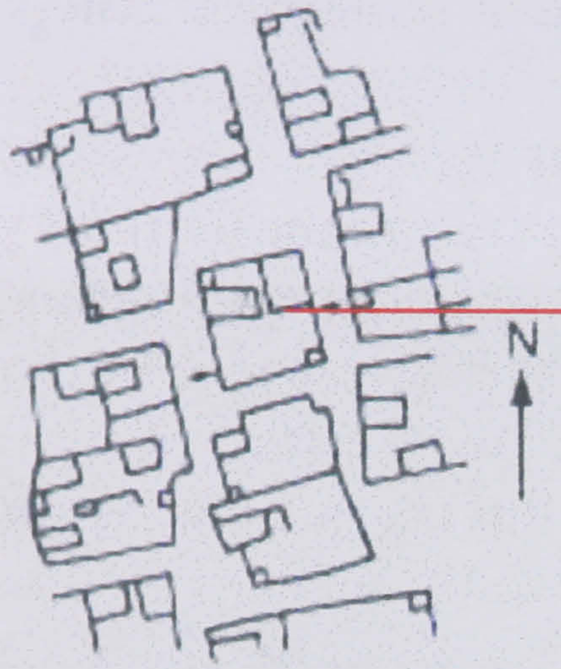
Figure 7. 2: Illustration of the types of Guttia prevailing in the area: the thatch Guttia is still used as temporary labourers' dwellings but the other types are no longer used.

7.3.2 Mud House Form

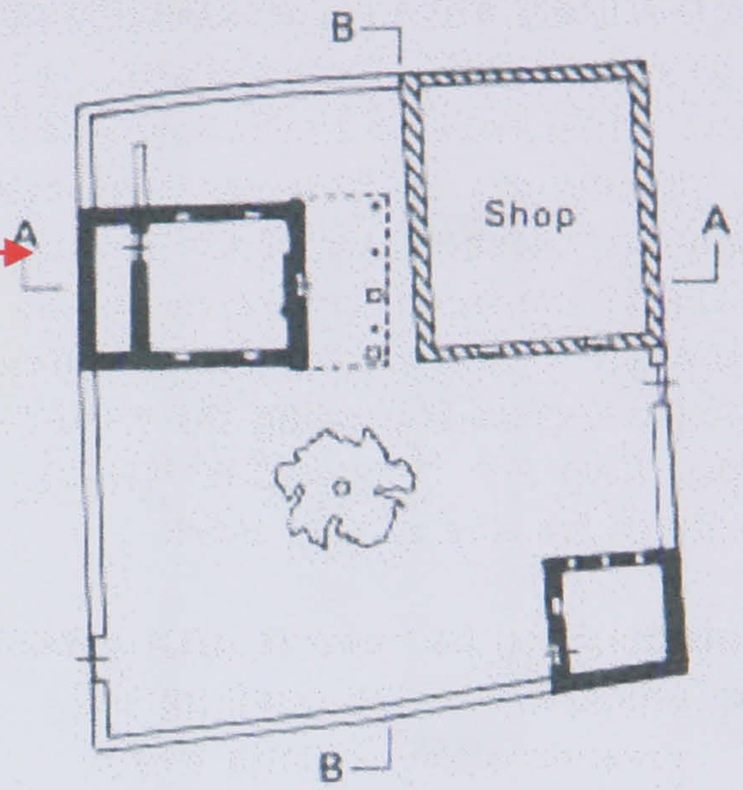
Mud houses are known all over the Sudan (Figures 7.3 & 7.4). The name refers to any house built from mud walls with flat roofs made of wood, thatch and earth. Mud houses were first introduced on the rivers Nile, where there was a concentration of Arab people in the Gezira area of the Sudan. After irrigation was established (1925), a mudroom unit of square plan with a flat roof superseded the circular plan form. The mud house is similar in construction to those houses of Arabs on the banks of the River Nile. The mud house could be a detached room, a room with a sunshade and store, one room or two rooms with a veranda or two attached rooms (see the core room section below).

The foundation for the mud walls is a trench not more than 50cm deep and the wall starts immediately from the bottom of the foundation. The roof is made of local wood construction covered by thatch and earth. Through time the flat roof was used extensively on mud walls. Although there is, sometimes, very heavy rain sloping roofs are not used. People used to build the mud houses in an area with no rain at all as in the northern part of the Sudan. Sun-shading elements are also very common. The house often has a kashasha or rakoba (Shaded areas) attached at the front and a store at the back. A sloping lean-to-roof is often attached to the East end of a room, in the form of a framework of roof wood or timbers supporting straw, stems of dura (sorghum) or cotton stems (kashasha) (Figure 7.3). Another method of providing shade is to construct an independent framework of poles or mud columns supporting a cover of straw or cotton stems finished with earth and it is known as 'rakoba' (Figure 7.4).

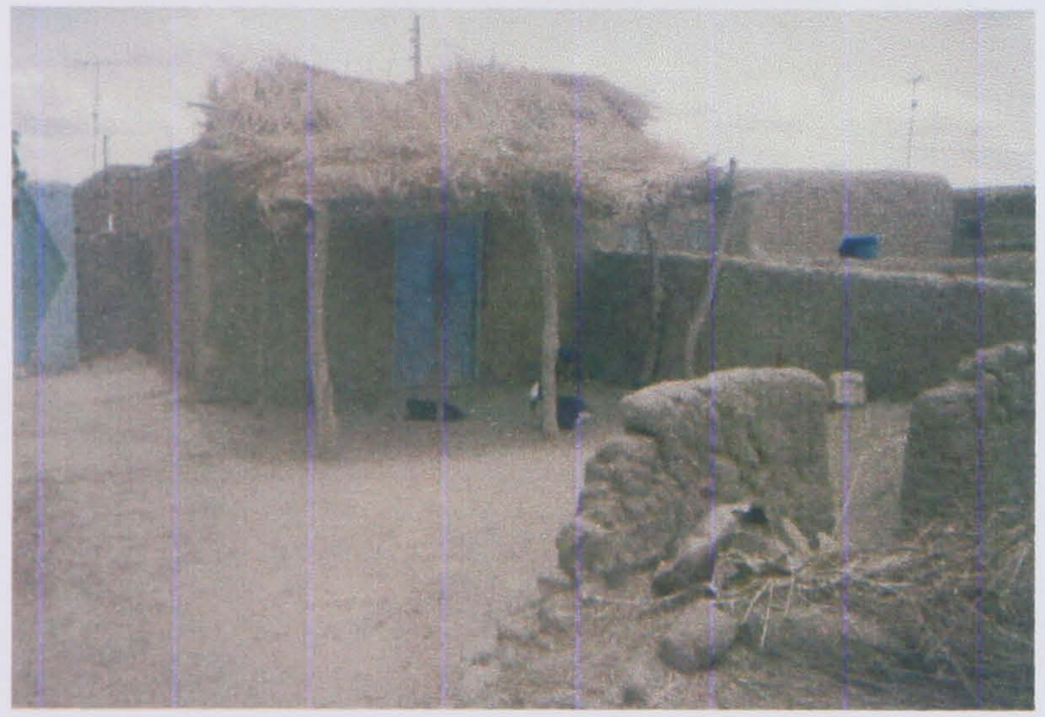
The square plan provides a room of approximately 4.6m², usually with one door and four windows. Rooms of this type became very popular in the 1940s and soon replaced all those rooms of circular plan. The walls, which are built of mud, support thin branches, which in turn carry a layer of straw and earth to form the flat roof. Other classes of rooms have also been used, including a storeroom (4.6mx 1.20m) often attached to the west-end of the room unit. This has a double function to store valuable things and protect the west-end wall from the sun's rays which are very hot in the afternoon. These forms are sometimes repeated in one hosh as required by the family and consolidated by the economical situation. The size of the family had a great effect on the number of units needed by the extended family. This type of mud dwelling, which still exists in between other houses, has been changed into Gishra-house (what is called here 'hybrid- dwellings: will be discussed later). The status and the size of the family have a great effect on these changes. Sometimes this type of dwelling is kept within the fabric of the new development of a house. It can be seen in the drawing of the once typical dwelling in El Sereiha village that this was very common and now is almost diminishing (Figures 7.3 & 7.4).



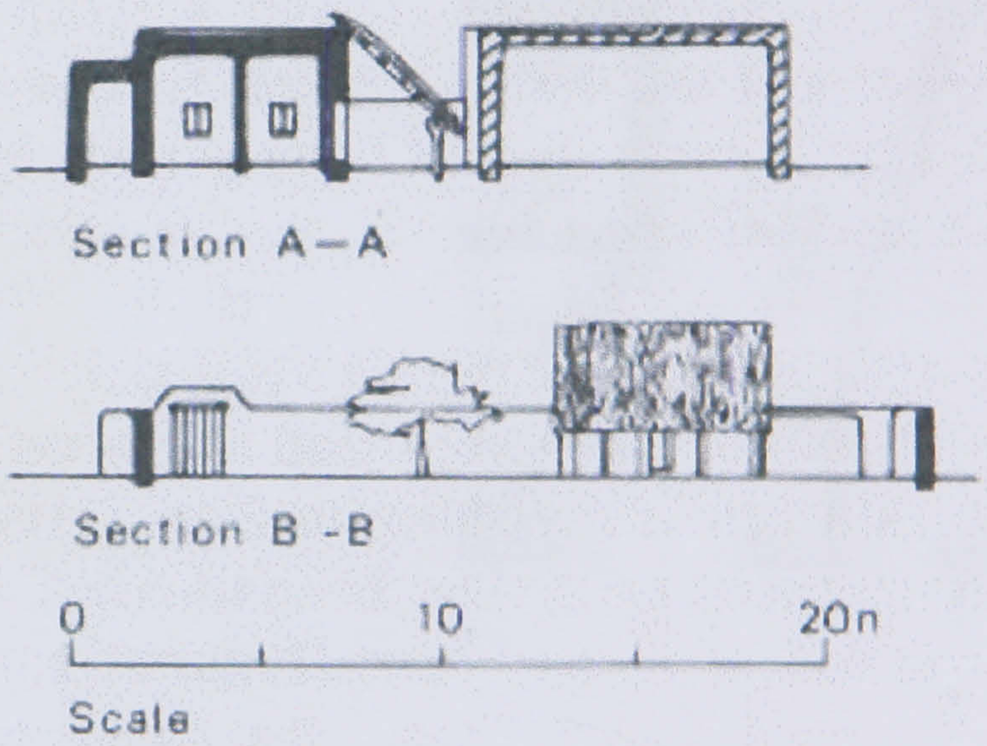
Site Plan



Plan

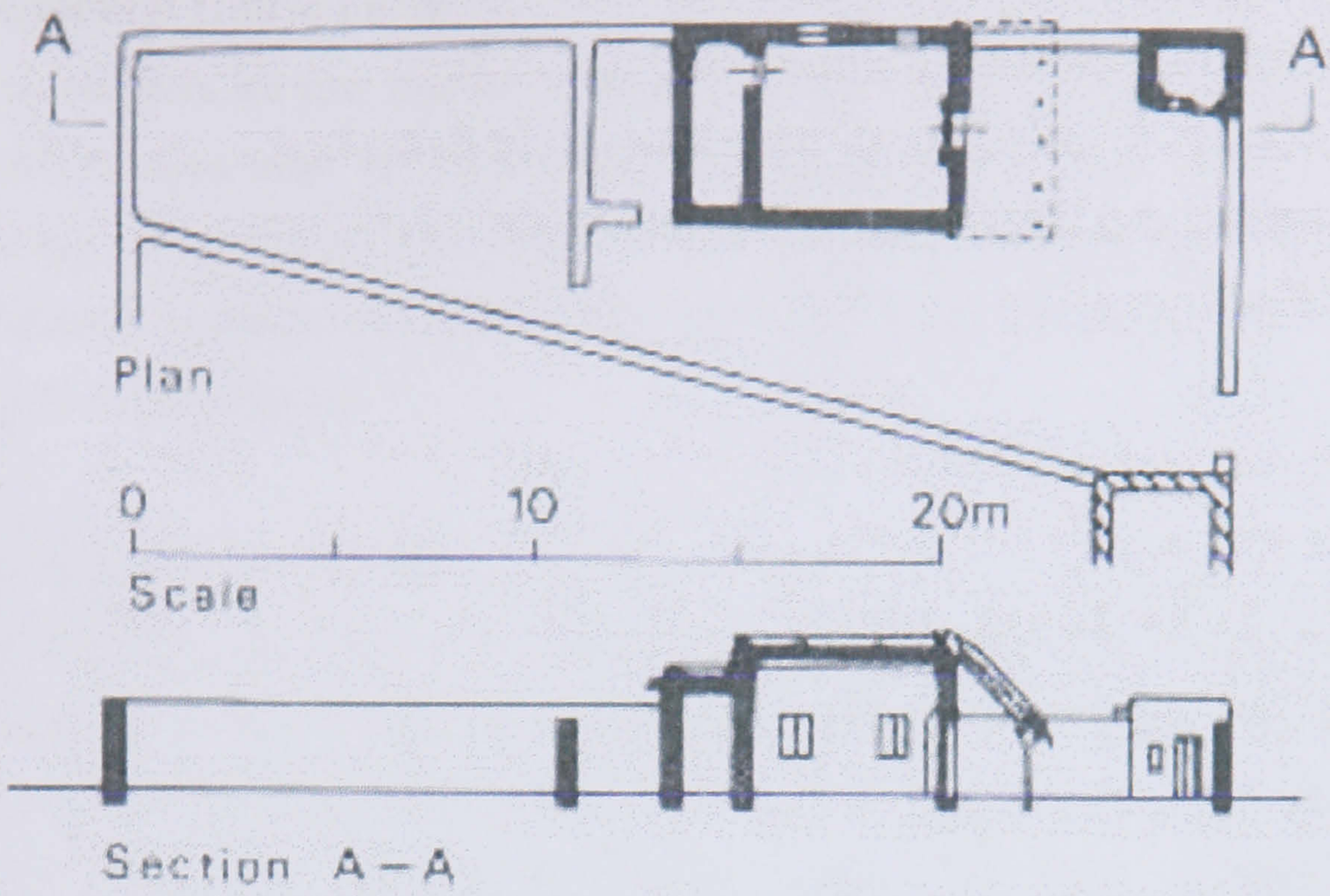


House photo



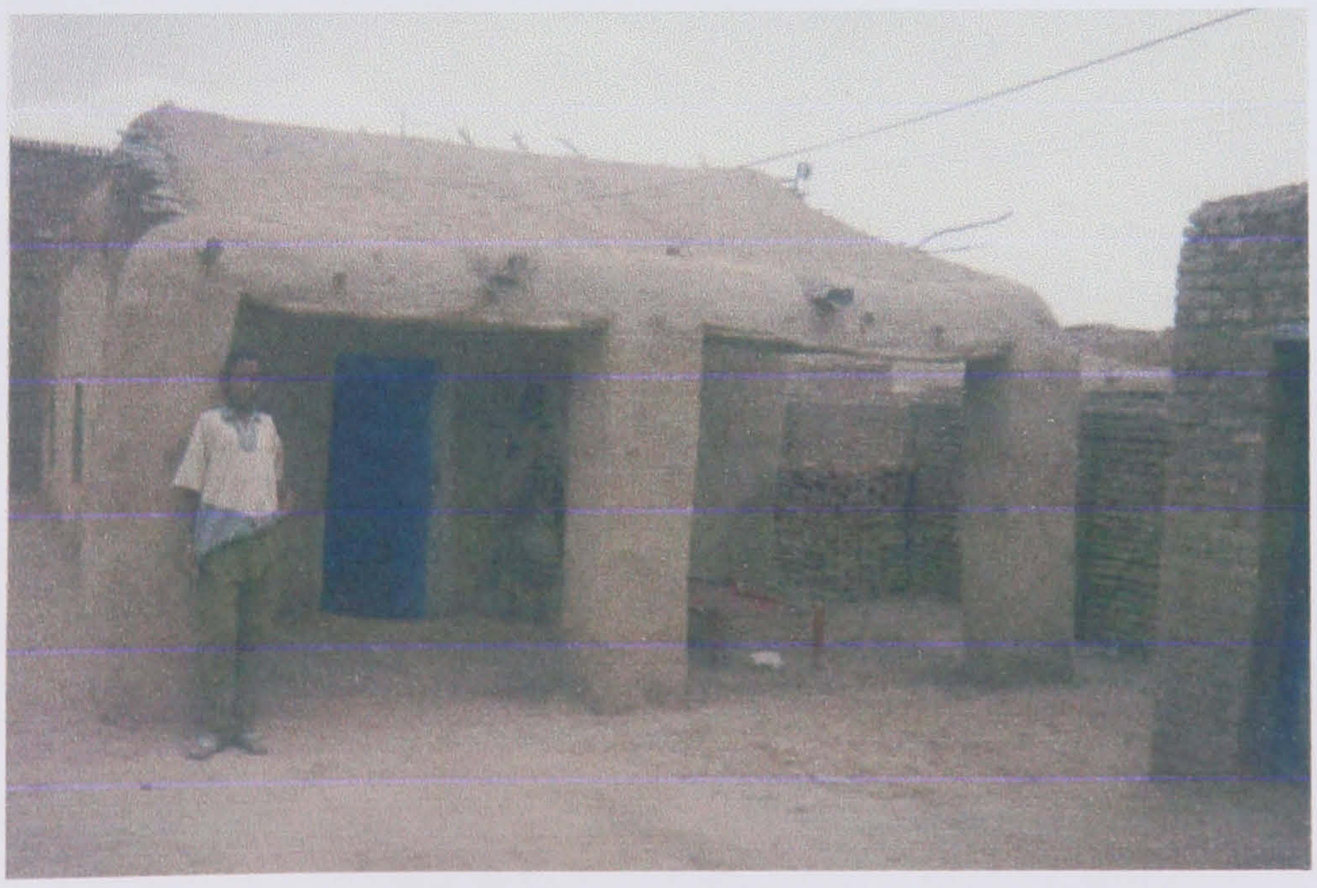
Section BB

Figure 7. 3: A typical mud house with a kashasha in El Sereiha village: Source Danby (1975)



A plan and section of a typical mud core room unit

A typical traditional mud house



Another view of the mud house with a rakoba

Figure 7. 4: Mud houses

7.3.3 The Colonial House Form

In the previous chapters we saw that these houses are characterised by their formal development. The Gezira Board owns most of the houses in the Farmhouses village, while the Ministry of Irrigation, railway association or local people who are specifically working in trade own the others. This section focuses on the governmental houses developed in the village, especially those affected by the socio-cultural structuring.

7.3.3.1 Low-Income Group House Forms

The houses of labourers and lower rank officials are basically composed of round rooms grouped around a courtyard or situated within the courtyard. The round room unit was established and then a smaller house of a round room and square kitchen was introduced to accommodate small households of low-income, and four round-room houses were built for larger low income households. The size of the round room is 3.6m in diameter and the square kitchen is 2x2m. The area of the plot is about (18x12) = (196) square metres. It seems the W/C was added later to the house. In the four-room houses (Figure 7.5) there are three rooms looking into a court-yard and the fourth opened to the exterior. The latter is used as a majlis (sitting room) to secure privacy for the court.

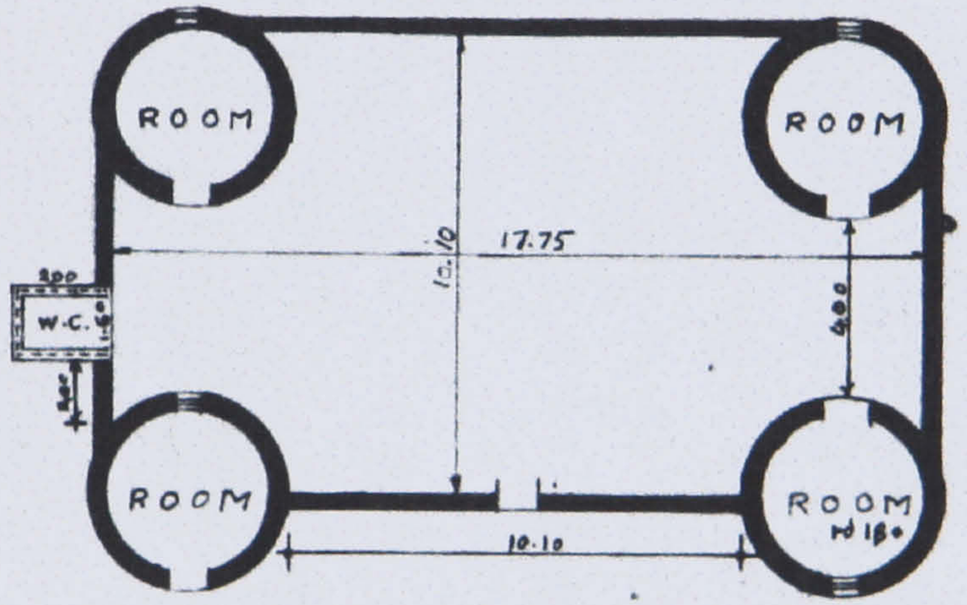
The foundation trenches are dug to 60-80cm deep and a two-brick wall is used for the foundation and then a 1½ brick wall is used and the conical roof is made from the brick with cement mortar. The floor is compacted sand. The red bricks are local materials and produced from the clay on the river Niles. This has an impact on the agriculture that is found on the banks of the rivers Nile. The following drawing Figure (7.5) illustrates the typology and construction of such houses, as they appear from the photographs.

The shape was taken from the Guttia. It represents the interaction of traditional and foreign thinking represented by the colonial legacy and Guttias; using redbrick round walls and a conical roof from red bricks, instead of walls and roofs from local wood and thatch.

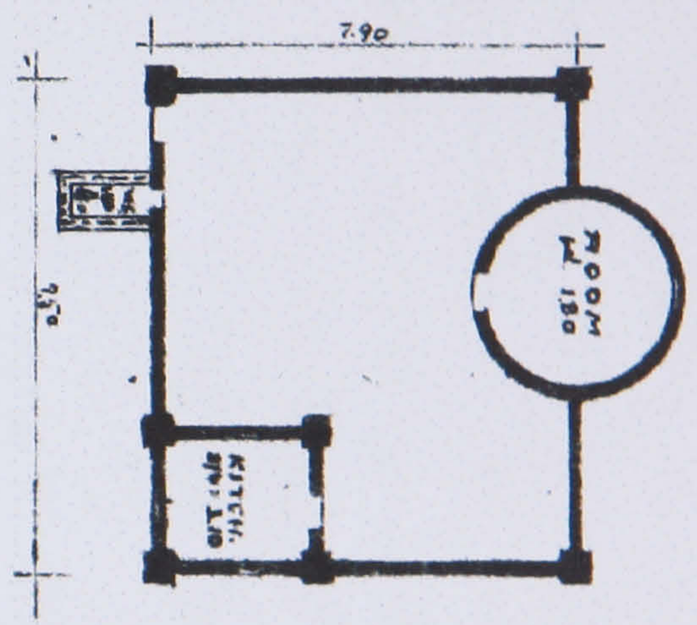
It seems that the built areas are small relative to the total area of the plot; about ¼ of the area, leaving the rest with the potential for people to extend on but the feeling of irresponsibility towards the house make the people not interested in adding other structures in the plot. The houses have still maintained their original form because of the rigid form itself and the regulations do not allow the inhabitants to make major changes in the building. This house reflects the adaptability and hybridism in the form of houses in the Gezira area.

First Group House Forms

A round single room built first for labourers in 1920s.



Circular rooms around a courtyard introduced 1920s



The square plan was introduced as well in 19500s. .

Figure 7. 5: Different types of the low rank houses, they are known as third class houses

7.3.3.2 Other Income Group House Forms

The medium and high income group houses were basically built for the British administrators at the beginning of the Gezira agricultural scheme in 1925. They are of standard plan. They are of square rooms surrounded with a veranda made of wire-mesh structure, located within a big farm. The rooms open into each other. The sitting/dining room is located at the middle of the house connected by two rooms with two separate bathrooms attached. The wire-mesh veranda is to protect the inner house from mosquitoes and flies and let the fresh air pass through (Figure 7.6). In these types of colonial houses the rooms were oriented for family use with another degree of privacy.

The two houses (Figure 7.6) have been built of red-brick walls, corrugated zinc sheets or roof-tiles for the roof and the floor is made of cement tiles. The roof is made of jack-arch structure covered with sand mortar to secure the slope to drain rainwater. The foundation trenches are dug with generous dimensions, usually 1m in depth and 80cm in width. The foundation is made of concrete since it is hard enough to counter the unstable cotton soil. Some houses are constructed of 1½ redbrick structure; i.e. 36 cm redbrick wall. The roofs are made of timber frames and either slates or clay tiles, known in Arabic as 'Garmeed'. The intensive trees which surround these houses have a great effect on the temperature. They reduce the hot weather in the hot season. The temperature is reduced by more than 15° C, according to the environmental research carried out by the Department of Architecture, University of Khartoum in 1967. The windows of these houses open North-South and allow cross ventilation through the windows that are of dimensions 80 cm X 150 cm. A wire-mesh structure is fixed to the outer windows to protect the inner side from mosquitoes. The structure will be described in more depth in the building material section in this chapter.

There have been some modifications in the British model to suit the socio-cultural way of life of the local officials. A courtyard or a hosh was added to the back of the house to give some privacy to the family. This need for privacy is also seen in changing the fences into solid walls and curtains used on the wire-mesh structure to cover the interior. The plans of the houses built after independence also reflect some modifications that were carried out on the standard model of the houses which were built before independence in 1956. A hosh or courtyard has been added to the design of such houses to provide privacy for women and provide the opportunity to segregate men guests from the rest of the house (Figure 7.7). As the guests come frequently, the sitting/dining room which is allocated for guests has a double function; they are used by the frequent guests or family members. Two doors connect this room to the other parts of the house, one through the bathroom and the other directly from the sitting/dining room. Also bathrooms with two doors and two W/Cs were built to enable the value of segregation to be confirmed.

In discussing the adaptation the traditional colonial houses, a question could be raised; what is the reaction of the people who are using them now? An answer came from one accountant living in the Farmhouses village as follows:

> *"First of all the house is too big for my family, because I have a family of one wife and two children. Secondly, the space arrangement does not suit our traditions and privacy, but the spacious covered area enabled us to change the uses of rooms, I think if this house is allocated to our extended family it may not work properly. We need at least a guest room that is not centralised in the middle of the house and separate bathroom and W/Cs" (The interview 2001).*

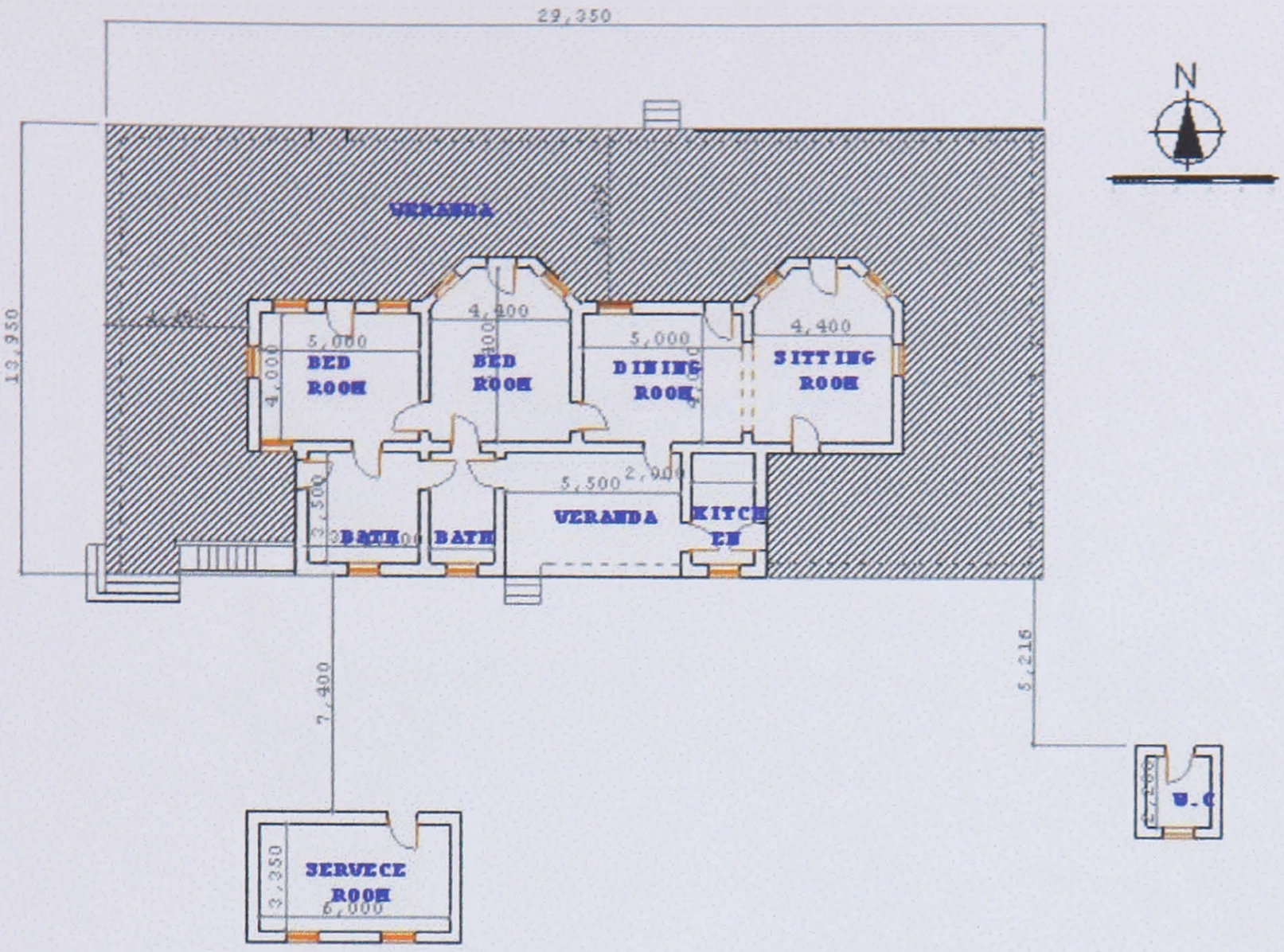
The creation of traditional housing units which provide greater privacy and which separate segments of the lineage, lead to transformation of the physical space through a structuring socio-cultural communication and interaction and building modifications. The modified forms, here, could be any form built by a certain culture within the context of a multicultural facet such as the Gezira area. The colonial houses were modified either through design as we see in figure 7.7 or through structural changes to the existing houses as seen in the photographs (Figure 7.8) such as by adding boundary walls or covering the wire-mesh by cloths.

The multicultural intermingling phenomenon created an open-ended design process: how the experience of these forms transforms conceptions of the model of house form and affects social interaction is of great significance to designers and planners concerned with the Gezira settlements. The process of adaptation and modification continues to form the traditional organic settlement of today. The following investigation within the existing housing models with comparison to the persisting formal house forms may highlight the socio-cultural as an important factor in the process of development.

The following diagram (Figures 7.6 & 7.7) illustrates the house forms developed to accommodate the medium and high rank officials before and after independence in 1956. The modifications that were introduced to the designs of the two types of houses after independence are meant to enable the users to fulfil their family requirements and socio-cultural way of life. The designs consist of house plans with hoshes.

The photographs (Figure 7.8) illustrate the forms that were built in the two eras of housing development in the Farmhouses village. They show the different styles that were built to accommodate different income groups. They also reflect the modifications carried out on both the colonial house with the addition of walls and curtains to the existing structure and to the design (Figure 7.7) which was built by the Sudanese élite.

A house form designed by the British before Independence



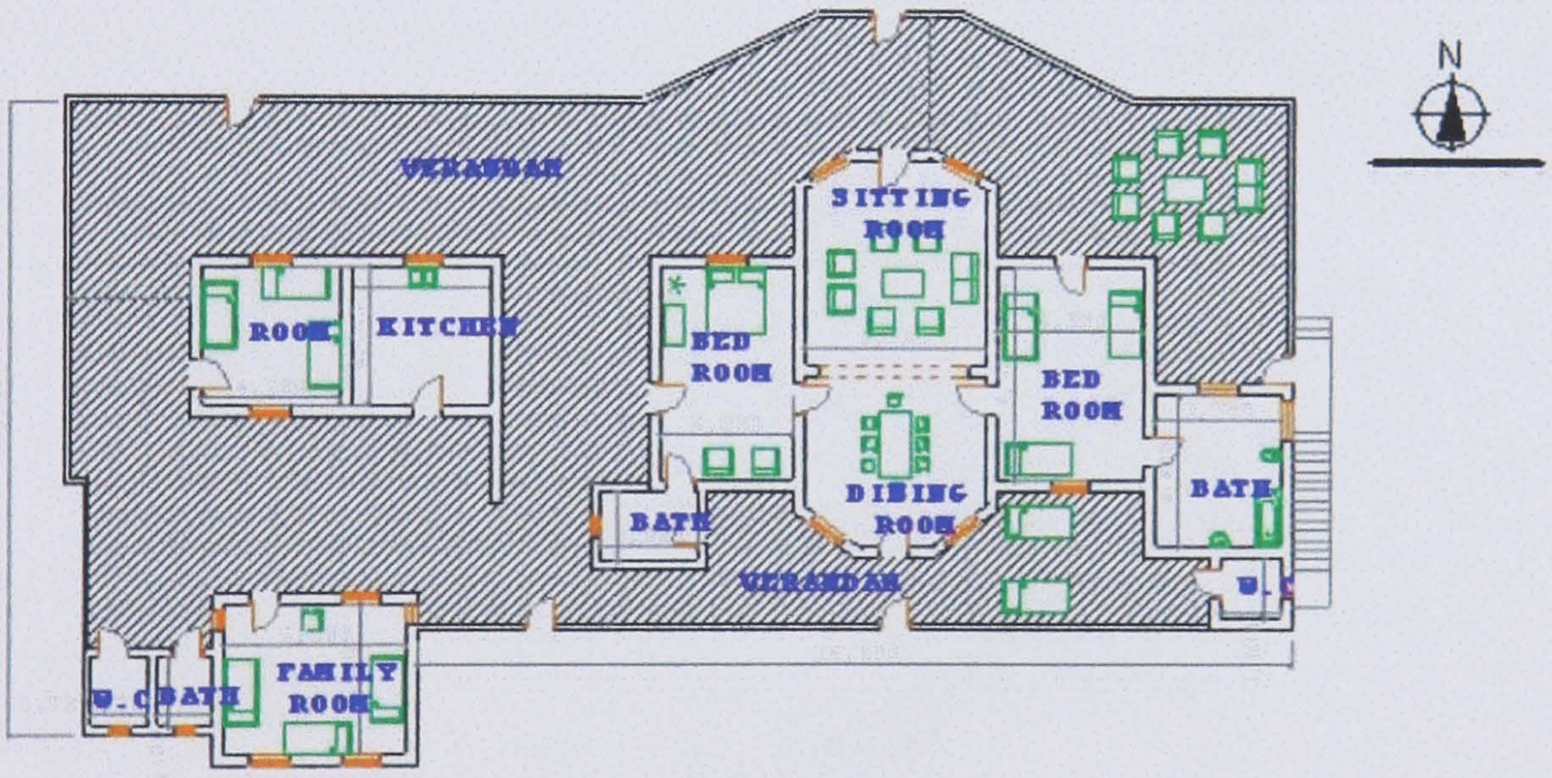
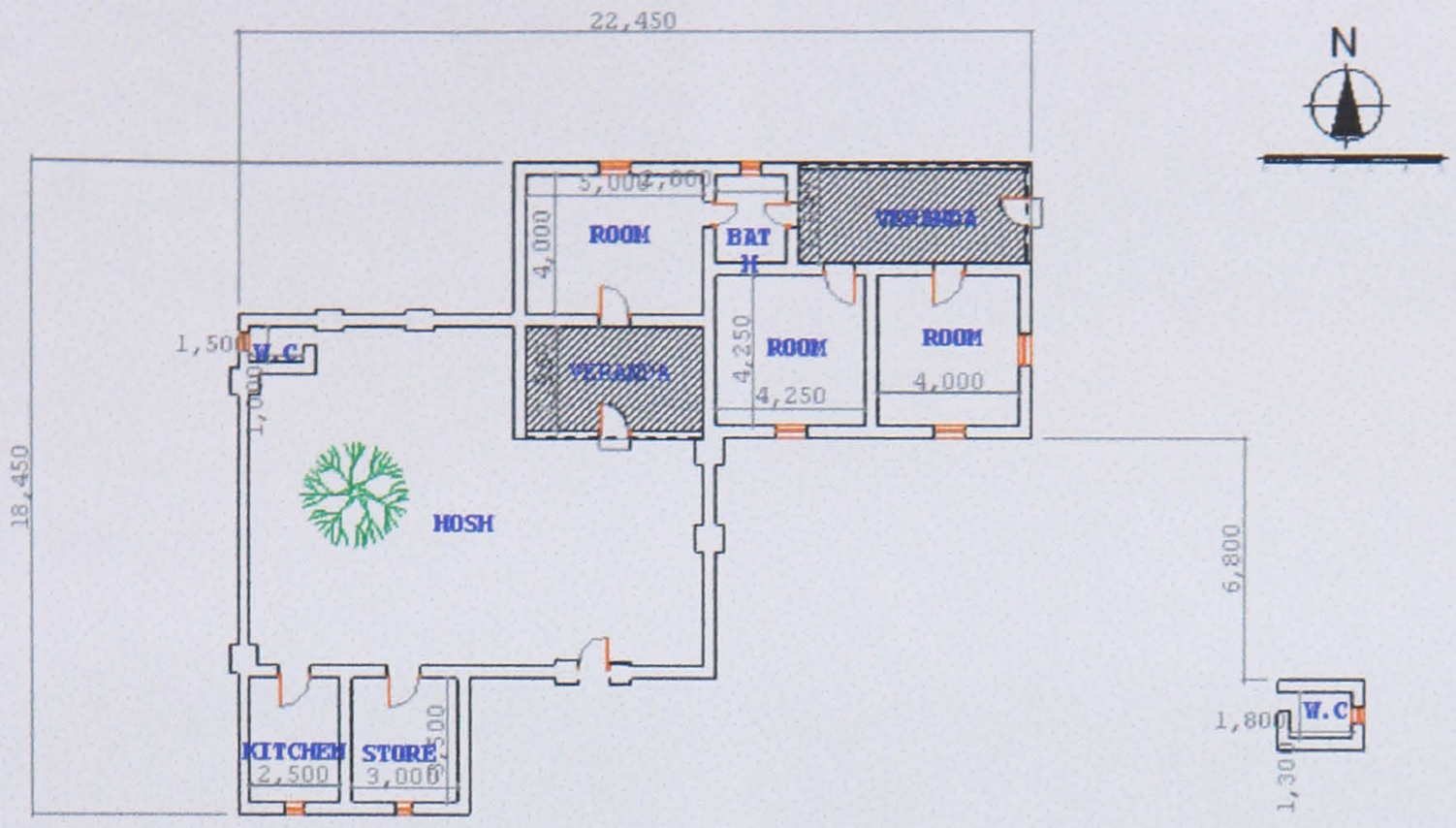
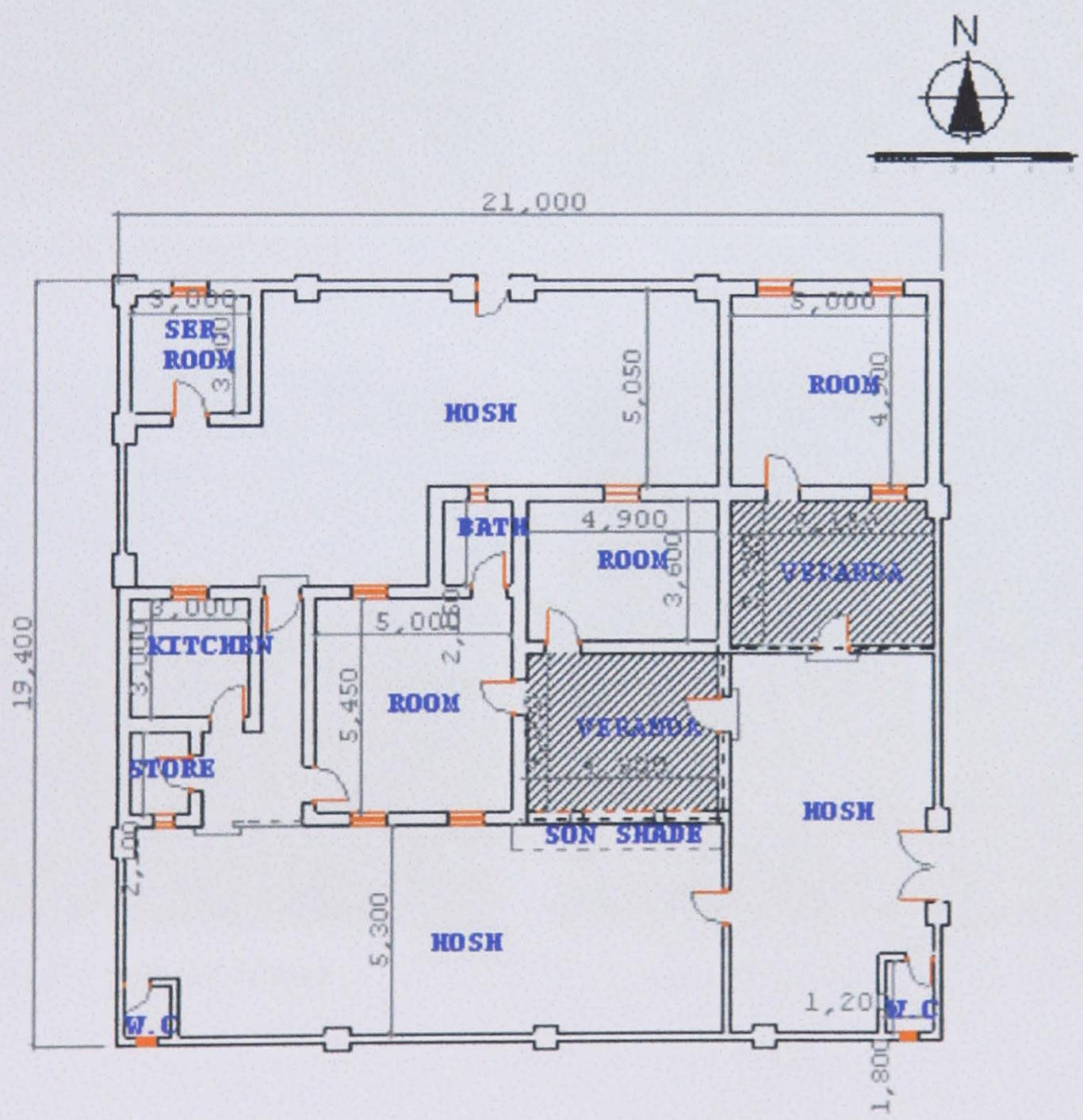


Figure 7. 6: Two types of houses; one is a small house to accommodate the medium-income groups and another, a large house to accommodate high-income groups

Houses designed by the Sudanese after independence (1956)



A

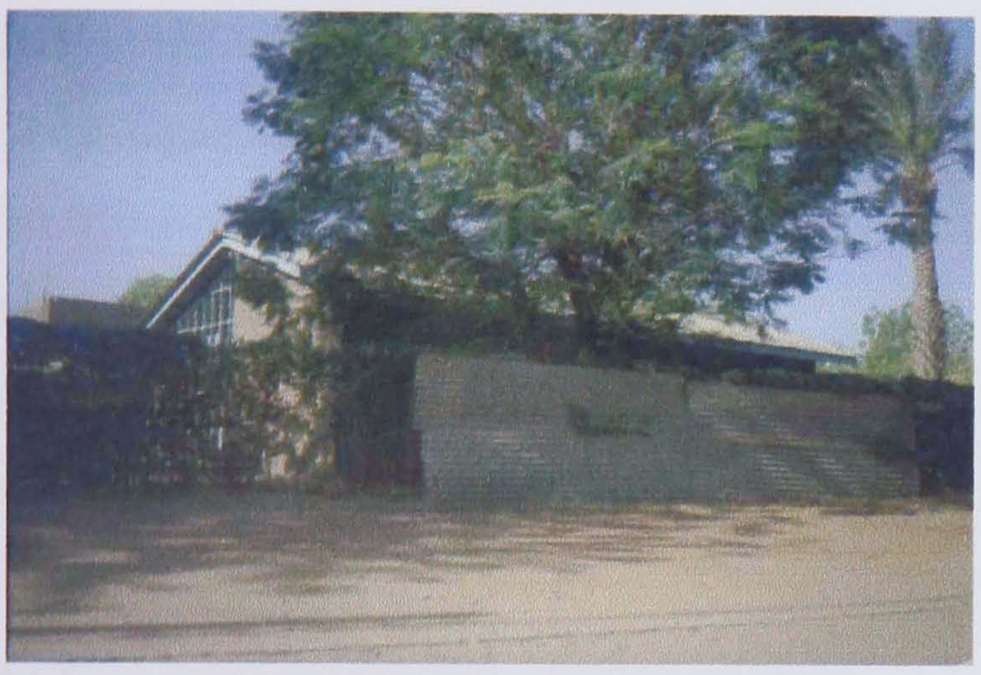


B

Figure 7. 7: Two House: A small house to accommodate the medium-income groups (A) and a large house to accommodate high-income groups and

A large colonial house

A large colonial house



A medium colonial house

A medium Colonial house

A small Colonial house

A modified design for a colonial model

Figure 7. 8: Illustrates the different types of colonial housing showing modifications run on the models built from the very beginning of the Gezira Scheme.

