Sudan University of Science and Technology

College of Graduate Studies

SPACE STANDARDS AND SOCIO-CULTURAL ASPECTS OF HOUSING DESIGN
(with special reference to housing development fund in Greater Khartoum)

المعايير الحيزية والخلفيات الإجتماعية والثقافية في تصميم المسكن بالتركيز على مشاريع صندوق الإسكان بالخرطوم الكبرى

A Thesis submitted in fulfillment of the requirement for the Degree of Doctor of Philosophy

By:
Eatezaz A/Rahman Mustafa Mohammedani
Supervisor:
Prof. Hasan Yasein Badawi

September, 2018

"Above all, we have to make room for people to decide how they want to live and dwell, and enable them to materialize these thoughts".

Adri Duivesteijn, alderman of Almere, The Netherlands
(Translation by Lei Qu1 and Evert Hasselaar)

DEDICATION:

This whole research is dedicated to **Allah**, from whom all good things originate and who made it possible for the use.

- **To my father's soul;**

  Once again, I wish you were here.

- **To my mother;**

  Because of You, I will be successful

- **To my brothers and sister**, Because of yours, I will be In Shaa Allah.
- **To my friends**, to all acknowledged persons as viable instrument for successful realization of this research and are dreaming of a better future, I dedicate this work.

.

Eatezaz A/Rahman

September , 2018

ACKNOLOGEMENT:

My limitless thank to the almighty Allah, and my grateful thanks and deep appreciation to all those who in various ways, contributed to the realization of this thesis.

First of all my special thanks are extended here to my supervisor **Prof. Hasan Yasin Badawi** for his valuable help, guidance, consideration and constructive comments. I am much indebted **Dr. Altieb Alhaj**, head of the Department of Architecture and Spatial Planning College for Technological Sciences, for his help and encouragement **Dr. Abbas Elkhider** for his support and help,

A lot my thanks to my teacher, friend and, sister **Dr. Mona Gibriel**, Academic Affairs of Architecture and Design Collage, Jazan Uuniversity, KSA, for her provided exceptional support and useful guidance, discussions, and the comments. **Dr. Zuhall Altyieb** the head department of human settlement Building Research and Roads Institute, University of Khartoum for her valuable help.

Also, I have to enjoy the attentive care of many genuine people who minimized the burden of this work. Among those who deserve a special mention: my friends Sulafa, Sahar, Rania, Dalia **Dr. Zeinab A bdellah** , Dr. Nada Ramadan for concern, help, and Targe Genawi for his genuine friendship. I would like to record my deeply-felt gratitude to my PhD colleagues at the Taha Architecture College at Sudan University of Science and Technology; Maiada and Allia for her genuine friendship and sisterly attitude.

My thanks to the residents of the study houses in the study population various neighborhoods which is built by the Sudanese Housing Development Fund in Khartoum city for their collaboration and hospitality. Also sincere thanks due to all people whom assisted us and provided us with information which helped us in our study; It is a pleasure to pay tribute also Dawat Alhagi, Rieham, and Sara, who helped in the circulation and the collection of the questionnaires. Special thanks should be given to Dr. Targe who guided me through some of the fundamentals of statistics for his invaluable contribution during the stage of data analysis.

I would like also to convey thanks to the Sudanese Housing Development Fund; Eng. Hassan projects head manger, Eng. Anass, Eng. Waffa for her helped, and Aamier Jalal for his assistance and helpful.Special thanks to Dr, Moez Gibriel for his support and encourage.

I wish to express my love and gratitude to my beloved family, my mother and my father for their endless love and support for their inseparable support and prayers.

I am deeply indebted to them for their continued support. My sincere gratitude is to my sisters and brothers for their unlimited encouragement and support.

ABSTRACT

Dwelling area and spaces are important aspects, in designing the house or in choosing suitable type of housing for dwellers. Space area affects the use of space negatively or positively to achieve the required needs and activities, we must put in mind adequate space for storage, movements, and furniture within our space. The research reviewed and examined the study problem, which it is the focus of architecture designers and planners on criteria of the housing quantitative aspect, and lack of focus on the qualitative aspect criteria by reducing the service's areas and room space in a manner, that does not fit inhabitants' socio- cultural aspects, also they reduce the housing space so that there is no available space to allow for future expansion to suit their conditions in buildings constructed by the Housing Development Fund (HDF)in Greater Khartoum.

The objective of this study is to ensure and confirm the interest in the quality of housing by providing housing space standard code for architects and planner in public and private sector. Another objective of this research is to give estimate standards, guidance areas and qualities for acceptable residential space and layout standards, by designing a program using computer languages give the establishment and determination residential spaces standard rates, and determine the minimum and maximum room areas , occupancy rates, space dimensions, and predictability in the future to build up space in the different types of house, so as to suit their activities according to their cultural and social demands.

The research reviewed with the study problem by surveying methods, using questionnaire and, site observation together with formal and informal interviews selected inhabitants in the different types of residential buildings and projects types that were designed and implemented by the Housing Development Fund in Greater Khartoum (HDF). 230 houses have been studied taken strafed random samples within 10 residential districts in Greater Khartoum, including different types of houses implemented before the year 2013 focus on low-income housing group.

Spatial analysis method was used as a data analysis methodology in the house design drawings. The socio-culture data was translated into numerical system and presented in a form of tables and graphs to be read, questionnaire data analyze by statistical analysis methodology. The conceptual framework of the Sudanese housing spaces Space standards code (SHSS) model was organized in a matrix structure using PhP. programming language based on 4 considerations that conclude from theoretical and practical analysis of the research problem. Housing Space standard model is a software program get it in internet, it is easy to use by the planners and designers in new residential projects, also it can use by citizen to view the shape and design of spaces and future expansion of the house horizontally or horizontally that suit the family taking into account the economic factor. The program also provides different options and alternatives for housing types of spaces, area, proportions and distances required, and it can contribute to the public participation house type preference according to socio- cultural composition.

The research recommended at both the level of planning and house design in the public and private sectors the need for population's acceptance, cultural awareness, acceptance of living in high density housing, to extent the horizontal expansion of Grater Khartoum, the importance of establishing laws governing ownerships share in one building and encourage citizens to own small areas to and secure their rights, and to benefit from other countries experiences in solving the problem of low-income housing, and housing density problem focusing on low and medium income housing. The research also recommended the establishment of Sudanese housing space standard code (SHSS) through an integrated program to provide a clear set of standards, guidance in the form of minimum areas and dimensions for acceptable residential space standard and layout alternatives and options in different housing type and style. Also it encouraged developing different types of housing starting from the traditional type.

Key word: Space standard, Housing, House design, Socio-cultural, Housing Development Fund, housing Space standard code, Low-income housing, Greater Khartoum, family, Area

الملخص باللغـــــــــة العـــــربية

تعتبر مساحة المسكن والفراغات السكنية عامل مهم عند تصميم المسكن أو عند إختيار نوع المسكن المناسب لساكنيه،إذ أن مساحة الفراغ تؤثر على إستعمال الفراغ سلباً أو إيجاباً لتحقيق الإحتياجات والأنشطة المطلوبة لإستخدام الفراغ فيجب أن تكون هناك مساحه كافيه للأ ثاث والحركة داخل الفراغ .إستعرض البحث مشكلة الدراسة والتي تتلخص في تركيز المصممين المعماريين والمخططين على المعايير التي تتعلق بالجانب الكمي للإسكان وعدم تركيزهم على الجانب النوعي وذلك بتقليل المساحات الخدمية ومساحة الغرف بما لايتناسب مع النواحي الاجتماعية والثقافية لساكنيه وكذلك تقليل مساحة المسكن بحيث لا تتوفر المساحة التي تسمح بالتوسع المستقبلي بما يتلائم مع ظروفهم الاجتماعية في المباني المشيدة من قبل صندوق الاسكان والتعمير بولاية الخرطوم.

الهدف الرئيسي من هذه الدراسة هو تأكيد الإهتمام بنوعية وجودة المساكن الجاهزة في القطاعين الحكومي والخاص بولاية الخرطوم ومن ثم عمل برنامج بإستخدام لغة برمجه محوسبة بحيث تعمل على إنشاء وتحديد المعدلات القياسية لمساحات الفراغات السكنية وتحديد الحد الأدنى و الأعلى لمساحات الغرف، معدلات إشغالها، أبعادها، التنبوء بالمساحة المبنية مستقبلاً، وأنواع الفراغات المختلفة التي تتناسب مع أنشطتهم حسب مطلباتهم الثقافية و الإجتماعية.

تناول البحث المشكلة من خلال الدراسة والتحليل المعياري بإتباع منهجية المسح الميداني لدراسة الحالة بإستخدام الأستبانه ، الإستطلاعات، والملاحظة بالإضافة إلي المقابلات الرسمية والغير رسمية لساكني المسكن في المباني السكنية المختلفة الأنواع والأنماط والتي تم تصميمها وتنفيذيها من قبل صندوق الإسكان والتعمير بولاية الخرطوم (HDF) ، وقد تمت دراسة 230 عينة تم أخذها بآلية العشوائى الطبقي في عدد 10 أحياء سكنية بولاية الخرطوم لتشمل كآفة أنماط المساكن المختلفة والتي تم تنفيذها قبل صندوق الاسكان والتعمير (HDF) بولاية الخرطوم قبل عام 2013م مع التركيز علي مساكن ذوي الدخل المحدود. تم استخدام طريقة التحليل الفراغي كمنهجية في تحليل المعلومات للرسومات التصميمية للمباني السكنية والتي تعتمد على ترجمة المعلومات الإجتماعية والثقافية لنظام حسابي يتم تمثيله في جداول ومخططات يسهل قراءتها كما تم تحليل الإستبانه بإستخدام التحليل الاحصائي.

تم إستخدام لغة البرمجة (PhP) كمنهجية فكرة تصميم وتنفيذ المودل الخاص لإنشاء كود للمعدلات القياسية في الفراغات السكنية (SHSS Code) وذلك بإستخدام العمليات الحسابية وبناءاً علي الإعتبارات التي تم الوصول إليها من التحليل النظري والعملي من دراسة مشكلة البحث والتي تتمثل في شكل الفراغ ، وظيفة الفراغ والعوامل المؤثرة فيه، العامل الاقتصادي، وعامل الزمن .

وقد تم وضع معايير خاصة بالمعدلات القياسية للفراغات السكية في مساكن ذوي الدخل المحدود والمتوسط من خلال برنامج يتم تزويدة في شبكة الانترنت العنكبوتية يسهل إستخدامه من قبل المخططين والمصممين في المشاريع السكنية ، كما يمكن للمواطنين الإطلاع على شكل وتصميم الفراغات ونظرة التوسع المستقبلي للمسكن أفقيا أو رأسيا وذلك طبقاً للعوامل الإجتماعية والثقافية للإسرة مع مراعاة العامل الاقتصادي كما يوفر البرنامج الخيارات والبدائل المختلفة لأنواع المساكن من مساحات ونسب وأبعاد الفراغات المطلوبة ، كما يمكن أن يساهم في المشاركة الشعبية للمواطنين بطرح أفضليتهم لنوع المسكن حسب تركيبة السكان الإجتماعية والثقافية.

أوصى البحث على مستوى التخطيط و التصميم المعماري بضرورة التوعية الثقافية لتقبل السكان بالعيش في مساكن عالية الكثافة والتي يمكن أن تحد من التوسع الأفقي بولاية الخرطوم ، أهمية إنشاء القوانين المنظمة للملكية المشتركة والجماعية في مبني واحد و ملكية المساحات الصغيرة ، كما أوصى بالإستفادة من تجارب الدول في حل مشكلة الإسكان وتحقيق الكثافة السكنية في مشاريع الإسكان الجماعية بالتركيز على ذوي الدخل المحدود والمتوسط . كما أوصى البحث بأهمية إنشاء كود للمعدلات القياسية للفراغات السكنية للمخططين والمصممين المعماريين في القطاعين الحكومي والخاص وذلك من خلال برنامج متكامل يتيح بدائل وخيارات في أنماط المساكن المختلف ، و تطوير أنماط مختلفة من الاسكان بحيث تتوفر فيها البدائل والخيارات التصميمية المختلفة .

الكلمات الرئيسية : المعدل القياسي للفراغ ,تصميم المسكن ,العامل الثقافي الاجتماعي ,صندوق الاسكان والتعمير ,كود المعدلات القياسية الس كنية ,مساكن ذوي الدخل المحدود الخرطوم الكبري ,الاسرة ,مساحة المسكن ، الاسكان

Table of Contents

Dedication ……..... .I
Acknowledgement ……..... .II
Abstract ……..…….....**.** .III
Arabic Abstract ……..... .IV
Table of Contents…….. .V
List of Figures……... .VI
List of Tables ……..….. .VII

CHAPTER (1)

(1-1) Terms definition …… 1
(1-2) Background……. 2
(1-3) Introduction…… 3
(1-4)The Research Problem and Rational……... 4
(1-5) Problem Analysis…… 6
(1-6) Research Aims……... 6
(1-7) Research Objectives…….. 8
(1-8) Research Questions……..… 8
(1-9) Research Hypothesis…… 9
(1-10) Research methodology ……..…….. 10
(1-10-1) Methods of data collection…….…….. 12
(1-10-2) Sources of information……....……. 13
(1-10-3) Field Work Method ……..…. 13
(1-10-4)Site Observation…….…… 13
(1-10-5) Questionnaires as a Surveying Tool…….. 14
(1-10-6) Questionnaire Formation and Aspects of the study..……..... 15
(1-10-7) Pretesting Questionnaire…….……..... 16
(1-10-2)Methods of data analysis ……..……...…… 17
(1-10) Research Scope and Limitation…….. 17
(1-11) Research Structure and Organization……..... 18
(1-12)Conclusion…….. 20

CHAPTER (2)

(2-1) Introduction ……..... 21
(2-2) housing and environment aspects……... 21
(2-3) Dwelling Types……. 23
(2-3-1) Bungalow/ Detached House …….. 23
(2-3-2) Semi-Detached House…… 24
(2-3-3) Terraced or Raw House…….. 25
(2-3-4) Apartment House…… 25
(2-4) Development of Urban Societies……... 27
(2-5) Urban Development and Urban Growth…….... 29
(2-6) urbanization process in Sudan ……... 30
(2-7) urbanization and urban change…… 31
(2-7-1) Development of Urban House Design and Image in the Societies…. 31
(2-7-1-1) Vernacular House…… 32
(2-7-1-2) Traditional Houses (Court- Yard houses) ……..…… 33
(2-7-1-3) Modern House……. 34
(2-8) Dwelling, Culture, and Modernity……..……...……...…….. 36
(2-9) Typologies of housing supply Mechanisms in Khartoum State……..…. 37
(2-9- 1) Traditional and Informal Houses……..……..…….. 37
(2-9- 2) Modern Houses……...……. 38
(2-10) Conclusion…… 41

CHAPTER (3)

(3-1) Introduction …… 42
(3-2) Social Housing…… 43
(3-3) the Quality of Housing Environment……... 44
(3-4) Housing development fund (HDF) in Sudan…….…. 45
(3-4-1) Housing development fund (HDF) house's types ……... 46
(3-4-2) Housing Development Fund's house typologies…….. 47
(3-5) Social housing in Arab world and developed countries…….. 54
(3-5-1) Social housing in Egypt…… 54
(3-5-2) Social housing in Pakistan…….. 55
(3-5-3) Social housing in Irish experience……... 56

(3-5-4) Social housing in Tunisia…….. 57
(3-5-5) Social housing in Addis Ababa……..…….…… 58
(3-6) Conclusion……. 60

CHAPTER (4)
(4.1) Introduction…….…….. 62
(4-2) Urban Environment and Culture…….…….. 63
(4-3)Socio-cultural Factors…….…… 64
(4-3-1-1) Domestic Routine…….…… 66
(4-3-1-2) Values and Norms…….…… 67
(4-3-1-3) Islamic Traditions and Privacy……..…. 69
(4-3-1-4) The spatial Interface Between Visitors and Inhabitances……. 71
(4-3-1-5) Housing According to Islamic Religion…….. 73
(4-3-1-6) Family Members' Coherence……... 76
(4-3-1-7) Human Activities and the Usage of Space…….. 77
(4-4) User requires and needs…….…… 78
(4-5) Life Style Theories…….…….. 80
(4-6) Social Stratification…….…. 83
(4-7) Social Structure…… 83
(4-8) Family Types…… 84
(4-8-1) Family Types According To Social Role…… 85
(4-8-2) Family Types According To Their Relationship……. 86
(4-8-3) Family Types According to the family Size…… 87
(4-9) Family Cycle…… 88
(4-10) User needs and social change ……... 89
(4-11) House Spatial Configuration and Lay Out……..….. 91
(4-11-1) Built Environment and Spatial Organization…… 92
(4-11-2) House design…….…… 93
(4-12)House Form and architecture morphology in Khartoum…….. 94
(4-13)House Form and Social Network…….…… 95
(4-14) Conclusion …….……..….. 96

CHAPTER (5)
(5-1)Introduction…….…….. 98
(5-2) Residential Density…….…….. 98
(5-3)Urban Planning Problems…….……. 101
(5-4)Planning Philosophies and Horizontal Expansion……. 104

(5-4-1) Horizontal Expansion problem ……... 105
(5-4-2) Plot Area and Size…….…….. 107
(5-5) Space and home…….…….. 107
(5-5-1) Home Space Standards…….…….. 108
(5-5-2) The Arguments For and Against Space Standards……. 110
(5-5-3) Home space standard International Comparisons……. 111
(5-5-4)The need of space standards…….……. 113
(5-5-5) Spaces demands and Standards…… 113
(5-5-6) The Relationship between Space and Well-Being……... 114
(5-6) Residential activities and space standards ……...……..... 114
(5-6-1) Layout and adaptability…….. 114
(5-6-2) Space as Configuration…….…….. 115
(5-6-2) Space as Configuration…….…….. 116
(5-6-3) House spatial area…….……. 116
(5-6-4) Room sizes…….……..….. 117
(5-7) Circulation in the home……..…… 122
(5-8) The proportion room and golden ratio…….……. 123
(5-9)Furniture space…….…….. 124
(5-10) Internal Space Standards…….…… 125
(5-11) Plot area and Space standards in Khartoum…….….. 127
(5-11-1) Clonial space standard in Khartoum…….…….. 128
(5-11-2) ongoing policy of space standard in Khartoum…….. 128
(5-11-2-1) Doxiadis plan (1960-1990)…….…. 129
(5-11-2-2) Mefit plan (1975)……... 129
(5-12) Code, standards, and guideline……..….. 130
(5-13) Social housing example, space area and room numbers…… 132
(5-14) conclusion…….…… 133
CHAPTER (6)
(6-1) Introduction…….…….. 135
(6-2) The choice of Greater Khartoum as case study …..…….. 135
(6-3) Demographics…….…….. 136
(6-4) Climatic Consideration…….…… 137

(6-5) The Choices Of Greater Khartoum As Case Study…….. 138
(6-6) The Case Study Selection Criteria……..…… 139
(6-7) Case study plane, techniques and stage …….…….. 140
(6-8) case study's target group…… 141
(6-8-1) House Types and Typologies in the target group…… 142
(6-8-1-1) According to the house type……..…… 142
(6-8-1-2) According to the design types and locality…….. 144
(6-8-3) Target group study work stages…… 145
(6-9) Descriptive e selection of the case study sample …….. 145
(6-9-1-1)Seif Mohammed house……..……... 146
(6-9-1-2)Alshafie Abdelwahab house……..……. 148
(6-9-1-3)Mohammed Hassan house……..…….. 151
(6-9-1-4)Awad NorAldieen Mohammed house…… 153
(6-9-2) Alwadi Alakhdar District project……..…… 156
(6-9-2-1)Naiema Ahmed Hasan house ……. 157
(6-9-2-1)Mukhatar Mustafa house ……. 159
(6-9-3) Hai Alomda District project……..……. 163
(6-9-3-1)Ommer Suleiman house ……..…… 164
(6-9-3-2)- Egbal house……..…….. 167
(6-9-3-3) Fatima Ali house……..……. 169
(6-9-3-4)Fatima Mahmmoud house…… 171
(6-9-3-5)-Ali Hammada house…… 173
(6-9-3-4) Iman Babeker house…… 175
6-9-3-5)-Mahasin House……..…….. 177
(6-9-3-6) Hajeer house……..……...…… 178
(6-9-3-7)-Abdelkader Mohammed Hashim house……..…….. 181
(6-9-3-8) Mashaer Ahmed House……. 183
(6-9-4) Apraj Alnilien Tower project…….…… 186
(6-9-4-1)- Mohammed Muntaser Ismaee…… 187
(6-9-4-2)- Eilham Ahmed Babeker house…… 191
(6-9-4-3)- Alla Mohammed House……..…… 193

(6-9-5) Dar Alsalam District project……..……. 196
(6-9-5-1)Eglas Ibraheim House…….. 197
(6-9-5-2)-Elfatih Ali Adam House……. 199
(6-9-5-3)-Mohammed Ali Mohammed House…… 201

(6-10) Conclusion……..…….…… 203

CHAPTER (7)

(7-1)introduction …… 205
(7-2)Data analysis methods…… 206
(7-1-1) Spatial Analysis……. 207
(7-1-2) Criteria for Analysis……..…….. 207
(7-1-3) Software Used In the Research…… 207
(7-3) case study analysis……..…… 208
(7-3-1) spatial analysis at the dwelling levels…….. 208
(7-3-1-1)Dwellings analysis Experimental Type (Raw house) …… 209
(7-3-1-2) Dwellings analysis apartment …… 210
(7-3-2) spatial analysis at the cluster levels…….. 211
(7-3-2-1) Semi-detached housing, spatial analysis…… 213
(7-3-2-2) Raw housing, spatial analysis…… 214
(7-4)Questionnaire analysis……. 216
(7-4-1) Research Application Process…….. 216
(7-4-1-1) Sample of the Study…… 216
(7-4-1-2) Evaluation of Measurement Tool……. 216
(7-4-1-3) The Sincerity of the Scale Content Test……... 217
(7-4-2) Questionnaire result……. 219
(7-5) conceptual framework of the research model…… 245
(7-5-1) Model Features…… 247
(7-5-2) Organization of the housing space standard Model…… 249
(7-5-3)The flow charts of determined the house model…….. 250
(7-6) Design conception model of (SHSS) ……. 253
(7-7) Model Matrix Structure……..…... … 254
(7-8) Descriptive of use the model Sudanese Housing Space Standards…….. 255
(7-9) conclusion……... 259

CHAPTER 8

(8-1) Introduction……. 261
(8-2) Achievement of objectives……. 261
(8-3) Research Limit…….. 261

(8-4) Contribution to knowledge…….. 262
(8-5) Conclusion of the research …….. 263
(8-6)Research recommendation……. 265
(8-7) Recommendation for further research …….. 267
(8-8) Discussion for further study ……. 269
References…… 270

Appendixes

1. Questionnaire Forms of cCitizens
2. Minimum Dimension for House Spaces
3. Household's Questionnaire Descriptive Statistic
4. Data based table of Sudanese Housing Space Standards Model
5- Ekhlas Ibrahiem Household's Questionnaire

LIST OF FIGUERS:

Fig (1-1) Problem Analysis "Problem Tree"……..…….5
Fig (1-2) Aim Analysis "Means-Ends relationships"……..……...7
Fig (1-3) Testing the hypothesis of the research conceptual frame work …….…….... 9
Fig (1-4) Built environment ……..…….....….. 10
Fig (1-5) Fields of research and data types collected…….....…….....… 11
Fig (1-6) Flow of Data Matrix, and Techniques …….....…….... .12
Fig (1-7) Flow chart of survey and research aspects…….....16
Fig (1-7) Research Scope and Limitation.....,,.....18
Fig (1-9) Thesis Structure and Methods and techniques ….....……19
Fig (2-2) percentage of Population residing in urban areas(1950-2030) for the.Sudan….29
Fig(2-2)Average Annual Growth Rate (1950-2030) for the Sudan……...30
Fig (2-3) Traditional Earthen Roundhouses, (Tamberma) Region of Togo and Benin.....32
Fig (2-4): Courtyard houses 33
Fig (2-5) Modern Housing Type (Residential complex, Doha).....34
Fig (2-6) Traditional houses in Sudan 37
Fig (2-6) Hai Alomda investment house…….....38
Fig (2-7) site and service project in Imdidad-Naser and Al-Reyad.....39
Fig (2-8) low-cost houses..,,,.....
Fig (2-9) Original plan of low cost in Hai Alomda ……..40
Fig (2-9) house Alshabia (source; Planning Ministry)…….…
Fig (3-1) Khartoum Map ……45
Fig (3-2) Egypt's low-income housing…….…..…….…54
Fig (3-3) Pakistan Public housing…….....…55
Fig (3-4) Social housing in Irish.……57
Fig(3-5) Social housing in Tunisia…….58
Fig (3-6) Condominium Houses in Addis Ababa……..…....
Fig (4-1) Typology of environment……..….64
Fig (4-2) Aspects, culture and their relation to build environment……66
Fig (4-3) Zuhair house and use of spaces (low cost house in Alshabia)…….……...……68
Fig (4-4) Privacy in the Islamic world……...72
ig (4-5) the relationship between guest's and family areas Talisman (Mexican) houses and U. S houses ……..73
Fig (4-6) Intimacy gradient house in the house, gate entrances, out-door, sitting wall.….74
Fig (4-7) Iman house analysis diagrams……..……...75
Fig (4-8) the use of spaces in nuclear family ……...….78
Fig (4-9) Human activities and the usage of space…….79
Fig (4-10) Framework for inquiry for the house Flexibility of Home spaces.……82
Fig (4-11) Life Style Theories……..…….83

(4-12) The relation between Family of orientation and Family of procreation……..……...86
Fig (4-13) Family types according to their relationship……87
(Source: Mohammad, Ayman, 2007)…….
Fig (4-14) household life cycle and space organization……..……...…...89
Fig (4-15) the relationship between changing social and Future building area ……...91
Fig (4-16) Space use linkage diagram…….…….92
Fig (4-17) House design…….……....93
Fig (4-18) Domestic spatial arrange…….……..…94
Fig (4-19) The separation between family and guest section……...……95
Fig (5-1) Khartoum Residential density ……..……..……100
Fig (5-2) Horizontal expansion in Greater Khartoum ……...….104
Fig (5-3)5 Migration to the capital …….……...…..106
Fig (5-4) Expectations of horizontal expansion in Greater Khartoum …….....……106
Fig (5-5) Space standard and housing design……..…115
Fig (5-6) Bedroom requirements and minimum space standards…….……....120
Fig (5-7) Total area used for circulation in the home and circulation zone dimensions..123
Fig (5-8) The room proportion suggested by Palladio…….……..…..124
Fig (6-1) Khartoum map…….……..135
Fig (6-2) Khartoum Structure Plan KPP5 2008-2035…….……...…..136
Fig (6-3) Urban Growth and population of the Sudan's Nine largest Urban Censuses…138
Fig (6- 4) Working across scale Limits of survey…….…...…140
Fig (6-7) Stages of the case study…….....143
Fig (6-8) Alamal district image…….....144
Fig (6-9)Alamal residential area cluster design……...…....144
Fig (6-10) Seif Mohammed house……..……145
Figure (6-11) Time and activity zone in the house…….……..…..145
Fig (6-12) Sief Aldeen house living-room……..…..…..…146
Fig (6-13) Alshafie Abdelwahab house Ground floor plan…….……147
Fig (6-14) Sief Aldeen kitchen and livening room space……...……147
Fig (6-15) Alshafie Abdelwahab Activities ……149
Fig (6-16) Mohammed Hassan house Ground floor plan…….…150
Fig (6-17) Mohammed Hassan guest's room ……..…150
Fig (6-18) Mohammed Hassan house the used of shade as multi activities……..…151
Fig (6-19) Awad NorALdieen female guests's room……..152
Fig (6-20) Awad NorAldieen Mohammed house bedroom……...….153
Fig(6-21) Awad NorAldieen Mohammed house Ground floor plan……. 154
Fig (6-22) Alwadi Alakhdar Neighborhood…….…155
Fig(6-23) Alwadi Alakhdar cluster……..…..…155
Fig (6-24) Naiema Ahmed Hasan house Ground floor plan…….…..…156
Fig (6-24) kitchen space in Naiema Ahmed…….…….. 156

Fig (6-25) Hosh usage in Naiema Ahmed Hasan house……..…157
Fig (6-27) Mukhatar Mustafa house Ground floor plan……..….159
Fig (6-28) Mukhatar Mustafa activities members……..…159
Fig (6-29)The used of Hosh Mukhatar Mustafa house…….…160
Fig (6-30) Hai Alomda image ……..……...…..162
Fig (6-31) Hai Alomda cluster……..……..162
Fig (6-32) Ommer Suleiman house ground floor & first floor plan……..……...163
Fig (6-33) Storage washing machine under the Stair……...…...163
Fig (6-34) Omer Suliman house indoor and outdoor spaces ……..……...164
Fig (6-35) Egbal house Ground floor plan……..…166
Fig (6-36) Table of activities members in Egbal house,……..……..……166
Fig (6-37) dining area in Egbal house……..…….167
Fig (6-38) yard used by the daughter for sleeping……...167
Fig (6-39) Guests' room in Fatima house ……..……..…168
Fig (6-40) Fatima house floors plan……..……169
Fig (6-41) - Fatima Mahmmoud house Ground floor plan……...170
Fig (6-42) living room in Fatima Mahmmoud house……..…170
Fig (6-43) Ali Hammada house floors plan……..……..172
Fig (6-44) Female reception area in Ali Hammada house……....173
Fig (6-45) Increasing of built up area in Ali Hammada house after 10 years……....174
Fig (6-46) ground floor plan in Iman house.....174
Fig (6-47) the use of the yard by children in Iman house 175
Fig(6-48) Iman house's table of activities members .....…….175
Fig (6-49) ground floor plan in Mahasin house.....…...176
Fig (6-50) male and Female reception in the yard in the evening in 177
Table (6-51) Storage in the yard Hajeer house.....178
Fig (6-52) - Hajeer house Ground floor plan..... ...178
Fig (6-53) - Hajeer house Ground floor plan 179
Fig (6-54) ground floor plan in Mohammed Hashim House..... 181
Fig (6-56) ground floor plan in Masher house..... 183
Fig (6-57) Alniline Tower Location plan 185
Fig (6-58) Alniline Tower..... 185
Fig (6-59) 186
Fig (6-60) Mohammed Muntaser Ismaeeil house plan.....187
Fig (6-61) ground floor plan in Eilham Ahmed Babeker house.....190
Fig(6-62) Eilham Ahmed Babeker ‘s Kitchen…..... ...190
Fig (6-63) Eilham Ahmed Babeker ‘s Guest room..... 191
Fig (6-64) Alla..... 192
Fig (6-65)- Alla Mohammed House plan.....193
Fig (6-66) Dar Alsalam low cost housing Location plan 195

Fig (6-67) Dar Alsalam low cost housing.....195
Fig (6-68)Eglas Ibraheim. house Ground floor plan.....196
Fig (8-69) furniture and circulation in the room in Eglas Ibraheim house.....196
Fig (6-70) the used of Hosh in Eglas Ibraheim house.....197
Fig (6-71)Alfatih house's kitchen space.....198
Fig (6-72) ground floor plan in Elfatih Ali Adam house.....199
Fig (6-73) Mohammed Ali Mohammed House ground floor plan.....200
Fig (7-1) Case study house analysis….....208
Fig (7-2) Permeability Diagram semi detached house….....209
Fig (7-3) Permeability Diagram apartments house….....210
Fig (7-4) Permeability Diagrams….....211
Fig (7-5) Dwelling grouping and cluster in Sudanese's Housing Developments Fund (Semi-detached housing-courtyard) ….....213
Fig (7-6) Dwelling grouping and cluster in Sudanese's Housing Developments Fund (Semi-detached housing-Apartment) ….....214
Fig(7-7) Dwelling grouping and cluster in Sudanese's Housing Developments Fund (Raw housing- Hai Alomda) ….....215
Fig (7-8) household Age (Year) ….....219
Fig (7-9) Gender: Frequency distribution according to Gender……219
Fig (7-10) Frequency distribution according to social status……...220
Fig (7-11) Education level ….....220
Fig (7-12) The Occupation of household….....221
Fig (7-13) Monthly income of household head in Sudanese pound……221
Fig (7-14) Occupation of the wife of the household head……222
Fig (7-15) how did you acquire this plot or house….....222.
Fig (7-16) Urban experience of the household in the capital……223
Fig (7-17) Length in living in the dwelling….....223
Fig (7-18) Family type….....224
Fig (7-19) Number of family members living in the house……224
fig (7-20) Is it others people living in the house…..... 225
Fig (7-21) Determine the ability of having a multiuse space in the house.....225
Fig (7-22) Effected activities when receiving guests.....226
Fig (7-23) Type of house..... 226
Fig (7-24) The number of building floors 227
Fig (7-25) The number of housing unit on the floor 227
Fig (7-26) Is the entrance injured or reveal the spaces in your house……....228
Fig (7-27) The size and layout of your home doesn't allow you enough privacy……...228
Fig (7-28) Dose the house has a private space to entertain guests from other members of the household 229
Fig (7-29) The Occupation of household.....229