7.4 Spatial Organisation

7.4.1 Dwelling Size

The size of plots and built-up floor areas indicate important features of the current housing phenomenon, out of which is the building materials used, construction cost, crowdedness at both village level and dwelling level, perception and use of space and overall the socio-cultural meaning is embedded in the components of the house (Awotona 1999, Rapoport 1969, Altman 1984). Thus here the focus will be on a comparison of the sizes of plots and components of the dwelling in both space domains of this study.

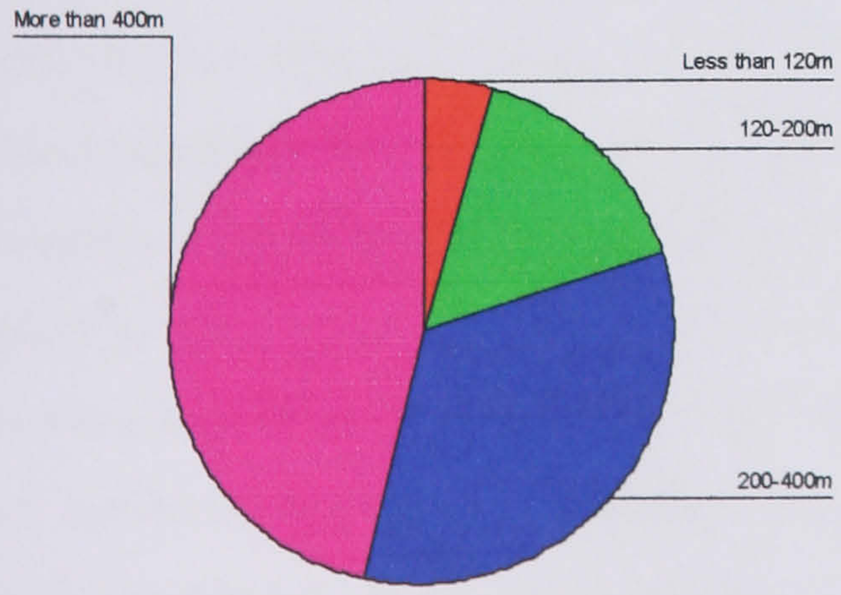
The survey carried out by the researcher (2001) revealed that most of the housing plots in the traditional village and its extension are more than 400 square metres. The area of the plot in the farmhouses village is approximately one acre (4200 m^2) for both income groups. The low-income groups have been provided with relatively small plots which fluctuate between 200m^2 and 400 m^2. The following diagrams (Tables 7.1 & 7.2) illustrate the areas of the plots in the two villages of this study. The tables show that most of the houses in the Farmhouses village (60%) are of more than 400 m^2. Observation and the interviewees confirmed the area is very large. It contains big farms around the houses. One of the inspectors assured that the size is one acre in total. The size of plots in El Sereiha village fluctuates between 120 m^2 to 1500 m^2 at maximum. Here the area is distributed between many households. Each household may get less than 60 m^2 in some cases.

How large is your current household's plot?

El Sereiha Village

Frequency & Percent Table

	Frequency	Percent
Less than 120m	9	4.5
120-200m	31	15.5
200-400m	67	33.5
More than 400m	93	46.5
Total	200	100.0



Farmhouses Village

Frequency & Percent Table

	Frequency	Percent
Less than 120m	8	8.0
120-200m	8	8.0
200-400m	24	24.0
More than 400m	60	60.0
Total	100	100.0

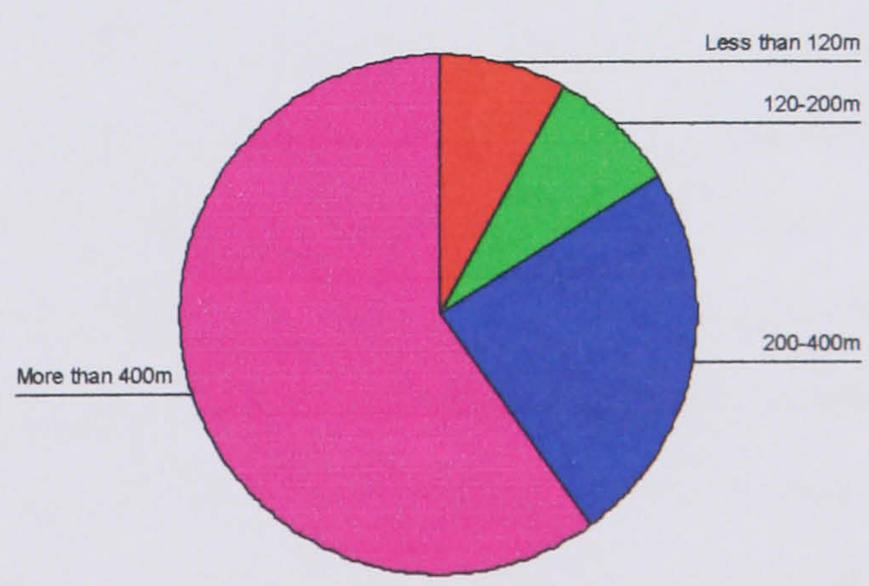


Table 7. 1: Dwelling Size and Form in the traditional village

Though the house is comparatively bigger than those in the traditional village, the built-up area is very small in relation to the plot area in the Farmhouses village. The covered area is considered as one unit in relation to the house in the traditional village that consists of scattered core-room units (see later). The following table (7.2) gives the relationship between the surveyed plot areas and floor area.

The village	El Sereiha village	Farmhouses village	Extension village
Total plot area	120 - 1000 m^2 (hosh)	4200 m^2 (standard)	500 m^2 (standard)
Total floor area	60 m^2 – 300 m^2	200 m^2 – 300 m^2	150 m^2 - 200 m^2

Table 7. 2: Housing Areas in the Space Domains

For analysis, the floor area of traditional houses surveyed was divided into four main categories: first, living area, which includes bedrooms and shaded areas; second, such common rooms as verandas and kitchens; third such basic ancillary facilities as store rooms, bathrooms and zeer (water pot) rooms (miziaras where people store drinking water); and fourth, the diwans with their attached ancillary rooms. The floor area of the Farmhouses surveyed was divided into four main categories as well: first, living area, which includes all sitting and sleeping rooms; second, such common places as entrance and verandas; and third, such basic ancillary facilities as kitchens, bathrooms, and store rooms.

The total floor area of rooms accounted for approximately 50% to 65% of the total plot area the old part in El Sereiha and its extension, but in the farmhouses' dwellings the ratio is very small compared to the large plot or the agricultural site. Diwans in El Sereiha old part accounted for 25% of the total plot area and 15% of the floor area of living rooms. In some houses about 25% of the total hosh is left empty for future extensions. Courtyards in El Sereiha village and the extension accounted for 35% to 50% of the total area, while another 15 % is used for domestic and storage areas, sometimes for animals 'zaribas' (animal yards). An animal yard is not common in the house nowadays. People keep their animals on their farms or even got rid of them. They depend on the market to get animal products. In some houses, milk animals are kept in sub-divisions formed by thin mud fences 'zaribas'. Households in El Sereiha village generally stored what was in excess of their needs in one or more storage spaces inside the "hosh". Sometimes they use a part of the "hosh" for storage. These storage spaces may be used to store agricultural equipment and produce.

The traditional village was characterised by the crowded manner of its houses due to the increase of the population (chapter four). The area for each household was a limited space. The tenants had to

extend themselves within these confined spaces as the hoshes were continuously divided between the extended family's members. The characteristics of present hoshes reflect that families have almost completed the required floor areas except for few spaces left for future development in limited dwellings. The reason for that came from an encounter that said:

> *"Each extended family got its land within the village. It extended itself within it. The extended families filled all the space required for living. The long run and continuous development and modifications are now difficult due to the increase of the households. The village is now a crowded space for families to extend within."*

The immigration phenomenon is one of the factors that affected the floor area. It confirms the house initial useable size is related to the needs of the family.

> *"Individuals with high education immigrated to Khartoum to work or settle to fulfil their ambitions as the rural areas no longer suit their social life. Thus such individuals built their houses in the urban areas."*

Another factor affecting the floor area is the financial situation of the family. For example there is no way for families of low financial status to build a diwan. Thus the relationship of the socio-economic factor with the economic facilities persists in shaping the form of the hosh although the courtyards are essential for certain domestic activities. The traditional households can only reach their floor capacity through the help of their members and their financial capacity. The next section identifies the processes of how the tenants manage to build their houses in stages of development through a process of core room production, known as 'nafeer'.

Then the climate and people's sleeping habits have a great effect on the floor area. In the hot-arid climate, especially in the Sudan, people tend to use outer spaces extensively, in particular at night. So a large percentage of uncovered area is usually left to meet such domestic activities. In most cases house rooms are used very frequently especially at night. During the day, people end to use the verandas, shaded areas and sometimes the shade of a tree.

In comparison the sleeping habits of the British dictated certain characteristics to the colonial houses in the Farmhouses village though the same condition is prevailing. The British used wire mesh covered roof terraces and wire-mesh verandas for sleeping at night and sitting during the day. Thus in both cases of study the distribution of spaces and floor area have their impact on the design of the house. Now methods of cooling and air conditioning have been introduced to the Farmhouses dwellings.

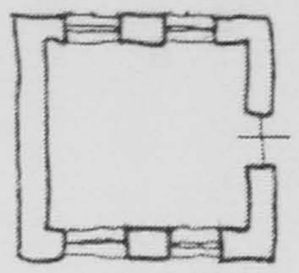
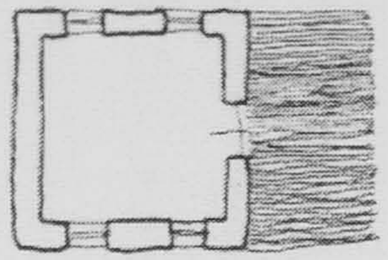
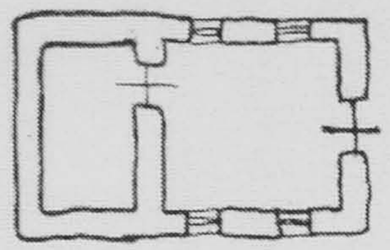
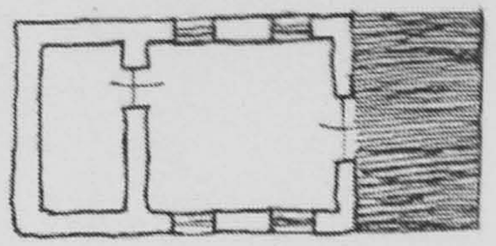
7.4.2 Core Room Units

We saw in the previous chapters that tenure has always been secure for the tenants in the vernacular traditional settlements and once the boundaries of a building site have been settled, it is customary to enclose it with a high mud or red brick wall to form a hosh. A house is then built by constructing core room units within the hosh as and when required according to the needs and financial ability of the family. The core room units were built within the hosh and then other units could be added to form the required house. This model was greatly attached to the movement of different cultures coming to the area since the beginning of the agricultural scheme. This type of dwelling development through a core unit is still practised in El Sereiha village. People, even in the new extension, built their houses in stages because of logistical reasons:

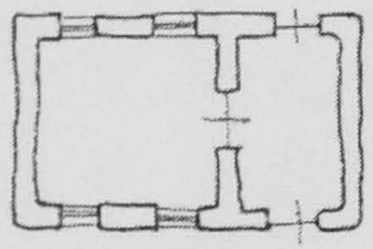
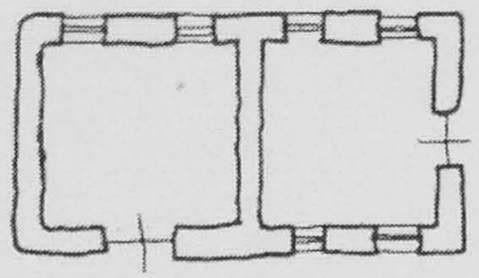
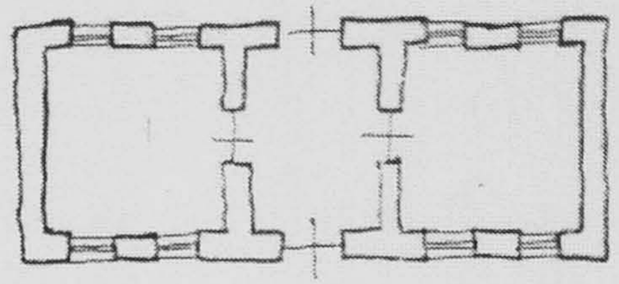
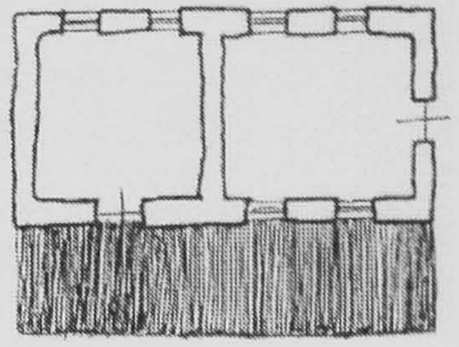
- This type matches the needs of the family. They usually build housing additions whenever the family requires more rooms to meet the growth of households or individuals. This confirms that the space and materials are dealt with in a sensitive and meaningful manner.
- Also this type enables the family to develop its dwelling according to its financial situation and ability. As the government does not help in housing provision and construction, this type of development has proved its efficiency in providing a reasonable housing quality to the inhabitants.
- Also the social cooperation reduces the cost of construction, as the people help in construction in a way known as 'nafeer', (when a family wants to build their houses they ask the villagers to join the work. They agree on the date and how to do the work; in a sense of a policy plan). It seems that the core unit system enables people joining the process of the nafeer to plan their time and to appoint persons of skills matching the type of work to be done.

Recently the type of construction has been changed to a most sophisticated process that forces the people to use other methods of construction; this will be discussed in detail in the section concerning the building materials and construction. The following schedules (Figure 7.9) illustrate the stages and type of forms that grew through time in El Sereiha village and its extension and led to the existing organic forms and had its effect on the colonial designers when they first thought of providing housing for lower rank staff. They built round rooms and tried to imitate the thatch and mud wall Guttias 'huts'. The core room units led to organic houses characterised by their simplicity and adaptation to the socio-cultural behaviour of the resident and meet their present needs. The tenants usually started construction with one of the core room units shown on the diagram (Figure 7.9 first and second examples) according to their financial ability and the number of relatives that could help. Then the houses grew as the requirements of the family increased.

First: Forms Appeared between 1923 and 1950:

			
Single Room	Single room with rakoba or kashasha	Single room with back store	Single room with store and rakoba or kashasha

Second: Forms appeared between1950 and 1970

Third: Forms appeared after 1970 in the traditional village

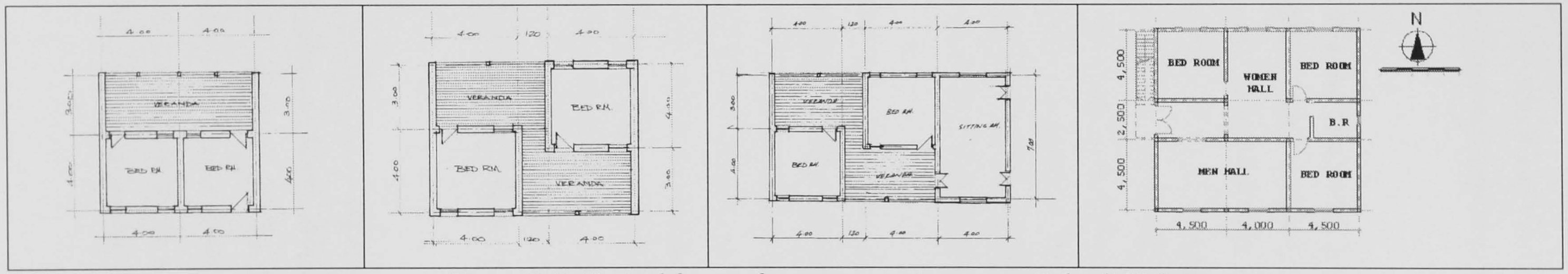


Figure 7. 9: Typical forms of core room units; source Taha (1974)

7.4.3 Development of the Traditional Organic Houses

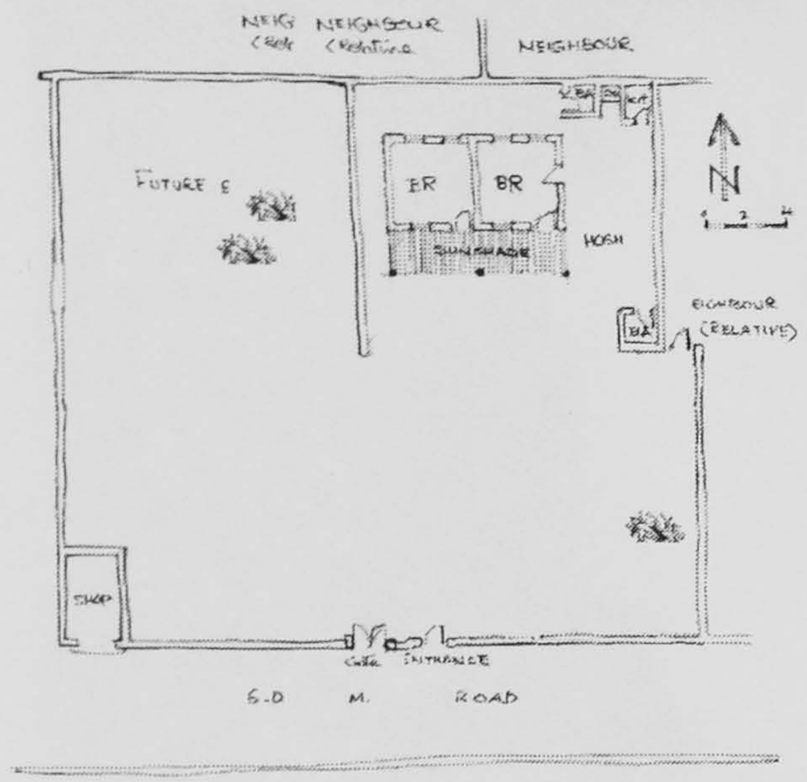
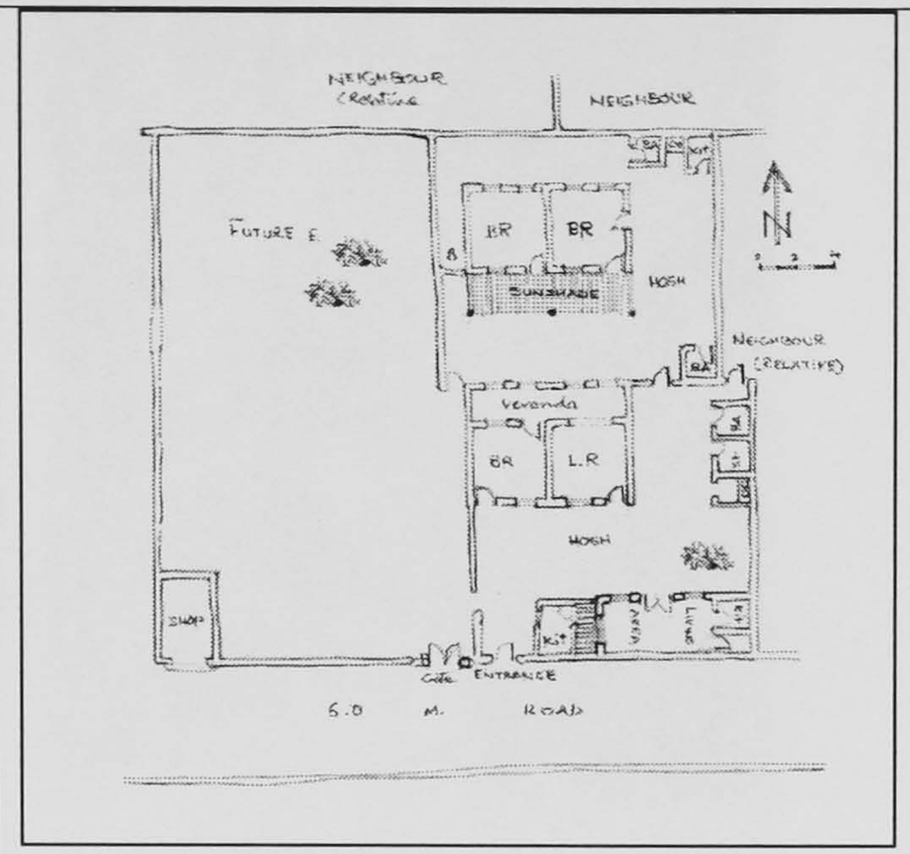
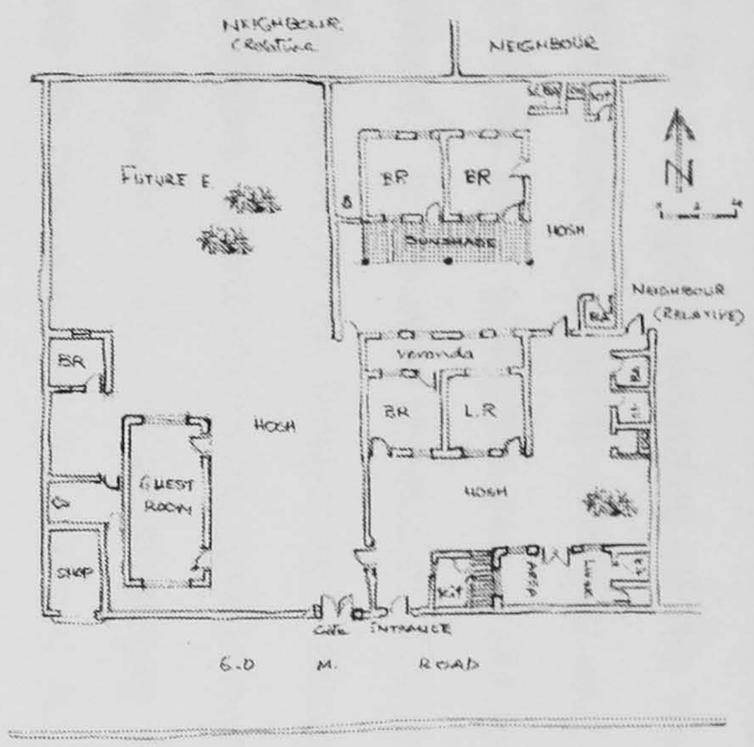
The traditional organic house usually passes through different stages of development according to the needs of the family and the financial status of the family. The space analysis of such houses revealed that the owners start their houses with a core room unit and then increase the number of rooms as the household increases.

The following diagram (Figure 7.10 A) shows different stages of development of a typical house in El Sereiha village that started with two rooms with veranda, and then added another two rooms with veranda and finally reached the stage of the diwan. An empty area of land has been left for future development. This type of development has two characteristics; first it gives time for the families to help each other in the processes of home making and second it goes with the financial situation of the family as we saw earlier the income of the family is low and depends on the farming income that is not considered a main factor of housing development but it supports it. Here the socio-cultural factors have a substantial effect in making homes through coordination and family support. Thus there is a relationship between the social, cultural, economic and space development.

After 1970 the system of planning and building regulations was introduced to control the development in the traditional village. The tenants should submit design proposals for their development within their plots. Architects, surveyors and others in the field of planning used to plan for the tenants. The ministry of housing developed certain plans for the tenants to build in stages (Figure 7.10 B). This type of development has not been very successful in the village. Observation showed very limited existence of such plans on the ground although there are many on approved papers. This means the typology introduced might not be a suitable design for the tenants, although architects tried to convey the socio-cultural understanding of the room core unit which was used extensively within the old hoshes. This also confirms that architects and planners have turned to the traditional environments for answers to modern problems.

It is true that such studies reveal the accumulation of previous generation's experience, but the experiences were the product of an entire society which had different standards, norms, values and building capabilities than designers'. The old houses almost look the same. The façades resemble each other in terms of building materials, technical skills, locations and sizes, entrances, windows, rooms and so on, yet each village has its own distinctive character. We have to ask ourselves, why are traditional villages so homogeneous? What made users and builders of an organic village follow the same conventions?

A: A traditional house at different stages of development:

	Stage One	Stage Two	Stage Three
Organic houses			

B: A hybrid house at different stages of construction: designed by élites as an alternative to the traditional house.

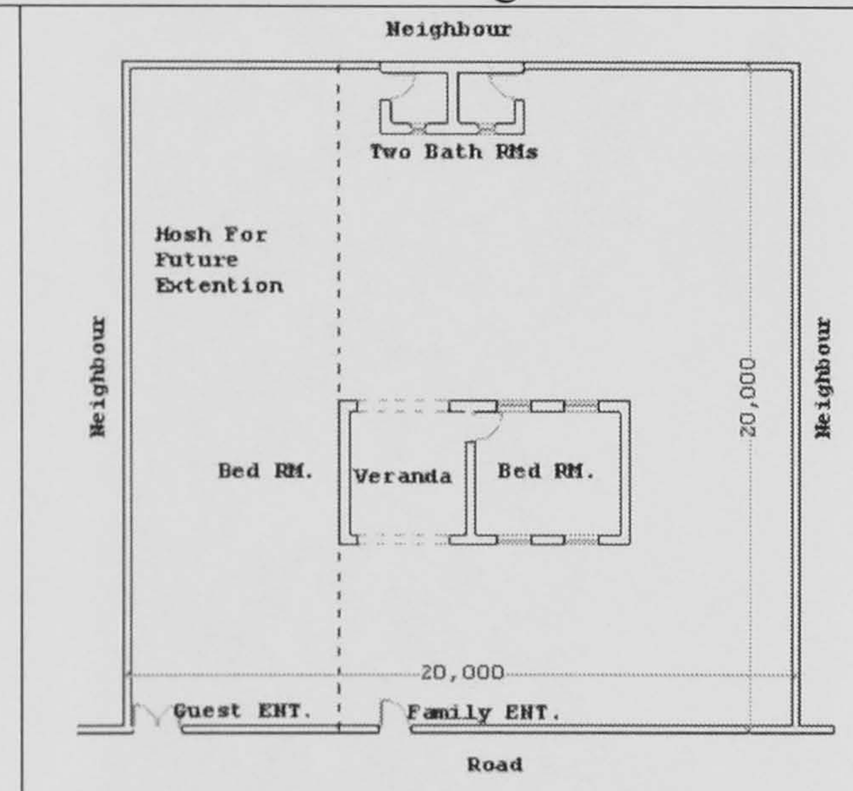
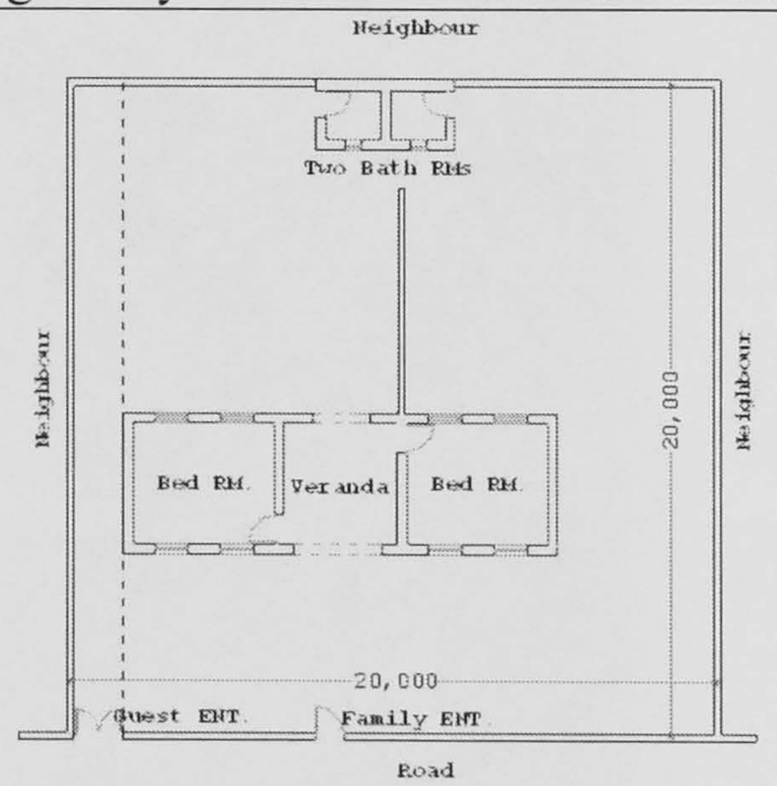
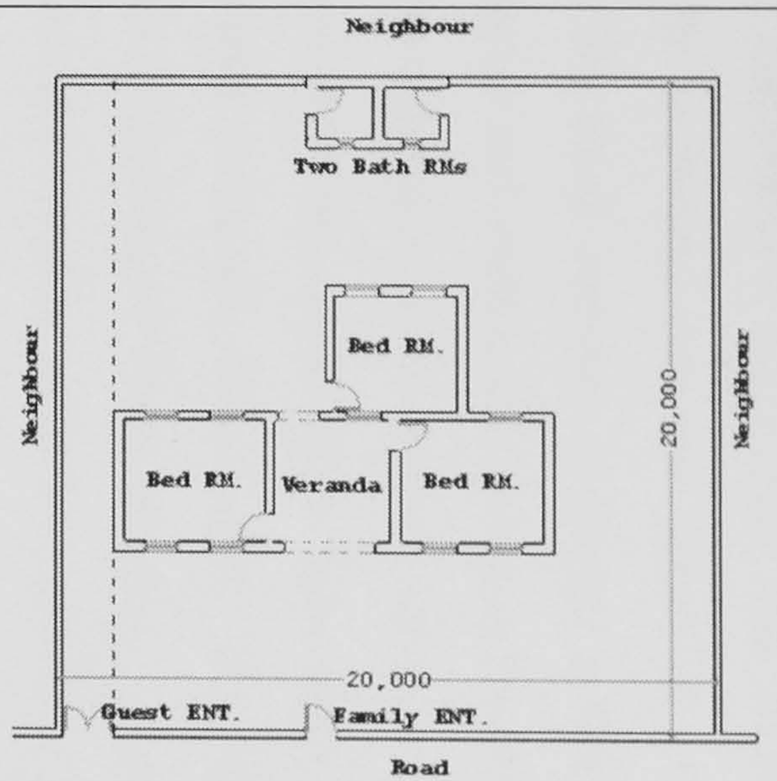
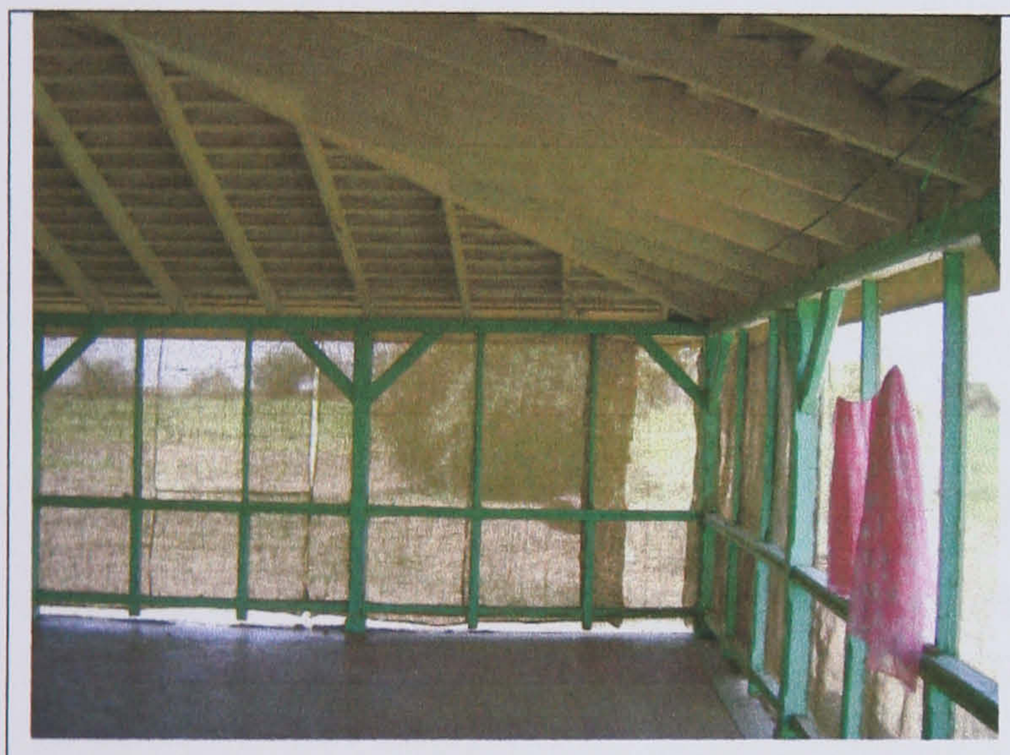
Hybrid house			

Figure 7. 10: Samples of vernacular house plans.

7.4.4 Dwelling's Entrances

When studying the different forms of dwellings it is of importance to enter them. The entrances are different in the two space domains of the study. In the traditional part and extension of the old village, usually there is a small entrance and a gate. The small entrance is always a family door leads to the family part, while the gate is the guest entrance and leads to the diwan in the traditional houses or saloon[28] in the new extension. There are other internal doors leading to other very private parts of the house or to the neighbours' houses. These doors are made either from recycled zinc materials or timber. Some times the gate is made from steel materials, reflecting the financial status of the family (Figure 7.11). The photographs reflect the uniformity of doors and blue colours. This is in contrast to the entrance to colonial houses. Here the veranda area is usually covered for protection against sun and rain, and although clearly acting as an entrance area, it is also a vital space for sitting and receiving the neighbours, especially in the afternoon. After independence (1956) the residents covered the wire-meshed verandas with fixed curtains to provide privacy (Figure 7.11).



view of an entrance through the veranda

A door from inside

A door reached through a zugag 'dead-end zugag'

A door from outside opened directly to the street.

Figure 7. 11: Views of entrances in different houses in the three contexts

[28] Both diwan and saloon are reception areas, as known to the dwellers in both contexts.

7.4.5 Family Living Areas

This part consists of many specialised spaces as we see in the arrangement for activities later in this chapter. The spaces are bedrooms for very private situations or for the family (chapter five). The traditional organic house differs in sizes and number of rooms according to the financial situation. There is the one bedroom house and sometimes there may be 4-5 bedrooms in a house. The principles of forming semi-private areas and the isolation of male guests from women of the family are always maintained, but there are limitless variations to the spatial arrangements of the hosh. In the one bedroom house people still stick to the value of privacy. In one bedroom houses and when a guest arrives quickly the room is changed to receive the guest and women take their place either in the shaded area or the kitchen place, which usually has a storage unit called 'Tukul' attached. Sub-areas of the hosh are also used as outdoor sleeping spaces for much of the year. There are places for different sexes and the location of the core unit limits these spaces dividing them into courtyards. The bedrooms are always connected to an open-to-sky courtyard either directly or through a rakoba or veranda.

The private part of a particular family home is the regulator of privacy or closeness from strangers or even from relatives. It is considered somebody's own or some sub-families own. Usually girls or a married son or daughter occupies this part. This is composed of rooms and courtyards for different activities, as will be discussed later in the section on the physical dwelling, the architectural organizations. As it is clear this system of family arrangement goes with the Islamic values of Muharam, which were discussed in chapter four. It also goes with the economic situation of the family; the home should be designed to accommodate the activities without intercepting the norms and other life requirements. People in El Sereiha rural village have different incomes, while at the same time the study shows that they arrange their way of living within their places to cope with their values and cultural heritage. From the above discussion, it seems that there three interacting factors which govern the relations of the family within the physical surrounding; cultural values, social relations and economic status of the family i.e. the family capability to afford to meet these values. Also, there is an interaction between relations of the members of the family with outside strangers, the activities of the people and place, which accommodates the values.

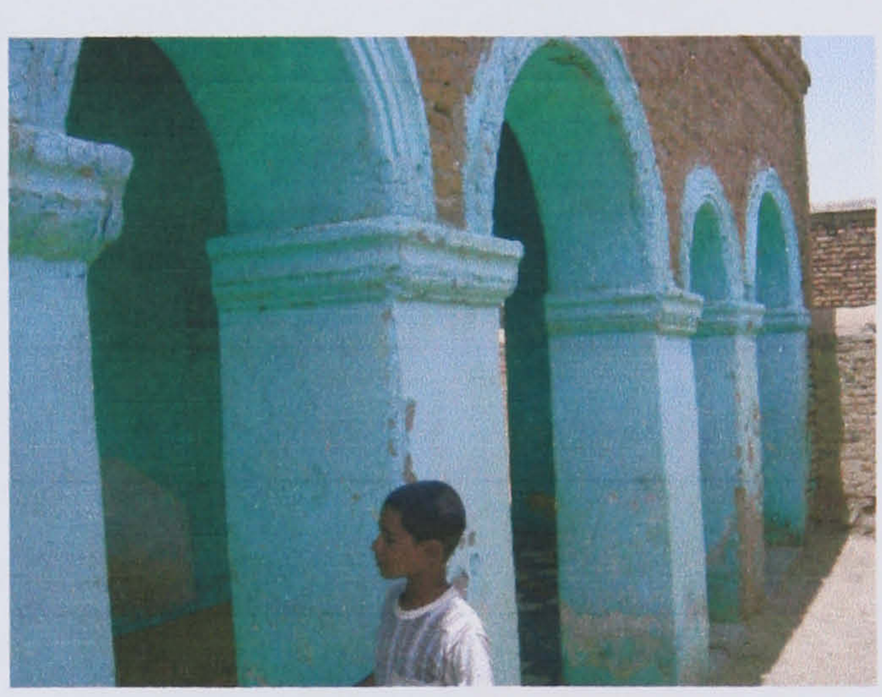
Here the regulators of privacy are the family area and the private area. The family area is the father's and mother's quarters where the members of the family have opportunities to be together; even guests from the extended family can be received here. The fact is that the study shows that the family living area is a part that composes kitchen, shaded area or small halls and rooms for the father and mother connected to the diwan and other nuclear family quarters, where sons' or daughters' families live; some times the adult girls practise their very private way of living. The primary function of the living halls and kitchen, besides the cooking facilities, is that the place

accommodates the function of joining the family together, as well as connecting the family to other people of the same extended family. This is not contradicting the values and norms because the family part carries on these functions at different periods of time and jointly receives members related to the family. This activity can be considered an activity connecting the family with the village society.

7.4.6 Diwan (Reception Area)

The Diwan forms a separate compartment with guestrooms and separate utilities, such as water jars and bathrooms. The diwans are characterized by their simple decoration using red bricks and the usage of similar arches. This means the builders were affected by the same culture at the time. Questions to the owners revealed that the technique was well known in the 1940s and 1950s when these building were constructed (Figure 7.12). Also these buildings reflect socio-economic status of the owners. It seems that the owners were the key figures of four families that constituted the society of the traditional village. Later in this chapter we will discuss the aesthetic understanding in the vernacular village in contrast with its extension and the Farmhouses village.

A diwan built in the 1940s



Another one built in the 1950s

view from outside (the diwan above)

View from inside (the diwan above)

Figure 7. 12: diwans built in 1940s and 1950s by builders for the key figures of the village.

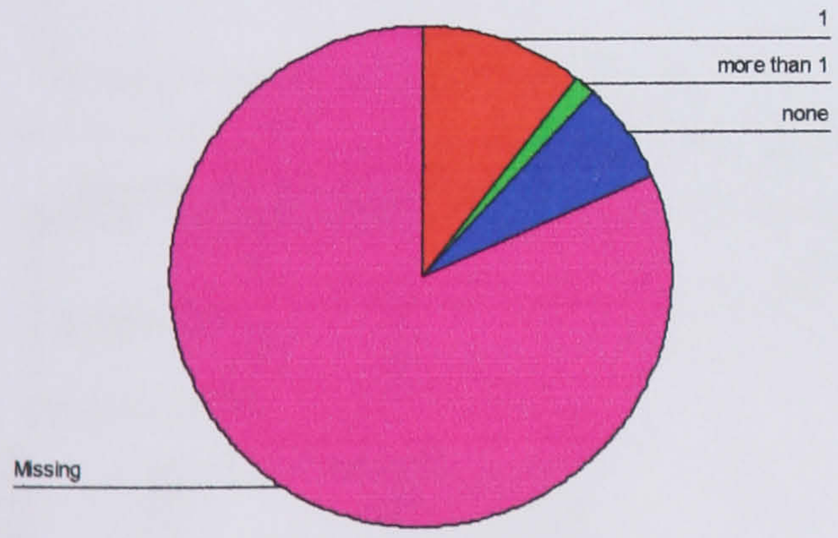
During Ramadan diwans and haras, if nearby, are changed to places of worship. People gather at sunset to have their breakfast in groups. They pray the five prayers in these diwans as well as in the mosque, and after the last prayer in the day, 'salat ala'sha', people have their dinner and then disperse. This celebration of Ramadan is known all over the Muslim world. If there is a marriage or funeral, diwans play a great part in receiving people and all the area in and out is changed and well maintained to receive guests who come to participate in the happiness or share condolences. All houses occupied by Muslims in both villages have to be ready for such events and occasions. It is important to recognise that the dwelling provides series of settings where people meet. There are of course innumerable dwellings that include a public function in addition to providing a home.