Fig (7-30) Separation between male &female section 230
Fig (7-31) Your children have a room with enough space in which they can play on their own..... 230
Fig (7-32) Where does the family eat the daily meals? .....231.
Fig (7-33) Separation between male &female section.....231
Fig (7-34) Doweling Total Area 232
Fig (7-35) The built up Area.....232
Fig (7-36) the size of the property in square meters ……233
Fig (7-37) Types of house expansion 233
Fig.(7-38) kitchen sufficient space 234
Fig (7-39) kitchen un sufficient space for small children.....234
Fig(7-40) does your house have enough Storage space.....235
Fig (7-41) store possessions 235
Fig (7-42) storage spaces.....236
Fig(7-43) is it your bathrooms have enough area……..236
Fig(7-44) How many meters squares are there in the bathroom ……...237
Fig(7-45) The corridors and stairs within your home provide sufficient space to move around the home with area 237
stored items or decorative objective 238
Fig(7-46)The corridors and stairs in your home are obstructed by furniture, stored items or decorative objective……..238
Fig (7-47) The amount of spaces in the corridors and stairs within your home makes it difficult to move furniture around 239
Fig(7-48) There is not enough space in all of the rooms to be able to move easily around the furniture 239
Fig (7-49) Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer? 240
Fig (7-50) Is it the removable and furniture provides a lot of space area……..240
Fig (7-51) which type of dining furniture do you prefer the fixed or movable?..... ..241
Fig (7-52) what are the activities that can be performed through movable furniture…...241
Fig.(7-53) home remodeling.....242
Fig (7-54) Have you remodeled this home, resulting in changing ……..……242
Sizes or uses of rooms? 243
Fig (7-55) If yes, please describe these changes and your reasons for making them ….243
Fig (7-56) Do you plan to remodel this home in ways that would change sizes or uses of space? Please indicate possible changes and your reasons for them.....244
Fig(7-57) Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer.....244
Fig.(7-58) The space within your home has been used efficiently by the designer …...244
Fig(7-59) Do you find that it is better that you and your family members to divide spaces and

residential unit? And what would you do? 245
Fig (7-60) Conceptual Model of the Research step 1 ……246
Fig (7-61) Conceptual Model of the Research step 2.....248.
Fig (7-62) the flow chart of determined functional efficiency of the house……..249
Fig (7-63)The flow chart of determined Form and Physical (Morphology)……250.
Fig (7-64) Flow chart of determined Development over Time efficiency in the house...251
Fig (7-65) Flow chat to determined Spatial Configurations and Area efficiency in the house……..252
Fig(6-66) Design Conception for low income group model (SHSS)……..253
Fig (7-67) Model matrix structure, (SHSS)……254
Fig (6-68) (SHSS) model programmed page.....255
Fig (7-69) Housing Space standards Model, (SHSS) 256
Fig(7-70) Analysis details of area and spaces 257
Fig (7-71) Housing Space standards of house in 2Dand 3D.....257.
Fig (7-72) Research Process Model.....258
Fig (8-1) research cycle 266

LIST OF TABLE:

Table (2-1) Dwelling types ……..……..25
Table (3-1) Type 1 House components……..…..47
Table (3-2) Type 2 House components……48
Table (3-3) Type 3 House components……..…….49
Table (3-4) Type 4 House components……50
Table (3-5) Type 5 House components……..…..51
Table (3-6) Type 6 House components……...…….52
Table (3-7) Type 7 House components……...…….53
Table(6-1) Estimate of population distribution (in thousands) by state2012 …… ..136
Table (6-2) Population Growth Rate…… ….138
Table (6-3) Target group house types…….…….. .141
Table (6-4) Target group Villa type districts……...…….…… ..141
Table (6-5) Target group Apartments type districts……. 142
Table (6-6) courtyard type districts selected in the case study……...142
Table (6-3) Annual rate of population growth in Khartoum city……..……
Table (5-8) Housing space standards ……...119
Table (5-9) Furniture sizes exclude circulation spaces……..……...126
Table (5-10) House Internal activities Space Standards ……..…....127
Table (5-12) Proposed plot size and residential units…….……...129
Table (5-13) the relation between houses, rooms, and persons……..130

Table (5-14) Housing code, standards and guidelines……172
Table (4-1) The average of household's number……..,,……..88
Table (5-2) Residential density at varying scales……..….101
Table (5-2) recommended size plot……....102
Table (5-3) Recommended size plot……..103
Table (5-4) Plots sizes in Arab countries……..108
Table (5-5) How to make room……..……111
Table (5-6) How to make room……..112
Table (5-7) Model of space and areas in Khartoum ……..…….…… 117

Table (5-8) Housing space standards.....119
Table (5-9) Furniture sizes exclude circulation spaces .....,.125
Table (5-10) House Internal activities Space Standards 127
Table (5-11) Person/plot ratio and the average rate of Occupancy per/room In the 1st and 2nd classes at Khartoum &Khartoum North .....,.....128
Table (5-12) Proposed plot size and residential units.....129
Table (5-13) the relation between houses, rooms, and persons…….…….....130
Table (5-14) Social housing area, room number example.....131
Table (5-15) Housing code, standards and guidelines……..……..…....132
Table (5-16) Sudanese housing space standards code……..…133
Table (6-1) Estimate of population Distribution by state2012.....137
Table (6-2) Population Growth Rate.....139
Table (6-3) Target group house types. 142
Table (6-4) Target group Villa type districts..... ..142
Table (6-5) Target group Apartments type districts……..…143
Table (6-6) courtyard type districts selected in the case study…….……143
Table (6-7) Seif Mohammed house classification data.....146
Table (6-8) House space configuration, numbers and acivities.....147
Table (6-9) Areas of the house in sq .m in Sief Aldeen house……..…148
Table (6-10) Alshafie house Clasification Data……..…148
Table (6-11) House space configuration, numbers and activities……..…149
Table (6-12) Areas of the house in sq .m in house…….……...…150
Table (6-13) Areas of Mohammed Hassan house in sq……..151
Table (6-14) House space configuration, numbers and activities……..…152
Table (6-15) Mohammed Hassan house space areas in sq .m……153

Table (6-16) Awad NorAldieen data classification 153
Table (6-17) Awad NorAldieen house 154
Table (6-18) Areas of the house in sq .m.....155
Table (6-19) Naiema Ahmed Hasan house classification house……..…….157

Table (8-20) Areas of the house and activities.....158
Table (8-21) Naiema Ahmed Hasan‘s Areas of the house in sq .m 159
Table (8-22) Mukhatar Mustafa house classification data……..……..159
Table (8-23) Mukhatar Mustafa house’s spaces, numbers and activities 161
Table (8-24) Areas of the house in sq .m 161
Table (6-25) Ommer Suleiman classification data sq .m 164
Table(6-26) House’s space configuration, numbers and activities……..…166
Table (6-27) Areas of the house in sq .m……..……....166.
Table (6-28) Areas of the house in sq .m in Egbal house ……..……..…168
Table (6-29) House’s spaces, numbers and activities.....169
Table (6-30) Areas of the house in sq .m in Fatima house.....170
Table (6-31) House classification data.....171
Table (6-32) Areas of the house in sq .m in the house.....172
Table (6-33) Areas of the house in sq .m in the house.....172
Table (6-34) Areas of the house in sq .m in the house.....174
Table (6-35) Areas of the house in sq .m in Iman house.....175
Table (6-36) Hajeer house classification data.....178
Table(6-37) Hajeer house Ground floor plan 180
Table (4-38) Areas of the house in sq .m in Egbal house.....180
Table (6-39) Mohammed Hashim house classification data……...….181
Table (6-40) House space configuration, usage, and Number……....182
Table (6-41) Areas of the house in sq .m in the house……...183
Table (6-42) Mashaer Ahmed house classification data……..……..…183
Table (6-43) Mashaer Ahmed house classification ……...184
Table (6-44) Areas of the house in sq .m.....185
Table (6-45) Mohammed Muntaser Ismaeeil classification data 187
Table(6-46) Mohammed Muntaser Ismaeeil classification data …….……..…..188
Table (6-47) Areas of the house in sq .m.....189.
Table (6-48) Eilham Ahmed Babeker house classification data……...…191
Table (6-49) Eilham Ahmed Babeker space configuration, activities and numbers…..192
Table (6-50)Areas of the house in sq .m 192
Table (6-51) Alla Mohammed classification data 193
Table (6-52) Alla Mohammed space configuration, activities and numbers……..195
Table (6-53) Alla Mohammed Areas of the house in sq .m.....195
Table(6-54) Eglas Ibraheim House Classification Data.....197
Table (6-55) Eglas Ibraheim House.....198
Table (6-56) Areas of the house in sq .m 198
Table (6-57) Elfatih Ali Adam House classification data……..…...199
Table (6-58) Space configuration, usage and numbers.....200
Table (6-59) Elfatih Ali Adam Areas of the house in sq .m house……..…200

Table (6-60) Mohammed Ali classification data 201
Table (6-61) Space configuration, usage and numbers.....202
Table (6-62) Areas of the house in sq .m 202
Table (7-1) Questionnaires Distributed & Returned.....216
Table (7-2)Cornbach's Tests.....217

(1-1)TERMS DEFINITION:

• A housing Unit, by census definition, is equivalent to the dwelling place of one household. It may occupy or vacant. To consider a housing unit, the unit must have its own kitchen Facilities.

• Homes' may refer to houses, townhomes, condominiums, apartments, mobile homes or trailers, or a group of rooms or a single room occupied as separate living quarters
• An accessory **Dwelling Unit (ADU)** is a housing unit is within, attached to, or next to a single family home. It has a separate entrance from the single family home. It differs from a duplex because it allowed, under certain conditions, in the single family zones.

Home and house definition:
The home encompasses the house or dwelling that a person lived in after birth and/or their childhood family house (s). It symbolizes the family relationships and life courses enacted within those spaces. It is the place where children nurtured and reared and leave when they come of age (Bowlby et al., 1997; Hunt, 1989; Jones, 1995) without the family at home is 'a house' (Gilman, 1986; Leonard, 1980).

Bachelard (1969) this house or dwelling is our 'first universe," shelter is our daydreaming, cradles our thoughts and memories and provides us with a sense of stability. Throughout our lives the house in which we born remains "physically inscribed in us"," (Jackson, 1995).
"Home is a social environment dependent on time or impresses time and represented by a personalized physical environment, such as a house, that nurtures attach meaning," (Gibbs, 2000).
Room: An interior space within a building enclosed by walls or separated from other similar spaces by walls or partitions, Kitchenettes, entry platforms, porches, spaces separated by room dividers, balconies, and other add spaces, enclosed or unenclosed, often counted as rooms or half–rooms.
The room count has become so confusing that one trend to describe one's apartment by the number of bedrooms rather than rooms.
Hosh: it means courtyard within the living spatial structure.
Recipe: it means semi- closed area near the kitchen, constructed with traditional materials, used as a service unit for washing dishes… ect.
Sala: The term means a semi-closed area used as a reception room.
Plot: The term means a small piece of land. In this study a piece of residential land, which has legal, judicial demarcations and identified with a number. There is no definite size, or standard, or regular shape

(1-2) BACKGROUND:

Developing World Cities will absorb 95 percent of urban growth in the next two decades. Habitat II, 1996 will expect by 2030, will be home to almost 4 billion people, or 80 percent of the world's urban population (Habitat II, 1). Urban settlements in Developing Countries, which are already in desperate physical conditions, economic and social straits, with substantial housing backlog deficiencies, assumed to face even more rural-urban influx and a greater need for housing (Awadel Kareem, M, 2008). Therefore, with the limited economic resources, high rate of birth, rapid urbanization and immigration in most of the adapted systems (Madibo, A, 2008)
People in developing countries find themselves in a situation where neither the new systems of physical and urban planning, services or social facilities are functioning, nor are the traditional systems maintained to serve as they used to be (Diffala, M, 1998).

Shortage of housing is a problem which has become an enduring feature of the urbanization process in the Sudan and appears to raise increasing alarm from professionals and politicians. Many reasons are there for housing shortages in the Sudanese community, Including high birth rates, and the increasing presence of nuclear family households (Dawson, C, 2011). Housing exacerbates these shortages because traditional Sudanese dwellings damaged by urbanization and many traditional practices. Housing mirrors social life has important implications developed Sudanese housing policy in the 21sl
(Alhassen, M , 2008).

Housing units are used to be provided in Sudan through plot and services mechanism where plots distributed to citizens through a certain criterion. The basic infrastructure; roads, water supply and electricity provided together. Citizens left with the job of finding suitable means to build their homes, according to the standards provided by the housing authorities. Recently, the planning and housing authorities proposed another mechanism by using payment method, so the government supplies the citizen ready units according to their income groups. It divided into three; the investment housing to the high income group; the economical housing for the middle income group and the low cost housing for the low income group (Altag, H and Shadad, M, 2008)

Space is an important factor when people are choosing a home, but many find a lack of rooms' space and this impact on the basic lifestyle needs. Residents granted, having enough space to store possessions and entertain friends. In more extreme cases, lack of adequate space for a household has also shown to have significant impacts on health, educational attainment and family relationships.

Many questions have a arisen in the housing issue in the Sudan like how do Sudanese conceptualize modernization in housing? Which polices of housing mechanism have more demanding space standards? For instance, what are the socio-cultural dimensions of the inhabitants, which affect to the layout of dwelling space Standards in new Government sector housing? For what has changed and what not, concerning culture and house design? Is inhabitants' satisfaction with internal spaces which allow for adaptation, conversion or extension? And how different space standards influence users' satisfaction? And what are the methods that will apply to restrict the horizontal expansion in residential areas?
The starting point of this research concentrate on the socio- cultural aspects of Sudanese society, which influence the houses spaces in terms of usage, configuration and, standards. Moreover the research concentrated on space standards which organized and built by Sudanese Housing Development Funds in Khartoum.

(1-3)INTRODUCTION:

The Global Strategy for Shelter to the Year 2000, adopted in 1988, which emphasizes the need for improved production and delivery of shelter. It revised national housing policies and an enabling strategy; offers useful guidelines realize adequate shelter for all in the next century.
The general requirements for adequate or decent housing have internationally accepted (Habitat II, 1996). it should provide a safe, healthy, comfortable and functional environment, at an affordable cost. However, the performance demanded for each requirement often varies from country to country according to the prevailing cultural, social, environmental, technological and economic conditions.
The Government at the national level advocates "adequate shelter for all", as one of the main objectives of the national strategic plan housing policy in Sudan (Eltag, H, 2008).

The housing situation in Greater Khartoum is unsatisfactory as for many people no decent housing is available. Housing policy formulated in order to the sever problem and shortcomings (Elhoweris. S, 2008). Quality of life of people depends, among other economic, social, environmental and cultural factors, on the physical conditions and spatial characteristics of our villages, towns and cities(Habitat II, 1996). Physical, social and cultural characteristics of the houses related to the socio-demographic structure, lifestyle, and spatial behavior, functional use of spaces and planned period of user residency. These parameters affect the user's spatial behavior, even though the syntactic characteristics of the house remain the same (Dawson. P, 2011).

Spaces can affect human behavior and communal organizations, regardless of their scales. Besides being a physical shelter, home environments are spaces possessing many symbolic, cultural and behavioral dimensions (Erincik, I. and Alper, 2003). Space is a key factor sustains a home and its ability to adapt to changing needs and has therefore put into policy.
Space standards set in other countries, through the local equivalent of the building control / planning permission system. Sometimes, space standards expressed as floor area, either of the dwelling or habitable room. In others, it derived from functional criteria based on the use of the rooms.

(1-4) RESEARCH PROBLEM:

Several practical problems which complicated database and design, inhabitants' behaviors, this is functional space standards, the use of shared and private spaces within the housing units. There should be enough room for residents to cook, eat, relax and socialize sufficient space for furniture and the storage of personal possessions. If homes are to have a long life, they must offer functional and adaptable spaces that meet the needs of families, children, and older people residents.
The research problem addresses **Planner reducing spatial relation as surface area of the house unit and build up area,** Furthermore they reducing the room spaces in the low cost housing (space standards code not suitable by Building Law and Regulation in the housing) . Beside residents haven't enough spaces and not satisfaction in the house size, which allow to adaptation, conversion and extension especially in low cost housing in the Sudanese Housing Development Funds' houses in Greater Khartoum (Fig 1-1)

So that' it should be enough space to allow to make the everyday lives in comfort, adequate space is a prerequisite for basic living. Several Planning Authorities related to countries adopted the own space standard code for both Governmental and private housing. In contrast information about space standards for designers which including dimensions for both the use and rearrangement of typical items of furniture not disappear. Perhaps from the previous statement the research recognized the important studying the problem of establishing relations between the dwelling spaces, standard, layout and Socio-cultural factors.

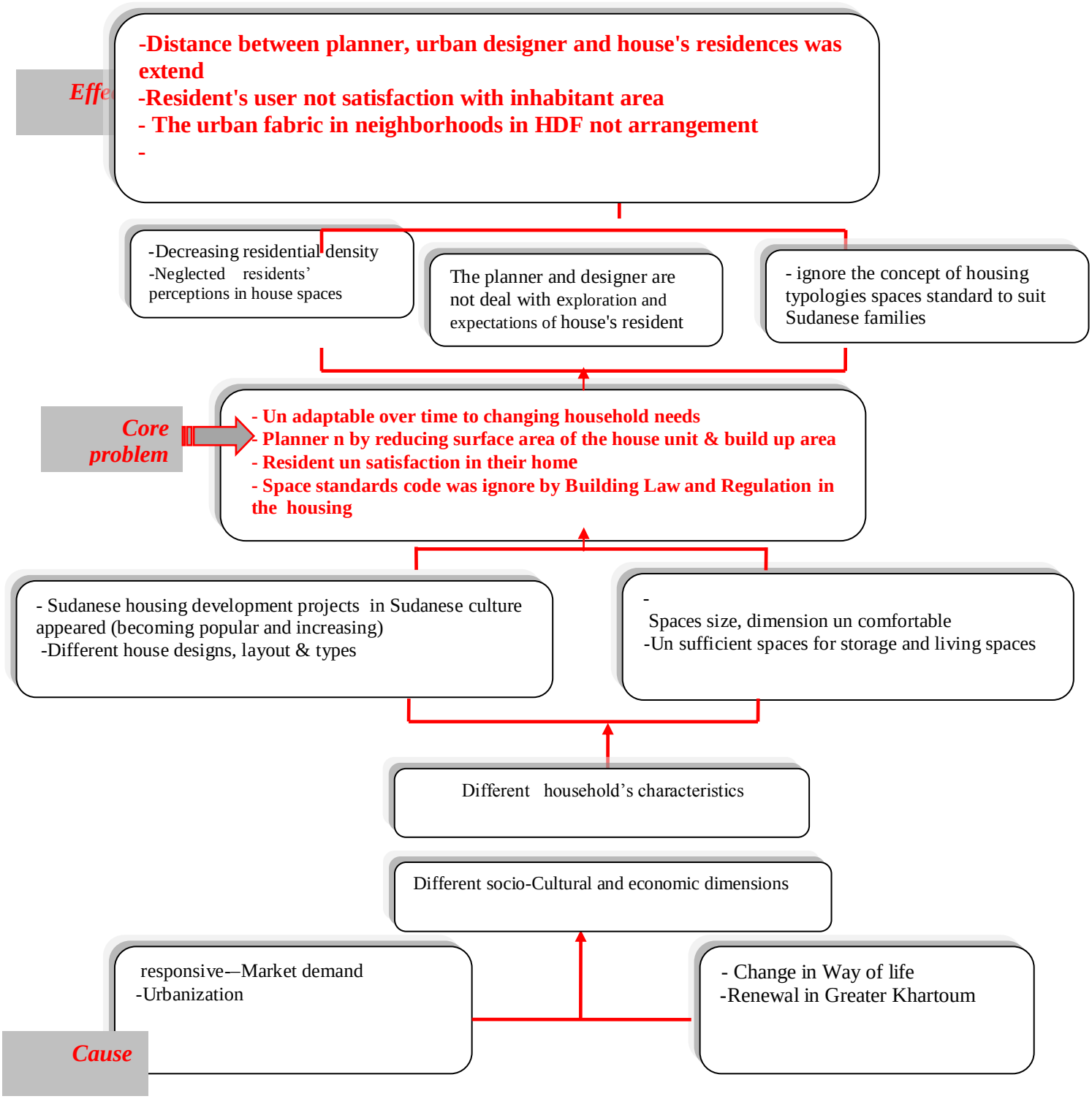


Fig (1-1) Problem Analysis "Problem Tree"

(1-5) PROBLEM ANALYSIS:

The following "Problem Tree" model based on the ZOOP* approach, analyze the existing situation illustrated in fig (1-1). This technique leads to better understanding of the problem through:

I- Identifying the major problem in the context.

II- Defining the core problem of this situation.

III- And visualizing the cause effect relationship.

(1-6) RESEARCH AIMS:

The aim of this research is to set out the standard of design expected from residential development and establish housing guidance code for planners and designers in Sudanese housing Also to -Promote sustainable urban housing by ensuring the high quality of space standards.

To analyze the objectives and goals which can achieve by the study, the following "Means-Ends relationships" model illustrated in fig (1-2) analyze the major policies which can be taken to achieve objectives of the research. This technique leads to better understanding of the problem through:

I- Identifying the major objectives in the context.

II- And visualizing polices effect relationship.

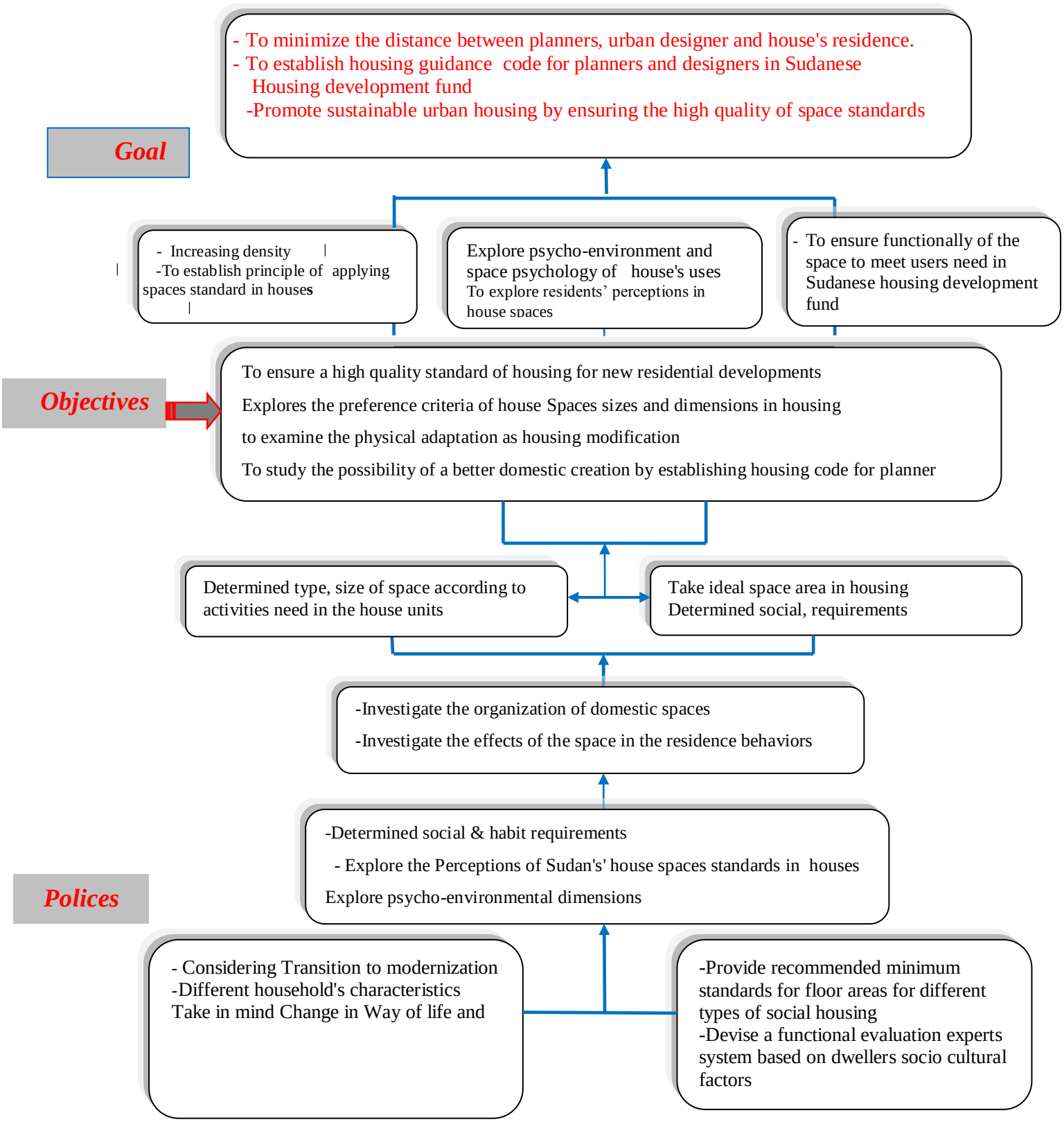


Fig (1-2) Aim Analysis "Means-Ends relationships"

(1-7) RESEARCH OBJECTIVES:

The main objectives of this study are:

1. To ensure a high quality of standard of housing for new residential developments in Governmental sector in Khartoum.
2. To test and analyze the concept of housing, which built with Sudanese Housing Development Funds in Greater Khartoum, and to examine the physical adaptation as housing modification
3. To study the possibility of a better domestic creation by establishing housing code for designer and planner Therefore, to provide a set of standards for a wide range in Governmental and private housing.
4. Explores the preference criteria of house's type spaces, sizes and dimensions in the housing
5. Review of good practice guidance on housing space standards available; in addition to examine how space standards implemented in Khartoum.
6. Study the relation between the dwelling space standard, layout and socio-cultural factors.

(1-8) RESEARCH QUESTIONS:

The researcher has posed the following questions for which the answers make up the basis assume this research to reach hypotheses that can put forward for testing.

1- Do internal spaces and layout allow for adaptation, conversion or extension?

2- where the people do their functions if they have insufficient living space for basic daily activities, storage, and needs within the house?

3-Do a cramped living condition has implications for both accessibility and for sustainability and for quality of life including health?

4- How different space standards influence users' satisfaction?

5- is house efficient to the socio-cultural conditions explain the differences in the space?

6- Is low-income housing organized and built by the Governmental (Sudanese Housing Development Fund) Organizations in Khartoum gives specific guidance on space standards?

7- Do buildings or spaces statutory minima in the house unit, such as building regulations?

(1-9) RESEARC HYPOTHISES:

To answer these questions, the researcher has reached the following hypotheses:

1. Provide insufficient living space for basic daily activities, storage, and needs within the house
2. "The internal space of new dwellings getting smaller and don't allow for adaptation, conversion or extension.
3. It is imperative that good quality housing provided to create a suitable and sustainable living environment for new and future generations.
4. In recent years, Government targets focused on unit quantity rather than the quality of provision, while establishing general design principles, does not give specific guidance on standards.
5. The differences of socio-cultural conditions in the Sudanese family.
6. Internal space standards influence users' satisfaction.
7. low-income housing organized and built by the Governmental (Sudanese Housing Development Fund) Organizations in Khartoum did not gives specific guidance on space

Fig (1-3) testing the hypothesis of the research conceptual frame work by using methods to achieve the broad goals of the study.

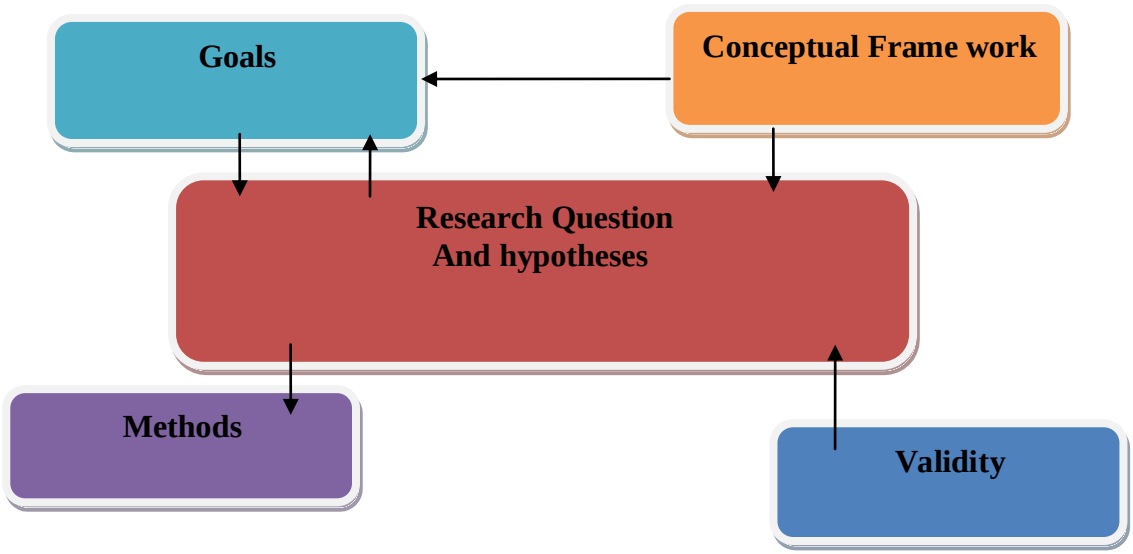


Fig (1-3) Testing the hypothesis of the research conceptual frame work

(Source: Author)

(1-10) RESEARCH METHODOLOGY:

For accomplishing thesis objectives, many methodologies used, based on the objectives that mentioned above, these methodologies are:

1. The researcher used the literature review accomplish the research aim
2. The researcher used an analytical study accomplish the research aim
3. The researcher used her own view and personal free choice to accomplish the research aim.
4. 3rd and 4 th aim of the research is a deductive analysis of
5. Re-synthesize them into chunks that can imply into a narrative context to accomplish the research aim.

The methods of this research offer a great promise for participatory researcher who would like to see methodologists describe and develop techniques that are closer to what researchers actually use in practice (Onwuegbuzie &Leech 2004). Fig (1-4) explain the elements of built environment includes the relation between the house, their inhabitants, and the socio-cultural factors which affect in the house lay-out, room size, dimensions and use of spaces.

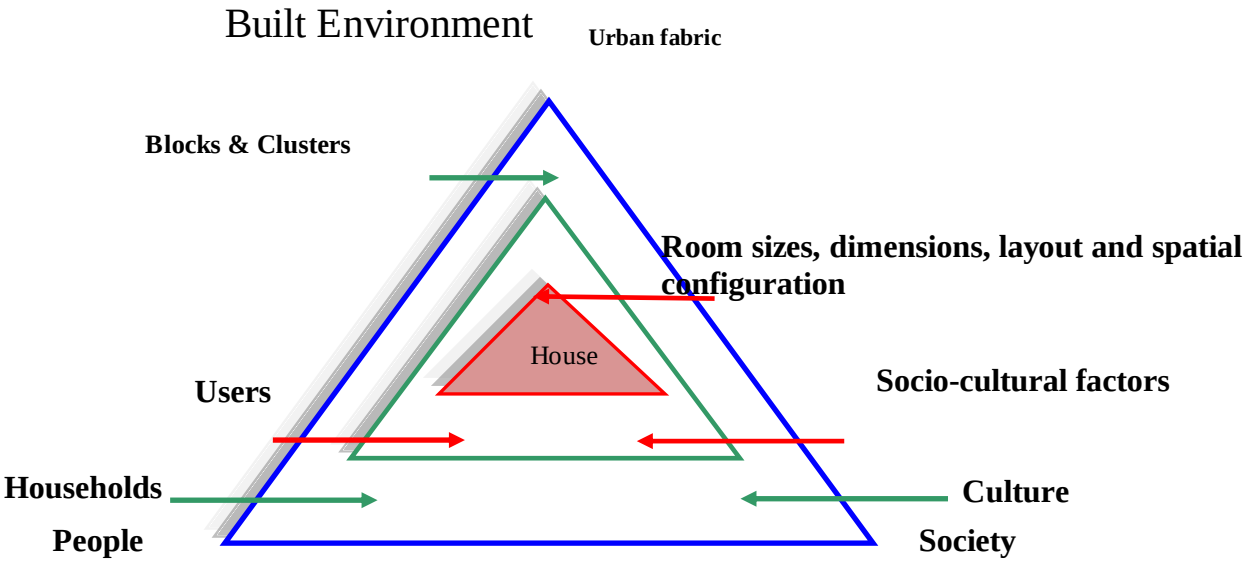


Fig (1-4) Built environment (Source: Thiberg; 1975, the triangle in the middle is added by author 2007the smallest triangle is added by Diffalah1998)

Since the current study lies within the, discipline of built environment analysis fig (1-5), the research methods have, reviewed the written literature in this field to include studies on human dimensions, human characteristic, movement behaviors, which influence the dwelling spaces in residential areas. The methodology for setting space standards tends to be based on occupancy numbers or bedroom size; however, the evidence base for the specific sizes, is often absent from the policy document advocating these standards. (Housing Design Standards, Evidence Summary, 2010).