The Diwan is a phenomenon presented only in the old part of El Sereiha village while a sitting area is seen in the formal dwellings in both the colonial houses and those built by the Sudanese in the Farmhouses village or the extension. A question answered by interviewers in the traditional village reflects that most of houses surveyed have a diwan while none of houses in the other villages has any (Table 7.3).

El Sereiha Village

Frequency & Percent Table

number	Frequency	Percent
1	21	10.5
more than 1	3	1.5
none	13	6.5
Total	37	18.5
System	163	81.5
	200	100.0



Farmhouses Village

Frequency & Percent Table

number	Frequency	Percent
none	60	60.0
1	32	32.0
5	8	8.0
Total	100	100.0

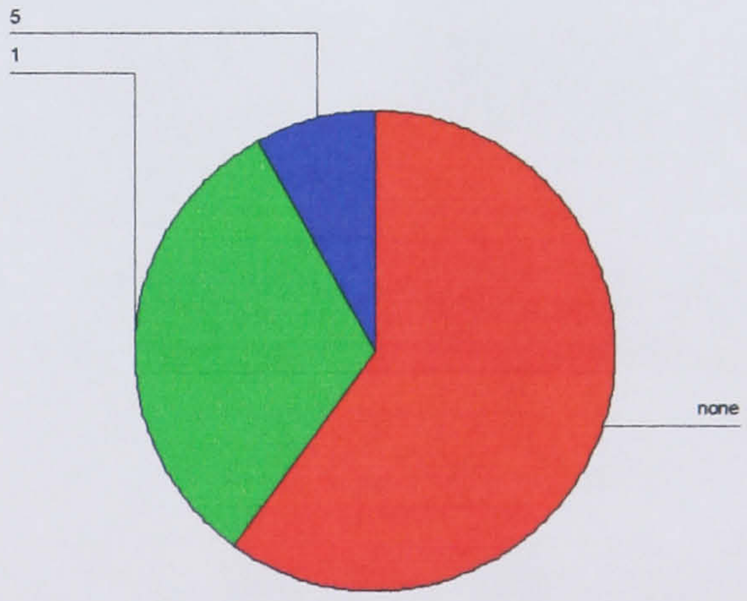
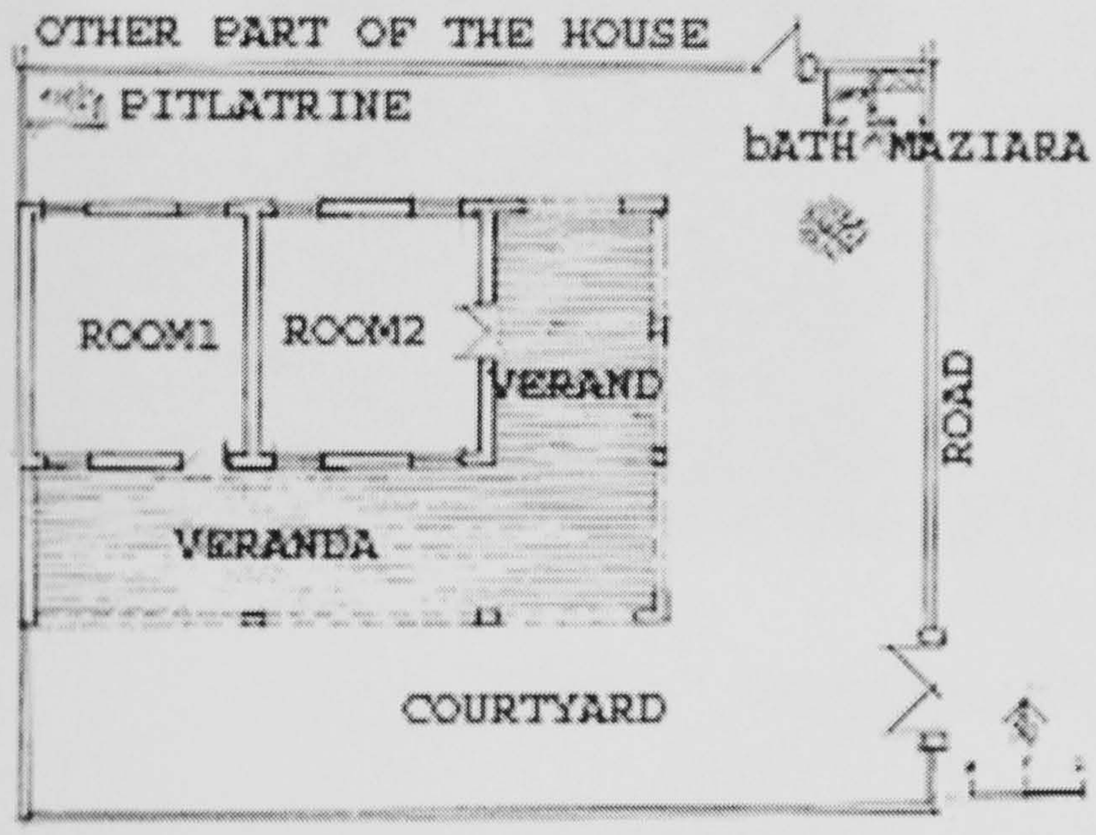


Table 7. 3: How many guestrooms do your household have?

The diwan is a place where the family opens itself to the outside world. Here the home carries the function of separating the family as a whole from the outside world. Therefore, the diwan gives the possibility to show connectedness and it gives the possibility to open itself. This a place inside the home where common guests of the family are received, and in the case of activities it is the most

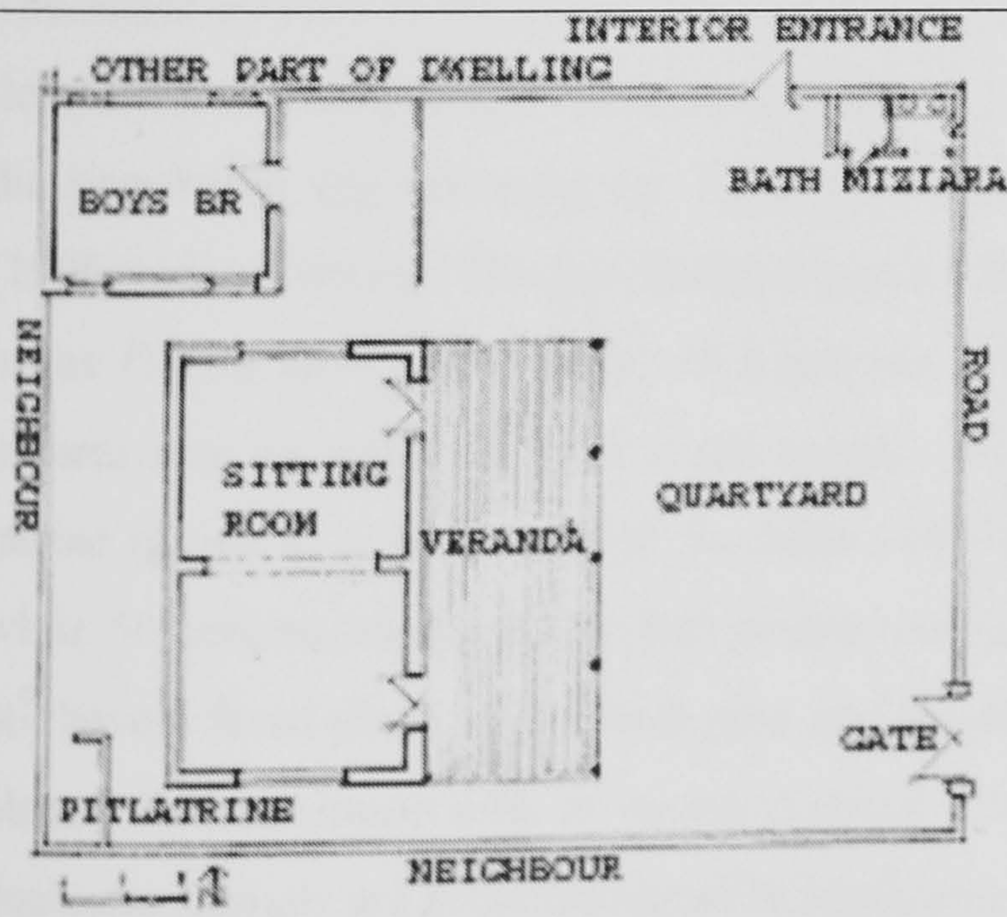
direct way to open their world to other people or strangers. It is carefully maintained to allow it to tell the history and to show off the status of the family to the strangers or guests, and it reflects the wider customs and norms that the family has held. At the same time the diwan or guest area usually expresses the specificity of the family as whole; relations trade with strangers. Here in the diwan some specific transactions of produce or even of farms usually take place. It shows the relations of the family versus the strangers. The following diagrams (Figure 7.13) show that there are two types of diwan known in the Gezira area of the Sudan as seen in El Sereiha village. The first plan usually composes two adjacent rooms with a veranda surrounding two sides of them; usually the South and East of the building. This reflect the adaptation to the climate condition; the sun inclination to the south and hot in the morning and no openings for the hot sunrays from the West to enter in the evening. The other one, which is newly introduced, is built as one place 'double-room size' with a shaded area in front only. This type has wide north-south windows. It includes a separate bedroom for guests and boys. It has also such ancillary rooms as bathrooms and miziaras. It is attached to the other parts of the house by internal doors.



This diwan model is the old traditional one composes of two rooms with veranda built in bricks supported on arches as seen in the photographs above (Figure 7.12).

The approximate room dimensions are 4.5mX4.5m and the width of the veranda is 3m the diwan is allocated in separate plot of 15mX15m.

This model still prevails as it was built from redbrick walls and jack-arches roof structure.



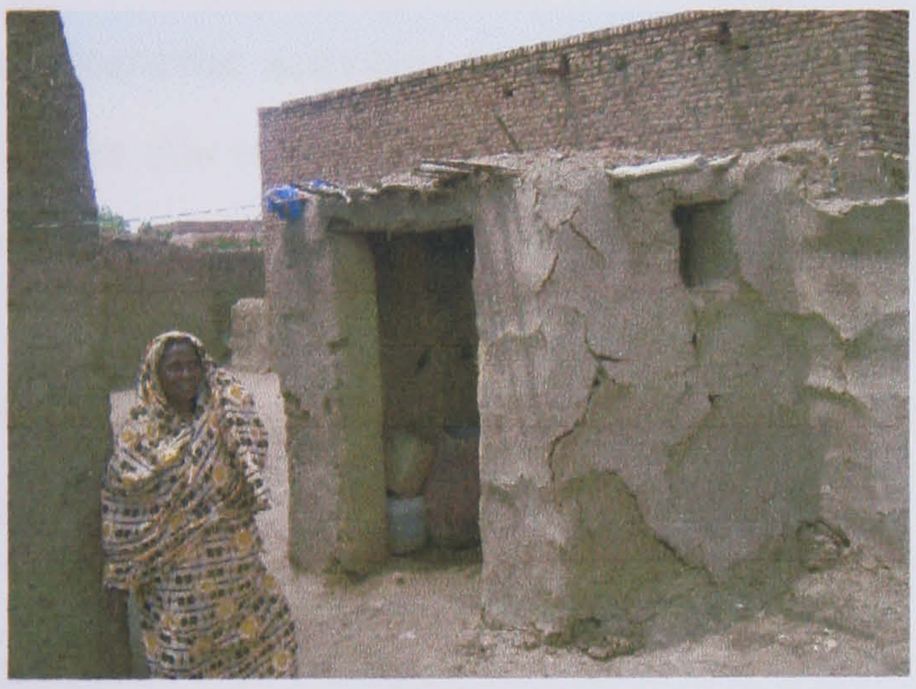
This model is introduced after planning intervention in 1970. It composes of one big room of dimensions 4.5mX7.5m approximately.

The veranda takes the shape of veranda of those colonial housing; made of wire mesh curtains and timber roof covered with insulating material, probably asphalt sheets. There is an additional room to be used by boys and sometimes the stranger guests.

Figure 7. 13: The different types of Diwan known in El Sereiha village

7.4.7 Utilities

Generally the services and domestic uses of these spaces were described by the 1995 Sudan Census. Some households have a separate kitchen room, called "Tukul", which is used mainly for storing food, utensils and fuel, and in a few cases food is prepared indoors on a permanent stove, with smoke and fumes finding their way out through holes in the wall. It is more usual for cooking to be done on braziers in the shade of the hosh wall or kashasha. The social research (2001) revealed that all domestic activities take place in the female hosh. Cooking was done outdoors, usually under the rakoba or kashasha where water storage jars, "zeers", are also kept. Nowadays cooking takes place on the veranda or a small kitchen attached to it. Sometimes a separate place for zeers is provided under a tree or in a place called 'mizyara'. The bathroom is a small place or sometimes in the back store. People used to go to near farms for w/c facilities. Nowadays a lot of changes have occurred in the structure of these houses and new models are produced and provided with a pit-latrine.



Mizyara in a small room

Mizyara under a tree

Figure 7. 14: Mizyara located in different places

The major sources of the fuel in the Gezira are charcoal and wood; the percent age of the population depending on charcoal and wood as fuel are 33 percent and 48 percent respectively. 61.8 percent of the population use kerosene for lighting, while 32.2 percent of the populations have electricity (1995 Sudan Census). The late Sudan Census (1995) reveals that 68 percent of the rural population in the Gezira have piped water, 18.2 percent of the population depend on canal water while 13.8 percent rely on wells for their water supply. Domestic sanitation is usually by means of the pit-latrine placed at a far corner of the hosh with its own screen walls. 42 percent have pit-latrines, while 50 percent have not any, but people use farms and bushes around the village. Pit-latrines do not have a fixed place in the hosh plan and people used to change it from time to time to different places. The maximum time of its use is about 15 years. It is smelly and unhygienic. Hens and other domestic animals are accommodated in some narrow space behind the latrine or other enclosed unit. In contrast the above space arrangement and family interaction was not catered for in the colonial model. The designer did not think of it when they first designed the absence of boundary walls, the

sitting area is situated in the middle of the house, and the houses are composed of shared facilities for both sexes. These houses are connected with farms and spaces for domestic use are not familiar in such houses. Most of the domestic activities take place, usually, inside the houses. All these houses were supplied with kitchens, water supply facilities and a bucket system for sanitation, which were changed into a soak-away system after independence.

I hope that the examples in this chapter demonstrate that the analysis of space is a powerful tool for the appreciation of human accomplishments in both space arrangement and social effectiveness and significance. It seems that the spatial organisation and societal behaviour have a reciprocal impact on each other. These formal and informal forms give signs, symbols of wisdom through their building materials and methods of construction.

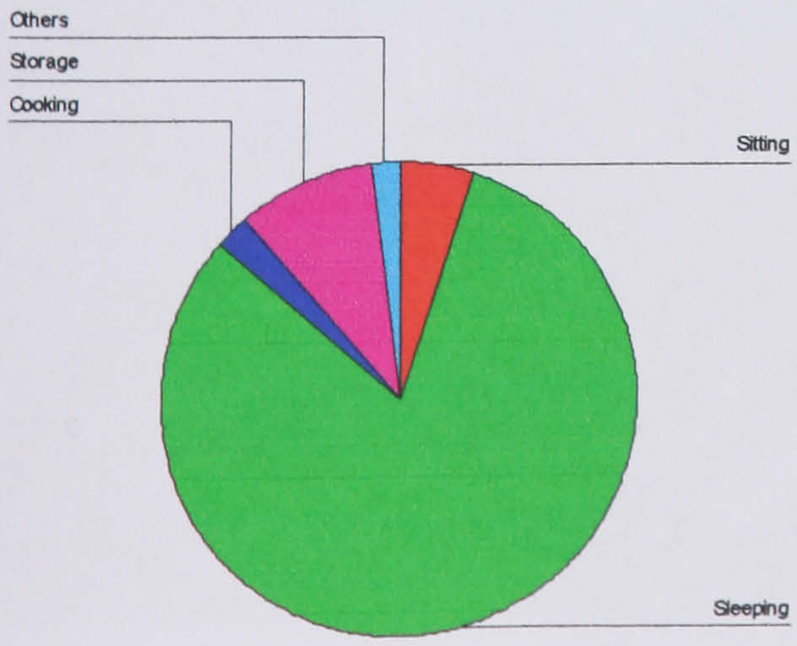
7.5 Activities in the Dwelling

The domestic activities take place in many parts of the dwelling as they will be decided in more depth in this section. The use of space depends on the activity and how people are socially attached to it. For example people use the outdoor space for sleeping extensively, while other activities take place in other areas, like cooking in a rakoba or Tukul, sitting; women sit in the shaded area, verandas or their rooms and men in the diwan. The following chart shows how these activities take place within the courtyards (Table 7.4).

El Sereiha Village

Frequency & Percent Table

	Frequency	Percent
Sitting	10	5.0
Sleeping	163	81.5
Cooking	4	2.0
Storage	19	9.5
Others	4	2.0
Total	200	100.0



Farmhouses Village

Frequency & Percent Table

	Frequency	Percent
Sitting	8	8.0
Sleeping	84	84.0
Others	8	8.0
Total	100	100.0

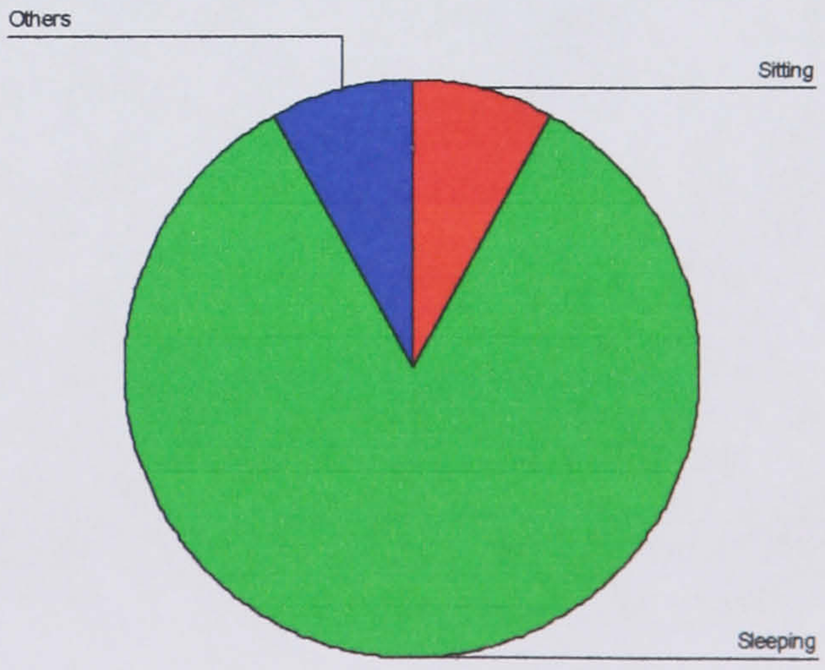
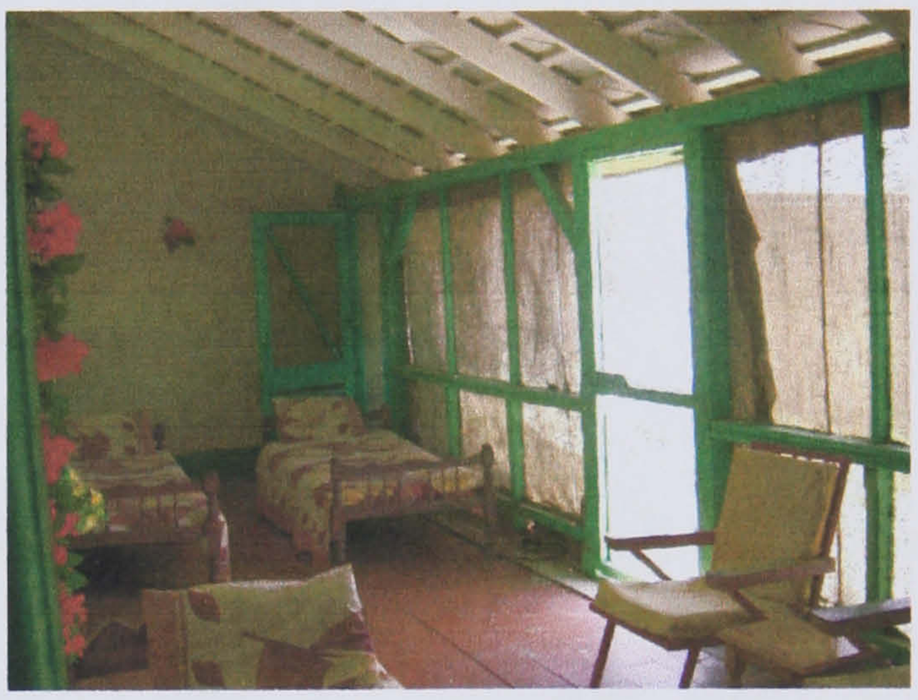


Table 7. 4: a chart shows the different activities take place within the courtyard: Source Fieldwork (2001).

7.5.1 Sleeping Habits

We have noticed that people sleep twice a day. In the afternoon, a siesta is essential for the farmers who get up early in the morning and go to work on their farms. Because the weather is very hot, they sleep in the shaded areas or verandas. Most of the people sleep outside the rooms. Although the rooms are of the national standard (4x4.5m and 3m high) and furnished in a decent way, people sleep in the courtyards. Also, here, privacy is highly secured. All doors are closed tightly and nobody is allowed to come late, especially to the private area unless there is a festival or family occasion. During the night the weather is not so bad in summer and fine in winter, so most of the people enjoy sleeping outside. In contrast, respondents in the colonial houses make use of the verandas or roof terraces for sleeping. Respondents explained that because of the huge amount of bushes and plants around houses they prefer to sleep in these areas to protect themselves from the mosquitoes and flies (Figure 7.14).

Outdoor space used for sleeping in the traditional village



Veranda used for sleeping in the Farmhouses

Ceiling fans are used for cooling verandas

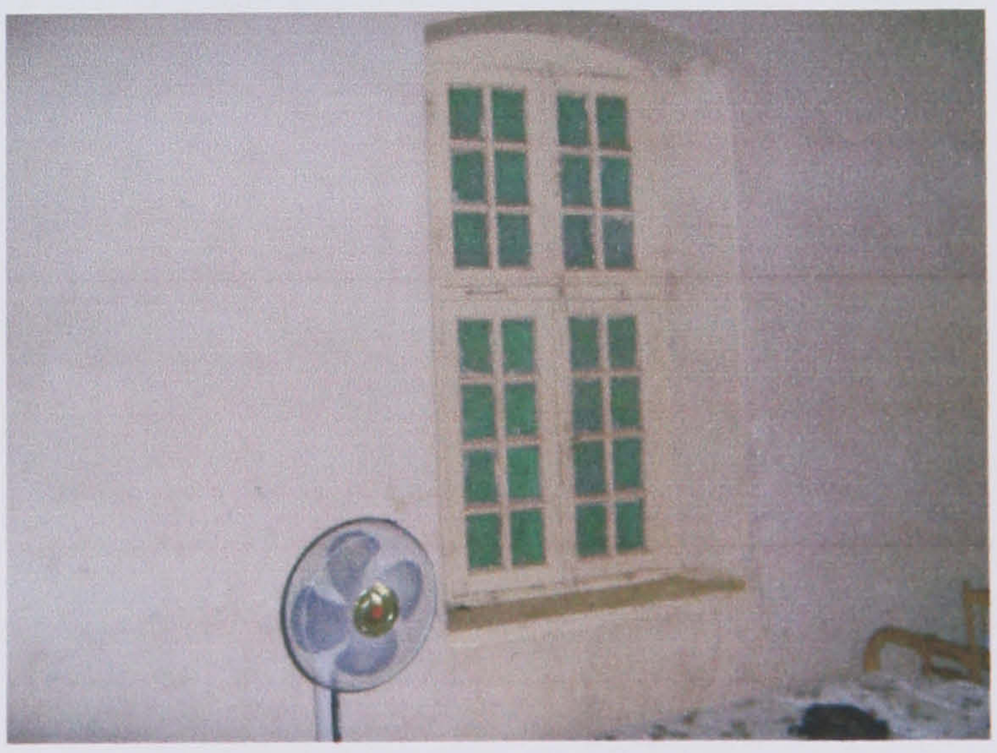


Table fans as well are used to cool verandas

Figure 7. 15: shows where people sleep in both types of houses of the study

7.5.2 Cooking Habits

Lawerence (1987) states that food activity is among the most basic of activities, which determine the form of a house and the relationships between its elements, hence a clear understanding of how, where, and by whom they are carried out can be central to introduce the interplay between domestic building form and space usage.

Internal kitchen spaces were not common in the traditional dwellings. The food preparation takes place in the open air under the shade of the rakoba or in any other shaded area. There is a separate room known as 'Tukul' used for making the local bread known as kisra, made out of dura floor (Figure 7.15). This is in contrast to a contemporary kitchen designed with the plan of the Farmhouses village's dwellings and the traditional village extension. It seems that women hardly use the kitchen in the new houses built in the traditional vernacular village and the kitchen provided is used as food utensil storage. They cook in the veranda or shaded area 'kashasha', and still make the kisra in the Tukul. We were told that in the past all cooking took place in the Tukul or in a rakoba attached to it. It seems that also the kitchens are very small in the new houses in the traditional village (2mX2m), while the kitchens in the colonial houses are relatively larger and vary between 2.5mX3.5m and 4mX7m.

Kitchens are a relatively unimportant space in the traditional dwellings. People cook on small movable stoves, using charcoal and cotton and wheat straw for energy. But now gas is familiar for most people in both settlements, and this obliged them to make a special space for cooking. Energy is one of the important factors in sustainability, (Chapter two).

Tukul with deserted steel plate for making kisra.

Small kitchen for storage only

Figure 7. 16: Views of Tukul and kitchen in the traditional village and its new houses respectively.

7.5.3 Eating Habits

Most of the traditional houses have no special dining spaces. People take their meals according to their sexes. Men take their meals in the diwan, either inside or outside. Women take their meals in the semi-private place in the veranda attached to the kitchen or in any room in this part. However, such activities have relatively low status and priority of space. People eat wherever a suitable place is provided, but the privacy of sexes must be secured.

Eating habits are always connected with the co-operation and family interaction with the community. People share celebrations and happy or sad occasions. During marriage or funeral people gather and have meals inside the rooms during the day and outside during the night. They just put out mats and sit around the meal that is arranged on a round aluminium plate (Figure 7.16). Dining tables are not familiar though in some houses they are found and used when certain guests, such as government officials, visit the dweller.

In fact meals did not take place at precise times, partly perhaps because of different timetables among family members. When food was prepared, the women, elder daughters or sisters if any, or if present, would serve the household head and other adult males. The food would be brought to where the man was already sitting, which could be almost anywhere within the dwelling or plot unless there were strangers. Then the meal would be in the diwan or the saloon in the newly introduced houses.

Guest having their dinner in a saloon

Food could be served in the sitting room

Figure 7. 17: Dinner habits and how it is served. Source fieldwork 2001

7.5.4 Other Activities

The dwelling and settlement is a stage on which a range of social interactions is played out on a daily basis. We have already discussed aspects of the internal dynamics within households and how these are accommodated within the dwelling. Other activities carried out in the houses are home-based enterprises, (See chapter five). Despite a market being available in the traditional village, there are many corner shops (Figure 7.17) exist within the village and its extension. In contrast there no corner shop was noted in the Farmhouses village and there is a two-day market. The family members work in this shop as their time permits. There is no fixed person, but any member can do the job.

A corner shop with kashasha and a mizyara

Inside the corner shop

Figure 7. 18: Illustration of shopping facilities for the villagers: corner shops.

7.6 Morphological Analysis of Housing Units

As we stated before in the previous chapters, spatial organisation of dwellings may be quite different in different cultures, periods and regions. The differences in social systems show morphological variety in dwelling layouts. Hillier, Hanson (1984) states that:

> *"The most widespread opinion about space is that the spatial organisation is a sign of the common attitudes and hierarchy of their different levels"*

In this study, morphology is meant to deal with the relations between spaces, rooms and how strong these relations are; the focussing point is the strength of relationships between separate zones within a group of spaces. These diagrams of relations between zones form the 'permeability' structure within the dwelling. The dwelling layout may hide the morphological relations and make the perception of that dwelling very difficult. Thus morphology has a clearer and abstract form of revealing the relations between spaces. As the dwellings of the study are very simple, the morphological characteristics of a plan layout are analysed with the help of a matrix system. According to their strength in relationships, all spaces are related to the connected activities of the household's members within the dwelling.

In the following pages we will relate some of the facts which emerged from the discussion on household pattern, and the kinship organisation to a number of hoshes or compounds surveyed in the Farmhouses villages as well as El Sereiha village and its extension. Two examples have been chosen from each village to illustrate various stages in the development of agnatic kinship groups and the repercussions of these developments on the layout and size of hoshes or compounds. Then we describe the physical plan of these different models in both types of settlement, informal and formal. We also explore the explicit and implicit cultural values expressed in the physical plan and how the changes in space or use of space (social cultural behaviour) affect each other. This will be clarified by analysis of spaces inside the house plan.

Thus, before investigating these space relations, it is of significance to discuss the relations of household within these dwellings and then produce the diagrams that justify the relations between different zones within a dwelling. Here we will investigate dwellings that represent different eras within both villages. First we analysed the relationships of the households who were living in the standard models of the Farmhouses at the time of the questionnaire and then we chose two different varieties of the organic dwellings in the traditional village and its extension.

7.6.1 Spaces versus Households

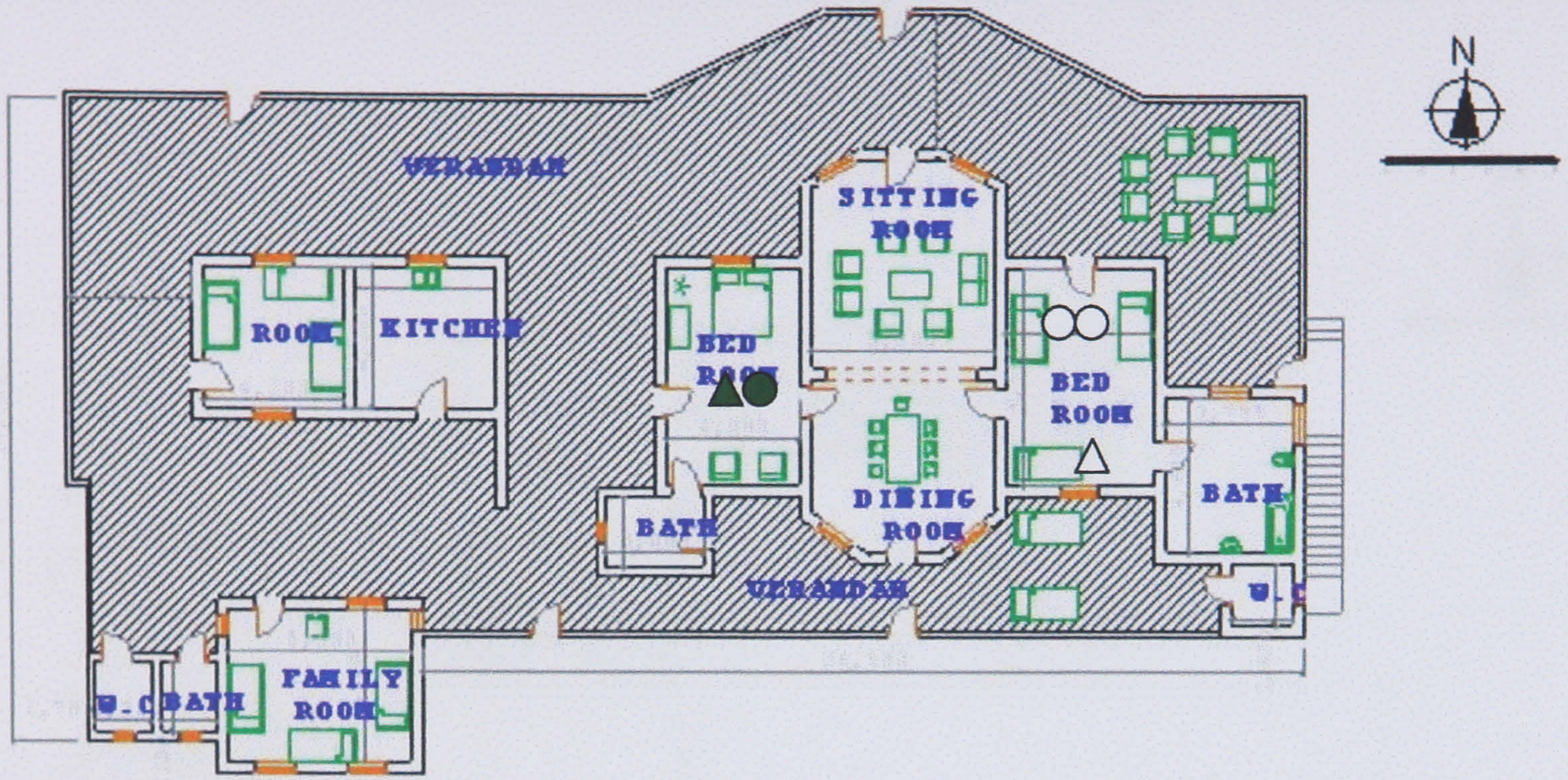
7.6.1.1 Colonial Compounds and Kinship Organisation

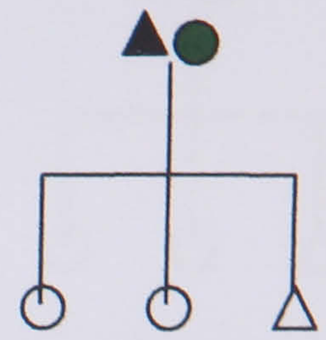
In the following pages we will relate some of the facts which emerged from the discussion on household and kinship organisation (chapter five) to two compounds surveyed in the space domains of this study. Two case studies have been chosen to illustrate various stages in the development of residential kinship groups and the repercussions of these developments on relationships of households to the size of the house. The following analysis of the layout and organisation of compounds in the Farmhouses village is necessary to the discussion on comparative analysis.

The first example is a compound situated in the Farmhouses village. The land on which the house stands was given by the government to the present tenant to live in during the time of his work in the area. The core of the house was built between 1920 and 1930 as a standard model. The family who occupied the house illustrated the households in the colonial housing. The compound head that moved to live in the colonial house, with his family, was anticipating a house relevant to his job-rank and not necessarily to his household structure. The second example shows a compound built after independence and modified to give a degree of privacy to the tenants. Only a wall was added instead of the hedges around the house. As a result of this moving situation and changes of households occupying the colonial houses, there have been no constructional changes or additions to the core house. This could be added to other reasons such as the government responsibility and ownership.

This type of nuclear household was found in almost all the colonial dwellings. Most of the compound heads have only one wife and even if they have two, only one was living in the compound (chapter five). However the strangers, who do not influence or contribute to the development of nuclear residential households in the Farmhouses village, are not considered here. Islam had, no doubt, some influence on the layout of hoshes, particularly in traditional rural areas. Polygamy and the different modes of religious marriages, in which people lay great emphasis on complete or partial seclusion of women, require a high degree of privacy which, combined with the genuine desire for security as well as building materials, techniques, and skill available to the community has produced the present day compound and several courtyards surrounded by mud walls. So the modified houses came to suit the socio-cultural organisation of the families who occupied those dwellings or houses. The following diagrams (Figures 7.19 & 7.20) show the relationships between the household and spaces in the two standard models in the colonial village.

First case study





Basic Family Unit

Key

- ○ Male
- △ Female
- ▲● Couple

Figure 7. 19: A typical first class house and its kinship diagram.

Second case study

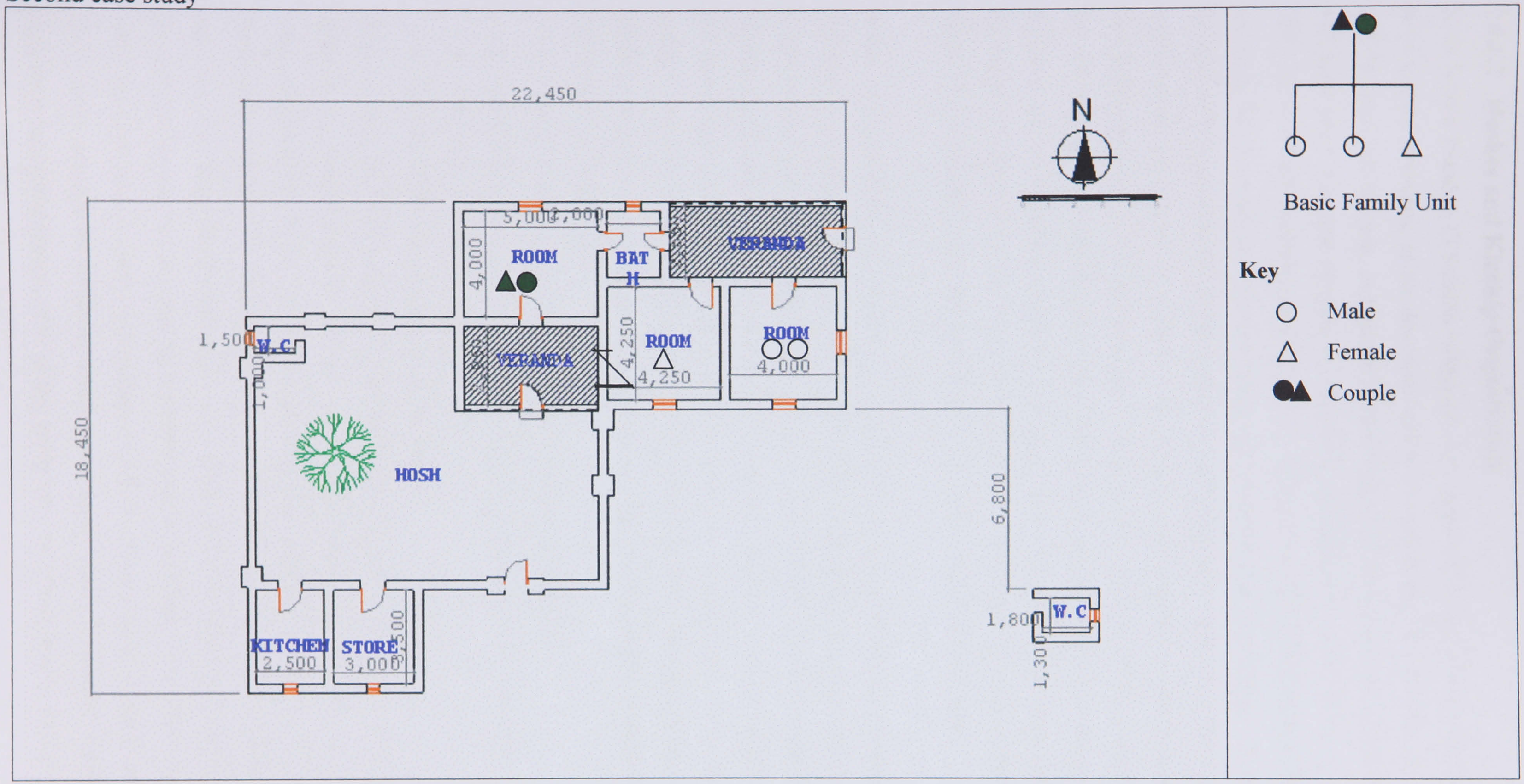


Figure 7. 20: A plan of house built after 1956 with its kinship groupings.

7.6.1.2 Hoshes and Kinship Organisation

Most hoshes found in El Sereiha village can be categorised in two groups first, a dwelling of three distinct divisions, as we described earlier in chapter five, the private, the semi-private and the semi-public parts, and second, a dwelling of only two distinct divisions, the family and guest parts. The first category was originally developed from the grouping of core room units that was built through time (Figure 7.9) while the second was produced after 1970. The model of the extension development could represent this type of dwelling. The first form can be seen in the typical house of the present-day in El Sereiha village (Figures 7.21 & 7.22). It represents an example of an organic house built to accommodate a typical family structure. The development of residential parts goes with the development of the household. Clearly; the informal house is divided into three parts, which accommodate the family's household structure and social cultural activities within the hosh. Thus there are three variables within the house arrangement interacting with each other to consolidate the way of life, the level of space (this in relation to the entrance door), household/s and social activities.

When we break down the households within these houses we find that there are more than one family members living in a house. The kinship groupings diagram following each plan shows most of the families are based on agnatic relationships. It could be established that the nuclear family consisting of a man, his wife or wives, and their own unmarried children was the first stage in a development cycle that gave rise to composite co-residential kinship groups. This nuclear family develops to form different kinds of kinship groupings, which are liable to split into two or more independent units. The most important reasons for such splits are, in order of importance:

- Social and economic success of the head of the households,
- High educational success causes the family unit to move to urban areas,
- Marriage of male descendents,
- Death of the first kinsman of the family,

In conclusion, the main differences between the households of Farmhouses village heads and those of the tenants may be outlined briefly. The most obvious difference is the higher average number of people, 8 in the households of the traditional village with 5 at most in the Farmhouses village. The different structures of the two households are perhaps even more important. The tenant head's household is usually part of a co-residential kinship group which may include his married sons and his collateral agnates and their issue. This kinship group for which the hosh head is partly responsible provides a certain amount of social stability as well as economic security for all its members. Farmhouses head's household, on the other hand, seem to be less stable groups, most of this group have no private houses for future security.

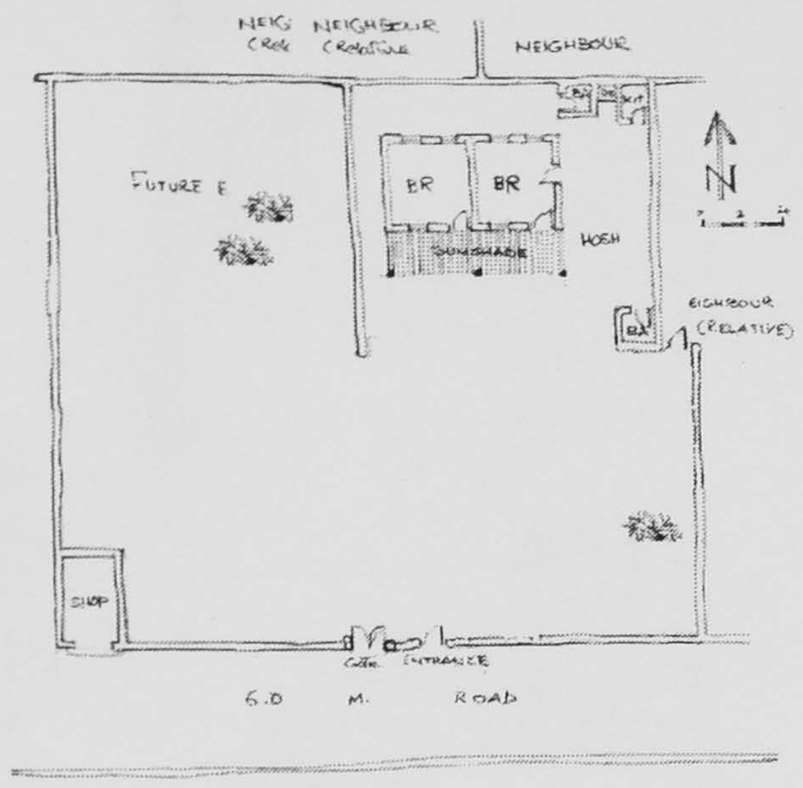
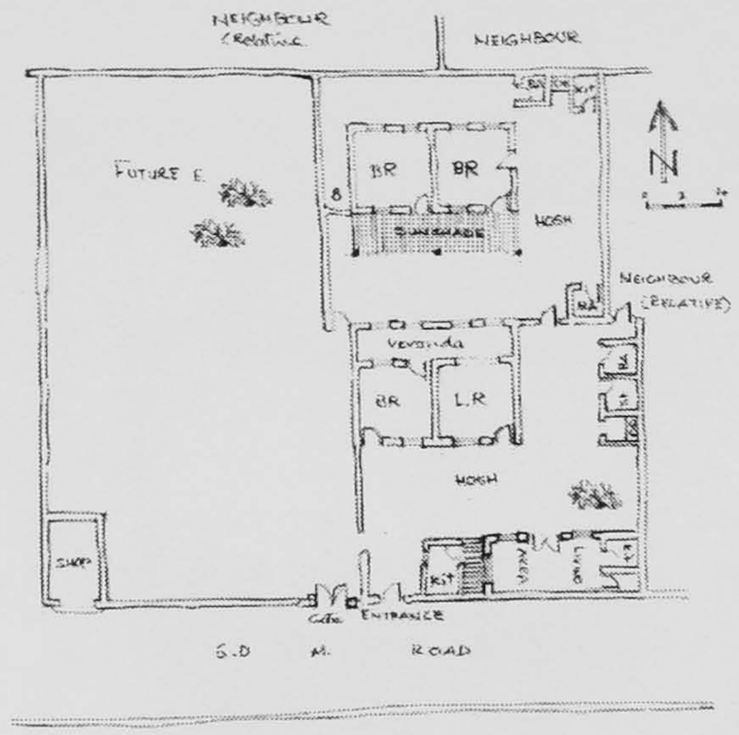
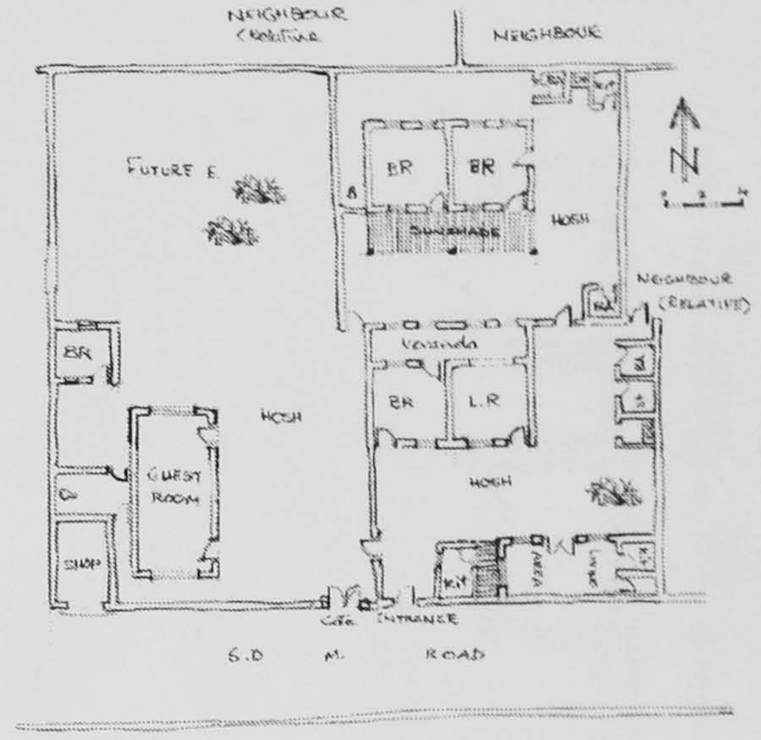
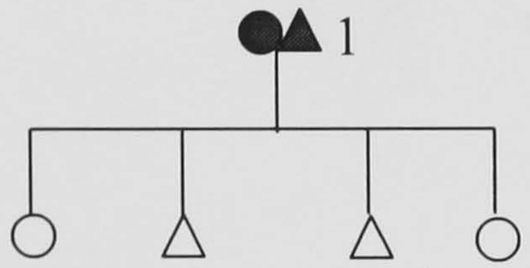
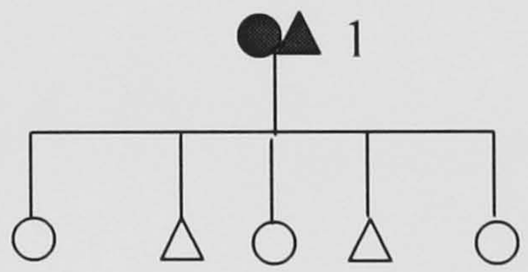
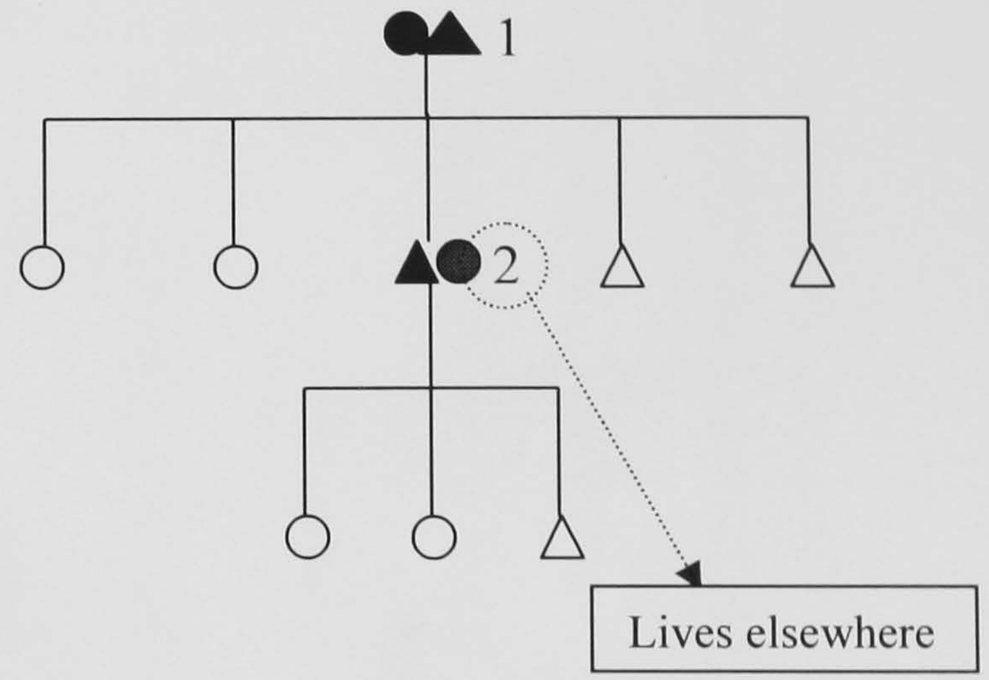
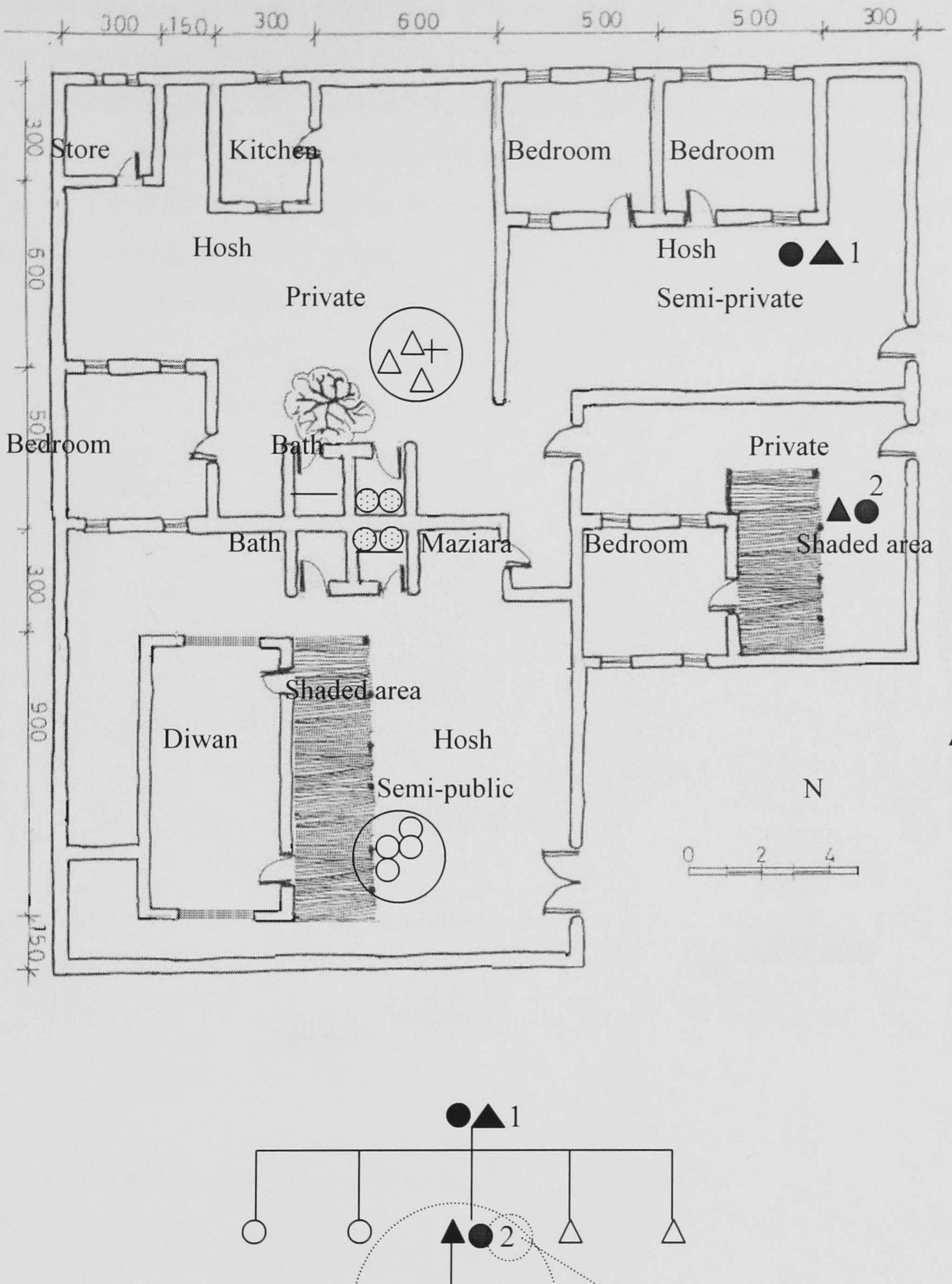
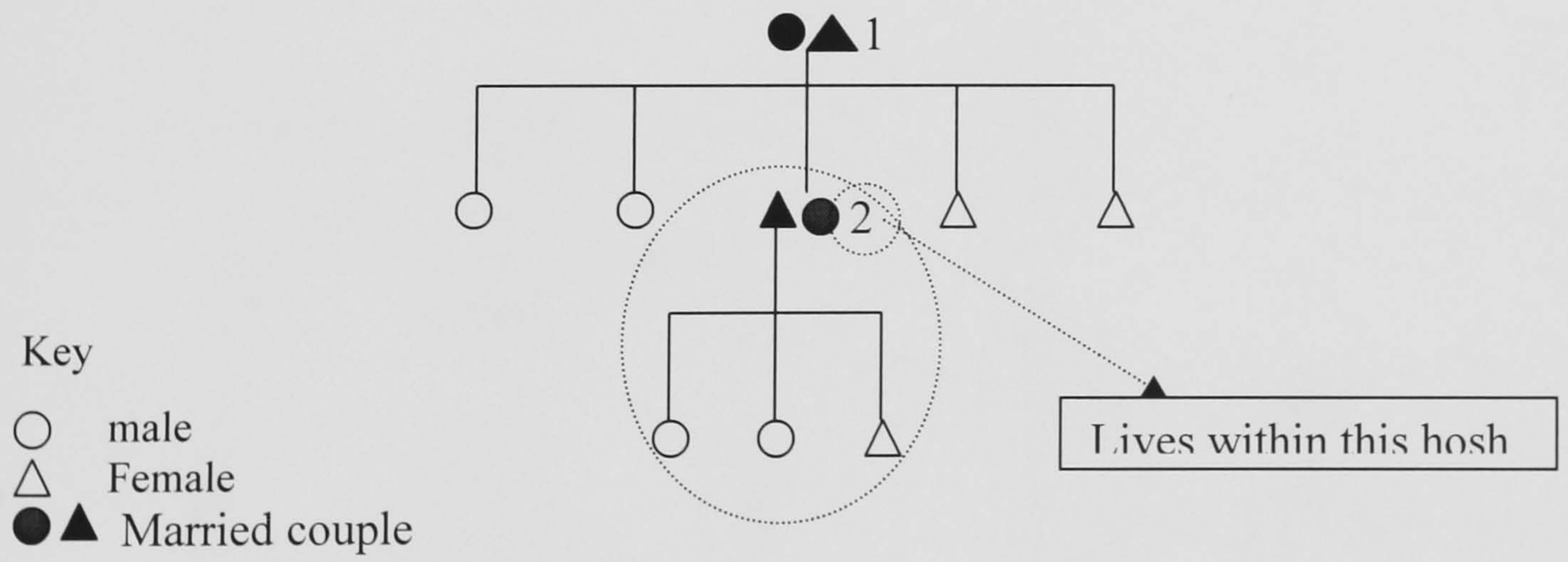
	Stage One	Stage Two	Stage Three
Organic houses			
Household Structure: Kinship grouping within the hosh			

Figure 7. 21: the development of the residential units within an organic hosh as the household develop,

Key ○ Male △ Female ●▲ Married couple





The Kinship groupings within the organic hosh

Figure 7. 22:To illustrate the kinship groupings and the relationship with the spatial organisation of the organic dwelling.

7.6.1.3 Hybrid Houses and Households

The household structure within the extension houses or hybrid dwellings showed most of the families are nuclear types. Most of those nuclear families in the new extension came from the old part of El Sereiha village. The displacement of nuclear families has relieved the compact extended families within the old part. The following diagram (Figure 7.23) shows the relationship of household structure and houses construction that was suggested by designers to convey the idea of the core room methods.

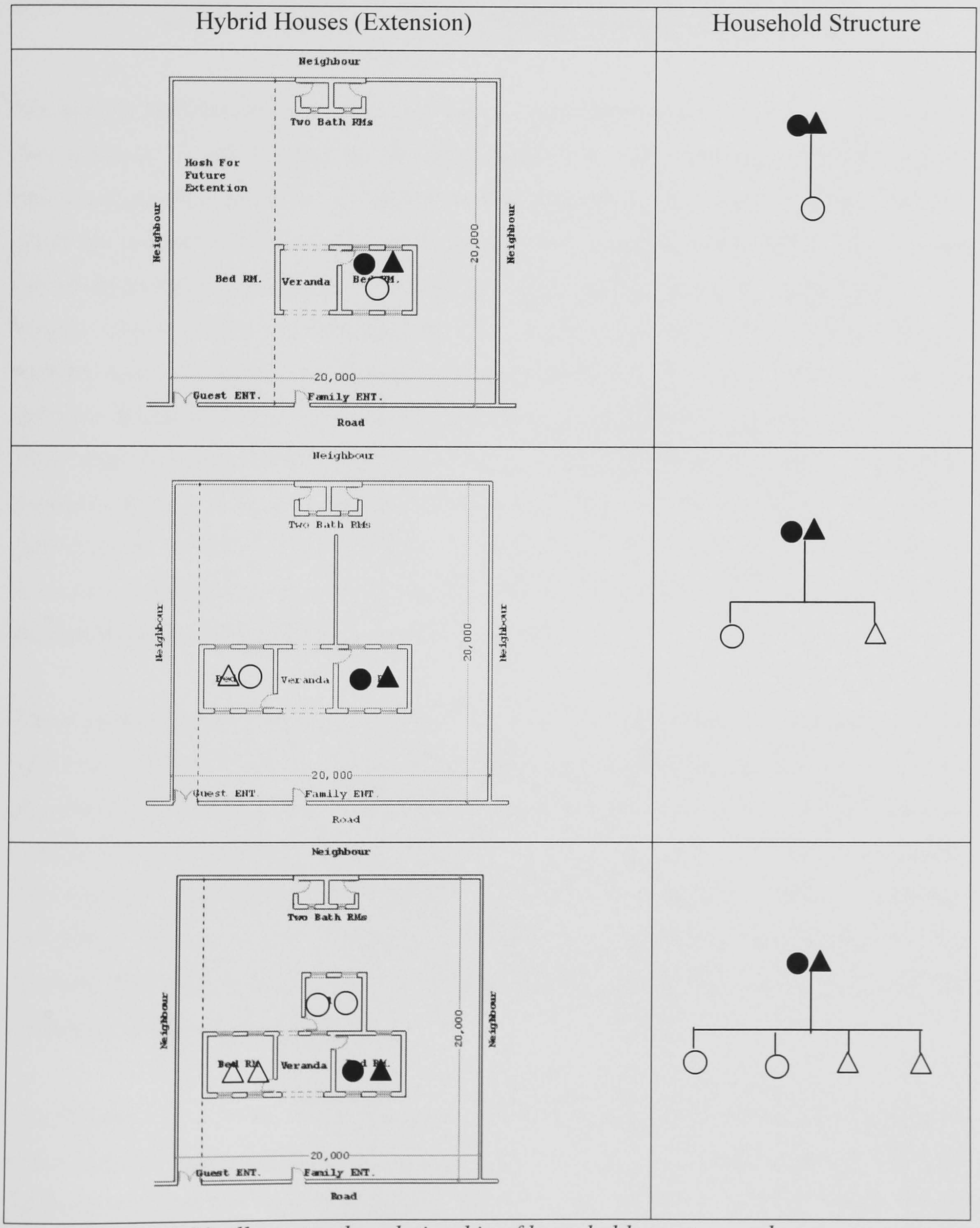


Figure 7. 23: illustrates the relationship of household structure and space: source Ministry of Housing/ Sudan.

7.6.2 Space versus Human Activities

Table (7.5) explains generally the relationship of spaces within the formal and informal dwellings. The table shows zones as identified in the socio-cultural organisation (chapter five) and the type of activities it accommodates:

Zones	**Space**	**Activities (Function)**
Zone one	Diwan guest or reception area	Reception of strangers
Zone two	Family rooms, semi-private	Family members Gathering area
Zone three	Women rooms, very private	Private section for women only

Table 7. 5: Illustrates the zones of living and relationships to activities.

The Bubble Diagram (Figures 7.24, 25 & 26) are used here to observe and level the weight of functional spaces relationship. In the diagram there is a list of design attributes (house functional spaces), and there are important indicators or symbols and sometimes colours, which are used to rank the relationship between these functional spaces. Bubble diagrams are used to define spaces, and spaces relationships. They have different sizes and shapes but they roughly match to what will be a real space in a building, and they are not specific and are without detail. Therefore, the bubble represents functional space connected with lines of different thickness to show the importance of the space relationships (Best & Valence 1999: 174). After preparing bubble diagrams, we use a zoning diagram to superimpose the bubble diagram over functional zones and sort the functional spaces by putting them in functional or activity zones in relation to the entrances. These functional zones could be based on grouping functional zones into public zones, semi-public zones, semi-private zones and private zones in relation to our analysis of dwellings in the Gezira area.

The purpose of using these diagrams is to record the changes in space organisation, which followed social and cultural changes, and explore the comparative characteristics and the phenomena of interaction impacts. In these diagrams we show bubble diagram imposing the zoning diagram to clarify the relationships between spaces and activities within these spaces. This approach also reflects the comparative nature between formal and informal dwellings and shows respectively the morphological analyses for examples of the low-rank houses, medium, high rank houses and then finally a typical example of organic houses of the traditional village and its extension.

The figures 7.24, 7.25 & 7.25 revealed certain facts that followed their history of change in shape, function and materials to be compatible with the socio-cultural behaviour with the different dwellings that have been built by different cultures. The fundamental changes can be

summarised in the addition of hoshes, addition of curtains and separate entrances and services such as bathrooms, pit-latrines or W/C.

The spatial arrangement and the space relationships in relation to activities confirmed the three zones that characterised the organic dwelling and one zone that characterised the colonial dwellings while the two zones as hybrid solutions for both communities as they were subjected to changes; the colonial community changed from the British culture to the Sudanese culture, while the organic community adapted to the space changes in the new extension. This confirms that both socio-cultural behaviour and space organisation are reciprocal and freely interacted.

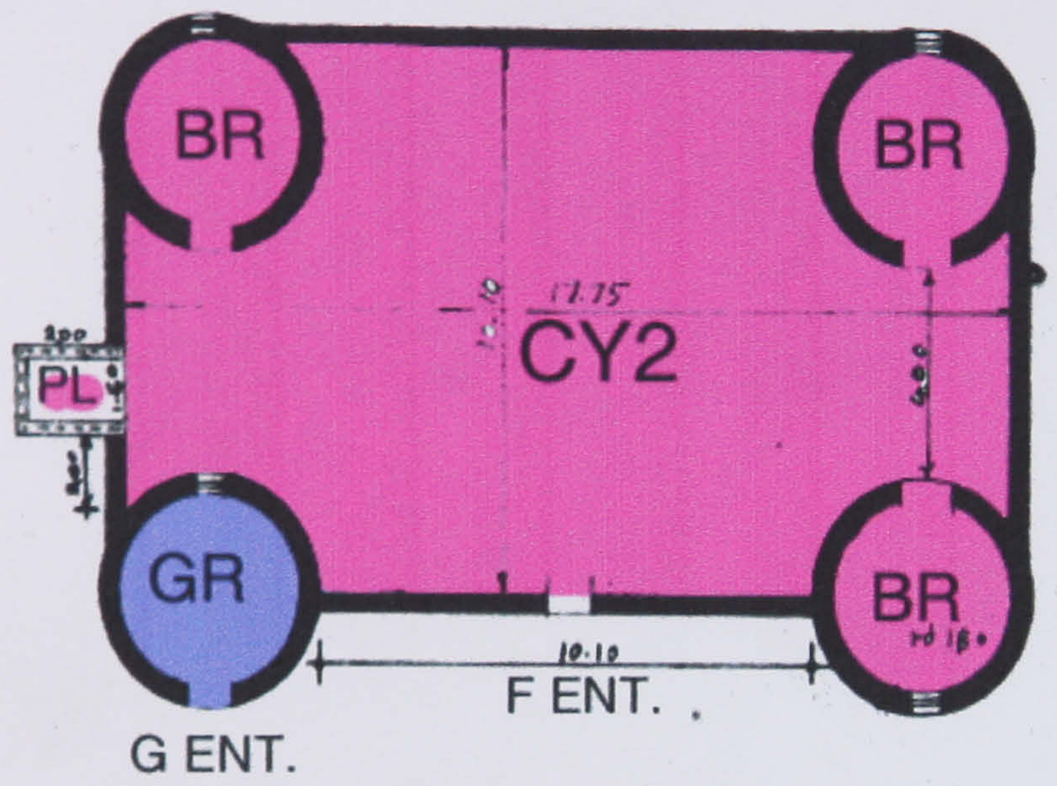
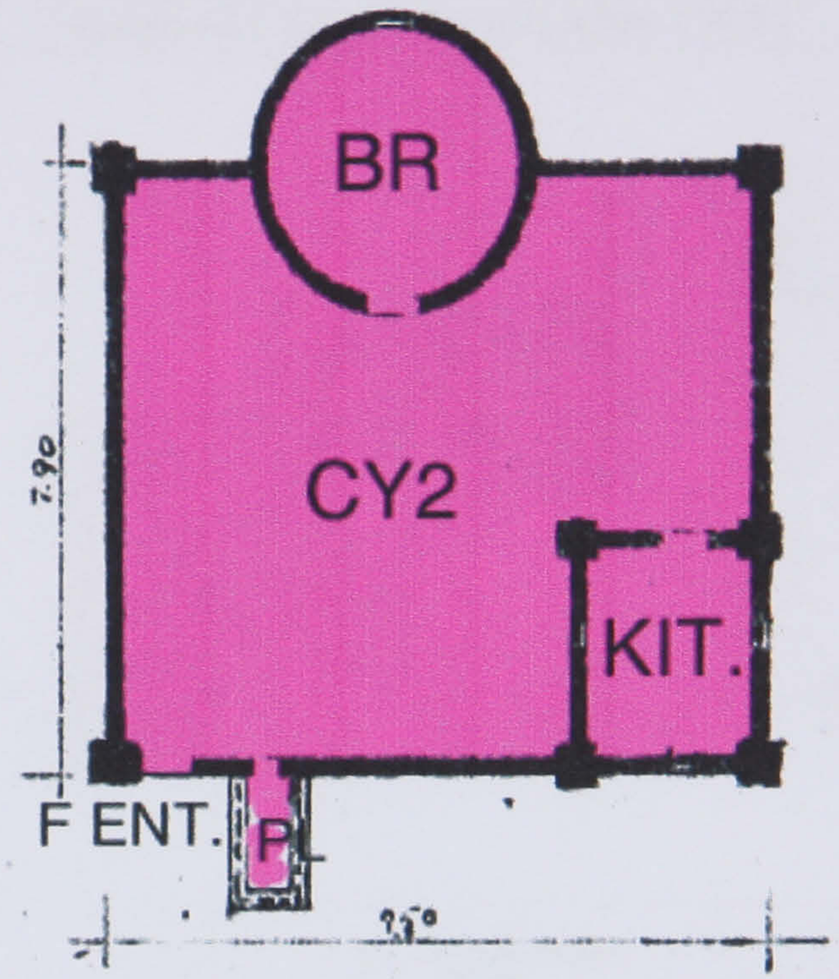
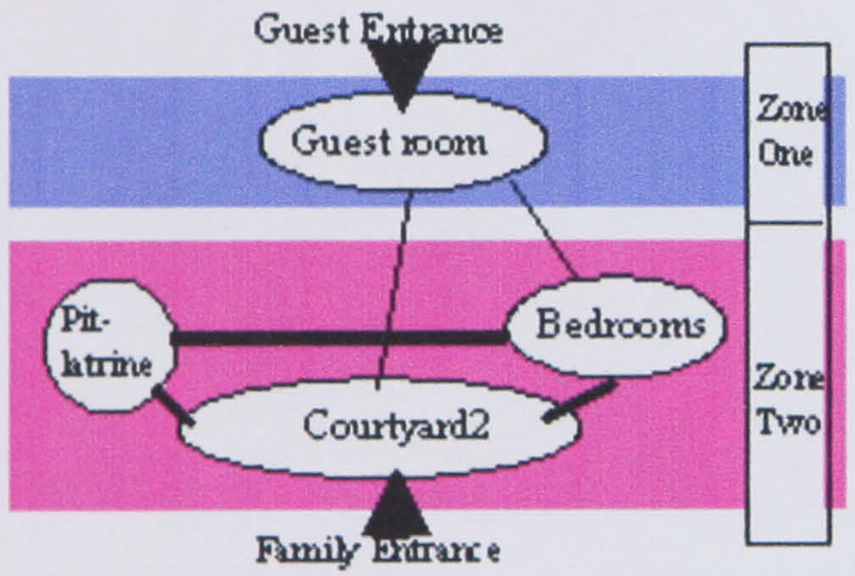
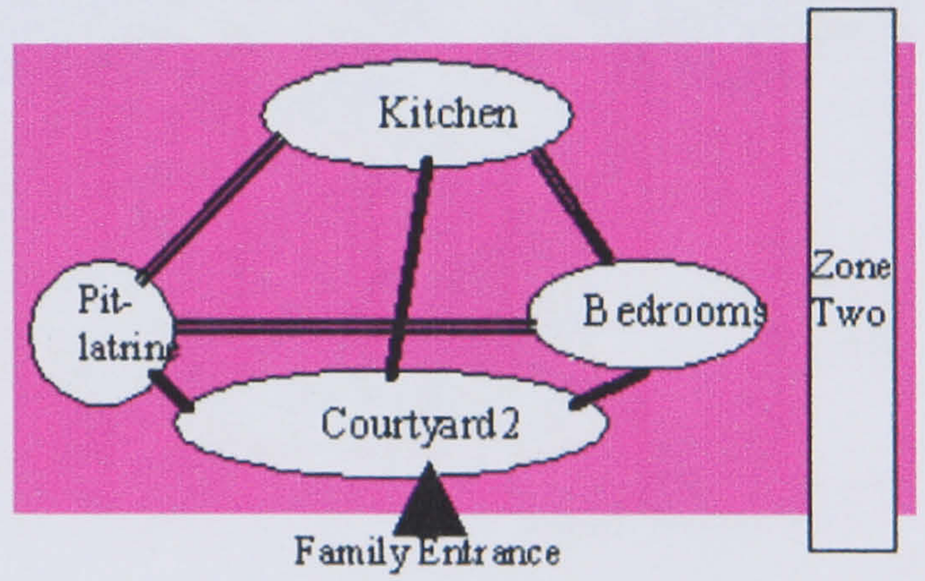
Also the figures revealed that the relations of the activities to space are highly connected to privacy, in particular the separation of women from men. The entrances, separate bathrooms and other amenities endorse this phenomenon.

The hosh entrances are again of interest. To reach the interior of the hosh one has to pass either through a guest or family entrance. These entrances lead to courtyards that are attached to the family or the diwan, and then through an internal entrance to the other parts of the house. Strangers are normally not allowed into the interior, and will meet the hosh head in the diwan.

However it is true that there are important facts in terms of hybridism in the following:

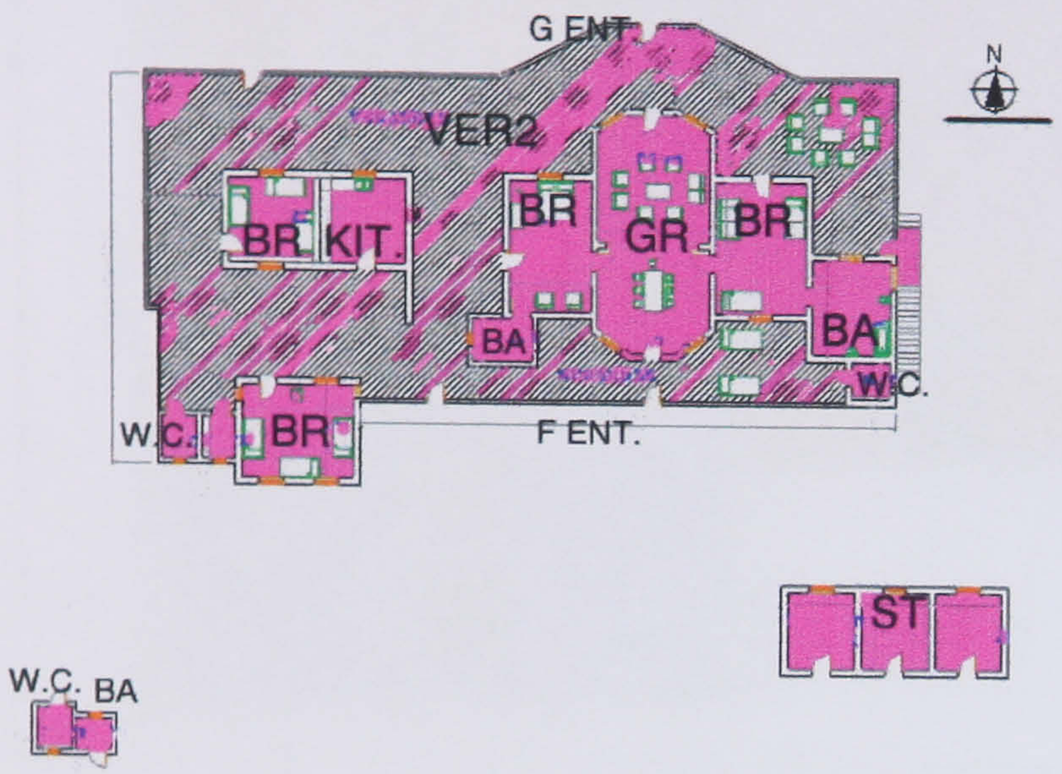
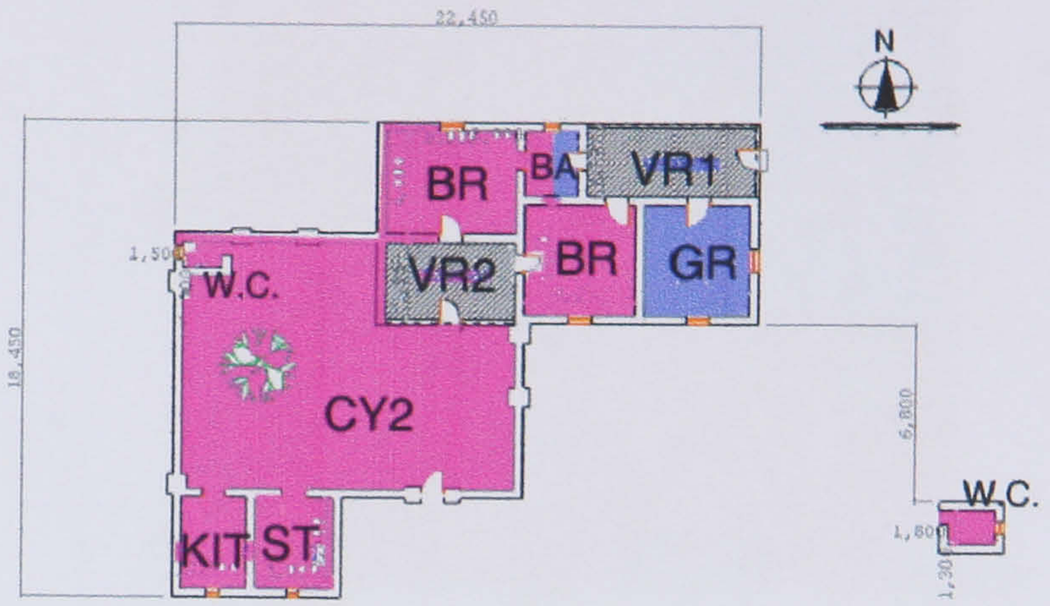
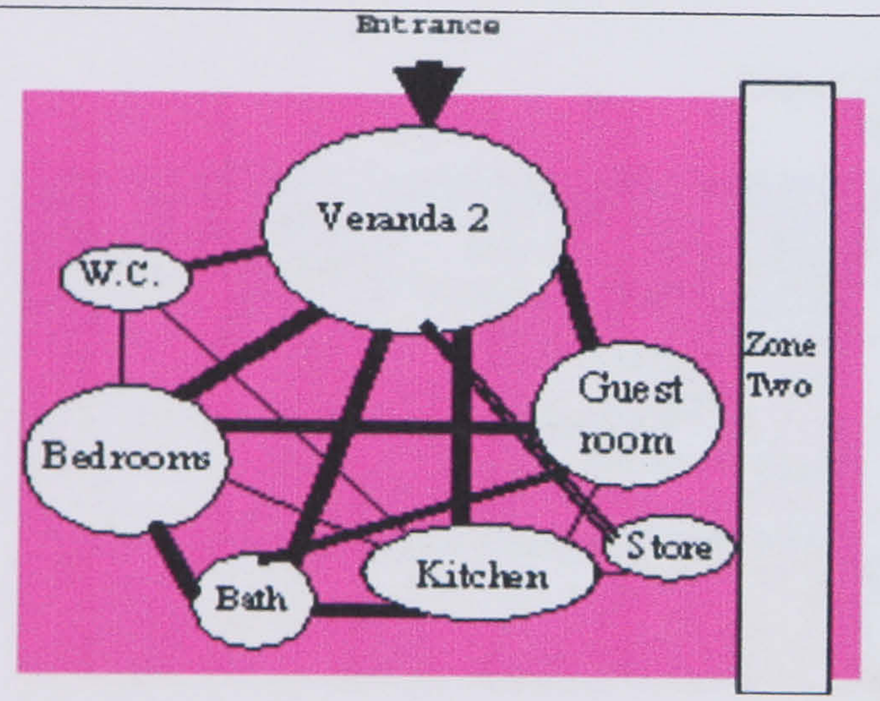
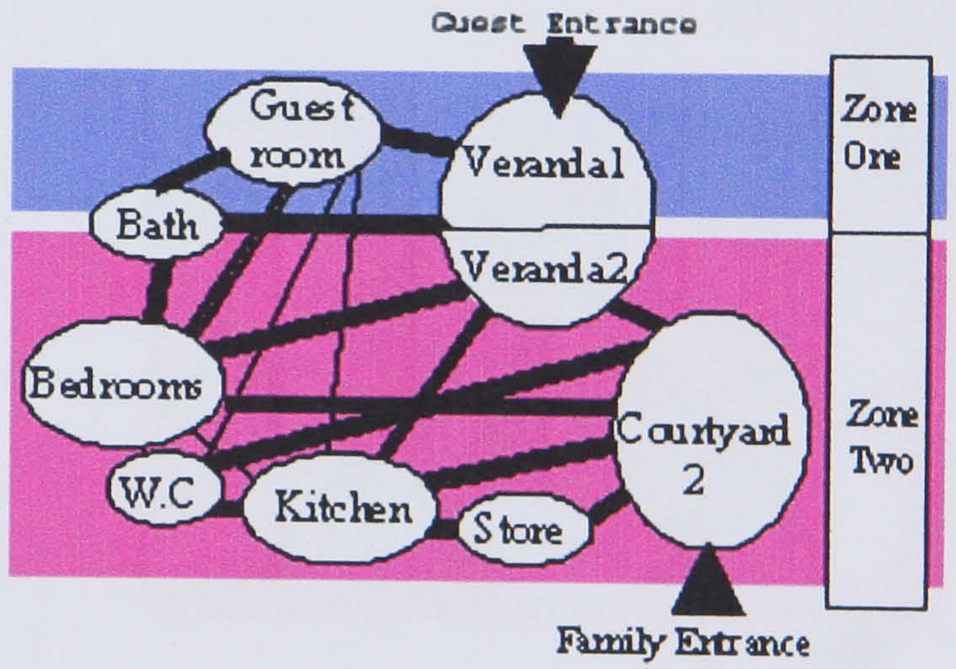
- The use of hut 'Guttia' in the colonial thinking represents the start of cultural interaction within the area. The technique showed a trial of introducing new materials for indigenous forms for dwellings of local people.
- Additions of curtains and hoshes to the colonial model confirm again the socio-cultural interaction and flexibility of houses to provide privacy for other cultures.
- The new houses introduced within the extension might reflect another dimension for hybridism in terms of using building techniques, building materials and space arrangement to follow the socio-cultural behaviour.