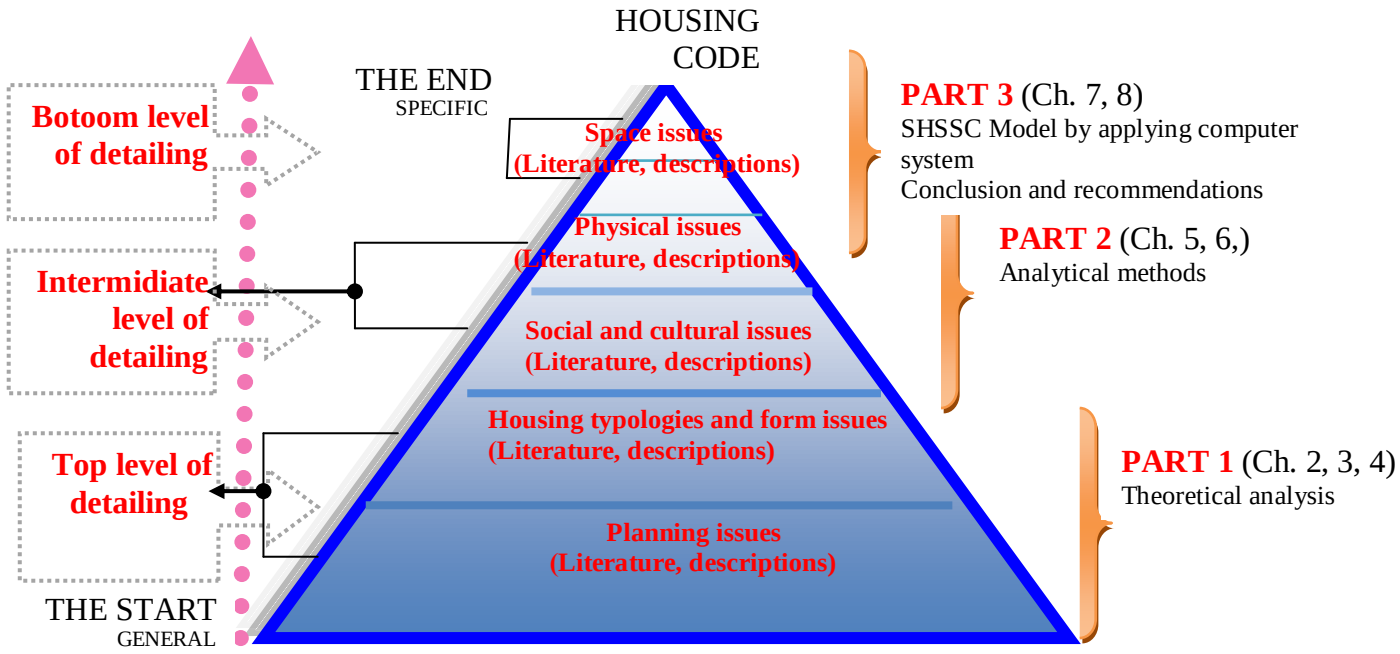


Fig (1-5) Fields of research and data types collected (Source: Author)

According to Gilham (2000) qualitative research focuses on what people say and what they do. Quantitative research is generally concerned with measurements and is characterized by a more structured and standardized data collection. Qualitative research views the individual or organization in a holistic manner rather than reduced to isolated variables. The use of a quantitative approach was limited to a small scale. The Quantitative data provided this study with essential statistics, while qualitative data enriched the research, discussion developing a better context for interpreting the results from statistical data.

(1-10-1) METHODS OF DATA COLLECTION:

Four techniques used for data collection:

- Statistical data on housing and planning in Greater Khartoum.
- Structure questionnaires to test resident's perception and adaptability.
- Field survey by using questionnaire which is a reasonable way to gather data from a potentially large number of respondents (Hus, et al. 2010) besides, site observation for recording the use of houses spaces in conducting domestic routine e.g. (maps, site visits).
- Measured drawings and photographs about building document for house Planning and design

Figure (1-6) explain Flow of ddata mmatrix, and ttechnique's from primary and secondary sources, including reports and statistics provided by governmental authorities and international organizations.

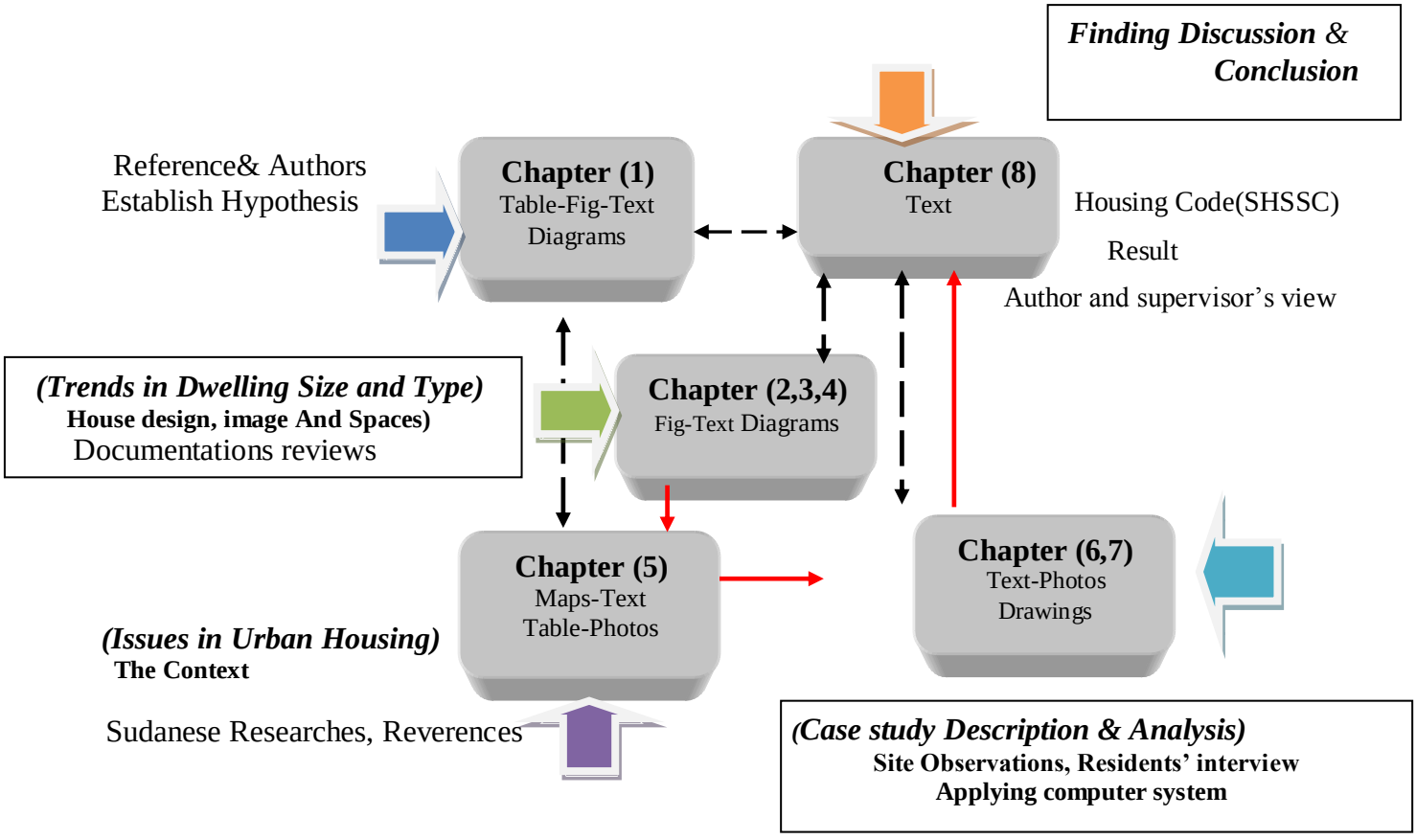


Fig (1-6) Flow of Data Matrix, and Techniques (Source: Author)

(1-10-2) Sources of Information:

Several methods of data collection used for this study:

- Documentation reviews, besides web sites, were the main sources for the preliminary information.
- Interpretation of experts' responses to the interview questions (sample selection).
- Books
- Dissertations and Ph.D. researches
- Lecture handout or notes.
- The World Wide Web
- Professional Magazines (Building, Project Manager,New Civil Engineer, etc.).

(1-10-3) Field Work Method:

This section describes in part four and five of this study. The researcher collects data from:

- Expert interviews for interview form (a few experts are interviewed to reflect an expert's opinion towards research themes, those individual are architects, a city planners and others of related disciplines).
- Formal and informal interviews from selected inhabitants, and completed by questionnaire. This illustrated in chapter four by description and analysis
- Inhabitants information.

(1-10-4)Site Observation:

To collaborate with the details got from individual quality standards concerning assessed sampled projects, on-the-site investigative observations of the projects were conducted. This was relevant to have first-hand information on the physical features of the projects, and also note changes that may have occurred over time. This was established by assessment of the real site situation, having secondary data drawn from there in and also from the developers.

The role of a 'complete observer' requires investigators to insulate themselves from any social contact whatsoever with the subjects. In view of the nature of this study, requiring observation and comparison of the quality criteria of 10 housing projects area in Greater Khartoum.

(1-10-5) Questionnaires as a Surveying Tool:

A questionnaire is a tool for collecting information to describe, compare or explain knowledge, attitudes or behaviors and/or socio-demographic characteristics of a target group. The main advantage of using questionnaires over other methods of data collection is that a large number of people can be reached relatively easily and economically (Elkalifa, A, 2011)., Thevendran (2003) claimed that the questionnaires advantages are : simple straightforward approach to study attitudes, values and beliefs; inexpensive; quick method to discern precise information; economical (Time & Cost); best method to use to discern information over a large or disperse geographical distribution (postal questionnaire); able to identify a wide range of opinions (interviews).

Taylor, P (1998) suggests the guiding principles for formatting the questions of the questionnaire by using opening questions should be easy without using open-ended questions with lengthy answers, and Pre-coding of answers as many items and response categories are possible to help tabulate and analyze data more quickly.

Preparing an introductory section that states the purpose of the questionnaire and assures respondent confidentiality (Taylor, P. 1998) so that, a covering letter was attached to the questionnaire revealing the purposes behind the survey and highlighting the importance of the topics investigated. The entire questionnaire involves 52questions which are structured into five main sections (1, 2, 3, 4, and 5). The entire questionnaire was printed in seven pages excluding the covering letter. Section (1) designed to provide general information about the respondent s, including: name, area, quarter, sector, block number and, plot number. This section provides a description of the abbreviations used throughout the questionnaire. Sections B and C are broken down into seven and four subsections respectively.

(1-10-6) Questionnaire Formation and Aspects of the study:

The main aspects of the study which were forming the questionnaire are:

A- Social aspect:

1- Items concerning e dwellers and development trends:

- Family structure.
- Family history.
- Family tribe.
- Type of tenancy and occupation

2-Items concerning the actual space use:

- Spatial situation of basic activities on the dwelling level.
- The problem concerning privacy regulation on the housing groups.
- The problem concerning privacy regulation on the level of the dwelling groups.

B- Economic aspect:

1- It was concerning the dwellers economic ability

- Income and employment

2-Items concerning transformation in improvement of **the house:**

- Past stage of growth and transformation of the house relation to the initial (dwelling).
- Plans for future changes.
- Personal; evaluation of the layout.

C- Culture aspect:

-Items concerning domestic routine and activities.

-Items concerning privacy.

-Items concerning the behaviors of house resident's in the space

D- Space area aspect:

-Items concerning the area. -Items concerning occupancy.

A draft of the questionnaire was prepared after a series of reviews and editing. Then, the questionnaire was handed to 16 persons who were broadly representative of the type of respondents targeted by the main survey. 10 questionnaires were handed person, whereas 6 were sent by e-mail. The comments and suggestions made by those respondents were incorporated into the final version of the questionnaire. Some questions were deleted and some were rephrased. The average time required to fill-out a hard copy was about 30 minutes commented on the length of the questionnaire noting, however, the relevance of the questions, the easy-flow of the questionnaire and the importance of the topic.

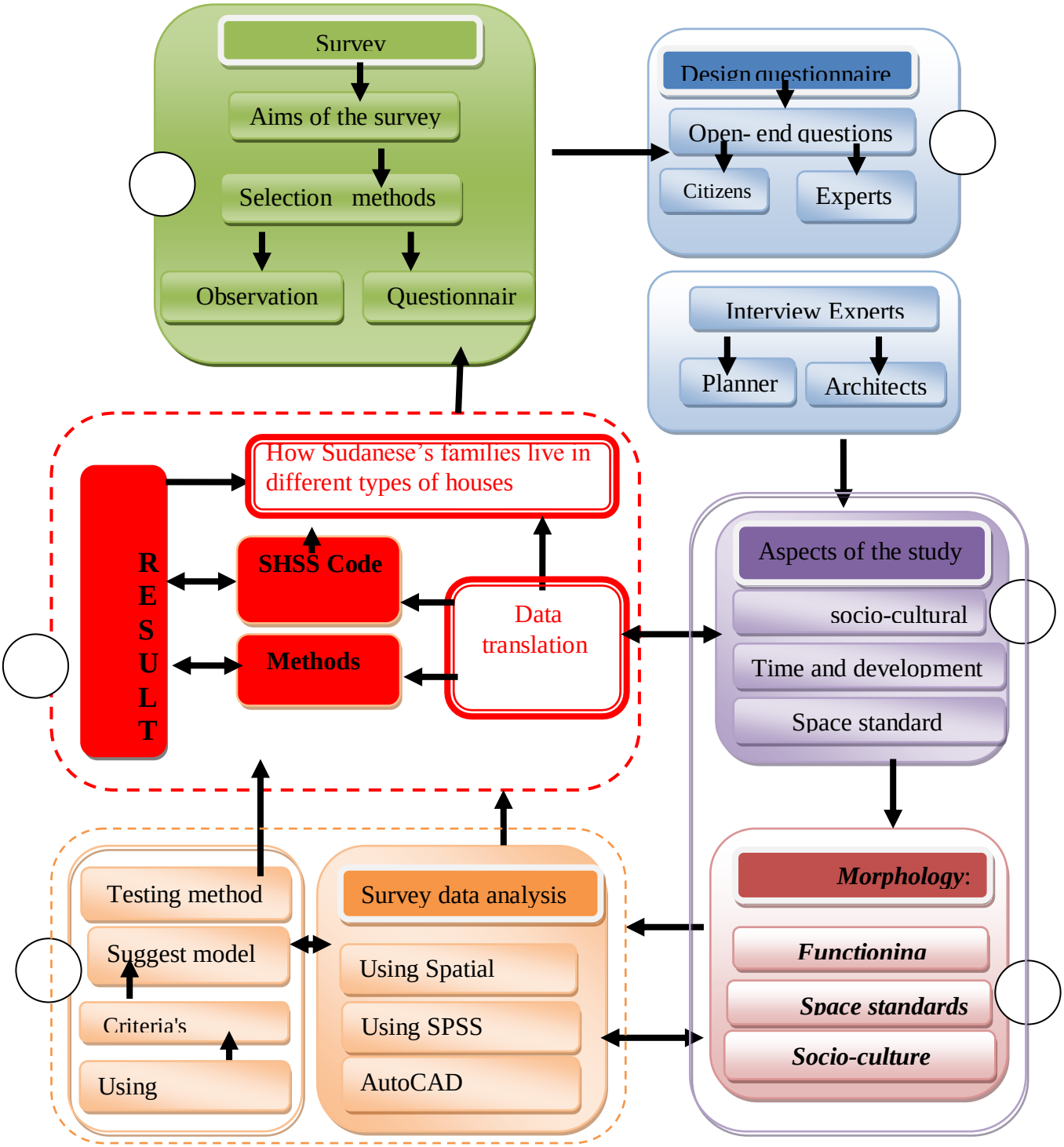


Fig (1-7) Flow chart of survey and research aspects

(Source: Author,2016)

(1-11) METHODS OF DATA ANALYSIS:

The research problem was addressed through quantitative and qualitative approaches, Qualitative research is characterized by an emphasis on describing, understanding, and explaining complex phenomena (Norman, 2003), falling under the mature analysis such as framework analysis which attempts to identify pattern, association and causal relationship in themes. This involves charting, identifying a thematic mapping and interpretation Preference criteria have often perceived and evaluated as qualitative; thus housing researchers generally avoid forming a theoretical model concerning Preferences.

It is generally assumed that such a model would have uncertain limitations and have a vague scope. However, evaluating the house preferences by employing a numeric based method is possible to agree upon some common features Comparison of human related characteristics and the spatial data can be analyzed through various spatial analysis software methods based on a mathematical logic such as Space Syntax and Spatial analysis which translate the socio-culture data into numerical system and the analyzed data is presented in a form of tables and graphs to be read.

(1-12) RESEARCH SCOPE AND LIMITATION:

To maintain a manageable approach for this research, scope and limitations are necessary to be defined. This study revised the research problem to establishment space standards based on social and cultural factors which affect the layout of dwelling space standards and configuration. Beside that the functional use of internal space in the housing unit in the Greater Khartoum. Fig (1-8) shows that Urban Environment compromise of three disciplines (Architecture, Urban design and urban planning). Urban planning has cultural, social and physical aspect discussions the external relations are the scope, such as building materials, construction methods, economic aspects and contextual aspects. The research focus on the housing projects which organized and built by Sudanese Housing Development Fund in the both levels of house and cluster in Greater Khartoum.