Thus the creation of expressive space has always been the task of designers, planners, architects and above all, in rural organic villages, it is of local builders and users. One basic aspect, however, has still been omitted. From remote times man has not only acted in space, perceived space, existed in space and thought about space, but he has also created space to express the structure of his socio-cultural background. It is true that any man who chooses a place to settle and live, is a creator of socio-cultural expressive space (Norberg-Schulz 1971)

	Colonial house for large labourers' family	Colonial house for small labourers' family	Notes
Plans			Key: • F ENT. = Family Entrance • G ENT. = Guest Entrance • BR = Bedroom • KIT. = Kitchen • BA. = Bath • PL = Pit-latrine • ST = Store • GR =Guestroom • CY2 = Semi private Courtyard
Space Relationships And Bubble Diagram			Key: Critical Desirable Not critical No-relation

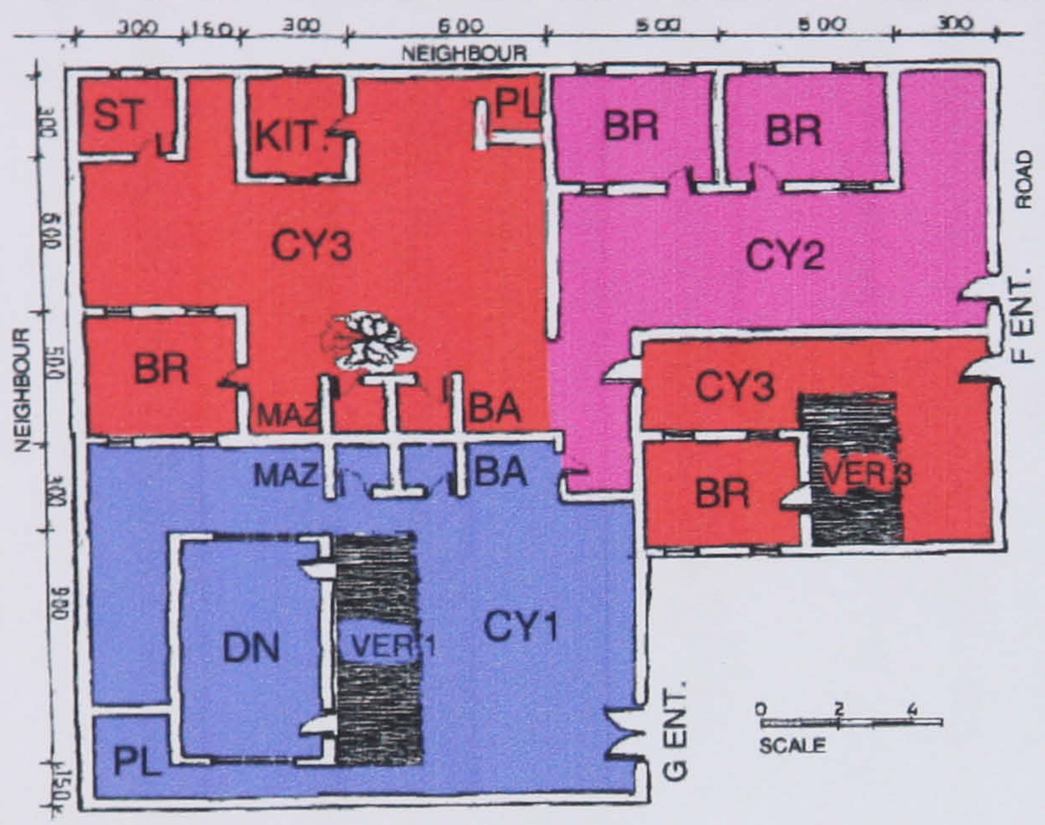
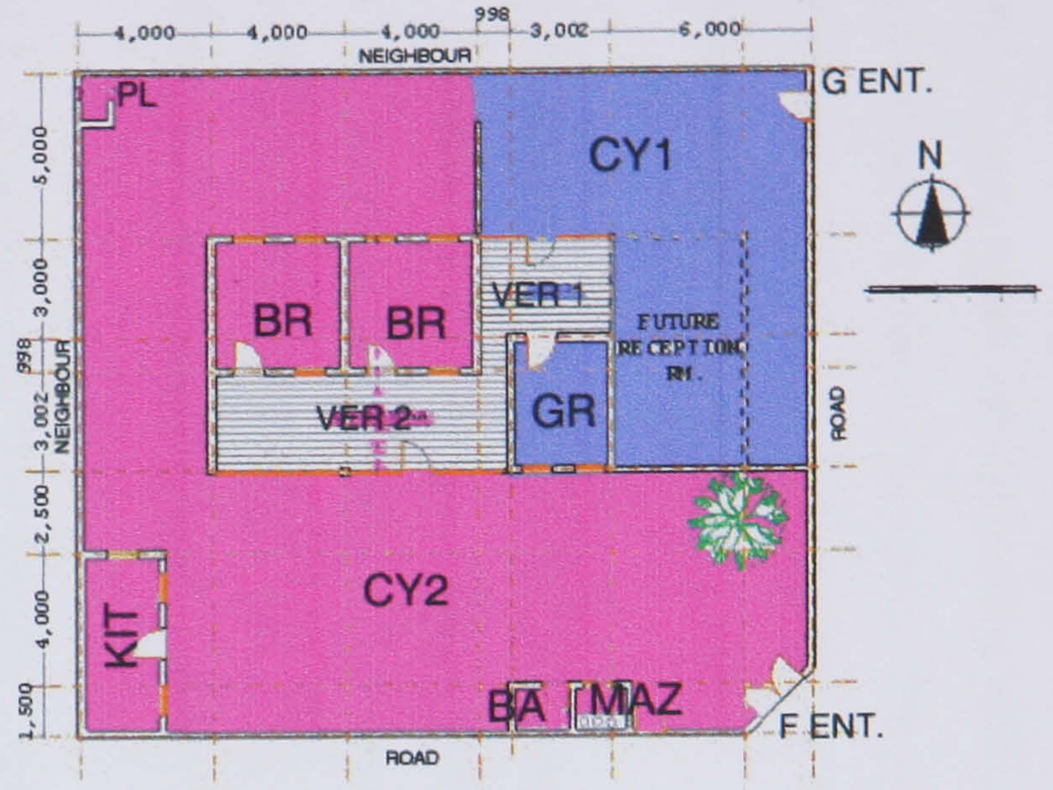
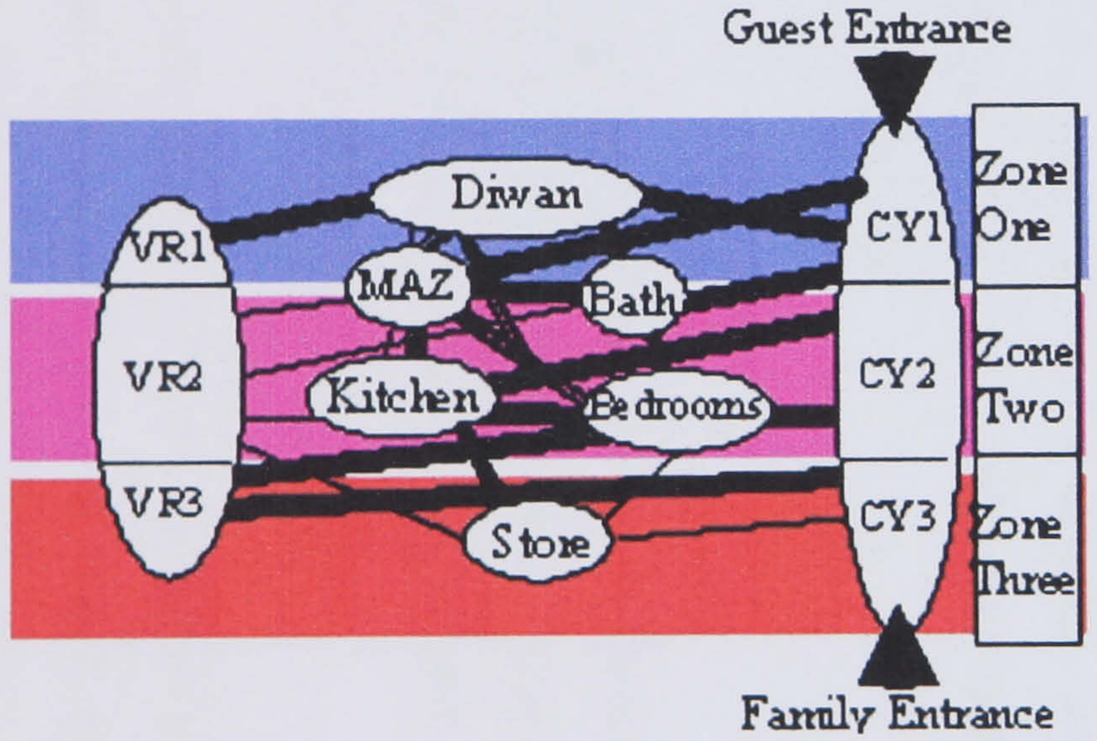
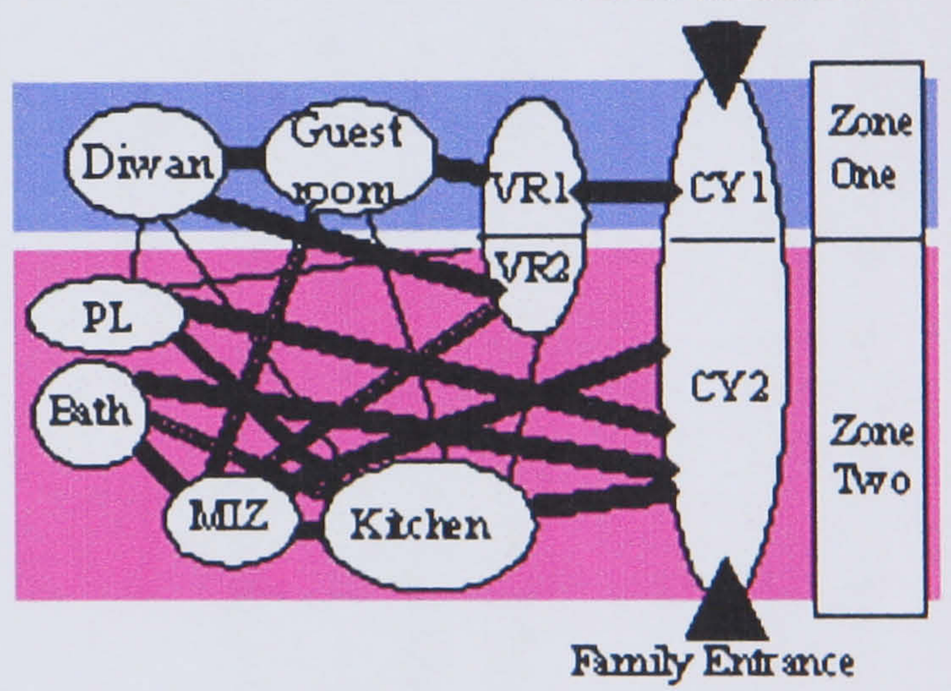
Zone one = Semi Public area Zone two = Semi private area Zone three = Private are

Figure 7. 24: An illustration of residential spatial organisation of low-rank dwellings and morphological analysis of space.

	Colonial House Model	Modified House Model (after 1956)	Notes
House Category			Key: • F ENT. = Family Entrance • G ENT. = Guest Entrance • VER.1 = Semi public Veranda or Rakoba • VER.2 = Semi private Veranda or Rakoba • BR = Bedroom • KIT. = Kitchen • BA. = Bath • W.C. = W/C • ST = Store • GR =Guestroom • CY2 = Semi private Courtyard
Space Relationships And Bubble Diagram			Key: Critical Desirable Not critical No-relation

Zone one = Semi Public area Zone two = Semi private area Zone three = Private are

Figure 7. 25: Bubble diagrams are used to define spaces, and space relationships. Two types of colonial houses were analyzed

	Traditional House Model	Hybrid House Model	Notes
House Category			Key: • F ENT. = Family Entrance • G ENT. = Guest Entrance • DN = Reception or Diwan • VER.1 = Veranda or Rakoba • VER.2 = Veranda or Rakoba • VER.3 = Veranda or Rakoba • BR = Bedroom • KIT. = Kitchen • BA. = Bath • PL = Pit-latrine • ST = Store • MAZ = Maziara • GR =Guestroom • CY1 = Semi public Courtyard • CY2 = Semi private Courtyard • CY3 = = Private Courtyard
Space Relationships And Bubble Diagram			Key: Critical Desirable Not critical No-relation

Zone one = Semi Public area Zone two = Semi private area Zone three = Private are

Figure 7. 26: An illustration of residential spatial organisation of extension dwellings and morphological analysis of space.

7.6.2.1 The Colonial Formal Compound/Kinship

In the following pages we will relate some results which emerged from the discussion on household patterns, and kinship organisation to a number of compounds surveyed in the Farmhouses villages. Two examples have been chosen from the sample to illustrate various stages in the development of kinship groups and the repercussions of these developments on the layout and size of compounds. Then we describe the physical plan of these different models in both types of settlement, informal and formal. We also explore the explicit and implicit cultural values expressed in the physical plan and how the changes in space or use of space (social cultural behaviour) affect each other. This is clarified by morphological analysis of spaces inside the house plan.

After the graph is formed, the analysis points out that the spaces in the lower rank house have only one level space (Figure 7.24). While in the medium and high rank houses the spaces show two levels of relationships (figure 7.25). In the core house the zone are 1 and 2 showing that strangers are not considered here, while in the modified house the zones 1 and 3 appeared and this shows the importance of segregating the strangers from the family.

7.6.2.2 The Organic Vernacular Compound/Kinship

In the organic house (Figure 7.26) the zones are 1, 2 and 3 showing that the three parts of socio-cultural organisation are important, while in the extension hybrid house the zones 1 and 3 appeared and this shows the importance of segregating the strangers from the family while amalgamating two zones (private and semi-private) in one zone.

7.6.2.3 New Extension's Models

Another formal form of housing has been developed in the extension of El Sereiha village where a formal planning system was introduced in 1970. The form has certain characteristics that confirm that the socio-cultural change is reciprocal to the change in space form. What are these space changes that are reflected in the new house extension?

Investigating the houses built in the extension, it was found that the percentage of the nuclear families which live in the extension was more than 85% of the total households, not like the traditional part where the percentage of the extended families was more than the nuclear families living in the same part (60%) but less than within the extension, though it was largely affected by the planning intervention. There are the interacted changes that happened to the traditional houses in the village:

- As we mentioned before the hosh system has been split into plots allotted for each nuclear family. The research revealed that people have adapted themselves to that form of dwellings although they modified some of the wide roads and many open spaces into smaller straight lanes. Instead of scattered rooms in the hoshes other grouped-room houses appeared in the extension. The known divisions of traditional hosh spaces for the segregation of the sexes is not clarified as in the vernacular dwelling, though privacy is secured by division of the plot into different parts.

- It seems that the married sons or daughters form a nuclear family immediately after marriage and move to a single house to form their own households, not like before when they lived with their parents.

- Instead of using local building materials and traditional shaded areas other imported materials and verandas were used. The regular square form of rooms of 4 m in width, as those of colonial buildings, was used.

The above-mentioned points reflect that the spatial organisation is an effective factor in modifying the activities and socio-cultural requirements. At the same time the socio-cultural activities can easily suit the development of new spaces on condition that the space can provide the basic requirements of socio-cultural values. The planners in the Ministry of Housing refer this adaptation to the methods of construction as the users or tenant's builders built the house and this was reflected in the changes to plans prepared by the Department to build in stages, as we were told during the fieldwork (2001). Observation gives another interpretation that most of the houses were built following the traditional processes of socio-cultural cooperation and processes of local builders. The society created a hybrid system in construction and home production within the new environment developed by the intervention planning processes.

7.6.2.4 Hybrid Models

The divisions of the extended families and the fall of the hosh system created new development in the area. This development has been greatly affected by the colonial housing system which was created by the British people earlier and then the Sudanese élites who followed the same westernised styles on two levels of development; the settlement and dwelling. Chapter six revealed how the hybrid planning system emerged and how the tenants adapted the phenomenon.

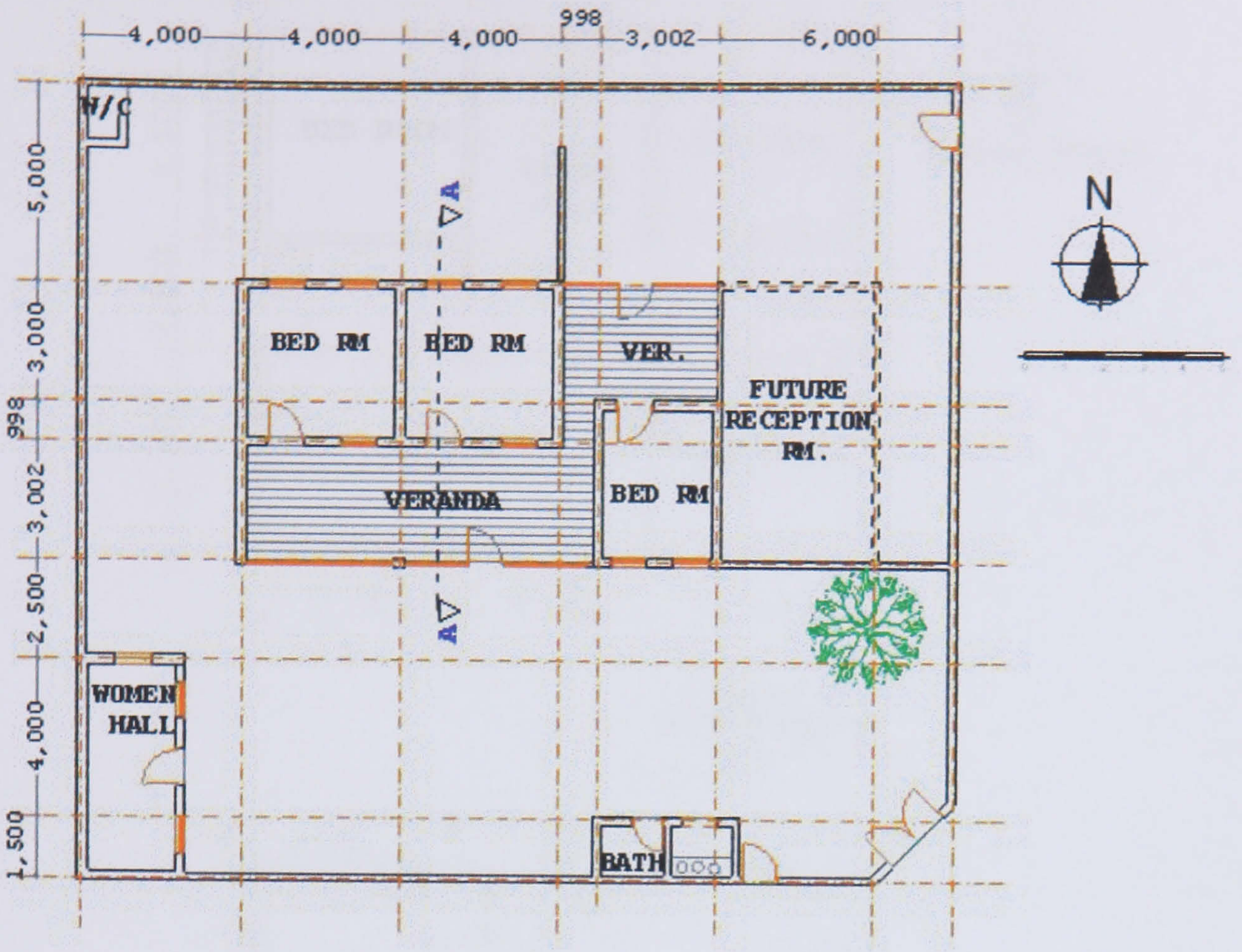
The dwelling hybrid model has gained a most important characteristic from this mixture of housing development; the methods of construction originated by both the traditional way of thinking such as the culture of cooperation that was built within the extended family and building materials used in the Farmhouses village. The following designs and sketches may reveal the changes in plans, forms and building materials (Figures 7.27 & 7.28). The form has reduced the verandas and shaded areas and introduced the central hall system which is well known in the urban Sudan these days.

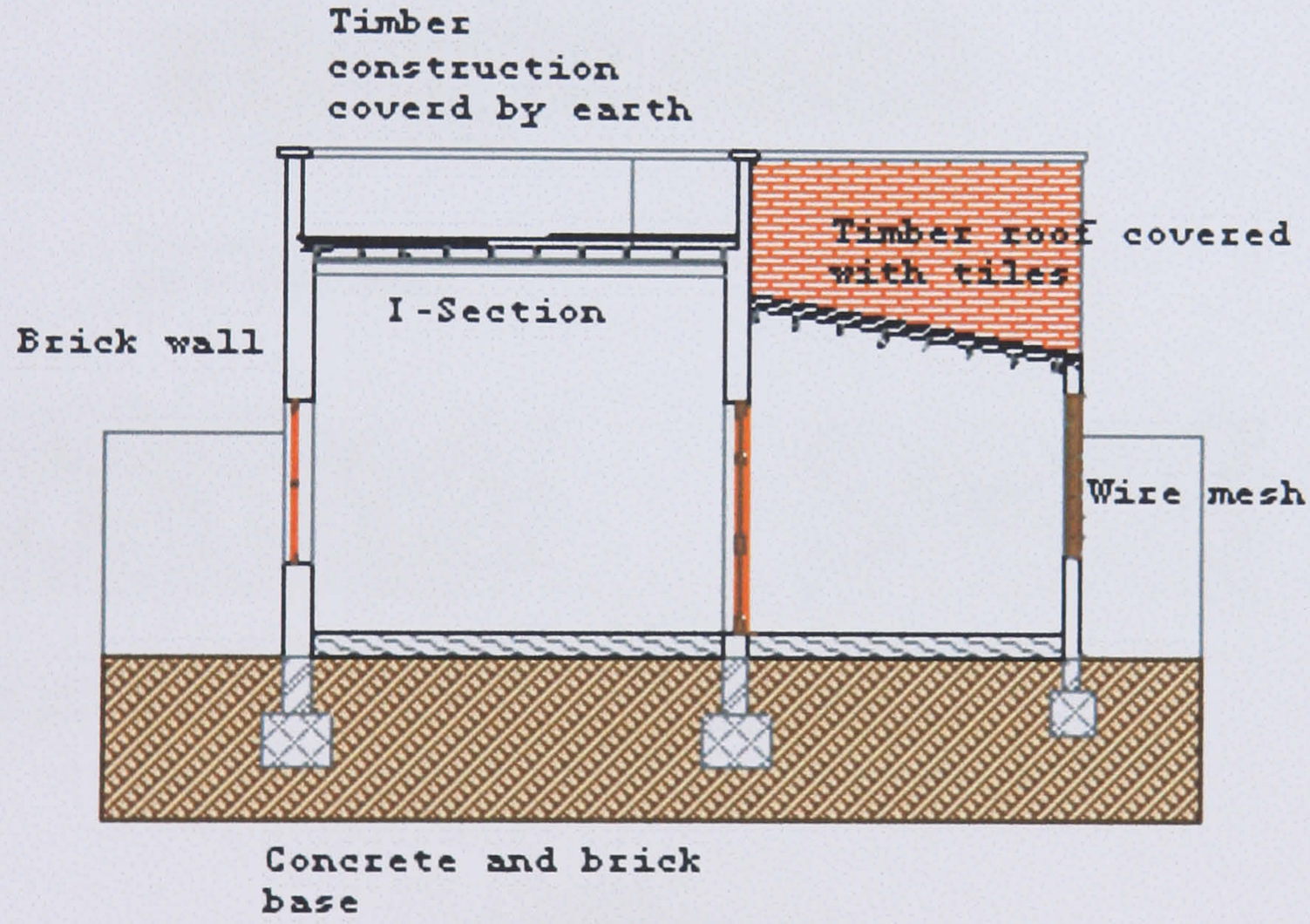
The needs of people for modernisation and the forces of socio-cultural inertia towards this modernisation lead the tenants to at least accept the coexistence within the new environment because their predecessors lived the first change of agricultural development in the Gezira area. Thus the process of adaptation and hybridism has been a result of intermingling processes of cultural interaction and a changing phenomenon of space. Therefore to coexist, the tenants must have the ability to cope with the religious ethics of privacy, the society values of cooperation and ways of modern technology of construction. But has this hybridism succeeded in fulfilling the requirements of the society and reacted positively with the environment conditions?

The models have secured shelters for nuclear families that have split from extended families. The split family has built its house introducing new methods of construction following some ideas of the traditional ways of thinking. Here many questions could be raised:

- Do these houses work physically to suit the climate?
- Do they work culturally for the nuclear family?
- Are they sustainable models? Can the Government meet the expectations of the rural inhabitants?

If the answers to these questions come in a positive way then the meaning of sustainability may pertain.





Section A-A

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Figure 7. 27: Typical houses built in the extension. They were affected greatly by the new design of the planners

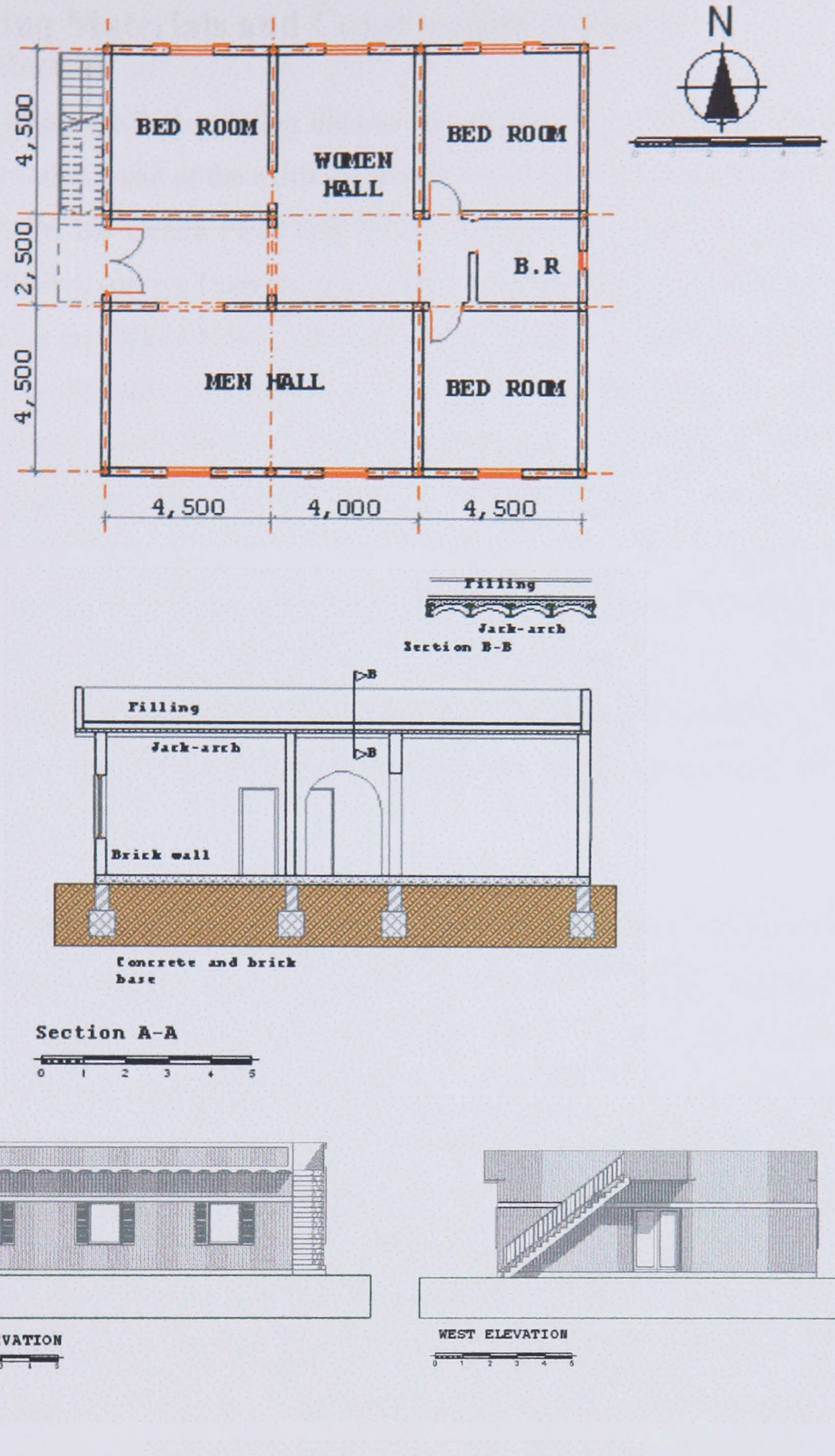


Figure 7. 28: New form constructed with new building materials borrowing the form constructed in the Farmhouses village with some modifications

7.7 Building Materials and Construction Methods

7.7.1 Introduction

Now that the wisdom of squandering the earth's resources is at last being questioned, it may be useful to examine some of the methods used for rural house-building in less prodigal times and resources. On the Gezira Plain clay houses (vernacular house), as durable as any mud houses in the World, survive from the end of the nineteenth century "Mahdist Regime" on the banks of the Blue and White Niles. Throughout the history of housing in the Plain, they were known locally by different names; as 'Dardora house', 'Dar' and 'Manzil', while 'Sarai' was given to the formal house built for Gezira Board staff. The earliest houses on the Gezira Plain may have originated as round thatched Guttia in the earliest part of the twentieth century and both they and later examples have been adapted to serve the changing needs of their occupants and are still in use as comfortable working houses. Unlike dwellings designed and built by the Government for people to live and work in, they are fit for their purposes. The aim of this chapter is to examine the performance of building materials in both forms of houses to examine how building materials fulfilled both the changing needs and the purposes of the occupants.

However, even during the relatively short period of history in the Gezira area of the Sudan, changes in lifestyle make a direct comparison in building materials important. Whenever building materials are mentioned, cost and methods of construction come to the surface. To compare the methods, and the cost of building a clay house with the cost of a brick three-bedroom or four-bedroom house, we must estimate the amount of work and materials which have gone into the building of the clay house, that is the social cost of the building. The cost here is not the money paid out but it is the number of man-hours required. Another valid comparison between the cost of a vernacular house and a colonial or modern rural house is the amount of maintenance required; the former were low-cost, high maintenance buildings, whereas the latter are high-cost, low maintenance. This is due to the change from labour-intensive to capital-intensive working. We could also consider the total cost, both erection and maintenance, over the users' lifetimes as a proportion of their lifetime income (not necessarily monetary). So far as the writer is aware, a calculation of the man-hours required to build a vernacular house or cost analysis of building a formal house has not been published for any part of the Sudan.

In the Gezira Plain all materials for these vernacular buildings come from nearby. Until the 1970s, when stone walls and window dressings came into use, all the materials and labour for the houses was local. Apart from the shaping of roof timbers and the collection of materials, all work was done on site. So the skills needed to build mud walls would have been common

knowledge. Neighbours and friends did the work and no outside professionals were required, except possibly for making mud courses (see later). This neighbourly tradition continues to this day with the communal running of the farming harvest and some building processes. When one looks at the Gezira traditional house for the first time, the eyes see something related to the environment, suited to the harshness of the weather and that accommodates the values that control the way of living in a humble structure that could be categorised as follows, according to the readings from El Sereiha village and Farmhouses village:

- The first category represents the model brought by the British and extensively used in the formal houses that were built from red brick and imported materials.
- The second category represents the mud dwellings, the simplest type of houses built from mud and local materials, which consists of a multi-use core room created by the dwellers to suit their way of living and the environment. The mudroom replaced the thatch Guttia, which are still used by the temporary labours.
- The third category represents the Gishra buildings, which is a form of mixed redbrick and sun dried brick wall and came as a result of hybrid integration between redbrick construction method and mud works.

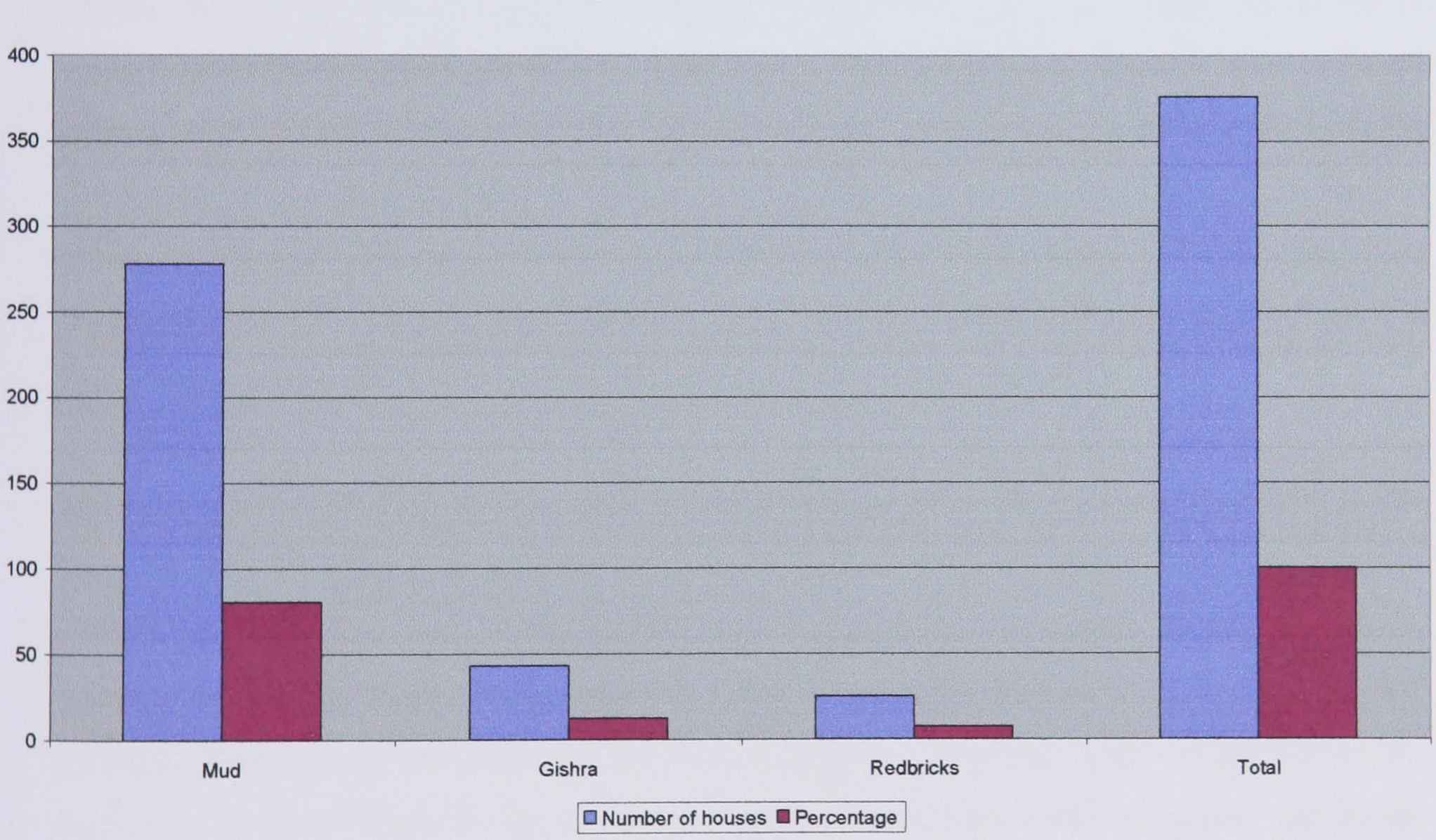


Table 7. 6: ***Graph to*** *clarify that mud buildings dominate the system of construction in El Sereiha village. 80% of the buildings are constructed from mud buildings.*

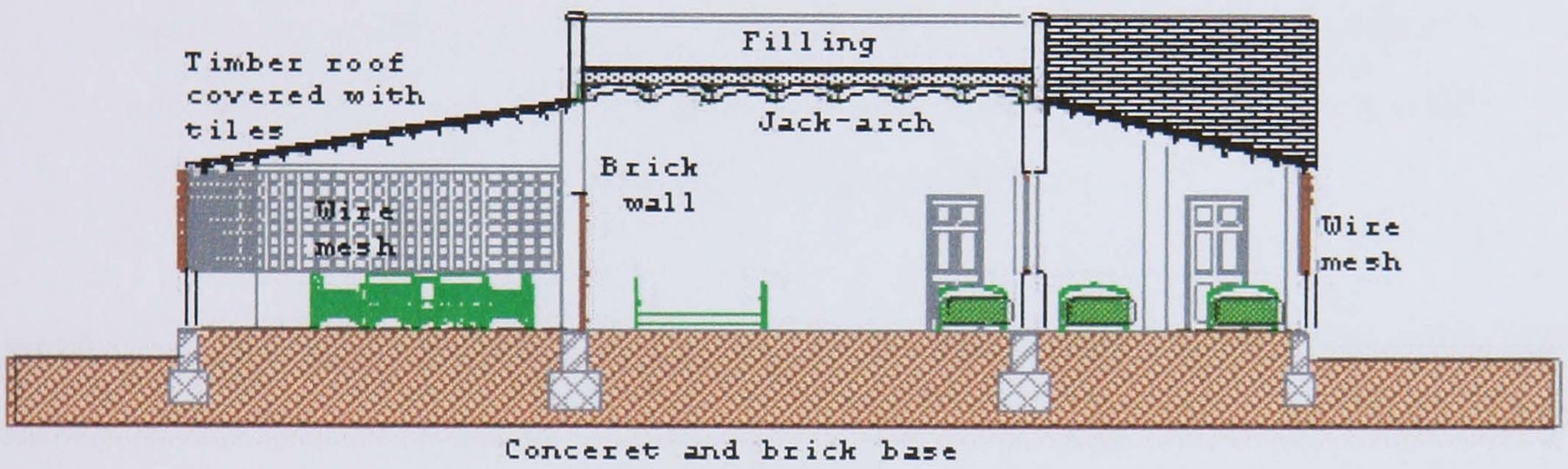
7.7.2 Redbrick Model

Although this model was known in other urban parts of the Sudan, it was introduced for the first time by the British to the Gezira Plain with the construction of the Gezira Scheme. It was used extensively in bridges on canals and in houses and buildings of officials. It is considered a more durable method of construction and it resists erosion by the rain, but it is rather more costly than the Gishra and jalous or mud bricks. Certain brick-making factories were established in Suba village on the River White Nile, where clay is available in abundance. To understand the performance of this construction method and compare it with the other methods, it is necessary to study the redbrick form and its relationship to the fabric and building in colonial buildings. Our standard farmhouse (Sarai) stands on a two brick strip foundation 1.50m high and its outside dimensions are 15m X 8m. Its walls and ridge are 3.5m and 5.3m high respectively. The walls are 1½ bricks thick (0.35m), constructed of red bricks and sand in a clay binder. A veranda surrounds the building and protects the rooms from direct sunrays. The veranda is made of timber frames and slate tiles but, after independence, corrugated zinc sheets with chipboard ceiling were used. The floor of the house is raised from the ground (0.60m high). Nevertheless, not all the standing buildings conform precisely to the dimensions and features chosen, but they represent the majority. Formal colonial houses are grouped according to the economic or job status, so houses of senior staff tend to be much more alike, both in plan form and dimensions, than those in lower ranking staff houses. The plan of the Gezira Plain has shown that all houses built by the Gezira Board are from red bricks. They built the bridges, small conical rooms for labourers, offices and houses for inspectors and clerical staff from red bricks imported or brought from the factory in Suba village (near Khartoum). To give a clear picture of such construction, it is important to survey the main parts of the structure of a standing building.

Redbrick walls: red bricks that are used in these buildings are either imported or locally made. They are locally known as engineering bricks, because they are manufactured in factories (Suba Factory). The cost of the factory and construction was added to the cost of the construction of the Gezira Agricultural Scheme (1925). The walls were constructed and plastered with cement mortar and painted with imported emulsion. Most of the houses are painted in white or cream. To the observer, it seems that a veranda made of timber frames and wire-mesh facades surrounds all houses. This is made to shade the walls and protect the occupants from flies and mosquitoes of the tropical areas. In every room there are large openings for windows (0.90x1.80) and doors (1.20x2.10). It means the walls are meant to cope with both the environmental conditions and the health situation. The wider windows enable the air to pass through. Although air movement is essential, thick and reflective walls are important as they reduce solar heat gain during the day and avoid the storage of heat,

which would increase discomfort at night. In hot dry climates, the desirable thermal properties for a wall encourage the use of thick walls and small openings.

Roofs: Since roofs are exposed to the maximum impact of solar radiation at mid-day it is un-suitable for use as a daytime living space during the hot months. It is evident that the roof is a determining element in the general form. In the colonial housing many types of roof were constructed to achieve the environmental purposes. The pitched roof made of slate tiles supported by timber frame and flat roofs made out of jack arches are all used to cover the brick walls (Figure 7.29). as we saw earlier the conical redbrick roof was used in Guttias.



Section A-A

Figure 7. 29: A typical section of a house in the Farmhouses village

7.7.3 The Earth Model

In vernacular settlements dwellings were built from mud, which is used either in-situ to make a homogenous wall or in the form of bricks that are moulded by hand or sun-dried and bonded with mortar of earth material. The former method is known as 'jalous' construction method and is gradually being replaced by mud bricks. The jalous walling is made in horizontal layers and each layer must dry out before it can support the next. Mud brick, on the other hand, can be used continuously so that the actual building operations take less time although more preparation is needed beforehand; the fermentation of earth with animal dung, moulding and sun-drying process.

The materials for mud construction (mud, straw, and dung) came from nearby, mud from pits either on the site or from fields not allocated for farming, straw from farms and dung from animal yards, which are located in the house or around the village. The only tools used would have been farming ones as spades etc. In this connection it is interesting to record the description of the mud construction first started in the Gezira Plain by the grandfather of a master builder known in the village.

"In the first place, people dig out foundations of the house, not more than 0.50m in depth, and then lay a course of mud or sometimes a row of stones. Then they procure, from a contiguous pit, as much clay or brick-earth as is sufficient to form the walls and having a good quantity of straw and dung to mix with clay and leave it for three days to ferment. The whole community tends to participate in the process of construction. But usually the work is left for two builders of most experienced hands to build and take care of the walls and four or six men fall to working the clay or mud by mixing it with dung and straw, others carry the materials. In this manner, a mud course 0.80m high of the walls of the house is finished in a day; after which they retire to a good meal and plenty to drink which is provided for them. This collective is called 'nafeer' and in this manner they make their houses within days" (Survey 2001).

These mud houses were generally made up in seven days up to ten days; for, when a person wanted a house built, he acquainted his neighbours, who all appeared at the time appointed; some laid on clay, some trod it, while others were preparing straw and dung to mix with it. This was done before the builders came to lay the courses of the walls. By this means, building comes low-cost and expeditious: and indeed it must be owned that they have brought the art of clay building to some perfection.

The neighbouring custom of communal building survived in Brittany and other parts of Europe until recently (Meiron-Jones 1982) and in country districts of Mexico to this day. In Africa it is still continuing, probably for as long as the practice of mud building itself.

However, this method of constructing buildings in several mud courses or 'lifts' with time allowed for drying and shrinkage between successive 'lifts' was not the only one current, and some buildings were certainly constructed in one day *(Jennings, Nina 2002, vernacular architecture vol. 33 2002: 19-27)* if large dried mud bricks were used. Harrison (in Jennings 2002) noted that when the walls of Lamonby Farm barn collapsed they fell in half-metre blocks, although they contained the usual thin bands of clay and straw. Thus it would appear that traditions of mud building survived side by side with other constructional methods. The method of one-day 'quick-build' was not known in the Gezira Plain. Possibly the quick-build method required more skill and experience in making dried mud bricks, possibly the other method was more suitable, especially where helpful neighbours were available.

Mud Walls: The basic material for the walls (both jalous and mud-brick) is made in the Gezira from a mixture of two kinds of earth, red and black. Suitable earth is often obtained a few kilometres distant from the building site and the mix depends on the availability of the two kinds of earth. The jalous or mud brick walls and roofs are rendered externally with a fermented mixture of mud and dung known as 'zibala', which is waterproof and has good thermal qualities. It has a very pleasant texture, giving a consistent visual character to the village, but a combination of extreme heat and heavy seasonal rain is very destructive and leads to flaking of the zibala. Constant maintenance is therefore necessary and usually carried out in June and July, just before the rainy season. Emergency repairs caused by heavy rains are made in August and September (Danby, M. 1975). The roofs are constructed, mostly, from round wood, timber joists and thatch. The thatched roofs are usually covered with mud and clad with 'Zibala' as well as the sun-dried or mud walls.

Building with mud is a common practice all over the world. Availability and climate properties determine the appropriateness of mud as a building material. There is an enormous difference in quality in the finished product depending on:

- The type of earth used to form the shape of buildings. There are the black cotton soil and the red soil. In the Gezira the black cotton soil shows a low standard of mud construction while the red soil shows a higher standard of durability in construction.
- The skill with which the construction has been built. A degree of specialization to generate a minimum standard of quality should be used. Poor professional skills have largely contributed to the low image of mud construction.
- Moreover mud-building technology often shows low durability performance if no measures are taken to avoid rain-erosion.

In provision of homes the mud construction might be a quick and an economical way because;

- The material is comparatively very cheap and available in abundance. The irrigation canals could provide mud easily. Water carries clay to most parts of the Gezira Plain.
- Also, the improvement of mud construction is very cheap. Experiments can use costless materials: the earth and straw. So the research methods could be developed easily.
- The climatic behaviour of the traditional building is preserved; as the temperature is very high, sometimes reading 46°C, mud performance in transmitting heat is good.

Architects improved the traditional indigenous construction by using improved compacted red earth and improved rendering materials to protect the walls and roofs from the rainwater. The following sections (Figures 7.26 & 7.27) illustrate the two types of construction

The house (Figure 7.30) was built at the beginning of the agricultural scheme, 1925, according to the survey carried out by the author in 2001. Figure 7.31 shows an improved mud house roof construction; it seems that they are using local materials for the construction and windows and doors from imported timber or from recycled materials as shown in a simple design below. The floor is from compacted sand or earth.

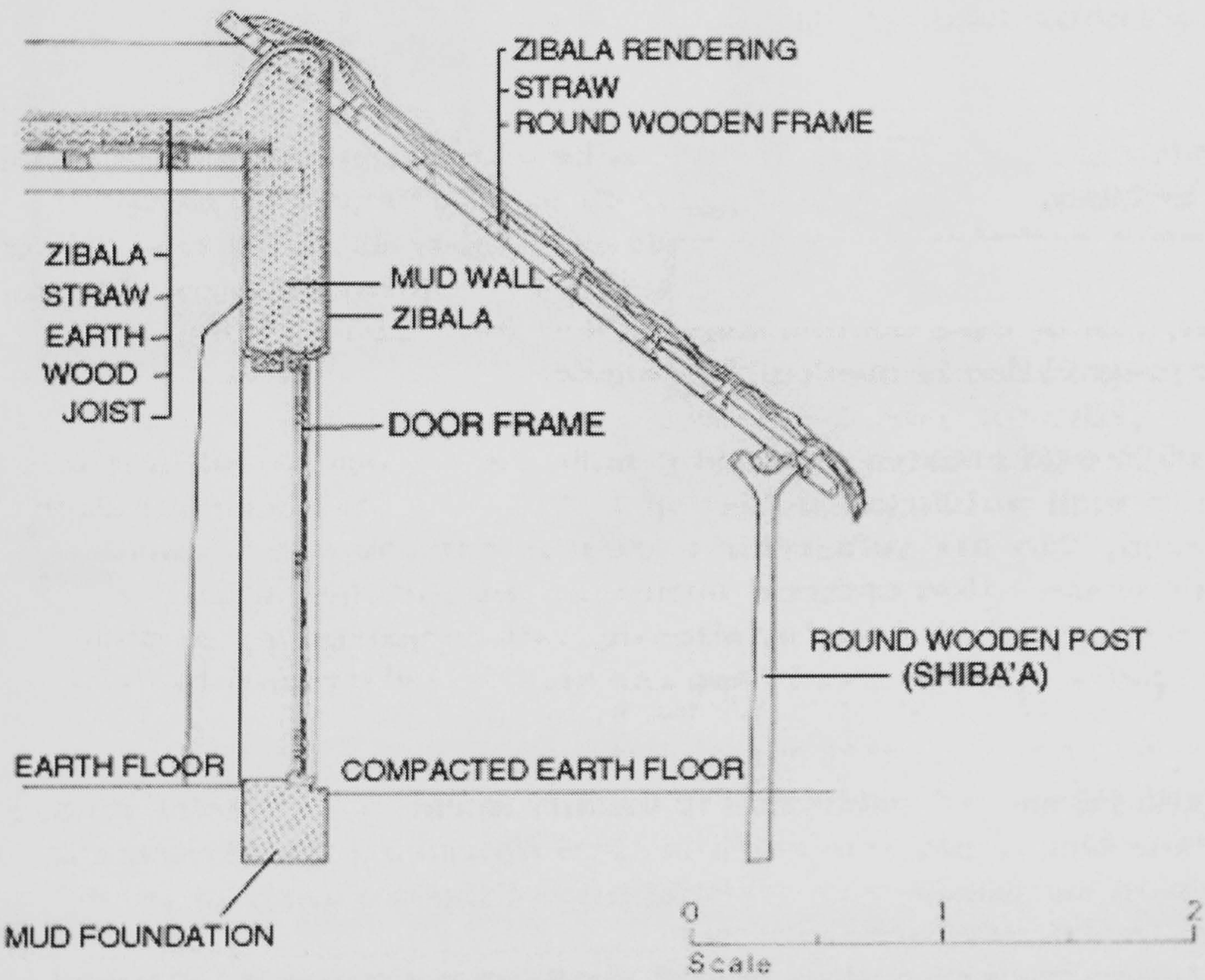


Figure 7. 30: Traditional indigenous construction

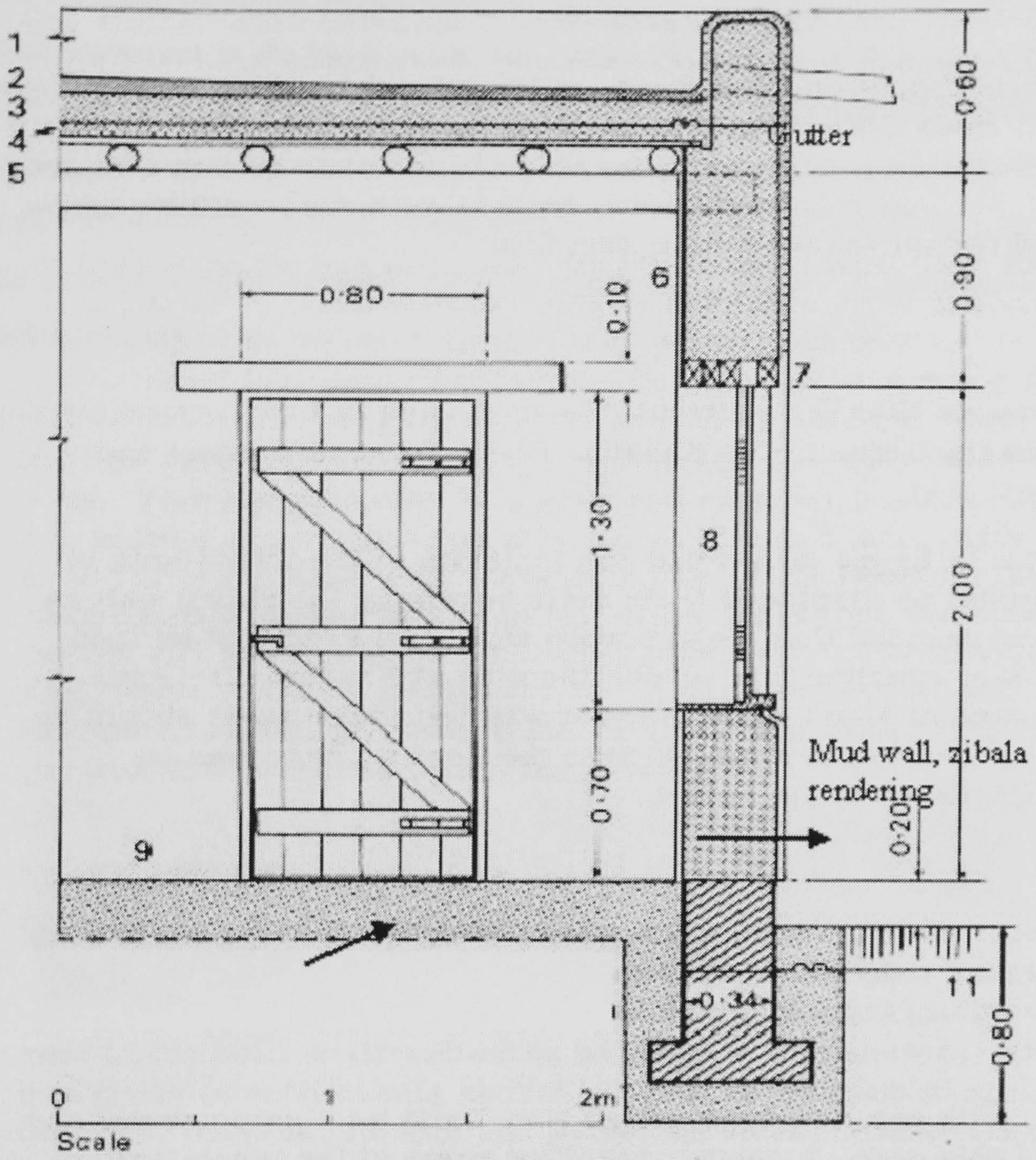


Figure 7. 31: Improved traditional construction

Key:

1, mud brick parapet, 2, zibala roof finish, 3, earth/straw insulating layer, 4, polythene sheeting, bamboo, 5, local timber joists and beam, 6 mud wall rendered with zibala, 7 timber lintel , 8 window 'timber' 9, compacted sand floor, 10, Compacted sand , 11 compacted earth

There are many difficulties involved in mud construction. The average life of the black soil jalous (mud wall) is about ten years; in exceptional cases such buildings can last up to 25 years. As these buildings usually have no foundations of any kind, they are vulnerable to ground movement in the black cotton soil, particularly in the rainy season when up-thrust occurs because of the expansion of the soil caused by saturation. Cracks occur in the walls, allowing rain to penetrate, particularly at the junction of roof and parapet walls. The wall base can also be undermined by rain and standing water. If the soil is red or carefully mixed with straw or dung, then the life-span would be much more. Figure 7.32 reflects the mud walls deterioration due to rain. The walls were built from the black cotton soil.

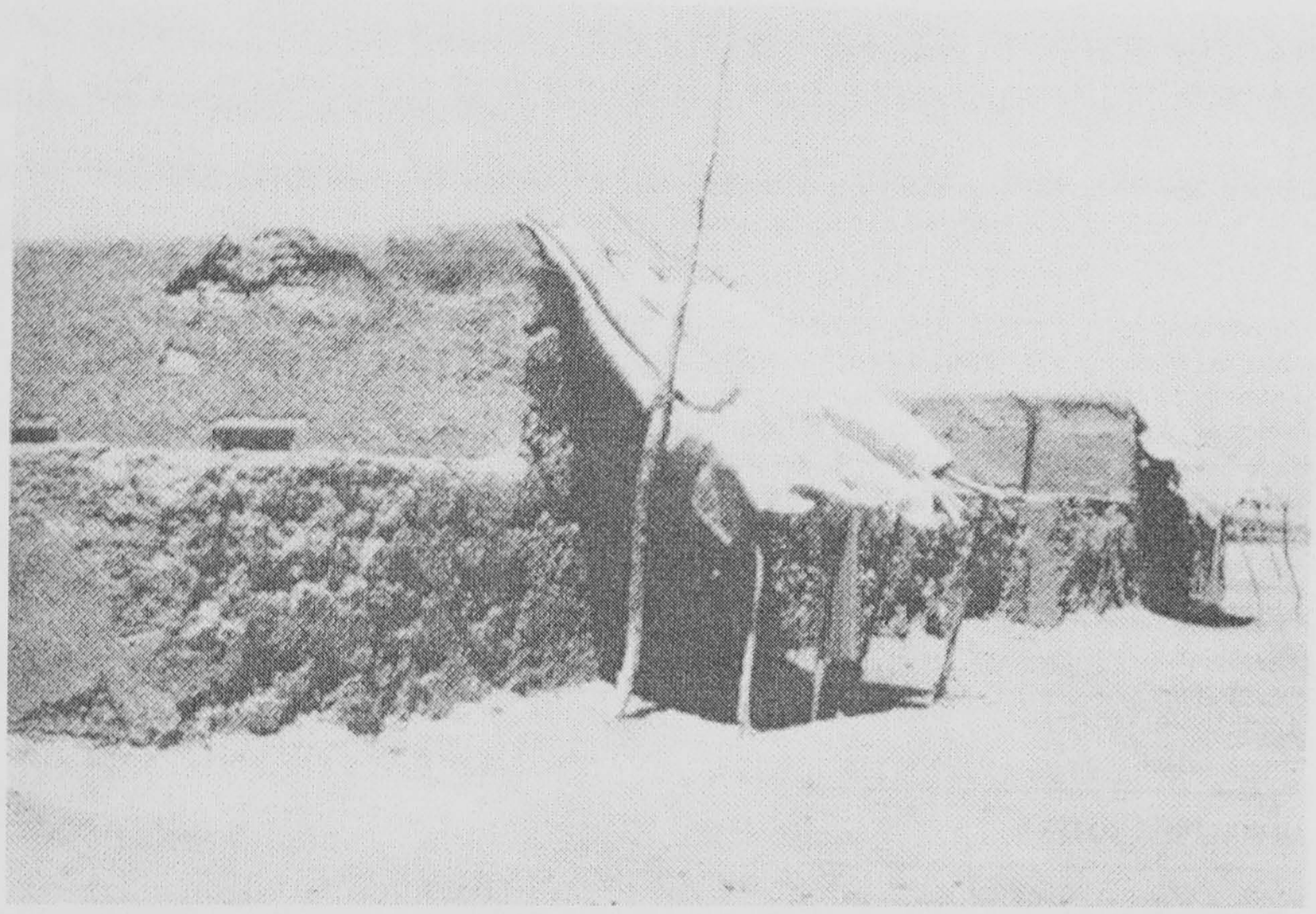


Figure 7. 32: Black cotton soil shows low durability; Red soil shows more durability; (Source, Danby, 1975)

7.7.4 The Gishra Model

In the beginning of the Gezira Scheme all buildings were constructed from local building materials, mud walls, baladi roofs and similar floors and shaded areas. Gradually, people have introduced 'Gishra Walls' to improve the quality of rendering of the mud walls. This could be a hybrid between the redbrick walls of the colonial housing and mud walls of the vernacular buildings. After 1970 when the planning intervention took a step forward, the settlement, house form and structure were greatly affected by the urban form and structure due to the types of materials used. Instead of one form of mud dwelling, several categories were created under the effect of the colonial system and the élite planning interventions in the area: see this chapter, the dwelling section. This reflects the interrelationships between cultures found in the area.

There are two types of red bricks in the Sudan; the local burnt bricks and manufactured red bricks. The local bricks are moulded by hand using the clay of the Blue Nile River and then put in heaps surrounded by wood and burnt. This embodied energy is very expensive, financially and environmentally. People bring wood from distant forests, which are affected by the removal of trees in an irresponsible manner. The Government fights this and many laws were passed to stop that, but in vain. However, for the Gezira Plain the Government calls for a more responsible criterion to be used. It encourages people to make use of the clay brought by canals, which cost the government a lot to clean from those canals and also to use the straw, which is available in the farms in bundles, for burning. On the second hand it directed the investors to increase the efficiency of redbrick manufacturing for usage of other parts of the country. The Gishra house is way of improving mud construction, built from red brick from the external and sun-dried bricks from the internal side. Table (7.7) shows the shifting of building materials from mud to gishra and redbrick. This reflects the effect of colonial buildings in the house construction.

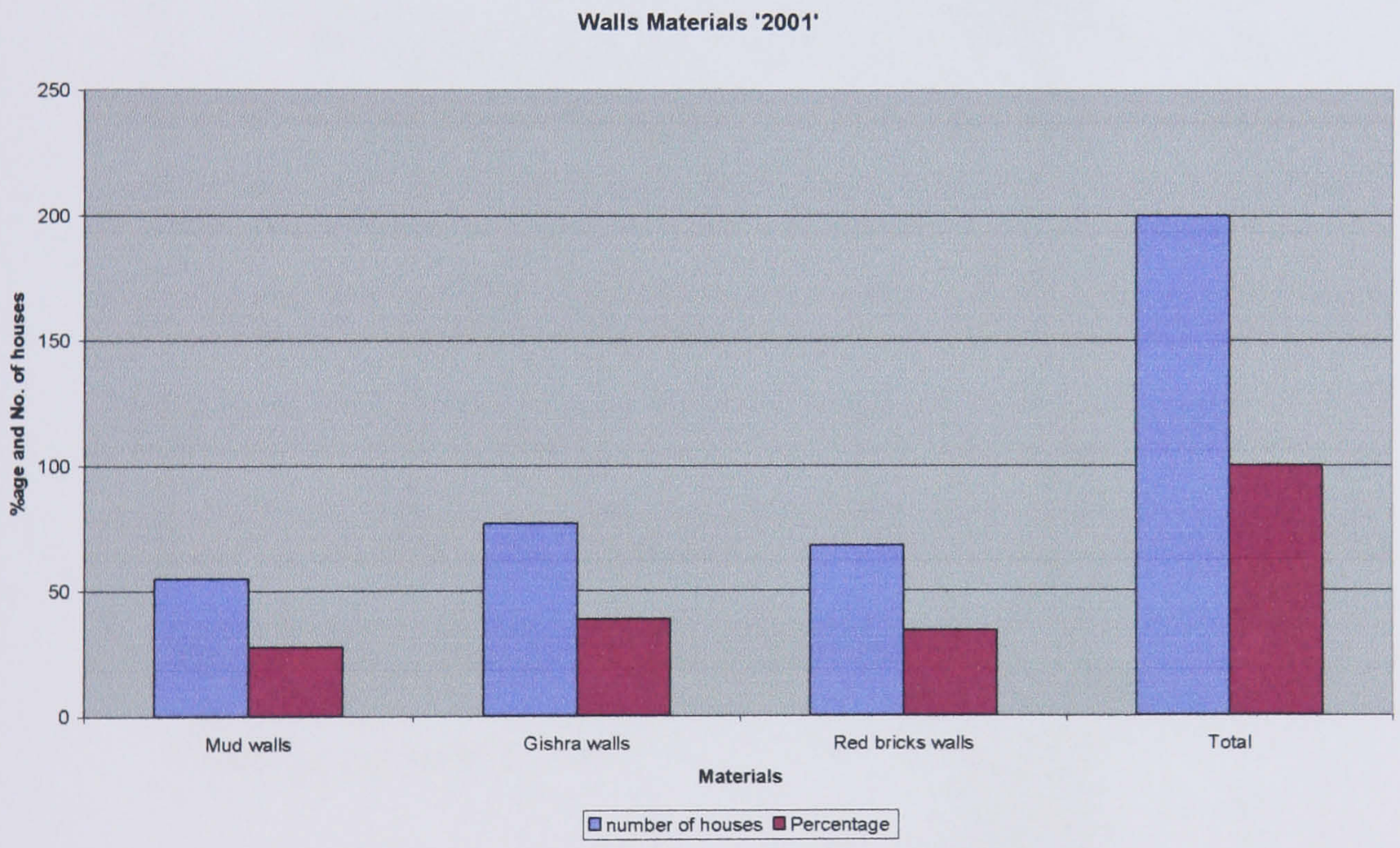
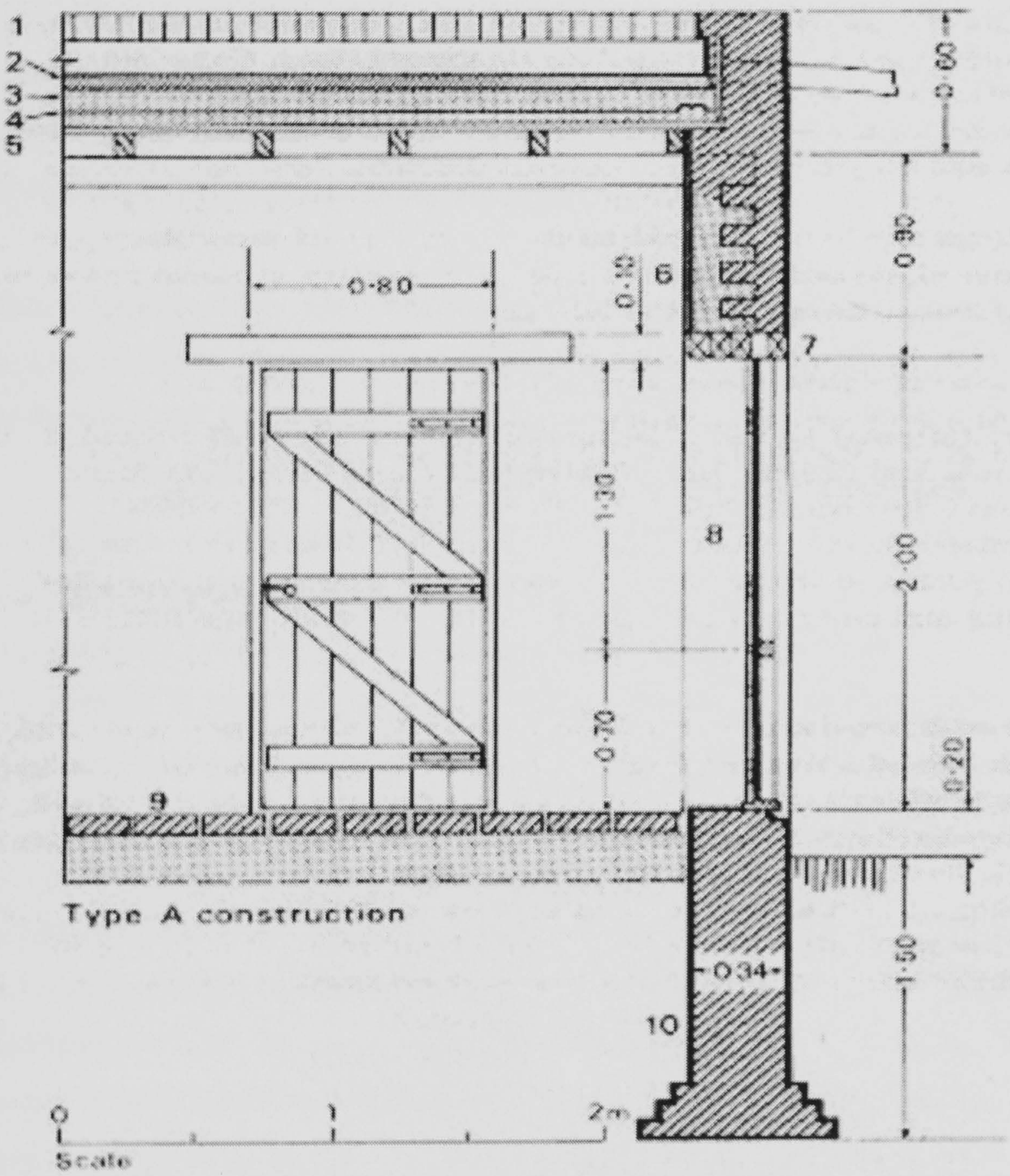


Table 7. 7: Shows different situation of construction. The percentage of gishra and red brick becomes more popular than the mud buildings.

Walls: As shown in the section of a typical room, the wall is built from burnt bricks on the outside and mud bricks inside. Mud mortar is used. The walls are plastered with sand mixed with gum powder, and then washed with white limestone emulsion, known as 'Jeer' paint. Large windows (0.40m x 0.70 or 0.80m) replaced the small windows 0.20m x 0.20m) known locally as 'Taga'. This bigger window is a reflection of the modern houses introduced within the village. The materials used for windows and doors have also been affected by the technology used by the British. Foundations to the wall are also built from burnt bricks.

People first dig a trench about 0.40m wide and 1.50m deep, and then they lay a staggered brick wall, (Figure 7.33). Roof covering: The flat roof is constructed in the manner described for the jalous houses. The thatch itself was usually wheat straw, a by-product. The roofs are flat in order to avoid earth slipping off, and this has the advantage that less straw is needed for the thickness required. New roofs are introduced; either from jack arches rendered with flint coating material to protect it from seasonal rains or from I-sections and timber covered by earth and flint coating layers. Sometimes flat concrete slabs are used on the roofs as a modernized system brought from the urban context.



Type A construction

Figure 7. 33: section through a room of Gishra walls

Key:

1. Brick-on-edge parapet coping, 2. Zibala roof finish, 3. Earth / Straw insulating layer; 4; Polythene sheeting, 5; Sawn timber boarding, joists, and beam (sometimes, an I-section is used), 6; mud wall, 7; brick wall 8; door frame, 9; Brick floor, 10; Brick foundation

7.8. Aesthetical Values

7.8.1 Introduction: Images

Earlier we saw that architectural display based on social status was in any case well documented in the domestic houses in El Sereiha village and building appearance can be equated with this social status, while in the colonial village the houses were allocated to the economic rank according to the type of the job. Most of the houses in El Sereiha village were built from mud, except the houses of the heads of kinships that were built from red bricks, as in the colonial buildings, which at the time reflected the importance of the occupants. It was significant that the leaders' houses were distinguished visually from those of the lesser ranks of society, however prosperous individuals might be. It is very clear now that the change of ideas about houses due to the long-range of processes, planning intervention and the knowledge of new building materials created traditional hybrid organic houses that reflect more complicated detail than the old simple organic house.

However, the beauty of the rural vernacular dwelling stems from its simplicity, humbleness and its usage of simple elements on its structure. Bachelard (In Kellett 1995:282) reminds us that the dwelling is an essential human activity, irrespective of its limited physical qualities:

> *"For our house is our corner of the world. As has often been said, it is our universe, a real cosmos in every sense of the word.* ***If we look at it intimately, the humblest dwelling has beauty.*** *Authors of books on 'the humblest home' often mention this feature of the poetic of space. But this mention is much too succinct. Finding little to describe in the humble home, they spend little time there; so they describe it as it actually is, without really experiencing its primitiveness, a primitiveness which belongs to all, rich and poor alike, if they are willing to dream."*

The environment is not an aesthetic exercise but the purpose is to accommodate cultural images, which represents a range of meanings. The built environment and objects within it are manifestations of such meanings (Rapoport 1969). People in their environment in rural settlements in the Gezira Plain consider the dwelling is of real satisfaction to their ambitions. They say the house is the people who live in it. In other words people make the house when they occupy it. So if we want to understand how to appreciate the beauty of these humble houses, we have to look at such settlements in terms of aesthetics without imposing other people's values and prejudices. A fair interpretation could be through considering this beauty from its human scale and its link to the environment in which it emerged. Let us therefore continue to look intimately at the rural dwellings in El Sereiha and Farmhouses villages and attempt to describe common aesthetic patterns, motifs and elements.

7.8.1 Decoration and Ornament

These are characteristics of spontaneous settlements identified by Oliver (1990) which would support the contention of Oliver himself who believes that through time the dwelling process in vernacular settlements will lead to more elegant and effective solutions. This was proved also by the improvement of the dwellings in El Sereiha village through time and socio-cultural interaction.

Although a conscious choice between different, freely available architectural styles was hardly possible in the old traditional village before the 1950s, the associative power of innovative detail was already evident in the Farmhouses village as in the extension and in the newly emerged development in the old village. The wide variety of these architectural changes in plan, amenities and structure, and in the external appearance of the houses, indicates the complexity of their causes and the central attribute of culture.

The dominant image in the traditional village is of order and symmetry, which is achieved through strong horizontal elements, particularly the apparently flat roof, which is suggestive of a more advanced technology of mud, protected roof. This flat roof is a now dominant feature in houses built after the 1950s in both villages, and it was an essentially traditional form. The hosh itself is an essential defining element of the traditional house, and now gives the élite houses their identification and privacy, as we see in the changes in the structure of built houses and the design of newly introduced houses.

The appearance of windows reflects the unity of both designs. Large windows replaced the small openings 'taga' that was an essentially traditional form. Then the natural colour of building materials dominates the appearance of all houses all the time, except on windows and doors a light colour was always introduced for environmental reasons. The blue and white colour can easily reflect the hot sunrays. The metal doors and windows are decorated with geometric metal shapes, although this type of decoration was not known in the early traditional houses as people had used plain timber doors and windows (figure 7.34). Another component in the façade of such dwellings is the wire mesh veranda. Although apparently fulfilling a health function, the wire mesh is frequently employed in a highly decorative way, with the interplay of lines and shadows complementing the compatibility to the severe environment. These verandas replaced the rakoba and kashasha in the traditional houses. It is rare to see painted houses from the exterior. In both houses the threshold is raised from the ground while in the traditional house it was not. Whatsoever changes or unity occurred, the causes are associated with a high social level and a product of cultural values, although

economy has its effect on the quality of houses introduced, essentially in the type of materials used.

Recently many types of decoration have been introduced to the appearance of dwellings, especially in the doors and windows. Before no special decorations were used in the traditional doors and windows. People used recycled materials such as iron, zinc or any available materials. Sometimes, they used perforated blocks at a higher level to release the hot air in the mud rooms. Doors were usually made of wood or recycled timber that had been used to contain commodities and other goods; such as tea, or textiles.

Other decorations were not known, especially in mud rooms, but where people used redbrick walls we found very limited decorations made from brickwork itself as it seen in the figure 7.35 showing the diwans. The decorations were always buttresses on the higher part of the parapet. There were other artistic features that were considered as important as any other aesthetical features known to many designers of contemporary architecture.

Figure 7. 34: Illustration of old traditional windows of small size and located at higher points in the mud walls.

The metalwork has been introduced extensively after planning intervention. The purpose of such decorative metal shapes is only for aesthetic reasons, while in other places these decorations are used for security reasons. The metal frame is fixed to the movable part of the window, while in few houses a wire-mesh is fixed to the frame; this is used to protect people from mosquitoes; this is another effect of the colonial culture.

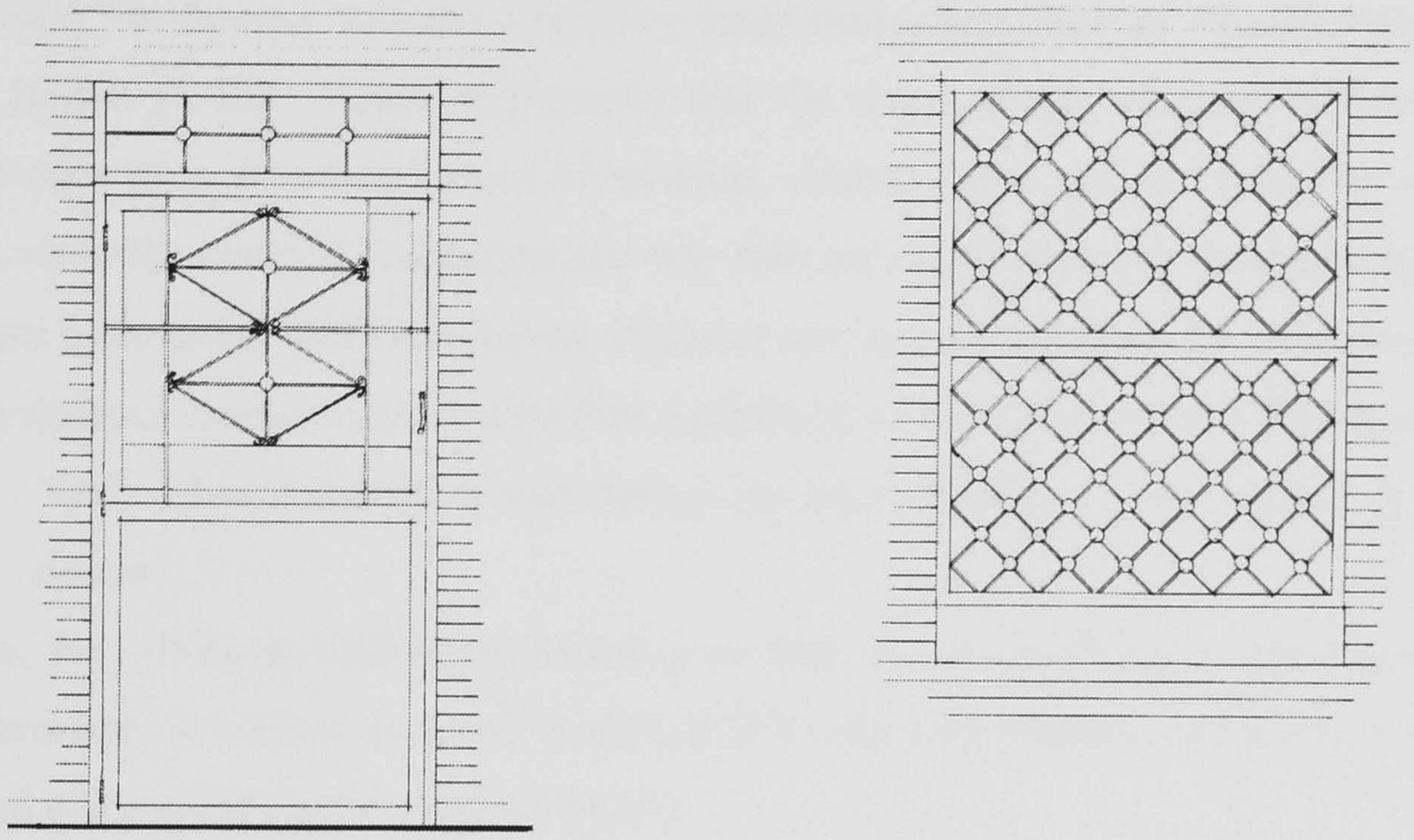


Figure 7. 35: Shows the type of metalwork used in the decoration of doors and windows in traditional housing.

The façade is then a controlled composition using limited elements to produce a visually natural image, which communicates in a direct and unambiguous way. The front space, where usually the diwan is located in the traditional houses, tends to be the place where greater effort and resource are expanded and where examples of high quality design may be more obviously identified. However the internal spaces and the rear parts have many positive qualities, despite a reduction in the permanence of the materials, which are often read at face value. The quality of spaces and their appropriateness to climate and culture are not intrinsically linked to the quality of materials, but the way such places are interpreted depends on the cultural value placed on such materials and technologies.

7.8.2 Quality versus Aesthetics

Many researchers in the field of housing analysis are conscious of the quality of many of the solutions and spaces produced in different settlements. Here we will concentrate on the characteristics of three different categories of housing for the poor:

Self-help housing programmes,

Social housing for the poor, and

Self-built environment created by the poor.

The housing for the poor was questioned by many researchers such as Oliver (1969), Turner (1976), Hamdi (1991). Turner emphasised that the users of the self-help dwellings could evaluate their own priorities: issues of location, security, cost and space on the top of the agenda, while the material characteristics only take on significance for those of high income after more basic issues had been solved. In social housing programmes the stress has been on building material characteristics rather than aesthetical values. Hamdi (1991:85) states that:

> *"Only when a society is well housed do their concerns turn to details of design..."*

However, the self-made built environment or in other words traditional vernacular dwellings could demonstrate certain qualities. Kellett (1995:288) lists certain qualities that a look to space and place could demonstrate: he states:

> *"Self-made environments do exhibit many of the qualities which we encourage future professional designers to achieve. Such a list might include: quality of light and shadow; scale and proportion; clarity of circulation; appropriate use of materials; simplicity of structure; articulation of space; responsiveness to activity patterns; efficiency of service layouts; sensitivity to hierarchy of users and privacy gradients; responsiveness to climate; flexibility to adaptation and change; appropriateness to site, etc."*

Many traditional vernacular dwellings exhibit these qualities that we respond to almost instinctively. The fact that we cannot recognize positive qualities in all dwellings and that many are indeed seriously deficient from all points of view, should not diminish the achievements of those that clearly are very successful resolutions of both shelter need and built form. Thus if the self-built environment builder makes fuller use of the available resources in terms of building materials, his appropriate technology, structural notions, user participation, standardization, comfort, flexibility, aesthetic considerations and expression, identity, economy, etc. is he not even better entitled to qualify as an architect? Turan asks (in Kellett, 1995:288).

7.9 Symbolism

There is a mutual relationship between man and his environment. Each shapes and is shaped by the other. And there is also a complex and changing relationship between dwellers and their dwellings, and that the construction of the physical fabric is intimately linked to the composition and reproduction of social relations and values.

7.9.1 Dwelling as an Expression of Moral Order

Our contemporary understanding of a nice house is the degree of its cleanness and tidiness. One can think that cleanness and tidiness do not match with such simple dwellings of confined space with earth floors and a dusty environment. It is noticeable that most houses in El Sereiha village are kept in immaculate condition. This cleanness and tidiness symbolizes the purity of decent people. The achievement of this internal and external tidiness within the hoshes is the work of women. Despite the simplicity of beds, mattresses and bedspreads, the arrangement and internal décor reflect the relationships between those humble people and the rest of the world. Also the simple equipment and utensils used for cooking sometimes in the open-air give the feeling of openness to the world. In such circumstances people do not wish to be equated with the inadequate physical state of the dwelling, but rather we are encouraged to admire how well-kept the confined simple dwelling is, both inside and out. Furniture is kept tidy and clean, the earth floors must be swept to conserve cleanness, the plates and cups must be neatly stacked in a clean place and aluminium-cooking pots must be polished as soon as they become black. The water place, 'mizyara', must be clean. Gullestad in Kellett (1995:291) considers the attention to the aesthetics of order and tidiness is vital because

> *"The connotations of a good home are moral, while the connotations of the expression of a nice home are of an aesthetic kind. However, through aesthetics a vision of a moral order is created and expressed"*

Figure 7. 36: on the right temporary furniture and on the left a fully consolidated dwelling; the walls are plastered and painted

7.9.2 Household Unity

Recognizing that the Gezira traditional settlements are the outcome of multiple cultural, economic and environmental forces, and thus the dwellers are the playing actors; their solidarity can be symbolically expressed by the dwelling.

> *"The dwelling can also be expressive of the unity of the household or lack of it, particularly between key members," (Kellett 1995:291).*

Oliver (1981:176) suggests that the sets and suites of matching elements are important symbols of unity. They represent order and totality as a series of objects which together form a coherent, complete and recognizable whole, with each individual component part of a larger group. They also represent the priority and aspiration to allocate resources to a series of related objects, rather than unrelated elements. By unifying the objects the household is also symbolically unified.

This can be illustrated with the idea that each married couple (perhaps a new relationship) in El Sereiha village must have at least one room separated from the other rooms in the same hosh to be the core unit for their marriage net and to form an usra. In Islam the usra (family or extended family) is the fundamental part of the whole community, and the unity within the usra is important for the continuity of order in different aspects of life. We have seen that the members of the usra work together to form both social unit and economic units. The unity of the usra is a circle attached to others to form a lattice that completes the community unity within certain limitations of ethics translated within the form of the house, in terms of Muharam and non-Muharam spaces. This goes with the belief of Gullestad:

> *"The more fragile the family's solidarity, the more important it is to stress symbolic unity" (in Kellett 1995:291).*

The dwelling in Islamic societies such as El Sereiha community is the place where tension and stress and critical issues are resolved. The resolution starts at different levels of the house itself. It starts in the core room between the couples, then the private family level etc. It continues to the level of the whole community represented by the key figures. Thus the house is a symbolic means of relieving the tension of the arduous life of the community. Household unity is also symbolized with the decoration of the house. Men finish the external rendering of the house with zibala while women decorate the interior with the paint of their own mixing operations, from ashes, dung and gum.

7.9.3 Morality and Traditionalism

In chapters four and five we examined how people, through time, achieved settlement hierarchy at both regional and local planning levels and formed an order within the planned built environment to serve their needs. The house form and layout in the traditional villages can be explained in terms of continuous evolution processes carried out by builders who stuck to a common set of general principles and traditionally approved methods. Taken together these principles and values mean that the dwellers are attempting, within the constraints of their resources, to create a rural form and housing areas which are as close as possible to their social cultural values. Nevertheless, the physical outcome of these compacted rural tissues has a strong mutual relationship between built form and rural space. Akbar (1988:11) maintains the sense of reciprocity between built form and urban space in Muslim environments as follows:

> *"Traditional Muslim environments changed gradually and harmoniously because the party in control of convention was composed of the members that were subjected to it. Thus consensus among parties was achieved. When regulations did not exist, parties had to settle disputes by dialogue. Successful inventions and applications by users and builders were transmitted to others through dialogue within a society that pushed for more experiences. Thus conventions were reinforced. This is the only explanation ...for the strong coherent conventions in traditional environments."*

It is certainly true that the layout has an inherent logic: each street, each housing plot should be of the dimensions required by the family rather than the equalitarian logic that characterizes modern conventions. This might suggest that such principles would be manifest in built form and social interactions. In housing this is manifest in the efforts both to demonstrate that there are no relative levels of affluence as well as not to distinguish between individuals through obvious visual differences in the dwellings themselves, as seen in the colonial and new extension's dwellings. In the colonial and some of the extension's settlements the reverse is the case. However, the continuity of cognition from generation to generation reflects the mutual relationship between the traditions and morality in space.

7.9.4 The Dwelling as a symbol of Co-operation

In any traditional society, such as El Sereiha village, the phenomenon of the co-operation and collaboration is of great significance to people as they inherit them through generations and

those phenomena are centred in the cultural values of their Islamic ethics. Although the social position of individuals in society plays a vital role in determining their actions, and rural inhabitants are highly conscious of their social status in the community, the condition of the houses does not at all reflect this status because members of the society work together to create a house for an individual. Another ethical value is that the house is not important for its physical value, as the social status will not be equated to the individual only but the house is the manifestation of the social status of the whole community. Of course these habits have been changed due to the social and cultural changes, because of the physical changes on the ground due to the planning intervention carried out to serve the settlements with services. New methods of building construction have been introduced and more fragile families appeared and the society began to shape itself to the national level designed by the élite.

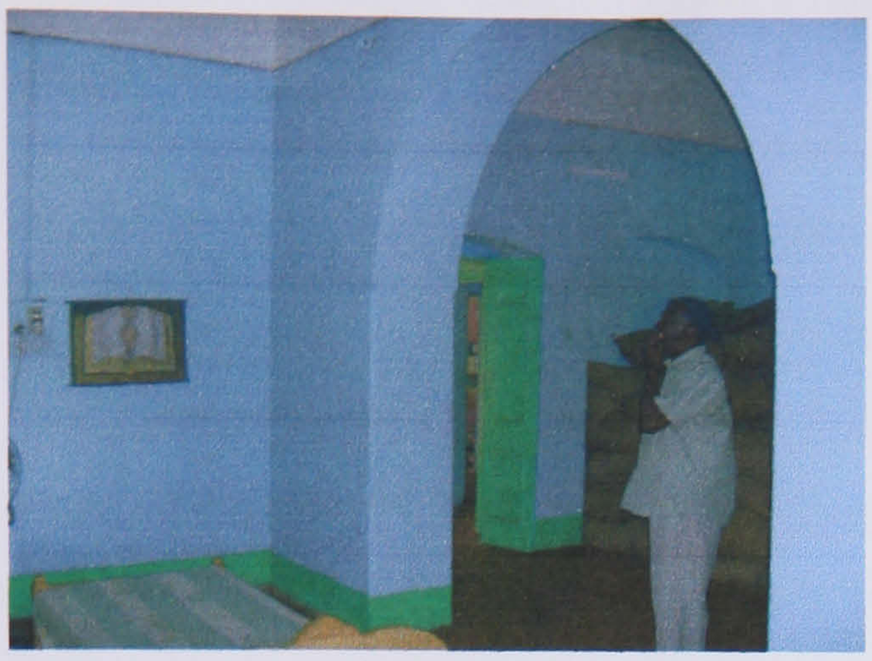
Despite the intention of the community to raise the status of the individual, the personality of the individual is kept alive. The individual initiates his requirements and selects the typology of his house. Turner has emphasized the existential dimension of self-made environment and believes that in home-building and local improvements a person can find:

> *"The creative dialogue essential for self-discovery and growth" (Turner, 1968:357)*

7.9.5 Colour

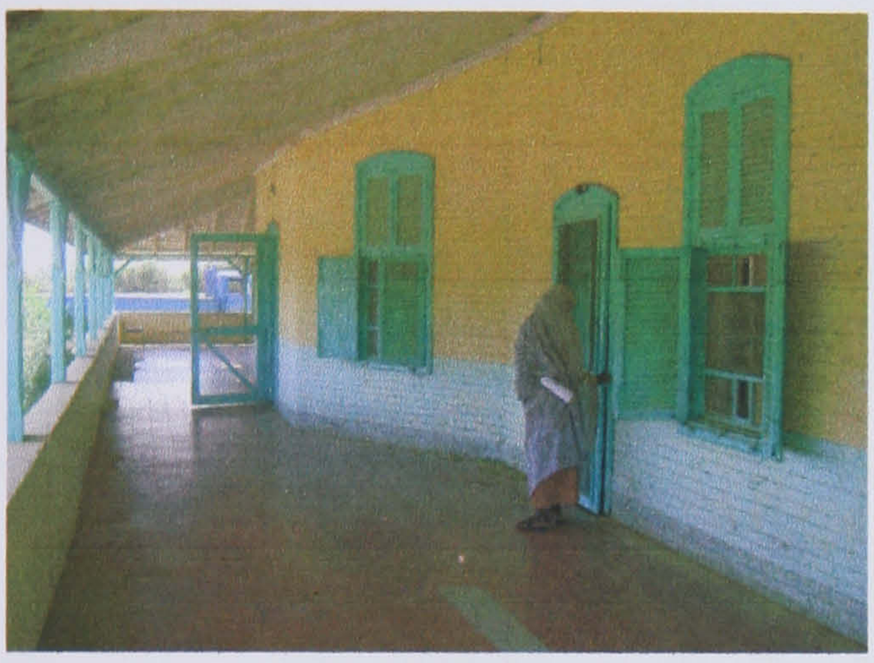
To psychologists colours have meanings. The colours symbolise certain factors of cultural values. As we noticed, and this is clear in all the photographs shown in the research that the colours used are either natural colours or shades of blue and green. These colours are used on the doors or windows of the house from the gate to small windows. The natural colour, especially earth, has a deep meaning for the residents. Most of the people in the organic settlements are 'Sophies' who devote themselves to God and consider this world probably deteriorates to the Earth.