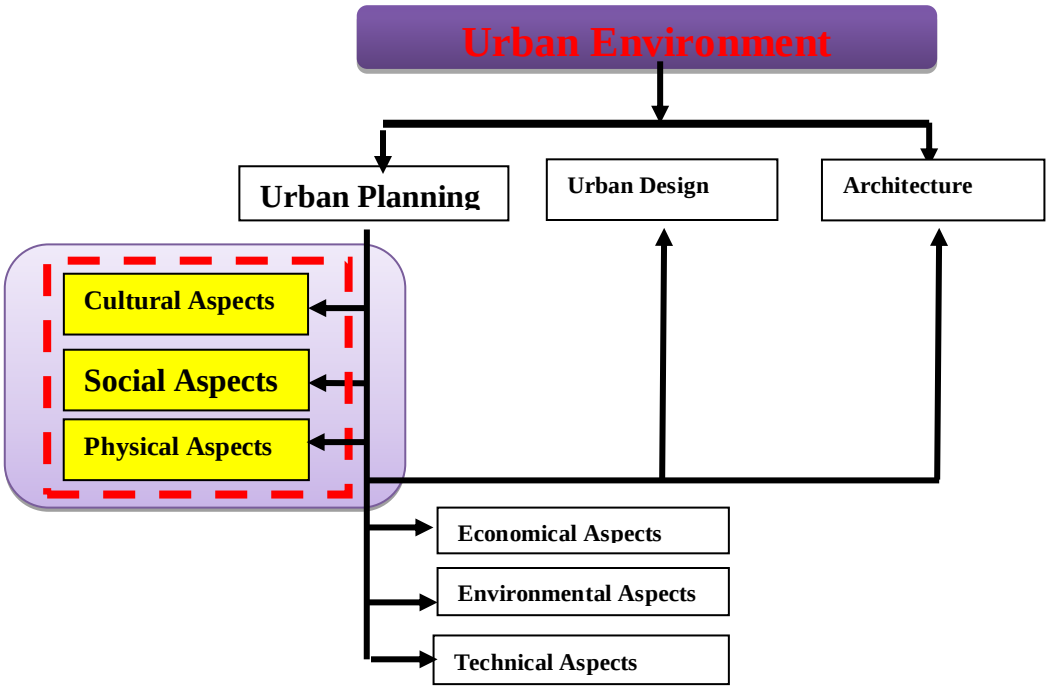


Fig (1-8) Research Scope and Limitation (Source: Author)

(1-13) RESEARCH STRUCTURE AND ORGNIZATION:

The research organized in three parts excluding chapter one (Figure 1-3). Chapter "1" deals with research nature and scope includes problem definition and rationale behind this thesis, aim statements of this study and, hypotheses. In addition to, it describes the research method used for this study (including research method, field work method, data sources). chapters "2, 3, 4" provides the conceptual and theoretical framework for the study, chapter "5 presents the full theoretical framework and connects with the local conditions of the study and, describes the local context of Sudan and Khartoum City. chapters "6, 7, the study, analysis and results, contains construe SHSS Approach, design of its software. Also, it identified the possibilities and the methodologies of applying SHSS Model (Low cost and medium income housing group potential and benefits of applying SHSS approach in Greater Khartoum Chapter eight; Approach to the case study. It discusses the contents of SHSS software and explores its utilization and application in co-operative Projects. Chapter nine;.. chapter " 8," description, finding results, and analysis, so it contains discussion and presents the discussion and refining of SHSS Approach, guidelines and recommendations based on the previous chapters to achieve the stated objectives.

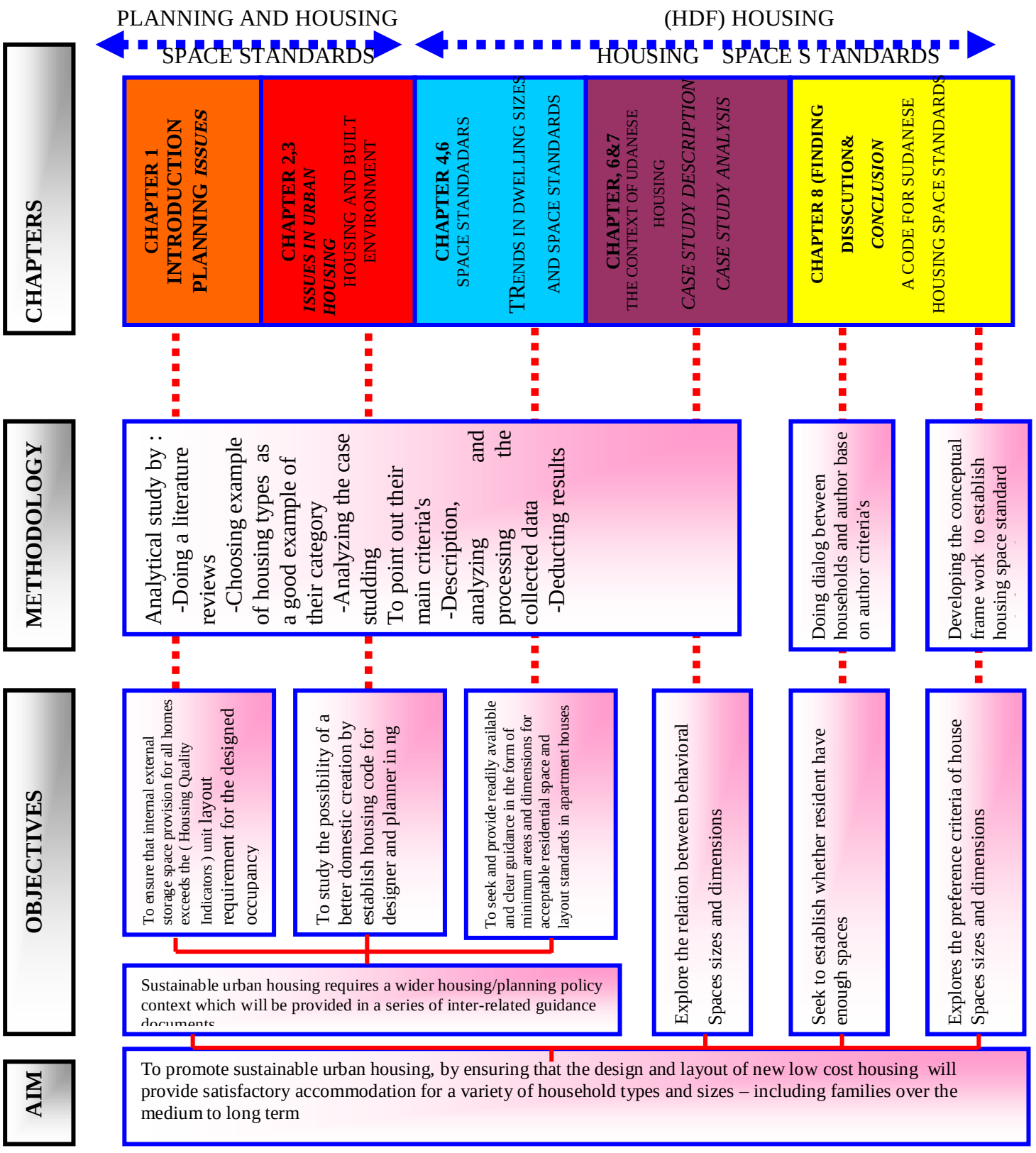


***Fig (1-9) Thesis Structure and Methods* and techniques** (Source: Author, 2012)

(1-16) CONCLUSION:

The research problem addresses **Planner reducing spatial relation as surface area of the house unit and build up area,** furthermore they reducing the room spaces in the low cost housing (space standards code not suitable by Building Law and Regulation in the housing). Beside residents haven't enough spaces and not satisfaction in the house size, which allow to adaptation, conversion and extension especially in low cost housing in the Sudanese Housing Development Funds' houses in Greater Khartoum.

The aim of this research is to set out the standard of design expected from residential development and establish housing guidance code for planners and designers in Sudanese housing also to -Promote sustainable urban housing by ensuring the high quality of space standards. It has posed many questions for this research to reach hypotheses that can put forward for testing

1- Do internal spaces and layout allow for adaptation, conversion or extension?

2- Where the people do their functions if they have insufficient living space for basic daily activities, storage, and needs within the house?

The research can be described as: as basic; quantitative; and qualitative research. The most appropriate common data collection methods that satisfy the three classifications of the research design are the survey method and the desk research method by using questionnaires, interviews, case study.

The method selected for the purpose of this study is stratified random sampling, a Questionnaire was contained 5 aspects of the study these aspects are, social aspect, cultural aspects, and physical aspects and, spatial aspects. Data was analyzed using descriptive statistics such as the mean and composite mean by using SPSS software.

evaluating the house preferences by employing a numeric based method is possible to agree upon some common features Comparison of human related characteristics and the spatial data can be analyzed through various spatial analysis software methods based on a mathematical logic such as Space Syntax and which translate the socio-culture data into numerical system and the analyzed data is presented in a form of tables and graphs to be read.

(2-1) INTRODUCTION:

The vital importance of housing as a fundamental human need and as a vehicle for economic and social development need not be argued. This understanding and the deteriorating urban housing conditions in most developing countries, that U. N institution held several conferences in Vancouver, Canada, in 1976. Habitat II reaffirms the results from relevant recent world conferences and has developed them into an agenda for human settlements which reaffirming commitment to better living standard for mankind.

The Global Strategy for Shelter to the Year 2000, adopted in 1988, which emphasizes the need for improved production and delivery of shelter, revised national housing policies and an enabling strategy, offers useful guidelines realize adequate shelter for all in the next century.

Shelter is a basic need that any human being aspires to fulfill. Its form determined on the one hand by social norms and practices and by environmental factors such as Physic graphic and climate, (Mabogunje, H , and Misra, 1978). Yet shelter acts in a physical sense, as an intermediary between man and nature, and in a social sense between man and society. It becomes the individual's identity symbol in society, reflecting not his personality but his technological, economic and social development. The concept of shelter defined to embrace more than conveyed by conventional terms like dwelling.

This chapter provides the conceptual and theoretical framework for the study and reviews disciplines of built environment analysis. Besides exploring the developments house design and image through time with, this represented in the following keywords:

- House design
- House types

(2-2) HOUSING AND ENVIRONMENT ASPECT:

J. Brotchie 1983 explained that, advanced societies are experiencing a series of technological revolutions, making profound changes, in the global societies, structures and economy. Spatial patterns, which have characterized earlier times, are now different.

Urban environment has of many disciplines such as; architecture, urban design and urban planning. For this study urban environment referred to the socio-cultural and spatial aspects of urban planning which affected space standards in the house.

Housing defined at the three levels

1- 1st level of Housing: the dwelling occupied by a nuclear or extended family household, A secure place where people practice a vital part of their daily activities, e.g. relaxing eating, ect.

A building for human habitation, one that comprises a ground floor and one or upper story "… The place we call home is combine physical and social environment, the interplay of which may create either a stimulating, satisfying background for people or a dull and frustrating one. It is the quality of the physical aspects of 'place' and the opportunities for social life and activity offered which will decide how good a home we give." (Spyer, 1971,)

A dwelling refers to a building or part of a building used or intended to use by one or more persons as living quarters. Each dwelling has its own separate entrance (s) with direct access to a public road or pathway. A dwelling may be a residential building by itself or a unit in a residential building, or part of a non-residential building such as a shop or factory with space used as living quarters.

"Housing is not provided shelter for a family, but also serves as a center of its total residential environment. As a focus of economic activity, as a symbol of achievement and social acceptance, and as an element of urban growth and income distribution, housing fulfills a social need and satisfies the criteria for remunerative urban investment,", (Grimes, 1976).

The concept of housing experienced to an extent by most people. Yet, the way home defined differs throughout the literature and between individuals (Rapoport, 1985).

A house is a physical structure that fulfills lower-level needs such as protection from the weather and intrusion, but the home will encompass these lower-level needs while also fulfilling higher-level needs (Maslow, 1970).

The Sudanese Context:

Diffala, M, (1989) describes it as *". The house is* in the Arabic language is synonymous to Manzel and Bayt. Manzel refers to a house as a constructed shelter, housing one or several families; Bayt has a traditional meaning of shelter, and refers to the family living in it A house in Sudanese context is the place for both the nuclear family and entertaining them. Sudanese house division into two sections male section (Diwan) a*nd family section".* In Khartoum, province 1992 authorities define dwelling as follows dwelling on the first point as a place for housing a nuclear family or an extended family household and on the second point assumed disappearance of the extended family household.

2- 2nd level of Housing: the group of the neighboring families which have common aspects such as social, cultural and economic similarities. These similarities make the lives of the neighboring families like that of the extended family, which was the prevailing way of living.

***3- 3rd level of Housing*:**

Housing comprises both social and physical contexts and settings supplying both sources of the potentials and problems. People perceive these contacts and react to satisfy their picture of home environment. (Abdul Aziz, A. and Abdullah, Sani Ahmad, 2009).

Housing is more than shelter and that the habitability of a house depends not only on the physical characteristics of the dwelling, but also on the social, cultural, and behavioral characteristics of users (Oladapo, 2006; Jiboye, 2010).

The World Health Organization (1961) described housing "as give any physical structures, used for shelter (Adesoji, D, 2013). This includes all facilities, equipment, services and devices needed for healthful living." Gans (1962) and Raven (1967) opined that the concept of housings related to the social, behavioral, cultural, and personal characteristics of occupants, I besides the physical, architectural, and engineering components of the home.

(2-3) DEWELLING TYPES:

The variable of structural of dwelling classifies the private dwellings into the following nine -exclusive categories: single-detached house, semi-detached house, row house, apartment or flat in a duplex, apartment in a building that has five or more stories, apartment in a building that has fewer than five stories, other single-attached house, mobile home and other movable dwelling.

(2-3-1) Bungalow/ Detached House

This refers to a free standing landed house standing on its own sharing no common wall or roofing with other separate dwellings. This includes strata or cluster bungalow/detached house with common areas and facilities shared by units in the development.

(2-3-2) Semi-Detached House:

This refers to one of a pair of ending houses joined by a common wall but not to any other dwellings. This includes strata or a cluster semi-detached house with common areas and facilities shared by units in the development.

(2-3-3) Terraced or Raw House:

Refer to a landed house in row houses, joined side by side together. There are no other separate dwellings either above or below it. This includes strata or a cluster terrace house with common areas and facilities shared by units in the development.

A wide range of terraced houses constructed during the nineteenth century. At the lower end range were 'two-up, two-down' cottages with a living room entered from the street, a

kitchen at the back, a staircase in the middle and two bedrooms above. At the other end were the grand houses built for wealthy families–five or even six stories with servants quarters top and bottom. The former has demolished; the latter converted into flats. In between were the great masses of terraced houses two- or three-story high. These built and have adapted to give successful family housing.

The plan form of most surviving terraced houses is the same an entrance hall leading to living and dining room and kitchen at the back; a staircase at the side leading to bedrooms (Figure 2.1). Graham, T. 2005)An Introduction to Urban Housing Design
House form originates from the British terraced house design (Hashim, R, R, & Yahaya, 2006). A typical terraced housing development comprises rows of rectangular housing lot (Hashim & Rahim, 2008; Wong, 1985). Each lot is narrow and deep with fenestration at the front and back (Chandler, 2005).

In Sudanese context:

Semi-Detached House: one of a pair of ending houses joined by a common wall but not to any other dwellings is the common types in Sudan.

Semi-Detached House a landed house in row houses, joined side by side together. There are no other separate dwellings either above or below it, used rarely in the Sudanese housing development fund projects, so that , it's not used before in site and services projects in Khartoum.

(2-3-4) Apartment House:

Apartment, flat - a suite of rooms on one floor of an apartment house
Apartment house: Defined as "a residential unit in a multi-unit building with groups or common access,".
Apartments are becoming a popular form of dwelling in urban areas. There are several reasons for this trend, including the impact of both the urban renewal measures promoted by this Department since 1986 and of the Residential Density Guidelines issued in 1999, and smaller average household sizes.
Four (2011) argued that high-rise buildings became common after 1994 to cope with the increasing need for houses. These buildings serve many households who cannot afford to buy land to build over. (Kim, Y, 2005), they also assumed that residential building's role and quality should because occupants spend much of their time inside it.

Because of increasing land prices, in urban areas, stated that build high-rise residential complexes became a more practical solution, in other countries single owned detached housing was dominant in the past when the household has almost complete control of everything in his dwelling from the design stage to occupation stage over the years.

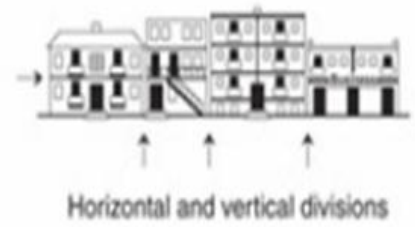
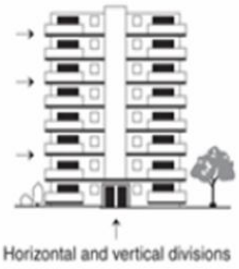
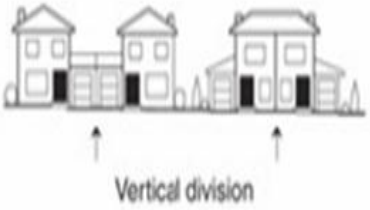
HOUSE IMAGE	DESCRIPTION
	4. Apartment or flat in a duplex–One of two dwellings, located one above the other. If duplexes attached to triplex or other duplexes or to other non-residential structures (e.g. A store), assign Code 4 to each apartment or flat in the duplexes.
	5. Apartment in a building that has five or more stores–A dwelling unit in a high-rise apartment building which has five or more stores. Also included are apartments in a building that has five or more stores where the first floor and/or second floor are commercial establishments
	6. Apartment in a building that has fewer than five stores–A dwelling unit attached to other dwelling units, commercial units, or other non-residential space in a building that has fewer than five stores.
	7. Semi-detached house–One of the two dwellings attached side by side (or back to back) to each other, but not attached to any other dwelling or structure (except its own garage or shed.) A semi-detached dwelling has no dwellings either above it or below it and the two units, together, have open space on all sides

Table (2-1) Dwelling types

In Sudanese context:

Private houses can be (villa) bungalow or other types. Bungalow or other types of dwelling have one or two stores, with courtyards within the plot and surrounded by boundary walls, fence or hedges, occupied by one or more households (Alagraa, O, 1985).

Several small private developers purchased plots of land within developed first and second class areas in three towns to develop them into high rise residential blocks of flats (Awadel Karieem, M 2008).

Leslie, (2012) and Doxiadis (1959) and Bushra (1979) found the number of designs (housing units in the area) containing different models and housing design and services attached to the planning and requirements this was like this planning.

A/ Apartment House:

Fit this pattern for capturing tiny (1-2) and small families (3-5) because the space of apartments allows existing many spaces and notes the difficulty of accommodating the growth of the family's size over time in the same apartment for the impossibility of horizontal and vertical extension and so favored to move to another place

B/ Single House:

Fit this pattern for all classifications of families of small, medium and large. We must pay attention to when distribute residential blocks in proportion Lot size (home with a built-up area of any growing space widget increase the size of the family along the built-up area of the piece to accommodate the growth of family's size over time by. Vertical extension in buildings that allow additional other floors .Horizontal extension in houses with large area

C/Row Houses:

Fit this pattern for all categories of families where the former differs from the pattern distribute single houses built-up area inside the house (next to and along the built-up area for several houses) Be along the plot built-up area to suit the growth of the size of the family over time by the horizontal extension limited toward adjacent homes or buildings in the vertical extension that will allow more other floors or move to another place in those buildings that do not allow more other floors.

D/Semi-detached Homes:

Fit this pattern for all categories of families earlier, where he differs from the pattern of raw houses Plan and along the built-up area of the two houses and leave the corridor inside the piece of extension services will be along the built-up area within the widget to fit the growth and the size of the family across the time through horizontal extension limited in a direction other cheek by jowl houses and extension of vertical buildings allow added other floors or move to another place in those buildings that do not allow add other floors

(2-4) DEVELOPMENT OF URBAN SOCITIES:

"The pre-industrial society depended predominantly on agricultural production, which occurred outside cities. Industrial revolution reversed this pattern of development, with manufacturing production, emerging at that time one of the major activities, taking place in cities. Postindustrial era reversed the pattern again, as manufacturing production moved to metropolitan peripheries" (Alkidir, A, 2011). Alvin, 1971, predicted that, the move from manufacturing to services production is an outcome of economic forces. Turnover in consumer preferences is under rapid lifestyle changes.

The breakdown of central society today was linking to our inadequate images, of the probable future. Alkidir, concluded that, every society faces not successes probable futures, but an array of possible futures, and conflict over preferable futures.

HIilder, H writes "modernity makes up the elements that mediate between a process of socioeconomic development known as modernization and subjective responses to it as modernist discourses and movements (HIilder, H, 1990). For many people today in the Sudan, Nigeria, Africa, and around the world, "today" or the "present often modified and influenced by the economic realities of everyday life, and most of it colored by their subjective individual experiences (Elle, N, 2008).

The Sudanese Context:

Challenges for urban planning as part of the urban environment will grow, when these rates of technological, economic, environmental and social changes increase. Alkidir, Abass said "*To predicts occur future rapid changes in Sudanese cities and urban life of their inhabitants, with the development and advances of ICT* (Alkidir, A, 2011).

(2-5) URBAN DEVELOPMENT AND URBAN GROETH:

As mentioned before, most of the population throughout the world continued to live for a long time in rural communities. But, as industrialization proceeded, the towns grew to large mega–cities: London, Paris, New York, Tokyo, others became large or medium–sized cities: Manchester, Lyon, Marseille, Miami and Madrid. Urbanization spread from the industrialized to the developing countries so such cities as: Mexico City, Sao Paulo, Cairo, Bombay, and Calcutta, qualified to include in the category of the largest cities of the world. Most of the larger towns located in developing countries and this shift towards mega–cities in developing countries is inexorable (Sebestyen and Pollington, 2003).

The distinction between rural and urban areas was only necessary with a consistent definition for each individual country where in most cases the limits set between 1500 and 5000 inhabitants, but as the international focus on problems related to urban areas has increased, comparable global statistics have become necessary. Hudson, 1976, and UNEP, 2000, discussed the need for defining rules and criteria for the delimitation of urban and rural areas to see urban development and its impacts. This became plain when one statistical overviews of urban population density and other demographic characteristics.

The population density of most cities in developing countries, including many of the largest, is not high if one considers the entire city. Urban areas are changing and developing. Another characteristic is that large and small land areas in the urban fringe or undeveloped land in the city center are occupied by the poor. Cities in developing countries have less industry than cities in the industrial countries, but the industry may have expanded without adequate planning and regulation.

The Global Report on Human Settlements presents a different view regarding the impacts of urban growth. It emphasizes the central role that cities and urban systems have in stronger and more stable economies that have underpinned great improvements in living standards for a considerable part of the world's population over the last few decades. Yet the Global Report, in surveying the evidence, found little substance to these criticisms, which cities blamed for it. The tendency to consider "rapid urbanization" as a problem forgets the close association between urbanization and economic growth (UNCHS, 1996). In this respect, rapid urban growth seen as reflect of the rate of economic growth, the higher level of urbanization in a country, the lower level of absolute poverty.

The most urbanized nations with the highest life are expectancies and the countries with the largest increase in their level of urbanization over the last 20–30 years are also those with the largest falls in population growth rates. In addition, cities and towns have been engines of growth and incubators of civilization and have facilitated evolve of knowledge, culture and tradition, by industry and commerce. The report also mentions some advantages of cities over rural settlements or dispersed populations from the viewpoint they support large numbers of people while limiting their impact on the natural environment. The success of cities, their equally obvious degradation problems, and finally their future have been the focus of much attention. New concepts were worked out, for example, the Garden Cities and the Self–Sustained Satellite Towns but as time went on, it became evident that their capacity to the problem of urban growth and large cities was limited (Sebestyen and Pollington, 2003).

In most of the developing world current urban growth is not well–managed and leads to major environmental and health problems such as inadequacies in shelter, infrastructure, transportation and services, associated with poverty as will further highlight in this study.

The World Bank describes the growth of the urban population as a "double edged sword" health and sanitation. Developing the institutional structure to manage the city in ways that, make sure that the advantages noted above utilized–and also done in ways accountable to urban populations is perhaps the most important and difficult aspect of urban development.

(2-6) URBANISATION PROCESS IN SUDAN:

Urbanization is a social process whereby cities grow and societies become more urban in contrast to rural communities. Urbanization increases the size of cities, and so influences the demand for housing, services and infrastructure. The process of urbanization in developing countries also involves changes in the social structure of the population, living standards, way of life and economic conditions (Hafazalla , A. 2008).

The decades since Sudan gained its independence in 1956 have saw the emergence of a process of rapid urban growth, characterized by an uneven distribution of urban populations over the various regions, the dominance of a few major cities and the concentration of population on the conurbation of Greater Khartoum in particular (Gore, 1998). As in most developing countries, urban change in the Sudan was mainly caused by mass migration of rural residents. Natural disasters (drought and desertification in the West and the rains and floods of 1988) and non-natural disasters (the civil war in the South) were the main causes of the so called by Ibrahim, 1984, "the massive drift of the rural population into the larger cities. Ibrahim and the UN, 1974, also recognized the role played partially by high fertility rates assumed to prevail in cities and the progressive extension of the administrative boundaries of cities.

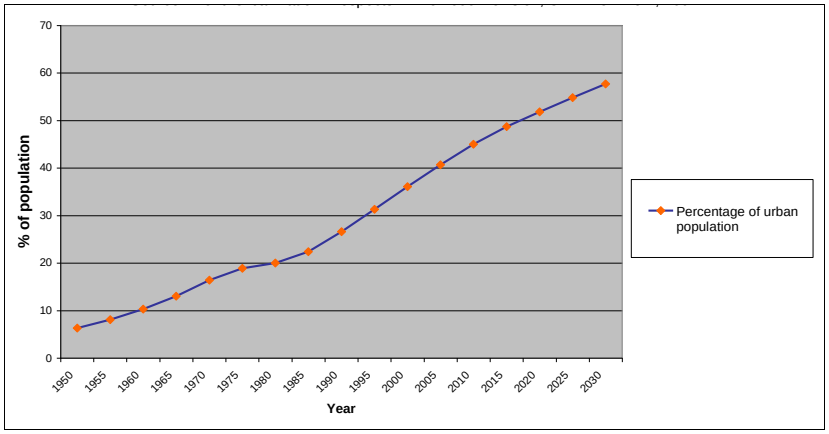
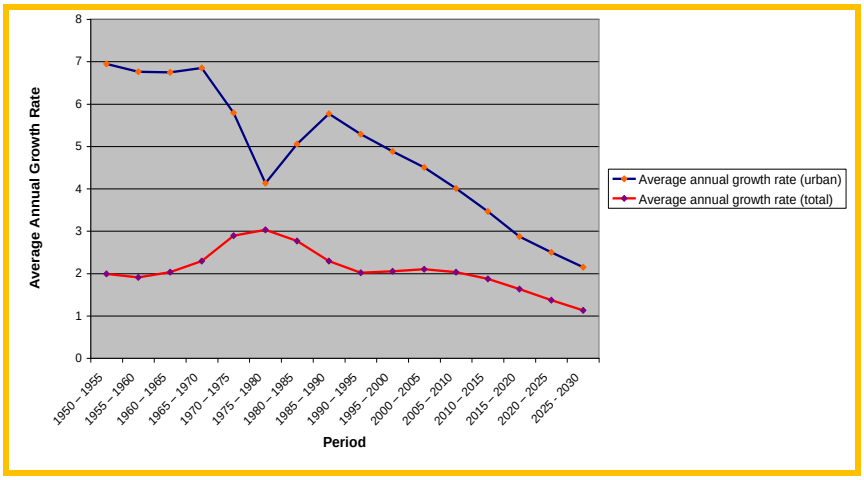


Fig (2-2) percentage of Population residing in urban areas(1950-2030) for the Sudan
(Source World prospects – the 1999 revision U.N New York 2001)

The latest UN statistics observes that the urban population of the Sudan increased from 20% of its total population in 1980 to 36% in the year 2000. It is expected to reach 52% by the year 2020. The difference in the population growth rates between urban and rural areas is significant. In the period between 1980 and 1985 the urban population of the Sudan was increasing at a rate of 5.1% compared to an annual rate of 2.2% of the rural population in the same period (fig 2-1)

The projections for the period 2000–2005 will be 4.6% of the annual increase in urban population and 0.7% for the rural population growth rate. The average annual growth rate for Khartoum according to the UN was 6% for the period 1970–1975 and 4.2% for the period 1990–1995. This posed added demands on the capacity of the city to provide land, shelter; infrastructure, services and employment as reflected in several statistics, see also fig (2-2). This urbanization pattern is also said to result in many urban problems such as increased housing rent, squatting, pressure on social services, shortage of various consumer goods and the large and flourishing informal economy.



Fig(2-2)Average Annual Growth Rate (1950-2030) for the Sudan

(Source World prospects – the 1999 revision U.N New York 2001)

"Few Arab capitals, except those where wars have been waged, can compare with Khartoum in its sad, swift decline over the past dozen or so years. Symptoms of poverty have invaded the city both on an unprecedented scale and in new ways, (Ahmed and El Batthani, 1995). Mention has been made by several scholars to how the city of Khartoum was most acutely affected by urban poverty which can partly be attributed to the uncontrolled growth of the city besides the lack of effective poverty–alleviating policies.

On the other hand, urbanization is not merely a matter of an individual or a group changing residence or their work, but involves changes in patterns of behavior and thinking, in attitudes towards work in a community that is characterized by an ever changing division of labor and work patterns. As in the words of an urban sociologist:

"The urban style of life, with varying degrees, is generally characterized by rapid change, rapid social mobility, weakening of the ties and intimate personal relations that characterize life in traditional primary or kinship groups, secondary controls, conflict of values and norms and considerable changes in the structure and function of the family, a materialistic approach to living, and a higher rate of deviant behavior,", (Younis, 1972).

Shortage of housing is a problem which has become an enduring feature of the urbanization process in the Sudan and appears to raise increasing alarm from professionals and politicians. There are many reasons for housing shortages in the Sudanese community, Including high birth rates, and the increasing presence of nuclear family households (Peter, C, D. 2011).

(2-7) URBANIZATION AND URBAN CHANGE:

Urbanization and urban change will greatly affect the transformation of a culture and any built environment. In other words, a domestic built environment may experience cultural and social changes due to urbanization and urban change. It has been understood so far that urbanization and urban change greatly affect the transformation of a culture and any built environment that is cultural and social changes are due to urbanization and urban change, so the re-engineering of a single space like a hut, arks, etc into a home, dwelling, houses, family compounds and even palaces be it traditional or contemporary house-types are the direct consequence of urbanization, but continuity and change weather, rapid or slow, are compulsory in any society.

The domestic spaces will change while others stay/continue in terms of organization, meaning and usage across the entire City. The explanations for these changes are associated with social and cultural change.

Forest and lee, (2003) believed that proper to re-assert the significance of domestic architecture in social change. Since the way in which domestic architectural system operates stay a key determinant of the quality of life. And the quality of life here refers to both its individual and collective aspects (Noel, E, 2011)

(2-7-1) Development of Urban House Design and Image in the Societies:

Design can mean different things, to different people. Architects, it can simply mean designing buildings responsive to their context. Landscape architects, it often means detailing the surfaces of public spaces, with hard and soft landscape elements and materials. To planners, it connoted the hazy notion of beautification (D. Walters, 2005).

The African continent, with its fascinating, rich cultures, has inspired many authors to trace the evolution, transformation, and development of its vernacular architectural forms, where patterns and the color come together to show social, symbolic and ritual meanings (Van. W; 1998, and Eilen; 1996). Enriched with the symbolic imagery of the traditional African building, African architecture described as being a direct evocation of its physical environment (see fig; 2-3). Its style taken as noted by Prussin; 1974, & others, not from Abstract aesthetic notions, but from the basic need and image the buildings have to serve. The following are illustrations of different examples of African vernacular architecture.

Vernacular architecture is now the term most used to denote indigenous, tribal, and folk, peasant and traditional architecture, which created and sustained through independent evolution and accumulated wisdom. Attempts to find an overall definition of vernacular architecture have been unsuccessful for the term used to embrace an immense range of building types, forms, traditions, uses and contexts, but possible to show several characteristics common to many types of vernacular architecture.

Fig (2-3): Traditional Earthen Roundhouses, (Tamberma) Region of Togo and Benin
(Source: http://www.transafrica.biz/images.htm)

(2-6-1-1) Vernacular House:

Vernacular architecture can offer lessons for architects in housing design, more than institutionalized architecture can. Architectural history deals with individual buildings, while vernacular architecture is always about town planning, if there is a statement made by

the vernacular built environment, a collective statement (Lekson in Turan, Mete editor 1990) Vernacular Aldershot & Vermont: Avebury, Gower Publishing Group England

*"**V**ernacular architecture, comprises the dwellings and all other buildings of the people. Related to their environmental contexts and available resources, they are customarily owner – or community–built, using traditional technologies. All forms of vernacular architecture are built to meet specific needs, accommodating the values, economies and the ways of living of the cultures that produce them,",* (Oliver, 1998).

Lawrence (1987) clarifies that the term 'vernacular' is a relative term determined by the 'time' and 'place'. He explains that what called today 'vernacular' for the next generations, whether architect–designed building or not.

Brunskill (1981) defines 'vernacular', as: that building which is permanent rather than temporary traditional rather than academic in its inspiration which say for the simple activities of ordinary people. Their form and simple industrial enterprise related to place, through the manner (referring to Lawrence; 1987). Fig (2-3) illustrates a example of vernacular architecture.

The Sudanese Context:

The Sudan enjoys a great ethnic, cultural and linguistic diversity difficult to overstate. It falls within what has termed a 'fragmentation zone' in African linguistic classification (Wilson, 1998) as it joins both features of Arabic and African cultures. The varied environment produces a complicated pattern of land use, which helps to decide the forms of settlement. The Encyclopedia of Vernacular Architecture, 1998, illustrated the basic features of that vernacular dwelling type in the Sudan belonging to various ethnic groups with describe the various socio – cultural aspects of their evolution.

(2-7-1-2) Traditional Houses (Court- Yard houses):

Much favored in the harsh climates of Africa and Asia, the courtyard house has met the need of cultures, where socio-religious practices are different to those in the west, but this house form has more received increasing attention in other contemporary contexts such as Alexander's housing in Lima, Peru, research at Cambridge conducted by Martin and Marsh (Colquhoun: 1999), recent housing projects in parts of Manhattan and Los Angeles, and housing estates in the Netherlands and Sweden.

The courtyard house as an alternative housing choice, it in an efficient and versatile planning forms. The courtyard house satisfies the need for privacy in dense urban situations, in hot, inhospitable climates, where survival demands that the shelter internalized in shaded courts (Derck Thomas: 2002), see fig (2-4).