The green colour reflects two things; the integration with the green land surrounding their environment and the devotion to Islamic values as green is the colour chosen by the First Muslims to represent them. Their emblem was made in green. The blue colour represents the cool colour that reflects the severe sunrays and it does not get dirty from the dusty winds. That is the case of the vernacular thinking but we find the Magnolia colour mostly used in the Farmhouses village. It seems the green colour is common between the two types of settlement. The following diagrams (Figure 7.37) reflect the colours in the two types of settlements.



Inside a House in vernacular settlement

Inside a diwan



Veranda in the Farmhouses Village

A colonial house with green colours used.

Figure 7. 37: views from both traditional and colonial buildings showing the colours used.

7.9.6 The Tree

The tree is as important as the green colour to the inhabitants. It represents the greenery and symbolises their culture. It also means coolness; the tree is of significance to residents as it gives them shade but they still know the difficulty of using it at night. We noticed that there are one or two trees in each house while there are no trees on the streets or open spaces. The explanation was given by the account of the senior doctor in the village hospital:

"The weather is very hot and dry and we know that trees are important for shading and cooling but unfortunately there is difficulty to grow more trees for the following reasons:

- *Shortage of water: yes there is plenty of water in the canals but the type of our settlement and the irrigation system cannot work together.*
- *Use of space: people mostly sleep at night in the courtyard and they know the dangers of sleeping under the trees by their instincts. You know emission of carbon dioxide in the night.*

- *Insects: Here Malaria is very common and the inhabitants are afraid of this disease and they think trees collect these insects while they have no means to fight them.*

Anyhow, there are certain difficulties to care for the trees and their consequences. Thus one tree is enough to symbolise their purposes and keep the meaning for the coming generations," (Fieldwork 2001).

It seems that the tree has environmental and cultural values to the inhabitants and it is of great important to the meaning of life. Another noticeable feature is that the tree is always a Neem tree, which was brought by the British people from India at the beginning of the twentieth century. It replaced the Acacia tree of the Savannah. People also found it useful to treat Malaria. They boil its leaves in water and drink it and they say it cures the Malaria.

Figure 7. 38: shows the tree is connected with sleeping and cooling the water jars.

7.10 Conclusion

This chapter described the main components of both traditional informal dwelling environments and the contemporary formal dwelling environments, trying to attach an analysis to the uses and activities that take place within it. Kellett (1995:294) argues that:

> *"The built form cannot be understood in isolation of its functions, and such functions go well beyond the practical issue of resolving shelter needs."*

The association of components in a form can tell us a lot about the conscious and unconscious beliefs of the user and his or her cultural context (Kingery 1996:8). We have seen how even dwellings of minimal material characteristics are charged with meaning, and are highly expressive of cultural norms and aspirations. The study of people through what they construct and make use of offers a new and fascinating perspective. The dwelling is thus a symbol suggesting and justifying values, relations and cultural categories.

Through arrangement of their dwellings, people express themselves as human beings related to certain social groups. Thus home is a part of the construction and reconstruction of social groups (Gullestad 1993:131). Therefore, the construction of dwellings is an important ingredient in the formation of a society. In the following chapter we expand this discussion about the rôle of the dwelling and the relationship between people and their dwellings, stating the changes in space and cultural values, which justify the reciprocal interrelationships between culture and space. We will return to many of the conceptual issues raised in the thesis and readdress the formation of settlements that enabled those people to build and construct their homes.

CHAPTER EIGHT: CONCLUDING DISCUSSION AND RECOMMENDATION

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8.1 The Theme of the Research

The primary theme of this study has been the attempt to probe beyond the physical perspective of rural residential housing to explore the meaning, design and use of traditional vernacular organic settlements. It has investigated the effect of the Gezira Scheme development, local people's socio-cultural factors and the Government planning intervention that influenced residential developments as settings for daily activities and as mechanisms for housing provision. Based on this theme, key questions were developed:

- What are the characteristics of the Gezira Agricultural Scheme's built environment that caused both evolution and limitations to residential development?
- To what extent has the traditional vernacular architecture supported the housing provision process?
- How have the colonial housing and planning intervention imposed on the traditional vernacular settlements affected the residential development in the Gezira area of the Sudan?
- How can these settlements be sustainable?

Answering these questions will enable us to learn some principles from the development of rural settlements that have grown in a multi-cultural area of significant economical development. As in most of the developing countries, especially the Sudan, such principles are important for the future development.

8.2 The Agricultural Built Environment

It was found that the scheme infrastructure (Canals and farms) are the principal factors to derive and control residential developments and related factors in the village of El Sereiha village (chapter four). Local people were left to develop their own housing within confined areas. This has meant that the development of the physical planning in the Gezira is guided by the decisions of the owners of the farms with the consent of the agricultural scheme authority. Geographical analysis of the pattern of residential and social mobility reveals that within the village level, the infrastructure boundaries effectively created sealed communities. For local people it was impossible to acquire land for extension, as the organic planning system running in the area was not the body to give the right to ask for more land. So, the household has only one way to expand and that is carried out through socio-cultural values that enabled people to extend themselves within the existing fabric of the organic spatial organisation, the hoshes system. To secure such land for extension a change should be carried out by the Government to let the planners and other authorities enforce, democratically, the resolution for land extension.

The morphology of the villages and the character of residential areas within the space domains undoubtedly reflect the socio-cultural power within the rural society. We have suggested that far from challenging the dominant power-relations, such a large scale of informal settlement activities actually reinforce the sustainability of the Gezira agricultural development. Although, apparently, the formation of the informal settlements might appear to be confronting the landed policies of the professionals or planning authorities, in fact such processes are promoted to consolidate the processes of housing production in rural areas. Although the infrastructure upgraded processes provide drip-feed improvements that are only forthcoming with the delivery of planning interventions or votes for the élite to gain access to public institutions through which they are able to gain social status and income privileges, they play a significant rôle in transferring small villages into large sustainable settlements.

Examining and clarifying the consequences of the agricultural scheme policies on the phenomenon of residential development of the local people had its own constraints. Decision-makers as well as conditions of geo-politics in the context greatly affected the socio-cultural factors and variables investigated in this research. The social aspects and cultural values also greatly influenced the settlement evolution and other physical factors and variables investigated in this study. The link between different levels of analysis is an issue of complexity that faces this research, because of the complexity of the interrelationships between various factors and socio-cultural backgrounds of people within the context. In the light of these arguments, the synthesis of the main findings have been demonstrated on three hierarchical levels, starting from the regional, through to local village and finally to the house level. Key findings were demonstrated in terms of the main socio-cultural factors that interacted with other factors to sustain the processes of vernacular built environment production.

The conclusion to be drawn from the Gezira agricultural development is that the success of the development of projects in any sector depends on an understanding of the sometimes complex socio-cultural and economic relations among household members and the wider context of the region and beyond. In contrast, success refers not only to the specific results of projects but also to their broader consequences for individuals. Furthermore, projects, even those that achieve their objectives, may cause barriers to settlements, which ultimately result in outright project failure. The development of the Gezira built environment sealed most of the communities and imposed barriers to expansion for the development of the traditional household. Negative results can be avoided, and the likelihood of success increased, if the socio-cultural dynamics governing the allocation of resources and responsibilities within the context are understood and taken into account in the planning process. In the Gezira area and

in terms of the above argument, the agricultural project has provided a degree of flexibility to accommodate the socio-cultural changes within the formal planning, leading to a method of adaptation resulting in an order of settlements that characterise the region today.

- Economic planning decisions have had an important effect upon regional development patterns; two types of development pattern were created in the area, formal and informal planning systems.
- Agricultural development and water policies revealed twofold factors: the economical support and physical barriers to these villages.
- The chronological approach revealed the importance of the socio-cultural issues of rural societies that supported the evolved vernacular organic villages of the Gezira context.
- The evolved vernacular traditional settlements interacting with the existing formal development have created a regional order that helps to organise the hierarchy of services and amenities within the region.
- Change in space has an effect on social cultural factors as well as the change in socio-cultural factors having their impact on the process of economic activities and people-movement within this space.

Thus any agricultural development must consider the existing and expected settlements that might be the core shelter of the inhabitants who could be the backbone of the economic development in any similar area and could form the pattern that could be a base for a consolidated fabric that will serve future generations.

8.3 The Vernacular Organic Settlements

We saw that in vernacular traditional architecture everyone builds his own house from local building materials and by labour and skills developed within the community, as in El Sereiha village. Clark (1982:1-3) argues:

"Everyone needs housing but few can build their own house."

He concluded that a house of any comfort needs land and materials found locally as well as special skills and the time to construct. The features of housing today, the labour, materials and skills have to be obtained from someone else and the terms on which they are made available are the root cause of many of the features of housing we can observe today.

The analysis in this study showed that the socio-cultural factors are the most telling factors that helped in both production of such houses and their fitness to the built environment in which they grew. Though the process of fitness and adaptation run prudently through time, this housing needed more consolidation in terms of services and amenities. There is one

reason why government has become involved in traditional housing, regulating tenancies and organising land ownership. Yet government action cannot alter the basic facts of housing. People aspire to certain types of house as well as simply needing a house – housing is not a homogenous commodity but a highly differentiated and culturally expensive product. The traditional process of housing design is a model of variations and adjustments; there is more individual variability and differentiation than in other standard types of design, of urban housing legacy. It is the individual requirement that modifies the type. Then circumstances may arise, allowing changes and alterations to sweep aside the community structure and spatial networks. Therefore, the interests of the planners and builders may not coincide with the householders. This conflict may create more complicated problems, as we observe in housing planned for the extension of El Sereiha village.

These informal organic settlements are now increasingly accepted within the broader definition of vernacular architecture. The increased interest in vernacular forms over the past three decades reflects the widening appreciation that there are many lessons to be learnt from them that can contribute to meeting contemporary and future building and planning needs (Oliver, 1987). Also Oliver (1969:12) describes the traditional houses that are built by the people themselves and their simplest forms,

> *"If they make no permanent mark upon the landscape, they are nevertheless forms with a history of evolution and have housed or accommodated as many people as any other housing type."*

The simple and humble architecture of organic villages, in addition to its intrinsic value, imposes different forces on the development and character of built form. This built form was inevitably the result of choices between possible alternatives. These choices reflect an image of an ideal life expressed through socio-cultural forces in the broadest sense, which are, therefore, of equivalent nature to formal factors in the generation of form in a productive area such as the Gezira. This socio-cultural interaction with the built environment forces created a form order that originated from the choices of local people as compared to the case of the users of the formal colonial housing. This form is flexible in its arrangement and construction. People add rooms when the social needs necessitate and it was built by a method of core room development (see chapter seven and below). The community is responsible for providing the land and help in constructing homes for its individuals.

The extended family system under the stress of modern life and cross-cultural interaction, especially through the media, made the members of the usra more enthusiastic to develop the usra house and look at individual housing as the duty of the community. Land-use planning has divided the existing hoshes into sub-divisions and encouraged the conversion of extended

families into the nuclear form of settlement through the land ownership system. No one can register his house (if it is less than 200m²) in the old part of El Sereiha unless he has proved that all other members gave up their shares. It was also found that the change in the family structure gives the users more responsibilities towards their single units and this created the feeling of real ownership that was absent in the extended family; the ownership was for the group or whole family and the standard of the house depended on the economic situation of the head of the family, who directs every development. Thus the vernacular housing construction considers to a large extent the core- unit method to fulfil family requirements. In contrast the absence of responsibility towards the housing production created many structural problems and space misuse in the Farmhouses village.

8.3.1 The Core unit System

In El Sereiha village it was found that the core unit system is an incremental construction that reflects individual circumstances and preferences. The concept of establishing a core unit that can grow in a flexible fashion is of relevance also to mainstream architectural design, particularly in response to the need for prudent change. The idea of the 'perfect fit between people and their physical settings or built environment' has been critically questioned when there is need for rapid changes. There is also emphasis on the value of minimal design in both practical as well as aesthetic terms (Kellett 1995). In El Sereiha village it was notable how the settlements were laid out to a flexible hosh system which embodied their expectations for the future, but which might take generations to achieve. The emphasis on the long-term commitment and vision of these users who build their own houses could create a complication for planners who want to change the existing organic fabric rapidly to accommodate modern expectations. The study has begun to explore the complexity surrounding the issue of motivation in rural housing behaviour.

The process of rural development is not just an aspect of physical and economic growth, but it is profoundly linked with the socio-cultural values and community participation. The challenge is to find socially just, economically viable, culturally transferable innovations, and ecologically sustainable solutions, which are appropriate to meet the needs of the future generations. When we fulfil these needs we can say we are approaching the meaning of sustainability in rural settlements, which is indicated by the four corners of the square pyramid model (see chapter two). In order to enable the implementation of a new strategy, it would be necessary to restructure the local bodies and service departments and to equip them to cope with the changing global system.

8.3.2 Socio-Cultural Values

We saw that, in the case study space domains, the image of such places is not necessarily connected or associated only with its physical features. There is another dimension to the place perception and image; it is the socio-cultural values which are embedded in these places. There has been a shift from the extended family to the nuclear family as a reflexive response to changes in spatial organisation and it has been followed with a loose fit between the housing and the family.

In viewing the house as the ultimate product of a long period of experience incorporating social, cultural, economic and environmental aspects, the designers and planners must be conscious of the vernacular architecture that has been conserved through traditions and life style. Generally, social, cultural, economical and environmental aspects played a major role in shaping rural housing patterns and house forms in this vernacular architecture in El Sereiha village. The house forms reflect the users' response to the built environment, the harsh arid-hot climate and socio-cultural changes. Since the beginning of the agricultural scheme in the Gezira area of the Sudan, there have been remarkable changes to the usra. It was found that two things followed the planning intervention that impinged on the organic development. The first is the need to consider the importance or potential importance of family and kinship and other aspects of culture to provide support where it is needed.

8.3.3 Material Choices

According to the findings and analysis carried out in the study, it seems the quality of houses is interrelated to the type of materials used, although most of the materials in both villages were local building materials except those used in the roofs and openings in the Farmhouses village and the houses built after planning intervention in El Sereiha village. The houses that appeared in the village after planning intervention demand higher standards, although they were built from local building materials. People themselves improved the quality of their houses through a hybrid process (chapter six). The gishra system has been used very extensively in local building industry and proved to be successful. It prevents the erosion due to rainwater and also it gives the natural appearance that people are fond of. Overall, it is easer to build and decorate it, as was clear in the case of the diwans. Successful places are built to last and stand the test of time, (Rudin and Falk 1999). Thus the hybrid gishra system may indicate sustainable directions.

The selection of materials must no longer be viewed from a narrow technological and financial perspective, if we accept that dwellings are more than shelters or physical structures.

Much research has gone into developing sustainable and affordable alternative technologies and materials to improve housing conditions. Two facts may be emphasised here; the economic and function options are either rejected or marginalized and the socio-cultural aspects are still being accepted.

- It was observed that building materials are used in a cost-effective way within the socio-cultural context.
- It was proved that in many cases there is a high awareness of the cost implications of design decisions, including the issue of durability. This takes into consideration the importance of the resource constraints.

8.4 Impact of Colonial and Planning Intervention

Housing is also a catalyst of change, the place where wider conflicts are resolved and the spark which fires off other changes in rural communities. For these reasons alone, the built environment of rural Gezira cannot be understood without understanding the organic housing development to introduce changes within the vernacular organic settlements. Then, a question should be drawn on the future directions of rural housing production and its relationship with rural planning. Inevitably this will reunite rural housing with many other aspects of sustainability in the environment in rural settlements. It was found that there is a reflexive relationship between housing, society and economy. Housing is a reflection of the socio-cultural and economic factors.

It was found that there was a complete ignorance of rural housing in the allocation of the government budgetary and grants system, though there has been a trial to re-plan some of the villages. This planning intervention was financed from the tenants' social support fund, which is usually taken from the profit of the farmers (2% of the Gezira income from cotton produce). This is usually run by the Social Department in the Gezira area to meet the social development processes. The economic reforms call for a significantly increased rôle by the investment in local settlement development. Local bodies have to gear up to encourage the 'Social Department' of the Gezira Board to provide services and support for rural development. Their capabilities need to be strengthened to harness the potential of community, cooperative and private sector resources in the development of the village. They have to reorient their rôle as a facilitator for which new instruments and institutions need to be created in order to achieve higher levels of mobilisation of resources, for equitable participatory service delivery and housing development.

It was found that the planning intervention has affected both the shape of the plot and the standard of the dwelling, and changed the socio-cultural activities as well. The adaptation of the Gezira dwelling and housing patterns to reflect the taste and cultural situation of the inhabitant or owner can be held to be an objective of quality of life, the ability to alter and extend a house to facilitate change in use and planning organisation or in quantity of users, making the best use of land and materials for the sake of the occupants, have been clearly illustrated by the organic development in the traditional village of study. In contrast although the colonial dwellings showed some limited flexibility, in modifications, to suit the socio-cultural behaviour of the Sudanese officials the absence of responsibility towards the house created an obstacle to altering and extending to facilitate changes in use and to make the best use of land and living space.

The colonial houses have not been subjected to continuous adaptation to socio-cultural changes of users but the élites make these changes whenever the users require, on condition that the budget is available. Although these houses were built of more durable materials and by more skilled labour we found most of these houses were obsolete, or about to be so, according to the comments of one of the S.G.B. engineers (interview 2001):

> *"Many reports have reached us asking us to allocate a large amount of money to renovate certain houses and these numbers increase every year as we make very minor changes in these houses. I think it is a pity not to rethink the design and use of the whole land as the negligence of the water around these houses may lead to a disastrous situation in the construction of these high standards of housing in relation to houses in the Gezira"*

The above discussion on settlement formation at the three levels of housing development reveals that we can learn from the studies of underlying factors behind these forms. It is precarious to apply western concepts to the problems of the organic settlements instead of looking at them in terms of the local way of life, ways of doing and practising things and specific needs, which mean their sustainability. If planners and designers accept the ideas which say the functions of houses are not primarily utilitarian (Rapoport, 1999), and at the same time realize that these functions may be better satisfied by traditional housing in the Gezira area of the Sudan than by new housing systems or planning intervention, then their attitude may change towards the housing pattern 'system of hoshes' and organic dwellings construction. Vernacular traditional housing may therefore be much more acceptable or desirable than has been assumed. The housing patterns and dwellings in the area should possibly be adjusted and improved accordingly to enhance the process of sustainability in the area, taking into consideration the hybrid processes executed prudently in El Sereiha village.

8.5 Questioning Sustainability

The Gezira area of the Sudan has shown, in the resource information, literature review and the case study analysis, an evolving interrelationship between the organic villages and the formation of the agricultural scheme, even though there was no integration between the two parts at the beginning of the scheme, (1925) and even though there was a lack of comprehensive policies and guidelines for strategic environmental planning.

8.5.1 Agriculture and Housing

The research showed that the socio-cultural relations played a significant part in the integration between tenants' settlements and the agricultural scheme processes. When the government started to look to sustainability of these relationships by introducing planning strategies, it was not fully successful. The planning intervention processes that run in piecemeal fashion have proved that no planning policy was put in place for a comprehensive built environment. Although these were considered as obstacles for sustainability, there were other factors more supportive of sustainability:

- The erection of the scheme itself is an investment that adds to sustaining the life of people in the area. It supported the income, which played a part in making the tenants preserve their values and traditions that were reflected in their residential organizations.
- The flexibility of ownership, which reflected the Islamic Sharie'ą Law, enabled successive generations to inherit agricultural lands and this created attachment to the lands, more sustainable life.
- The produce of the scheme supported the basic needs of the tenants; food, water, shelter (material available locally), etc.
- The spirit of partnership and participation, which was developed through time, enhanced the way of life. This was reflected, clearly, in the participation of the tenants in the preplanning processes and it proved its success.
- Mud buildings can be maintained to withstand the weather; this has been proved by experiments carried out in the area. At first mud and thatch buildings proved to be rather more sustainable than other materials, such as imported timber, redbrick. Nowadays there is potential in the use of redbrick but the local people need technical support in order to prevent the erosion of the riverbanks.

8.5.2 Production and consumption of Housing

We saw how the built form is produced within a particular social, cultural, economic and environmental context and how it cannot be interpreted meaningfully without reference to these aspects. The study of vernacular traditional architecture encourages interpretation of the built form as an order with an understanding of factors that influence decision making over the built environment as a whole and hence the interpretation of the users within the process of housing production. This perspective becomes important in the informal context, where the users are the main producers. The engagement of users with the process of production and hence the integration of production and consumption makes such environments of interest.

In many formal contexts the processes of housing production and consumption occur separately. This is certainly true of most conventional housing delivery systems, (Kellett 1995). In studies of organic development the processes of housing production that lead to shelter and consumption are intimately interlinked in space and time, and in both the users are the same.

8.5.3 Visual Issues: Simplicity and meanings

As we always experience the whole rather than any single part in isolation, we appreciate environments as ensembles. To make them more ordered, visually coherent and harmonious, however, we select and choose some features.

We could recognise that such balanced patterns enable the built environment to be coherent. The simplicity of the Gezira vernacular settlement forms reflects the unity of space and social cultural groups within these settlements. The study of the vernacular traditional layout of space in the Gezira area of the Sudan has stressed the importance of the spatial organisation incorporation with the social cultural organisation to form a distinctive order.

- At the centre of a settlement an open space 'hara' is a nodal place on significant corridors linking the inner village to the outer peripheries where services and amenities are located.
- This central node is surrounded by a mixture of commercial and community uses at a minimum level of provision leaving the majority of services to be located in the outermost areas.
- Also the node is surrounded by the residential uses that have accesses to the node and periphery.
- The edges contain a wider range of facilities such as the two days market, the mosque, schools, health centres, etc. The population is able to access the complete

range of facilities within walking distance if the size of the village is kept to its traditional setting.

- The land for the dwelling is affordable so that the dwellers have flexibility in constructing their homes and have easy access to land ownership as the kinship and households system provides housing for people in need.

Considering the above order may lead to reconsidering the system of 'Hoshes' to accept the modern conditions without denying the identity of the traditional way of thinking or the efforts of planners and designers to improve the traditional settlements to cope with the new expectations.

8.5.4 Socio-Cultural Expression

The narrow view that regards rural inhabitants as simple-minded and superstitious has attempted to remove visual issues from the agenda, and certainly encouraged traditional exponents in their view that such built environments are not architecture. This study has demonstrated that the simple rural dwellings communicate a degree of aesthetic satisfaction with their symbols in the form, materials and other elements. There is a realisation that effective design solutions must work at the level of meanings which particular forms and images communicate (Kellett 1995). Such meanings are constructed through the process of dwelling construction and the process of production and consumption.

8.6 Towards a Sustainable Framework

Due to socio-cultural norms (values, beliefs, traditions, interests, purposes) differences that existed between the inhabitants of the two villages, evidence derived from interviews conducted with inhabitants, key figures, as well as from personal experience, showed that internal cultural intermingling and residential housing assimilation of both groups worked together successfully. This has meant, to a large extent, that both groups have confined themselves within the boundaries of the economic developed built environment.

Therefore, the framework suggested in this research that will perhaps facilitate to address the complexity and elasticity (i.e., balance) of the rural traditional organic development in comparison to the formal housing, is based on the idea of assimilation. This means the social and cultural dimensions are dynamic that lead to a situation where both groups share equally the benefits of the residential development or any other social development. Thus, the framework assumes that the level of improvement of traditional organic residential development depends on four key components:

Understanding the history of the evolution and socio-cultural values of both settlements; Emphasis will be on the history of evolution of the place, space, heritage, meaning of things, values, aspirations and landmarks and their meanings. This will be based on assimilation and adaptation paradigms. Assimilation and adaptation will allow understanding of the process of hybridism which enabled both groups to coexist and live more integrated ways of life.

Connectivity between socio-cultural power and economic agricultural development; the study showed that local people's settlements have not been included in the process of planning from the beginning of the agricultural scheme. Traditional vernacular housing has supported the farming system for decades, while on the other hand the farming system has sustained the processes of residential improvement. Thus in any economic development, the socio-cultural needs must be central to any economic development to complete the circle of development. It was proved through the comparative study that there is a great connection between agriculture and the built environment on one side and any other development within this context, so we should consider the connection between any development within any future agricultural development and we have to cater for the integration between different settlements to serve their purposes and functions efficiently.

Participation of both groups at all levels of residential development; this will allow understanding the needs of each group, since needs are not static. Participation alone is not enough to influence the process of decision–making. However, it should be enhanced with socio-cultural and planning power sharing arrangements of residential development. This strategy is more flexible than the top-down polices.

Technical support in the housing construction processes; this will enable parties, élites (designers, planners, etc.) and tenants to understand each other and cooperate in housing construction processes and investigate the practical ways of implementation. Knowledge and skills are necessary to understand people's values, behaviours and needs to construct appropriate and responsive environments.

This framework could guide the decision-makers and bodies involved in the process of residential development (formal and informal) to accurately determine the situation of the local people at a given moment in time and space. Moreover, this framework might be the first step to allow for varying degrees of assimilation and adaptation, while retaining local

people's identity and socio-cultural needs. The framework proposed a four corner model of sustainable development that would provide parties with:

- The recognition of social values and cultural norms manifested within the vernacular architecture of local people, the main stakeholders of farms (economic facilities), in other words recognition of the simple and humble architecture as a vernacular that is being challenged by:
  1. Change from extended family to nuclear.
  2. Impact of the car/ technology.
  3. Viability of new building materials.

- The protection of identity and culture of such humble vernacular development.

- The restoration of efficiency of economic development supported by the power of socio-cultural integrity will enhance socio-economic sustainable development and quality of life, and

- The right for parties involved to keep their rôles in the processes of settlement improvement and planning intervention and to control their own affairs with mutual integration with the stakeholders.

8.7 Process of Residential Development Improvement

The process of improving traditional residential settlements and housing production is interrelated to the previous process; however, it focuses on the practical side of development.

1) ***Provision of land and land configuration:*** the agricultural scheme has created sealed situations hindering the expansion of the local traditional settlements. The planning intervention processes have released such situations and provided land for extensions; though there have socio-cultural changes that have swept away traditional collective self-build efforts, such as effective efforts of extended families in the residential development.

2) ***Provision of infrastructure and services:*** The planning intervention gave primacy to the villages concerned in the field of services. It affected the planned centres in the area and a new order emerged. This process started by piecemeal provision of services through social pressure and was completed by the process of planning intervention. An integrated form to involve all villages may be the solution. Basic services such as the provision of water, sewage

and roads are essential for health and communication. This not only reinforces the residential quality, but also protects the environment.

3) ***Improving the economic condition of housing development:*** there is a need to develop a mechanism that reduces the financial capability for developing residential housing under the new arena of housing construction and land provision for the tenants. Furthermore, there is a need to create more opportunities and avenues of Government financial sources for housing subsidies and support. This could be through the 'Social Department' and other available financial sources. Also, deep reading of socio-cultural practices and using social power may reduce the cost of construction and labour. Concepts of home and visions of the future lie at the heart of improving living conditions; hence support of intervention policies, which aim to upgrade conditions for the vulnerable within society, could be informed by understanding the issues of organic order and proper implementation of planning intervention policies.

4) ***Affordability:*** the housing production process in the vernacular built environment takes a long time to take its shape and that is not in tune with the new way of thinking and the expectations of the people. People now, everywhere, are looking for quick and rapid housing improvement and provision to meet their needs and governments should react to support agricultural production. The central Government's financial and technical abilities have failed to provide prompt housing production and at the same time the destruction of the socio-cultural system may cause pitfalls that are not at all preferable.

There are issues of interest that have emerged as consequences of planning intervention processes; at the centre of them is housing affordability. To achieve affordability we should emphasise the need for research and technical support in the field of building materials, as the agricultural facilities and extensive presence of the clay in the area would give a great opportunity to researchers to provide the tenants with the local building materials they need to preserve the essence of the vernacular traditional buildings and architecture. At the dwelling level, the core room unit is generally accepted into the new design processes. It was proved that it is preferable socially and culturally, as it was used extensively through decades to guide the process of housing production. This process was not strange to the process of housing provision policies, as the government started to give sites and core units to low-income people in urban areas.

8.8 Further Research

Comparison of two settlements of two different cultures seeking to develop solutions for production of a sustainable built environment in rural vernacular architecture and traditional housing forms rather than Western models needs deeper examination and further research development. Although the present study gives modest understanding of the phenomena of sustainability in a rural built environment, much more explanation is needed for understanding housing production in traditional villages in order to create more principles for planning intervention. Carrying out such research will not only help broaden the explanation of the issue of the study, but will also facilitate in finding ways to maintain a well-functioning sustainability in traditional-oriented societies and their built environment in both urban and rural areas. Of course it is clear that the urban fabric in developing countries have contained many traditional villages, which either already existed in the urban vicinity or were brought by immigrants from rural areas in the form of illegal housing development in urban areas. More insight into such phenomena may highlight deeper understanding of the socio-cultural behaviour of immigrants and how to support the residential development in both urban and rural situations.

The study has also highlighted the importance of building materials to sustainability in the built environment as the locals extensively used those locally available, especially earth materials, so it is of great interest to study such cheap material. Although research projects were developed in Sudan on earth materials, training for using such technology is not proceeding at the same pace. Development of earth materials is of significance to facilitate continuity in the building process within the rural context in particular. Deep research and further earth building materials development will assist affordability for the rural built environment, especially, for the poor.

8.9 Concluding Remarks

This thesis has dealt with the traditional vernacular settlements of the Gezira area of the Sudan where an effective built environment has been established and attracted many cultures to live intimately that enabled the dwellers to interact with most aspects of development. Investigation of the socio-cultural behaviour of such a phenomenon is often difficult to pinpoint. For this purpose, a review of general literature was traced from various disciplines, such as planning, sociology and anthropology, politics and geography. Analyses indicate that to conserve vernacular architecture, an understanding of socio-cultural motivations is essential. In this understanding planning policies deal with places where vernacular architecture is pertaining in an economic developed area, designers and planners challenge the

hidden forces of a community in addition to other physical ones. Failure to capture the spiritual, psychological and materialistic needs of groups means that planners should review their policies towards vernacular places. If planning acts as an intervening variable between traditional knowledge and modern thinking, between theoretical ideas and actions, then the policy should wait until the facts (that deal with people's lives) are available, and not adopt the idea of "we have no choice". Moreover, it was revealed that settlements might be described as the art and science of ordering the use of land and character, and setting of buildings and communication routes. This means that rural development does not only deal with the physical and economic, but also with the social and cultural aspects (norms, believes, emotions and achievements). All these features together manifest the meanings and the significance of the built environment especially if uncertainty is the prevailing mood of the community and its architecture (vernacular).

Comparison through asymmetries between two settlements of different cultures are not only manifested in the residential settlements of each group, but are also reflected in the psychological behaviour of the local group in a way that affected the order of settlements and dwellings. The outcome of this understanding is significant first and foremost to national professionals, decision-makers, people in research settings and élites concerned with those domains. The outcome consists of the following key criteria:

- Firstly, it provided insight into information about the aspects of rural residential settlements of indigenous local inhabitants and formal waged officials within the context of an economically developed area.

- Secondly, both types of planning serve as mechanisms for enhancing the process of economical development and tools for production of houses for the inhabitants. Thus those who design and implement planning intervention processes should learn from humble experiences to sustain the way of living.

- Thirdly, in addition to the main factors that constitute residential development, socio-cultural considerations are of considerable importance. Development without recognition of social and cultural factors cannot be sustainable.

- Fourthly, there is a basic need for recognition (by planners and designers) that the local traditional humble houses are vernacular architecture and they have to conserve

them; at least to reflect their sensuality in space taking in consideration the image of the car, viability of new building materials and changes in family structure.

- Finally, the élites who are centralised should not continue to formulate the shape for remote areas by introducing exotic plans, and at the same time the local people's traditions should work in tandem with the planning intervention processes.

The thesis provides evidence that, working empirically; people are well able to navigate themselves to shape resources nearer to the realisation of their values. Evidence that at least tells us there are many ways in which to make a home meaningful, sustainable and far from rural deprivation.

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Appendix A: List of Interviews

The following is list of interviews conducted with the space domains' key figures; field inspectors, other officials and sheikhs in the organic village. The interviews run parallel to the questionnaire and sometimes with it to clarify any ambiguity. The interviews were found very useful in the research procedure. All interviews were taken in June, July, August and September 2001.

Community Leaders

Officials:

Head of Engineering Department in Barakat

Abu Galib: Senior Accountants in El Turabi Division

Ali Guneim; Surveyor in the Planning Office in Wad Madani

Haram El Sereiha Inspector

Kab El Gidad Inspector

Kab El Gidad Block Senior Inspector

Head of El Sereiha Municipality

Muzamil: Foundation School Headmaster

Peasants:

Haj Ahmed: Sheikh of the village.

Haj Sideeg: one of the oldest peasants in El Sereiha village

Sheikh Ibrahim: Head of the Agricultural Committee

Abu El Hassan: Imam of the Mosque.

Other not nominated names of certain figures of both villages.

Appendix B: The Questionnaire

QUESTIONNAIRE:

INTERVIEWER:.....
LOCATION:.....
HOUSE IDENTIFIER:.....
HOUSEHOLD IDENTIFIER:.....

CHARACTERISTICS OF THE HOUSEHOLD:

A household is;

1- One person living alone in a unit in a compound,
2- A group of people (not necessary related)living in a unit with a housekeeping,
3- The compound may contain more than one unit and consequently more than one household,

What type of accommodation does your household occupy?

Single family house ☐ 1
Extended family house ☐
Multi-family house ☐
Other, ( ) ☐

Type of the house!

Traditional dwelling ☐ 2
Contemporary dwelling ☐
Government dwelling ☐
Other, ( ) ☐

How do you own this house?

Original owner ☐ 3
Inherited house ☐
Family house ☐
Rented house ☐
Other ( ) ☐

How did you or the owner build this house?

By contract ☐ 4
By self-help (government programs) ☐
By personal efforts (alone or with family) ☐
Other( ) ☐

interviewer	House identifier	Household identifier

Do you own another house elsewhere?

Yes ☐ 5
NO ☐

If yes. where is it? (Insert number, if more than one house.)

In this village ☐ 6
In another nearby village ☐
In the nearby town ☐
Other ( ) ☐

FAMILY STRUCTURE:

How many households live with you in the same unit?

One household. ☐ 7
Two households, ☐
Three households. ☐
More (NO.) ☐

Including yourself how many people are in your household? (Live with you and share the same food) ☐ 8

Adults, 16 years and over, ☐
Children, under 16 years, ☐

Are you?

Single? ☐ 9
Married? ☐
Divorced/separated? ☐
Widow/er? ☐

If married how many wives do you have?

One wife ☐ 10
Two wives ☐
Three wives ☐
More, (no.) ☐

If you have more than one wife where do they live?

With you in the same unit ☐ 11
In another separate unit ☐
In another village ☐
In an urban area ☐

2

Interviewer	House identifier	Household identifier

DETAILS OF HOUSEHOLD MEMBERS: 12

s. No.	Relation to household	age	Sex		Education	work
			male	female		
1						
2						
3						
4						
5						
6						
7						

Relation to household husband, wife, children, mother, father, grand mother, etc.
For Age and Education; insert only the number of item below where appropriate:
Age (1)-from 0 – 5, (2) 6 – 14, (3) 15 – 18, (4) 18 – 24, (5) 25 – 29, (6) 30 – 39, (7) 40 – 49, (8) 50 – 59, (9) 60+
Education (1) Kindergarten, (2) Primary school, (3) High secondary school, (4) University, (5) Higher studies. (6) Quranic school

What is your household religion?

Islam ☐ 13
Other ☐

Is there any member of the household has different religion?

Yes ☐ 14
No ☐

When did your household extended family arrive in this village?

Before inauguration of the scheme ☐ 15
After inauguration of the scheme ☐

HOUSE CHARACTERISTICS:

USAGE OF THE SPACE:

How large is your current household's plot?

Less than 120m ☐ 16
120-200m ☐
200-400m ☐
400 + ☐

How many rooms are there in the house?

Bed rooms	☐	Family rooms	☐ 17
Living rooms	☐	Sitting rooms (diwan)	☐
Dining rooms	☐	kitchens	☐
Verandahs (shaded areas)	☐	store	☐
Toilet or other facilities	☐	others	☐

Interviewer	House identifier	Household identifier

How many out door spaces are there in the plot?

One	☐	18
Two	☐	
More than two	☐	

What are these outdoor spaces used for?

Sitting	☐	19
Sleeping	☐	
Cooking	☐	
Storage	☐	
Home-base work	☐	
Others	☐	

How many guestrooms do your household have? ☐ 20

At what extend are you satisfied with your house?

Very satisfied	☐	21
Satisfied	☐	
Not satisfied	☐	
Difficult to say	☐	

Where is the animal yard?

Inside the house	☐	22
Outside the village	☐	
In the farm area	☐	
Elsewhere (mention)	☐	

Communal spaces:

What are the communal spaces used for?

Praying	☐	23
Playing	☐	
Festivals	☐	
Other, (.....)	☐	

How often do you go to these spaces?

Every day	☐	24
Every week	☐	
Every year	☐	
Never	☐	

Which of these spaces do you prefer?

Public space	☐	25
Outdoor private space	☐	
Indoor private space	☐	

4

Interviewer	House identifier	Household identifier

BUILDING CONDITIONS:

Construction:

What is the material the house built of?

Indigenous materials	☐	26
Local manufactured	☐	
Imported	☐	
Mixed materials	☐	

Do you think the building materials used in your house are?

Good	☐	27
Fair good	☐	
Bad	☐	

What is the type of the walls?

Mud walls	☐	28
Gishra walls	☐	
Red bricks walls	☐	
Other (.....)	☐	

What is type of the roof?

Baladi, (using indigenous material)	☐	29
Corrugated zinc	☐	
Concrete	☐	
Other (.....)	☐	

What is the floor finish made of?

Tiles	☐	30
Sand	☐	
Bricks	☐	
Others (.....)	☐	

What is the type of the foundation?

Mud	☐	31
Bricks	☐	
Concrete	☐	
Stones	☐	
Others (.....)	☐	

How many times have you extended your dwelling since you lived in?

Never	☐	32
Once	☐	
Twice	☐	
More than that,	☐	

5

Interviewer	House identifier	Household identifier

How did you improve your dwelling?

By extension	☐ 33
By alteration	☐
By demolishing	☐

When do you usually maintain your dwelling?

Yearly	☐ 34
More than once a year	☐
Less than once a year	☐
Never	☐

Infra-structure & services:

Water supply

Self (well)	☐ 35
National (connected with meter)	☐
With the neighbor	☐
None	☐

If it is none. from where you get drinking water? ☐ 36

Electricity

Self (generator)	☐ 37
National (connected with meter)	☐
With the neighbor	☐
None	☐

If it is none, what do you use for the power? ☐ 38

Type of sanitation

Pit (soak-away)	☐ 39
Septic tank (Flush)	☐
Farms or any other places	☐
Others	☐

Telephone

Self	☐ 40
Common (box)	☐
Others	☐

Solid waste

Taken by the municipality	☐ 41
Dumped inside the plot	☐
Eaten by the animals	☐
Disposed to the farms	☐
Other, (.....)	☐

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Appendix C: Examples of an Answered Questionnaire

إستبيان

رقم الباحث .....(81)..... الموقع :.....

مؤشر المنزل :..... مؤشر الأسرة :.....

خصائص الأسرة :-

- الأسرة هي شخص واحد يسكن بمفرده ( )
- مجموعة أشخاص يسكنون مسكن واحد (✓)
- العائلة تشمل أكثر من أسرة تسكن فى مسكن واحد ( )

1- أي نوع مساكن يلائم الذي تشتمل عليه أسرتكم ؟.

1/ منزل أسرة (✓) 2/ منزل لأسرة ممتدة (عائلة) ( ) 3/ منزل لأسر مختلفة ( )4/ أخر ( )

2- نوع السكن ؟

1. منزل قديم ( ) منزل حديث (✓) منزل حكومى ( )

3- كيف امتلكت هذا المنزل؟

1. ملك قديم (✓) 2. منزل موروث ( ) 3. منزل العائلة( ) 4. منزل مؤجر ( ) 5. أخر ( )

4- كيف تم بناء هذا المنزل

1- بالمقاولات ( ) 2- بالعون الذاتى من الدولة ( ) 3- بطريقة شخصية(✓) 4- أخر ( )

5- هل تمتلك منزلاً آخر ؟

نعم ( ) لا (✓)

6- إذا كانت الإجابة بنعم أين هذا المنزل (إن كان أكثر من واحد العدد

أساس العائلة :-

7- كم أسرة تسكن معك فى هذا المنزل؟

1- أسرة واحدة (✓) 2- أسرتين ( ) 3- ثلاثة اسر ( ) 4- أكثر ( )

8- أذكر العدد بما فيهم أنت كم شخصا يسكنون المنزل؟

1- بالغين ، أكثر من 16 سنة (✓) 2- أطفال أقل من 16 سنة( )

9- هل أنت ؟

1- عازب ( ) 2- متزوج ( ) 3- مطلق ( ) 4- أرمل ( ) أرملة ( )

10- إذا أنت متزوج كم من الزوجات؟

1- زوجة واحدة ( ) 2- زوجتين (✓) 3- ثلاثة زوجات ( ) 4- اكثر ( ) 5- اذكر العدد ( )

11- إذا كنت متزوج بأكثر من زوجة أين يسكنون ؟

1/ فى هذه القرية ( ) 2/ فى قرية مجاورة ( ) 3/ فى مدينة أخرى( ) 4/ أخر ( )

12- بيانات أسرية

الإسم	العمل	التعليم	النوع		العمر	الصلة برب الأسرة
			ذكر	أنثى		

العلاقة الأسرية زوج ، زوجة ، أطفال ، أم ، أب ، جدة لأم ، ... ألخ

العمر والتعليم : أكتب الرقم المناسب

(1) صفر – 5 (2) 6 – 14 (3) 15 – 18 (4) 19 – 24 (5) 25 – 29 (6) 30 – 39 (7) 40 – 49 (8) 50 – 59 (9) 60+

13- ماهي ديانة الأسرة؟

الإسلام (✓) أخر ( )

1

إستبيان

رقم الباحث ..... الموقع :.....
مؤشر المنزل :..... مؤشر الأسرة :.....

14- هل هناك شخص له ديانة أخرى ؟
نعم ( ) لا (٤)
15- متى وصلت الأسرة لهذه القرية ؟
قبل إنشاء المشروع ( ) بعد إنشاء المشروع ( )

خصائص المنزل :-

16- المساحة المستقلة ؟
أقل من 120 متر ( ) 120 – 200 متر ( ) 200 – 400 متر (٤) أكثر من 400 متر ( )
17- عدد الغرف؟
غرفة نوم (٤) غرف للعائلة ( ) غرف جلوس ( ) غرف معيشة (١) مطابخ (١) غرف طعام ( )
مخازن ( ) فرندة ( ) دورة مياه أو اي وسائل اخرى ( )أخر ( )
18- كم من المساحات اخالية فى القطعة الواحدة؟
واحدة ( ) إثنين ( ) أكثر من إثنين ( )
19- ما إستعمال هذه المساحات الخالية
جلوس ( ) نوم (٤) طبخ ( ) تخزين ( ) صناعات منزلية ( ) أخر ( )
20- كم غرف للضيافة بالمنزل؟
21- إلى أي حد أنت مقتنع بمنزلك؟
مقتنع جدا ( ) مقتنع (٤) لست مقتنع ( ) من الصعب الحكم ( )
22- هل هناك زريبة ماشية ؟
فى القطعة ( ) خارج القطعة ( ) فى المزرعة ( ) فى مكان أخر (حدده) ( )

الفسحات العامة

23- ما إستعمال الفسحات العامة؟
للصلاة ( ) للعب ( ) للإجتفالات (٤) أخر (.....) ( )
24- كم مرة تذهب لتلك المساحات؟
كل يوم ( ) مرة كل اسبوع( ) كل سنة ( ) لا أذهب بتاتا ( )
25- أي هذه المساحات تفضل ؟
المساحات العامة (٤) المساحة داخل الحوش ( ) المساحة داخل المنزل ( )

حالة المباني:

التشييد :

26- ماهي مواد البناء؟
مواد محلية (٤) مواد مصنوعة محليا ( ) مواد مستوردة ( ) مواد مختلفة ( )
27- هل تعتقد أن المواد المستعملة لبناء المنزل ؟
جيدة (٤) جيد جدا ( ) سيئة ( )
28- ما نوع بناء الجدران؟
جالوص ( ) قشرة (٤) أخر (.....)
29- ما نوع الأسقف؟
بلدى (٤) زلك ( ) خرسانة ( ) أخر (.....)
30- ما نوع إنهاء الأرضيات؟
بلاط ( ) رملة (٤) ضفرة ( ) أخر (.....)
31- ما نوع الأساسان؟
جالوص ( ) طوب (٤) خرسانة ( )حجر ( ) أخر (.....)
32- كم مرة قمت بزيادات فى المنزل منذ السكن فيه؟
لم يحدث ( ) مرة واحدة (٤) مرتان ( ) أكثر من مرة ( )

2

إستبيان

رقم الباحث ..... الموقع :.....
مؤشر المنزل :..... مؤشر الأسرة :.....

33- كيف تحسن المنزل؟
بالإضافة ( ) بالتغيير ( ) بالهدم( )
34- متى تتم الصيانة فى؟
سنويا ( ) أكثر من مرة فى السنة ( ) أقل من مرة فى السنة ( ) لا أقوم بها إطلاقا( )

الخدمات الأساسية :-

35- المياه ؟
بئر خاص ( ) خدمية بالمتر ( ) مع الجار ( ) لاهذا ولا تلك ( )
36- مـــن أيـــن تـــأتى بالمـــاء وإن كـــانت لاتوجـــد الوســـيلة؟
(.....)
37- الكهرباء :
موتور خاص ( ) توزيع عام ( ) مع الجار ( ) لاشيء ( )
38- ماذا تستعمل للوقود (.....)
39- ما نوع الخدمة الصحية ؟
دورة مياه عادية ( ) حوض مستك تانك ( ) فى الخلاء( ) أخر ( )
40- التلفون؟
خاص ( ) صندوق عام ( ) أخر ( )
41- الزبالة؟
تجمع بالمحلية ( ) تلقى داخل القطعة( ) تأكلها الأغنام ( ) تنقل للخلاء ( ) اخر (.....)
42- التعليم أين يدرس أطفالك؟

نوع التعليم	فى القرية	فى قرية أخرى	فى المدينة
أولية			
أساس			
ثانوى			
جامعة			
أخرى			

الخدمات الطبية:-

43- أين تتلقى العلاج؟
فى القرية ( ) فى القرية المجاورة ( ) فى المدينة المجاورة ( )
44- أي نوع من العلاج تجده فى القرية ؟
عيادة فقط( ) مستشفى ( ) الاثنين معا( )
45- إلى أي مدى أنت مقتنع بالعلاج؟
مقتنع جدا( ) مقتنع ( ) لست مقتنعا ( ) من الصعب تحديد ذلك ( )

العمل والدخل :-

46- أين تعمل ؟
فى القرية أو حولها( ) فى القرية المجاورة ( ) فى المدينة المجاورة ( ) أخر (.....)
47- ما هو نوع العمل ؟
مزارع ( ) عامل زراعة ( ) موظف حكومى ( ) خاص ( )
48- إلى أي مدى أنت مقتنع بطبيعة عملك؟
مقتنع جدا( ) مقتنع ( ) لست مقتنعا( ) من الصعب تحديد ذلك( )
49- كم عدد الحواشات ؟
مزرعة 2 فدان ( ) مزرعة 4 فدان ( ) زرعة 8 فدان( ) أكثر من ذلك العدد ( ) لايوجد( )
50- كيف تحصلت على هذه المزرعة ؟
مزرعة عائلية ( ) مزرعة موروثة ( ) عن طريق الشراء ( ) أخر ( )

إستبيان

رقم الباحث ..... الموقع :.....

مؤشر المنزل :..... مؤشر الأسرة :.....

وضع الإنتاج في هذه السنة

القطن	القمح	الذرة	أخر ( )

51- هل لديك وسائل دخل أخرى ؟

نعم ( ) لا ( )

52- إذا كانت الإجابة بنعم وضح

.....

53- كم عدد الذين يعملون بالأسرة ؟( )

54- كم تصرف سنويا لتحسين منزلك ( )

55- كم تدفع أنت وشركاءك في الأسرة .....

56- كم تدفع لهذه الخدمات؟

مياه .....

كهرباء .....

الصحه .....

التعليم .....

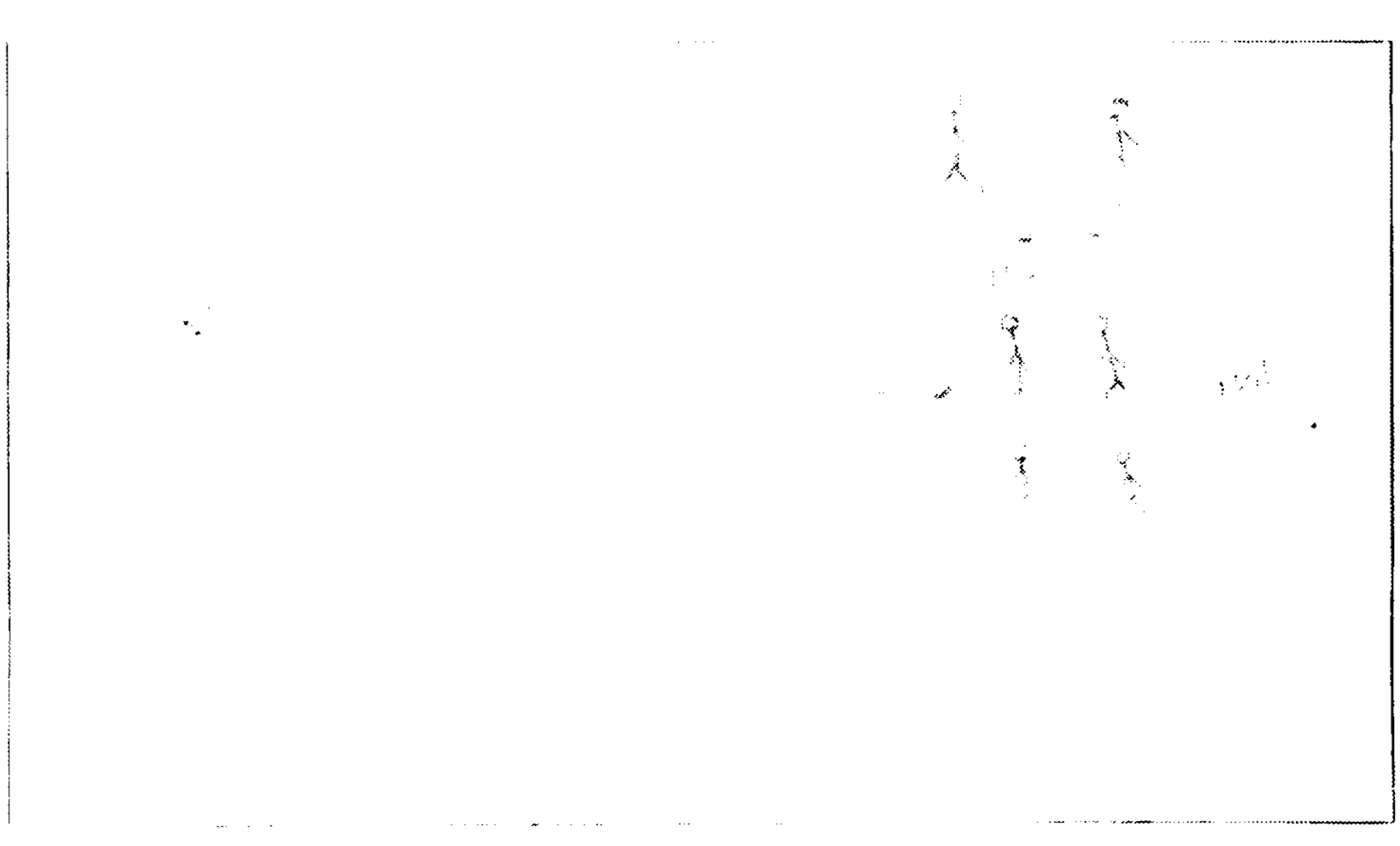
التلفون .....

اخر .....

57- كم عدد الحيوانات التى تمتلكها؟

أبقار	أغنام	خراف	أخر

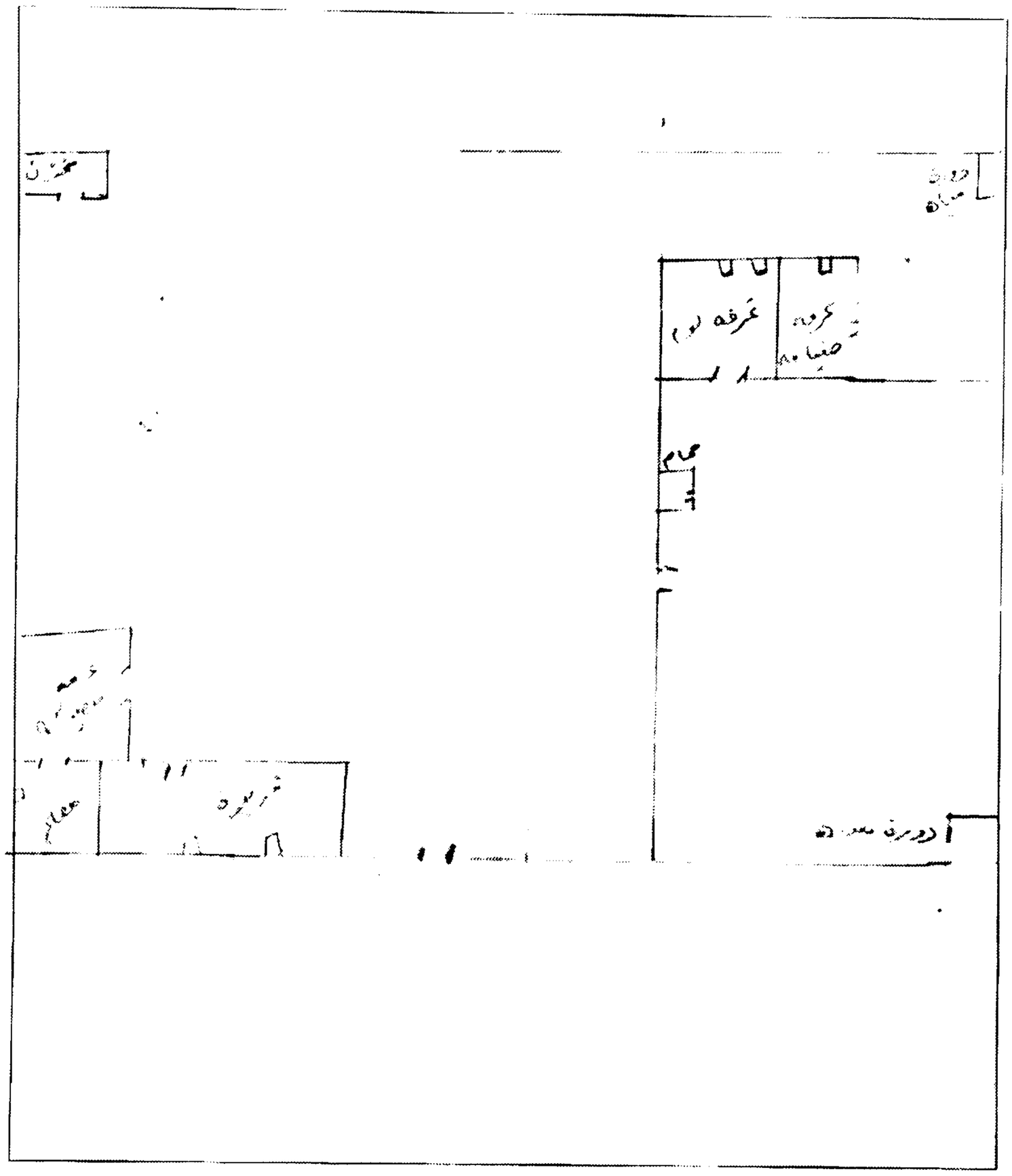
أرسم كروكى لتركيب إستمارة



إستبيان

رقم الباحث ..... الموقع :.....
مؤشر المنزل :..... مؤشر الأسرة :.....

إرسم كروكي للمنزل



Appendix D: Reflection on the Fieldwork

It is the structure and program of the social survey, which was carried in the two domains of the study, the Farmhouses Complex and El Sereiha village.

Means of Data Collection

The following table, 1.2 shows the different surveys mechanism to be used to validate the information required for the research. These types are suggested to cover both space domains in a parallel way.

Survey (samples)	Social Survey: questionnaire Building Survey: use of space
Interviews	Personal Contacts and Focus Groups
Observations and Photos	People activities, Space usage, Fixed Features, Building Materials, and Methods of Construction
Statistical Sources	Annual or Periodical Statistics, Censuses, and Letters and Other Documents
Official Archives	Planning and Housing Reports and Gezira Board Records,

Types of Surveys would be carried out

Questionnaire preparation

Questions would cover the following areas in the villages,

General	Location, roads, canals, farms, distance, etc.
Components	Planning: space, forms and relations, usage, etc.
Architecture	Rooms, floors, roofs, structures openings, etc.
Activities	Movement, praying, sleeping, sitting, cooking, eating, etc
Services	Education, water, sewage and drainage, electricity, etc
Kinship	Family structure, community structure, relationship, etc
Income	Income generation
Land-use	Land tenure, land ownership, etc

Activities and issues to be covered in the questionnaire

The Semi-Structured Interviews

People, Attitudes, Properties, Anticipation for the future, Culture construction, Needs of the people could be covered by interviews designed to fill the gap not covered by the house-to-house questionnaire.

The Fieldwork Progress

The fieldwork will cover 300 houses, 200 houses from El Sereiha village and 100 houses from the Station Farmhouses Complex, i.e., the fieldwork in both villages will run in parallel. 10 students from Omdurman University, Department of Architecture & Planning, will carry the fieldwork. Everyone is supposed to finish 3 questionnaire everyday. It means the work will be finished in 10 days.

The Time-scale

Preparations	12 days
Village I 200 units,	10 days
Village II 100 units	
Recording & Observations	6 days
Interviews Personal	7 days
Focus groups	7 days
Official Documents	10 days
Rest, Fridays,	8 days
Unforeseen work and Rearrangement	10 days
Total time required	**70 days**

Note: Some work may be carried out at the same time of the Fieldwork such as, Experiments, photos, observations, Survey, etc.

Appendix E: Findings

The following tables show the different findings of data.

Table9. 1: Household Structure

A- Household Structure:			El Sereiha Village		Farm Houses Complex		Notes
			Frequency	Percent	Frequency	Percent	
A- Household Number		1 household	137	68.5	60	76.9	It seems in both types of dwellings:
		2 households	43	21.5	12	15.4	Single families dominating social life
		3 households	20	10	6	7.7	
B- Person/household		Adult	95	47.5			Also there are 3 persons per room,
		Young	105	52.5			Density seems low; 40-50 per Feddans
C- Marital Status		One	156	78			
		2 - 4	44	22			
D- Social Aspects	a. Sex	Male	171	85.5	72	92.3	Males dominating head of households
		Female	29	14.5	6	7.7	
	b. Age	0 - 15	41	20.5			
		16 - 24	9	4.5	6	7.7	
		25 - 59	135	67.5	54	69.2	
		60+	15	7.5	18	23.1	
	c. Education	Foundation	126	63	29	37.2	
		High School	64	32	31	39.7	
		Higher Education	10	5	18	23.1	Diversity of Education
	d. Work	Farmer	119	59.5	0	0	
		Private	56	28	12	15.4	
		Government	25	12.5	66	84.6	

Table9. 2: Housing Typology

B- Housing typology:	El Sereiha Village		Farm Houses Complex		Notes
	Frequency	Percent	Frequency	Percent	
Traditional	180	90	6	7.7	It seems traditional houses are dominating the locals' settlements.
Contemporary	16	8	6	7.7	Contemporary housing is new to the area[29]
Government	4	2	66	84.6	Government housing is the houses built by the colonial system and national governments carried on the process

Table9. 3: Dwelling Size and Form

C- Form and Size of Dwelling:		El Sereiha Village		Farm Houses Complex		Notes
		Frequency	Percent	Frequency	Percent	
A- Areas	0 – 200 m	66	33	12	15.4	
	200 – 400 m	51	25.5	18	23.1	
	More than 400 m	83	41.5	48	61.5	Most of houses are more than 400m2
B- No. of Rooms	2 Bedrooms	81	40.5	72	92.3	Most houses 2 bedrooms
	3 Bedrooms	45	22.5	6	7.7	
	More than 3	74	37	0	0	
C- Open Space and Courtyards	Sittings	29	14.5	9	11.5	
	Sleeping	150	75	63	80.8	Sleeping in courtyards is necessary
	Others	21	10.5	6	7.7	
D- 'Diwan' as a Reception Space	None	156	78	45	57.7	Diwan is important in traditional house;
	One	9	4.5	24	30.8	Not so required in colonial buildings
	More than one	35	17.5	9	11.5	

Table9. 4: Dwelling Construction

[29] Contemporary housing means here the new houses using new building materials such as cement and steel.

D- Dwelling Construction:				El Sereiha Village		Farm Houses Complex		Notes
				Frequency	Percent	Frequency	Percent	
A- Materials			Indigenous materials	125	62.5	51	65.4	Most of houses are built from the indigenous materials
			Local manufactured	55	27.5			
			Import	4	2	18	23.1	
			Mixed materials	16	8	9	11.5	
B- Skills				Build by tenants		Engineers		
C- Quantity				Every tenant has a house		Fixed number		
D- Quality	a. Satisfaction	a. With work	Very satisfied	82	41	48	61.5	Satisfaction is good
			Satisfied	48	24	15	19.2	
			Not satisfied	41	20.5	15	19.2	
			Difficult to say	29	14.5	0	0	
		b. With house	Very satisfied	78	39	12	15.4	
			Satisfied	56	28	30	38.5	
			Not satisfied	41	20.5	24	30.8	
			Difficult to say	25	12.5	12	15.4	
	b. Building condition		Good	130	65	34	43.6	Conditions of buildings
			Fair good	48	24	27	34.6	Are good.
			Bad	22	11	13	16.7	

Table9. 5: Life Style of the 'Usra'

E- Life Style:		El Sereiha Village		Farm Houses Complex		Notes
		Frequency	Percent	Frequency	Percent	
A- Religion	Islam	189	94.5	78	100	
	Other	11	5.5	0	0	
B- Use of public Space	Sitting	31	15.5	9	11.5	
	Entertainment	150	75	63	80.8	
	Other	19	9.5	6	7.7	

Table9. 6: Services and Amenities

F- Service and Amenities:		El Sereiha Village		Farm Houses Complex		Notes
		Frequency	Percent	Frequency	Percent	
A- Water	National (connected with meter)	157	78.5	6	7.7	78.5 of people have tap water, others with neighbour.
	Connected with neighbour	9	4.5	13	16.7	
	Not connected	34	17	59	75.7	Most of farm houses 75.7 have no tap
B- Electricity	National (connected with meter)	192	96	60	76.9	For both villages
	Connected with neighbour	3	1.5	0	0	
	Self (Generator)	4	2	12	15.4	
	None	1	0.5	6	7.7	
C- Sewage		Pit-latrine		Septic Tank		Septic provided to G.H but not traditional, only 'pit-latrine'

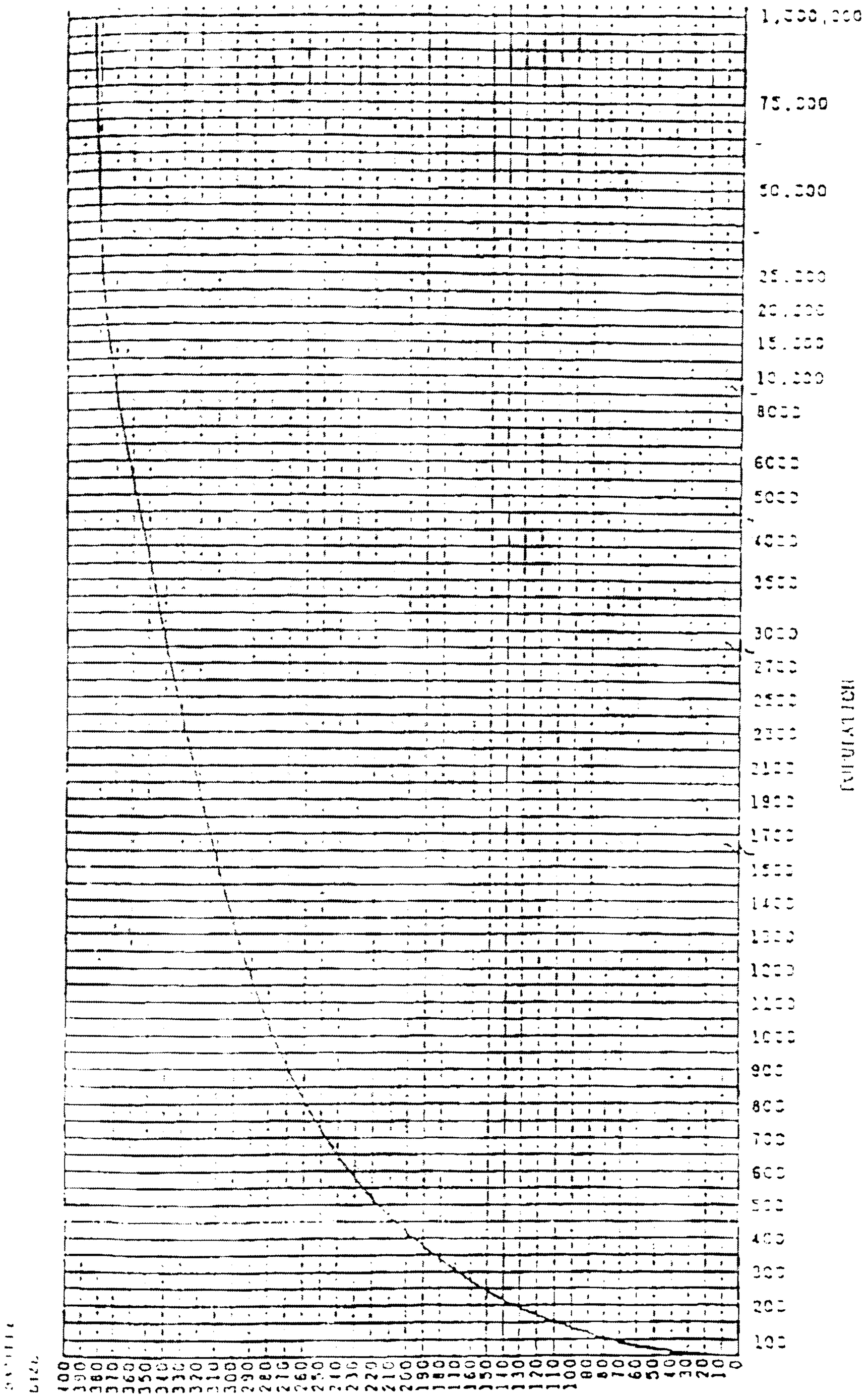
Appendix F: How to determine the sample survey

Table Determining the Sample Size from a Given Population

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Source: Krejcie and Morgan (1970). "Determining Sample Size for Research Activities". Educational and Psychological Measurement. 30. Pp 607-610

Relationship Between Sample Size and Total Population



Source: Krejcie and Morgan (1970), "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 30, Pp. 607-610.

Appendix G: Information on the Gezira area of the Sudan

ملحق (2)

السكان والقرى

القسم	عدد القرى	السكان	الاسر	ذكور	إناث	المقيمين بالداخل ذكور	المقيمين بالداخل إناث	المغتربين بالخارج ذكور	المغتربين بالخارج إناث	كتلة مجاورة للقرية
الجنوب	111	165770	25017	75289	90481	2336	241	1221	33	16
الحوش	65	78168	9522	37130	41038	0	0	1157	27	37
الوسط	109	207713	27689	98057	109656	0	0	4744	742	136
المسلمية	96	212186	32179	102133	110053	1518	121	3238	116	130
ودحبوبة	53	88518	13137	38519	49999	522	261	1868	27	98
الشرقي	60	119347	17948	51530	67817	0	0	3719	15	16
وادى شعير	78	149035	21488	70833	78202	201	66	2675	28	87
الشمالي	89	252355	43283	112916	139439	555	15	6097	18	89
الشمالي الغربي	79	116574	19761	52230	64344	0	0	2194	3	67
ابوقوتة	69	79471	10298	37209	42262	0	0	544	21	23
الجزيرة	809	1469137	220322	675846	793291	5132	704	27457	1024	23
الكاشمي	61	111319	12879	48025	63294	1	1	1237	250	58
الهدى	53	89133	14549	32387	56746	0	0	1814	4	53
ود المنسى	39	122228	13287	54914	67314	90	119	958	217	84
النحابيد	40	123650	19045	49790	73860	0	0	1430	31	62
معتوق	42	133263	15819	61338	71925	157	20	1783	270	71
الماطورى	39	88832	12698	44973	43859	4129	323	1946	47	64
الخاموسى	19	70634	8218	35135	35499	2	2	792	0	30
الشوال	22	53357	6069	24756	24601	14	14	243	9	40
المناقل	315	792416	102564	351318	441098	4393	479	10203	828	40
المشروع	1124	2261553	322886	1027164	1234389	9525	1183	37660	1852	1161

ملخـــــص (3)

عدد المزارعيـــن وحجم الثروة الحيوانية

القسم	عدد المزارعين				حجم الثروة الحيوانية					
	رجال	نساء	أطفال	الجملة	أبقار بلدية	أبقار محسن	ضأن	ماعز	حمر	خيول	إبل
الحلوى	4459	485	52	4996	33073	276	28764	17820	9107	209	52
الخوش	2537	339	42	2918	8849	43	7241	16832	1525	211	0
الوسط	4846	619	174	5639	16349	898	14760	37034	4534	413	
المسلمية	5141	991	83	6215	25021	1506	17157	50995	5546	647	31
ودحبونة	2865	526	76	3468	16075	564	16139	30517	2826	207	10
الشرقى	3788	373	35	4196	24364	1274	42436	48680	4963	174	0
وادى شعر	6475	1003	77	7555	25401	980	52855	63759	5845	452	
الشمال	7888	804	129	8821	22678	1554	26859	43294	13150	946	26
الشمال الغربى	4610	317	69	4996	17239	3067	25196	33503	6635	241	0
البوتونة	4234	232	95	4561	10071	3	17923	14889	4656	169	
الجزيـــرة	46844	5689	832	53365	159120	10165	249330	387323	58787	3669	119
الكاشف	5284	531	10	5825	38816	103	59290	53260	6745	332	
الهدى	5522	732	248	6502	12132	660	24958	19100	4576	273	
ود المنسى	7697	558	249	8504	20154	387	28479	20125	3299	475	
اللحايد	7249	707	294	8250	19220	7	26930	18085	5964	291	
معتوق	8346	1085	380	9811	37875	539	59600	59135	7165	577	
الماطورى	6998	877	92	7967	26771	77	59975	44034	8928	275	477
الجاموس	5221	413	223	5857	24230	25	28500	31400	7940	146	100
الشوال	2671	282	60	3013	17047	105	28330	6115	4224	550	2215
المناقل	48988	5185	1556	55729	195745	1903	326062	253294	48843	2919	2792
المشـــروع	[illegible]	[illegible]	2368	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.1

ملخص (5)

خدمات مياه الشرب

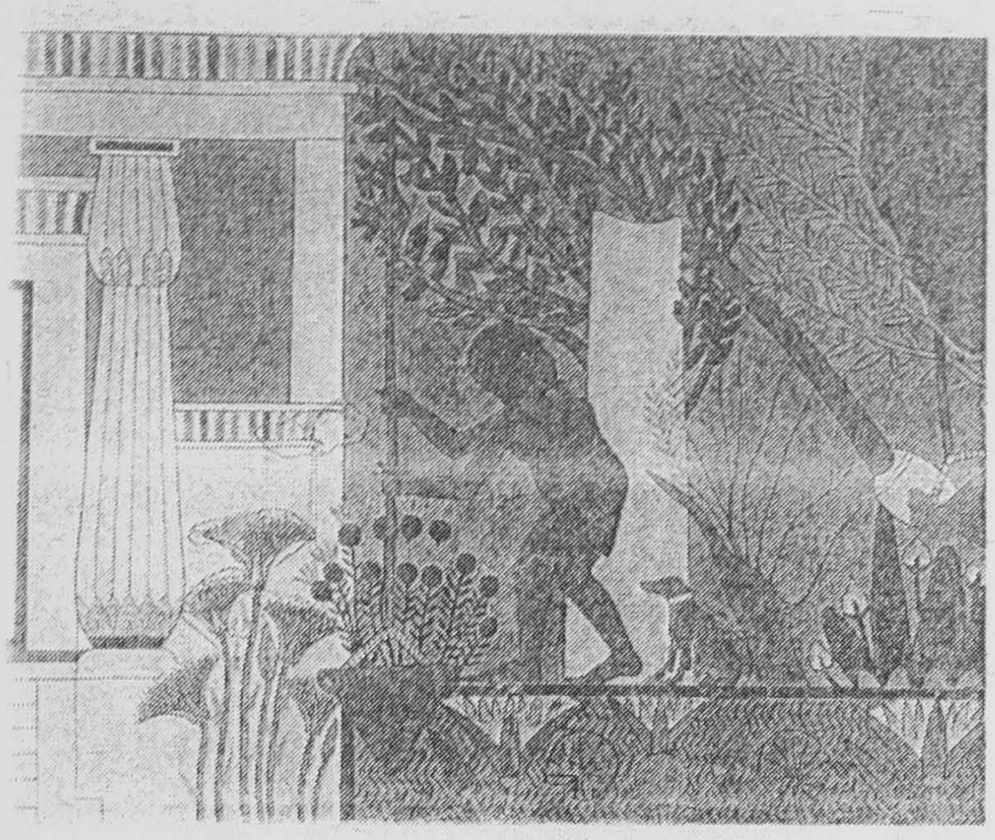
القسم	مصادر مياه الشرب: بئر حوض	مرتفع فلنج	نزحة	بئر سطحي	توصيل من قرية	مضخة	توزيع المياه للمنازل: ماسورة من الشارع	ماسورة في المنزل	حلد من النزحة
الجنوبي	101	0	1	0	2	35	61	69	100
الحوش	54	0	0	0	6	15	27	38	1
الوسط	111	1	2	2	2	16	22	85	3
المسلمية	114	0	0	1	4	10	83	61	93
ودحبوبة	62	0	1	0	3	3	33	19	51
الشرقي	65	2	1	2	1	7	20	30	7
وادى شعبر	102	3	2	1	0	10	64	44	74
الشمالى	111	26	7	0	1	6	61	57	80
الشمالى الغربى	70	0	14	4	5	4	29	38	14
السوقوتة	52	4	8	0	1	6	51	14	11
الجزيرة	842	36	42	10	25	112	456	145	446
المكاشفى	57	6	3	2	2	1	42	21	7
الهدى	58	10	26	12	3	0	37	12	26
ود المنسى	23	17	7	0	0	0	25	14	4
التحاميد	20	16	9	4	0	0	14	5	13
معتوق	13	23	7	1	0	0	17	20	
الماطورى	1	32	9	0	1	0	17	31	25
الجاموس	0	13	5	0	0	0	14	14	-
الشوال	7	8	18	0	1	0	11	12	3
المناقذ	179	125	84	19	7	1	177	139	92
المشروع	1022	181	12		32		631	554	58

ملحـــق (6)

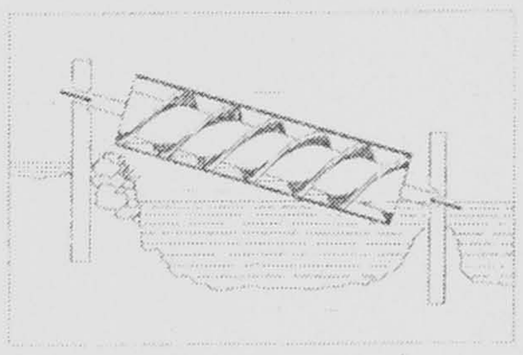
الخدمـــــات التعليمية

القسم	رياض		أساس بنين		أساس بنات		أساس مختلطة		ثانوى بنين		ثانوى بنات		ثانوى زراعى		معهد دينى		مدرسة حرفية		ارشاد نسوى		معلمين أمية	
	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	مدارس/فصول	تلاميذ	فصول	تلاميذ	مراكز	دارسات
الجنوبى	29	1282	16	7276	18	7220	44	12006	10	2300	13	2109							2	70	4	112
الخوش	26	905	11	3296	10	2973	28	7120	8	1206	7	1357									1	25
الوسط	89	3290	30	10207	29	9650	41	12090	203	2543	13	2606			2	100			165	749	51	1017
المسلمية	94	3785	88	8420	304	7702	315	10115	17	2319	196	3057	1	200	3	490	3	120	7	328	45	1363
ودحبوبة	44	2488	13	4534	12	3800	21	5170	10	1197	10	1646					1	35	3	258	16	501
الشرقى	32	1763	14	5900	15	5995	36	9744	13	1965	5	1300					1	700	7	434	6	240
وادى شعر	72	3075	26	8317	25	8184	287	8612	57	2244	139	2689									23	732
الشمالى	73	4093	46	16193	44	15702	38	11468	20	4291	20	4421			4	315	1	100	13	675	4	270
الشمالى الغربى	53	1997	11	3818	11	3961	43	11339	9	1563	8	1295					1	120	3	121	41	1014
ابوقوتة	16	649	10	2855	9	3234	26	6669	3	426	3	470							1	32	1	135
الجزيرة	508	23387	265	70816	477	68421	876	96339	414	20054	349	20950	1	200	9	985	7	1075	206	3697	201	5509
المكاشفى	14	655	8	2340	8	2270	44	12949	6	860	4	400							4	140	12	418
الهدى	33	1476	10	3528	11	3559	31	10679	5	701	5	1025	1		1	80			1	20	14	423
ود المنسى	28	1252	10	4040	9	4550	29	8733	8	1492	8	1377									2	55
التحاميد	33	1507	15	4791	14	4392	23	6353	8	1005	7	935							1	50	4	143
معنوق	27	1943	21	7285	22	7114	24	6881	8	1122	10	1541	1	100					8	310	6	247
الماطورى	24	1533	13	4059	12	3132	27	8134	5	1180	1	106							3	100	1	30
الحاموسى	7	395	14	5231	14	4881	1	140	4	568	5	646									1	30
الشوال	1	50	6	2321	6	1956	11	2093	3	283	3	269									1	40
المناقل	157	8814	97	33595	96	31854	189	56002	47	7214	43	7290	1	100	1	80			17	610	41	1386
المشروع	5	315	36	11441	573	10441	1000	3[illegible]	1	1[illegible]	1	[illegible]	1	100	1	80	7	1075	223	[illegible]	21	6095

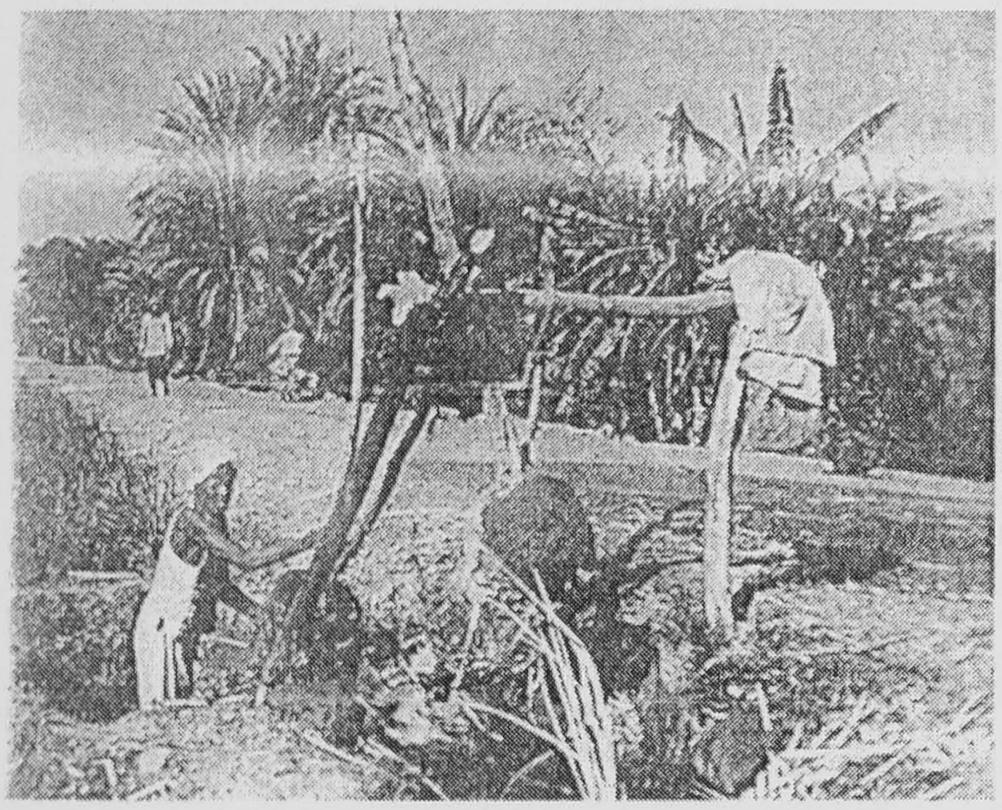
Appendix H: Examples of Pharaohs' Traditional Water Irrigation

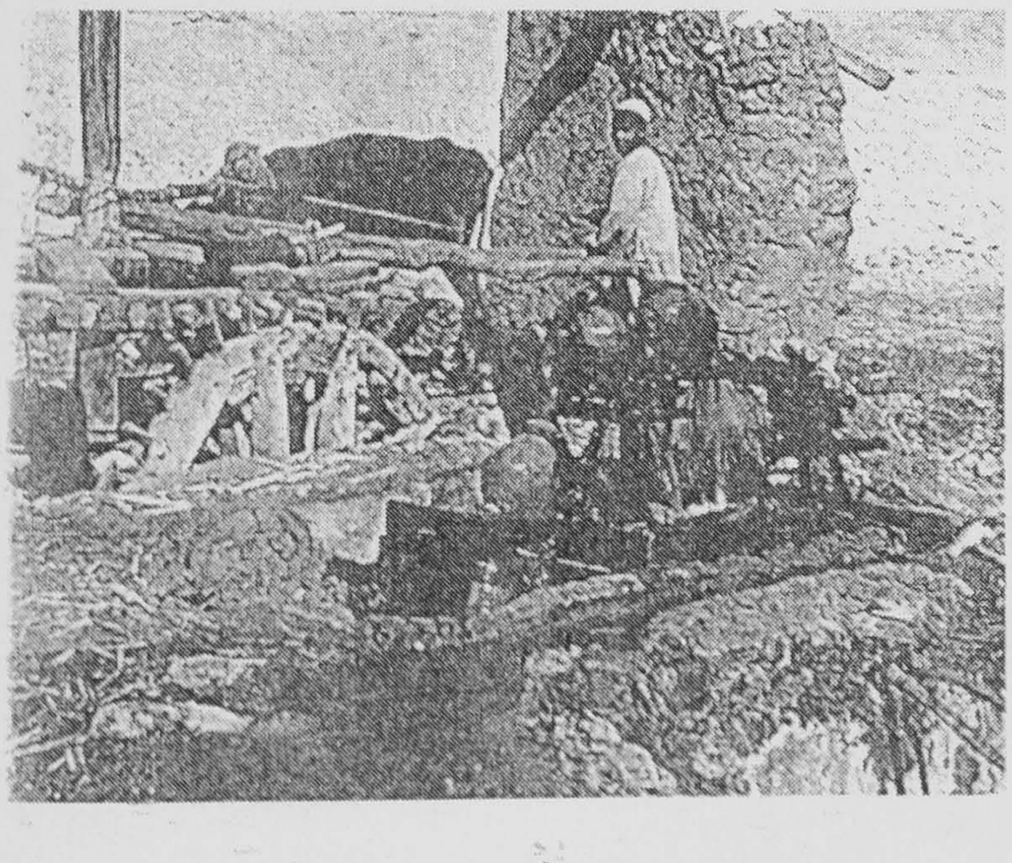


80 (left) Shaduf
Western Thebes, Deir el-Medineh, tomb of Ipui; New Kingdom; Nineteenth Dynasty, ca. 1240 BC.
81 (left, center) Modern shaduf, ca. 1960
The shaduf appears in tomb wall scenes from the New Kingdom on; it is a mechanical device for raising water and is used above all for irrigating gardens. A long stick hangs on an upright post that is free to swivel. On one end there is a heavy stone or lump of Nile mud serving as a counterpoise. At the other end is a bucket at the end of a long rope that is dipped into a low-lying canal and the water then transferred to higher canal. This was also a method for obtaining drinking water. The Archimedean screw, which was turned by hand, was not invented until Ptolemaic times.



82/83 (left and below)
Modern Archimedean screw, ca. 1960
The Archimedean screw was invented in the Hellenistic era for raising water. On the inside of the cylinder-shaped object was an inclined screw whose thread carried the water upward.





The moisture that remained in the ground was sufficient to nourish crops for their entire growth cycle. Using a system of basin irrigation, only one harvest per year was possible. Not until Ptolemaic times could a second harvest be achieved by converting to canal irrigation. Devices for raising water were used for irrigating large areas.

To regulate the forces of nature great projects of hydraulic engineering were undertaken. In the Third Dynasty a gigantic barrage was constructed in the Wadi Garawi south of Memphis to store the water that poured into the Nile from wadi flashfloods after torrential downpours.

In the Middle Kingdom canals were built to circumvent the first cataract or as transport routes from the Nile Valley to the Red Sea. The Faiyum

84 Modern saqiya, ca. 1960
The waterwheel, the *saqiya*, was invented in the Hellenistic era; instead of being turned by hand it was powered by animals. A horizontally rotating wheel was driven by cattle (today by water buffalo) and, by means of gearing, turned a wheel that moved vertically. This in turn drove in parallel another wheel fitted with buckets that scooped up water and raised it to fields up to a height of 10 m. Today, this laborious work has generally been replaced by automatic pumps.

"Egypt-the World of the Pharaohs" كتاب مصر ص. 378

Source: From the book: Egypt-the World of the Pharaohs p378. The same system was used on the River Niles in Sudan.