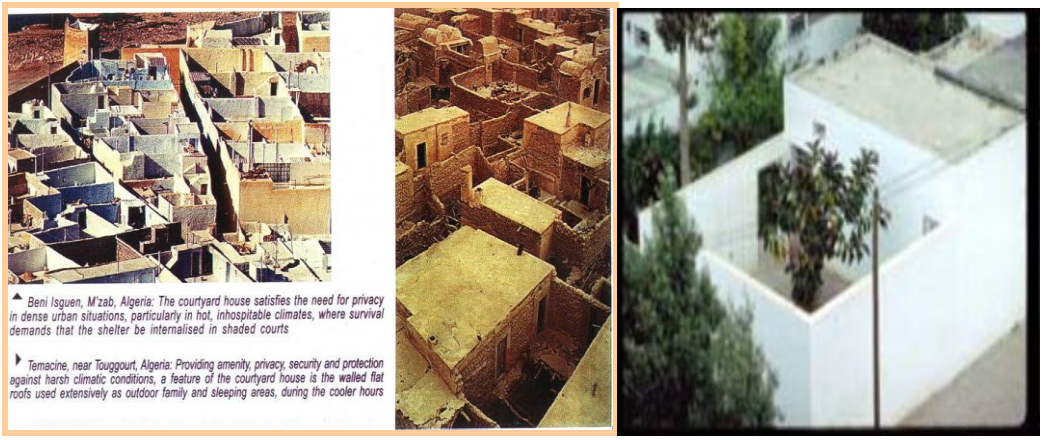


Fig (2-4): Courtyard houses (Source: Derck Thomas: 2002)

The courtyard house providing an amenity, privacy, security and protection against harsh climatic conditions, a feature of the courtyard house is the walled flat roofs used as a door family and sleeping areas, during the cooler hours (see fig 2-5).

Fig (2-5) Modern Housing Type (Residential complex, Doha).
(Source: Tarek Abdelsalam a, Ghada Mohamed Rihan b, 2012)

(2-7-1-3) Modern House:

Modern Architecture evolved less than a century ago. Its task was to reconcile an idealized vision of society and to rediscover the "true" path to architecture. It was about creating architecture that embodied the ideals of a modern age.

This encompassed the works of architects who lost confidence in tradition and rebelled against it. They believed the traditional forms of architecture, and daily lives were becoming outdated, thus modern architecture became create an authentic style, a contemporary‟ style, making drastic breaks from the past and suiting the needs of a modern industrialized society. The notion of antiquity‟ so became implausible (Ncube Chiko,) at the second half of the last century a new architecture (labelled as modern western or international architecture) spread through the Arab region see fig (2-3).

Modern domestic buildings exist in diverse style, yet there are common features. For instance, they accommodate, in their design the traditional courtyard which might induce changes in the pattern of domestic family life. Many people attracted to this new architecture since a modern innovation and are technological achievement. The majority of architects, and academic of 3rd worlds, including Arab region, have adapted the new western architecture.

Al. Kodmany (1999), who conducts a recent field study in Syria on important residential visual privacy, proves that the female inhabitants of both modern and traditional houses wish complete privacy and demand a concrete physical barrier from strangers and neighbors.

"Modernity" for May thus meant to create a new unified metropolitan culture. A notion like this implies dominate a programmatic concept of modernity. Rationality and functionality were the qualities that are given first priority. "Rationality" in this context should interpret in a broad sense: what May and his associates had in mind was a culture that expected a future society, rationally organized and conflict-free, made up of people with equal rights and common interests (Horkheimer and Adorno, 1990).

The new architecture would have to be consistent with the new conditions of that life: The achievements of the twentieth century that surround our everyday existence have given a new form to our lives and have had a fundamental influence on our way of thinking. For reasons such as this becoming clear that in its design and construction, housing will have to undergo changes like those that led from 46 the stage coach to the railways, from cars to airships, from the telegraph to the radio, or from the old craftsman's workshops to factories a change that goes hand in hand with transform the entire production and economic life of former times into that of our own century. (Heynen, H. 1999).

An openness to everything that is mobile and transitory is another feature of the new form of everyday life: Because the outside world of today affects us in the most intense and disparate ways, our way of life is changing more than in earlier times. Our surroundings will undergo corresponding changes. This leads us to layouts, spaces, and buildings of which every part can alter, flexible, and which can combine in different fashions. (Heynen, H, 1999).

(2-8) DWELLING, CULTURE, AND MODERNITY:

Living in a house is a personal matter and has to do with developing individuals in family life. It cannot dictate by the interior designer *"I did not grow up, thank God, in a stylish home. No one knew what it was yet. Now, everything is different in my family too. But in those days! Here was the table, a totally crazy and intricate piece of furniture, an extension table with a shocking bit of work as a lock. But it was our table, ours! Can you understand what that means? Do you know what wonderful times we had there? Very piece of furniture, everything, every object had a story to tell, a family history.* The house never finished; it grew along with us and we grew within it."

The house has to please everyone, contrary to the work of art, which does not. It brought into the world without their being a need for it. The house satisfies a need and responsible to everyone. It has to serve comfort, is revolutionary, and conservative like the work of art.

The work of art shows people directions and thinks of the future. The house thinks of the present. Man loves everything that satisfies his comfort. He hates everything that wants to draw him out of his gained and secured position and that disturbs him. Thus he loves the house and hates art. Does it follow that the house has nothing in common with art and architecture is not too included among the arts? That is so. A Tiny part of architecture belongs to art: the tomb and the monument. Everything else that fulfills a work is too excluded from the domain of art.

Features of Urban Dwellings in Sudanese Context:

A thesis by Farah, E; 2000, shows general aspects to gain comprehensive understanding, rather than statistical knowledge, of the spatial configuration of homes through analyzing the socio-spatial structure of the houses syntactically. Another paper that's written by (Osman, A; 2002), as a section of an ongoing study on 'Space, Place & Meaning in Northern Rivera in Sudan, identifies and analyses the spatial and physical features of settlements and buildings along the Nile Valley in Northern Sudan. Themes that investigated in this study revolve around the house which seems to be a vital unit where the attitudes of a society manifested.

Wilson (1998) describes common features of urban dwellings in the Sudan as he *predominant urban dwelling in Northern and Central Sudan comprises compound hosh defined by a mud – brick wall about 2m in height, and with at least two doors, one being the women's entry to which only close family members have access. Within this living space, partitioned into public (men's) and private (women's) area, are several flat–roof rectangular mud buildings containing between one and three rooms. Attached to one of these buildings is a porch in which guests entertained. A plain one–room building, with holes in the walls instead of windows, forms the kitchen." (Wilson; 1998).*

(2-9) TYPOLOGIES OF HOUSING SUPPLY MECHANISEMS IN KHARTOUM STATE:

(2-9- 1) Traditional and Informal Houses:

It represented 90% of the dwellings in Sudan. These types of houses found in the rural areas, but with urbanization, many villages now integrated within the urban settlements. Thus a mixture of traditional and modern houses founded within the urban centers of Sudan (see fig 2-6).

Fig (2-6) **Traditional houses in Sudan** (Source: Osman and Suliman; 1996).

1. **Traditional house in urban areas:**

It enters which in the male domain. Each house divided into two domains, one for males and the other for women. The male domain is accessible from the street while the female domain is at the back of the house.

As for service areas; the kitchen in one corner of the back yard to method fire risk as charcoal for cooking fuel is common and still. The bathroom found in the male courtyard. Toil in the front yard, but it also divided into two parts with entrances facing opposite direction. The land ownership is freehold and the plots are large (up to more had 200 sq. m.) Fawzi; 1954, every house has boundary wall, to support privacy (Osman and Suliman; 1996).

(2-9- 2) Modern Houses:

Theoretical explanations for reasons behind modifications are various. One which accepted is that housing modification expresses a resident's personality, tastes, interest, lifestyle, values and social status (Rapoport, 1969 & 1981; Nasar, 1989).

The Government offers three types of support. The first and most common is ‘site and service’, followed by state-built public housing and upgrading programs. (City limits: urbanization and vulnerability in Sudan report, January 2011)

State-built housing, the Sudan Estate Bank has constructed apartment blocks for the middle classes as an investment, to use the revenues for public housing projects (Eliskan) at a later stage.

A- State Built Projects

The State built projects give dwelling units with both physical and social infrastructure for groups.

1-The first is for civil servants and workers, provided on a hire-buy basis, with one story.

2-Low-cost houses constructed by the department of housing. Awad ElKareem,M. 2008, said the low cost housing unit comprises a plot area of 280 t0 300 m2, including one room, a kitchen a pit latrine and boundary wall. The unit built in brick wall and concrete roof.

3- Governmental employees, who housed in villas (one or two stories) or in blocks of flats.

4- Economic and investment housing project the plot and the buildings inside are the same as that of low cost unit. But economic housing units have distinguished locations such as a corner plot or facing a main road within the same low cost area (Awad ElKareem,M. 2008, 2008)

5- Institutional housing projects.

Institutional housing in Khartoum State housing comprising two types: Constructing residential blocks of flat on dispersed plots of land in already developed areas and constructing several houses on planned parcels of land (see fig 2-6)

Fig (2-7) Hai Alomda investment house **(**Source: Author; 2005)

B- Private Houses:

1- Site and Services: in Khartoum the major form of housing schemes are the Site and services schemes for different income groups who built their own houses (Saeed &Badri 2009) and (Sin & Davies 1991) these income people apply for the plots in either, first, second and third class areas see fig (2-7). These plots leased with subsidized costs, which allow the disadvantaged people to gain plots at a low cost, but there are several problems that relate to this planning approach (Bhalt and Navarete; 1991), these problems stated by Bhalt and Navarvete as:

-The economics, bias in planning disregard the social aspects of design

-The incorrect assumption on family income, and structure, and relate that to plot sizes.

-Projects follow 'blind' methods for the allocation plots.

-Project lacks variety of open spaces and plot size, and no provision made for multi-family plots.

- Involve the project participants in the decision -making process kept to a small - at the dwelling unit level (Bhalt and Navarete; 1991:10).

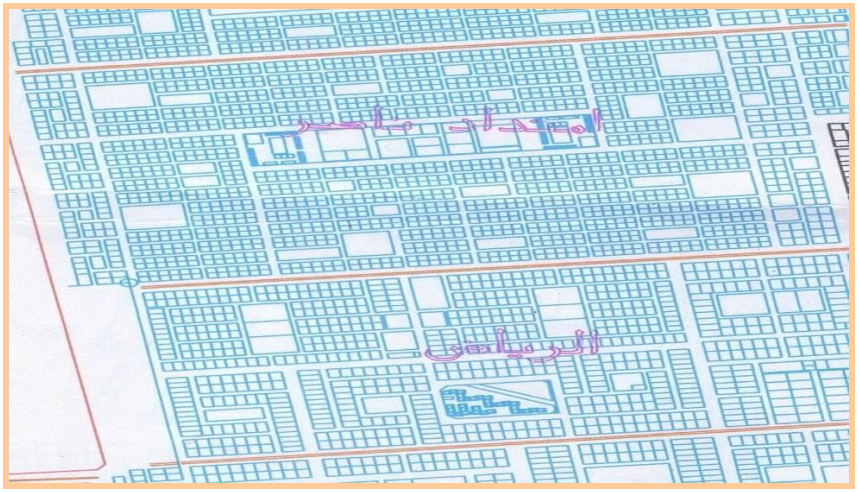


Fig (2-8) Site and service project in Imdidad-Naser and Al-Reyad
(Source; Planning Ministry)

El-kheir, (1989) describes the consequences of the site and services policy in Sudan *"Housing plans had a comprehensive view of material, financial, labor force and other need necessary for their efficient implementation. They normally concentrated on plots distribution and erecting sample houses for low -income families'. These targets were unmet because land in Sudan is 95%". Government property and that should favor efficient disposal of residential plots, the slow pace of the government in distribution plots led to scarcities and next cost rise of land. The land becomes a commodity sought for its*

own sake as profit generator not a development resource. Government policies strengthened.

2-Low-cost Houses:

Low cost housing project began before independence in 1949-1954 when the first dwelling constructed in Khartoum New-Dium East, followed by another complex of dwelling in Khartoum north in 1961-1963. The succeeding projects 1970 used new building material and methods. Reduction of plots sizes to200 m2 was one of the main objectives of the project (see fig 2-8 and 2-9).

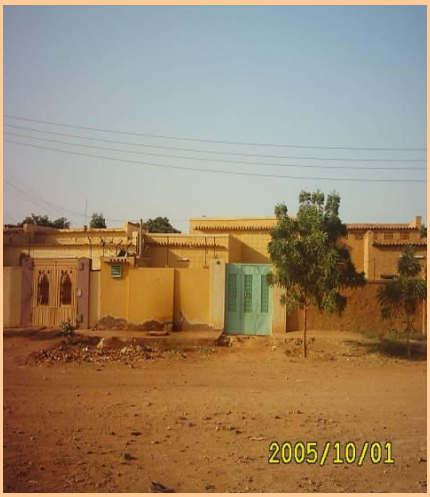


Fig (2-9) low-cost houses In Hai Alomda

Fig (2-10) Original plan of low cost house Alshabia (source; Planning Ministry)

3- Blocks of Flats:

These are multi-story building from three up to eight stories, sheltering many families. This development is increasing. According to' Khartoum structural plan report' it was not common in the past, due to factors such as: climate, want for privacy, religious and social traditions, and attitude about land ownership, large household Size, construction, technology, and building materials. The block of flats consisted only 1.1% of the total house types in Khartoum (Doxiadis, and Mustafa partners: 1991).

(2-10) CONCLUSION:

Challenges for urban planning as part of the urban environment will grow, when these rates of technological, economic, environmental and social changes increase. Modern domestic buildings exist in diverse style, yet there are common features in Greater Khartoum For instance, they accommodate, in their design the traditional courtyard which might induce changes in the pattern of domestic family life. Many people attracted to this new architecture since a modern innovation and are technological achievement. The majority of architects, and academic of 3rd worlds, including Arab region, have adapted the new western architecture.

There are two types of modern housing development in Khartoum; State built projects offer dwelling units with both physical and social infrastructure for groups Site and services is a major form of urban housing provided in Khartoum according to their income people applies for the plots in either first, second, and third class areas

Blocks of flats are multi-story building from three up to eight stories, sheltering many families. This development is increasing. According to' Khartoum structural plan report' it was not common in the past, due to factors such as: climate, wish for privacy, religious and social traditions, and attitude of land ownership, large household Size, construction, technology, and building materials.

Apartments are becoming a popular form of dwelling in urban areas. There are several reasons for this trend, including the impact of both the urban renewal measures promoted by this Department since 1986 and of the Residential Density Guidelines issued in 1999, and smaller average household sizes.

Low-cost housing projects offer dwelling units with both physical and social infrastructure for groups according to the economic factor

A Low-cost house constructed by the Sudanese Housing Developments' Fund comprises a plot area of 280 t0 300 m2, including one room, a kitchen a pit latrine and boundary wall. The unit built in brick wall and concrete roof.

(3-1) INTRODUCTION:

Social housing designs should aim for as much flexibility as possible within the financial limitations to allow for retrofitting, early compromises in terms of spatial layouts, designs or servicing may not allow for this.

The basic goal of housing policy is to provide the whole population with adequately equipped dwellings of suitable size in a well-functioning environment of decent quality at reasonable cost. To make this overall goal more tangible, and also to include recent new dimensions in housing policies

The development of the housing situation in countries is influenced both by their government's housing policy and by a number of external factors, such as the socio-economic and demographic situation and political, administrative and legal factors (Boelhouwer and van der Heijden 1992). To better understand the historical development of social housing, it is useful to grasp its contemporary function and characteristics. The following text briefly describes the development of social housing in the contexts of housing policy and how socio-economic development in different countries affected by it.

In Sudan there is Sudanese Housing Development Fund providing cheap reasonable housing for limited income and poor citizens in Khartoum state

(3-2) SOCIAL HOUSING:

Social housing and social housing policy must conceptualize and as well understood, the relationship of social housing in the broader housing environment must be clear. The social housing, which follows relates to the overall intentions of the Social (Medium-Density) Housing program, which notes the need for institutional mechanisms to hold rental housing as a public asset over time, for the help of a range of income groups.

1-Social housing defined:

A rental or co-operative housing choices for low income people at a level of scale and built form which requires institutionalized management. And which provided by accredited social housing institutions or in accredited social housing projects in designated restructuring zones.

2- An accredited housing institution defined as a legal entity established with the primary aim of developing and/or managing housing stock that has Funded through the give programs given in this policy, which institution has Being accredited by the designated regulatory body (defined in this policy).

The housing stock can own by the housing institution, or it can own by groups of residents. Housing institutions should not see as short-term vehicles for providing housing to a written market segment, but seen as robust, sustainable institutions, established to aid in providing the social housing choice? Housing institutions will so have to show financial and operational sustainability over time while adhering to the guiding principles for social housing.

3- An **accredited project** is a project in which government makes a subsidy contribution to make rental units which provided by a private sector actor affordable to those qualified for social housing. The project receives accreditation through the designated regulatory body. The notion of accredited projects allows take part private sector developers and rental management agencies in social housing provide to bolster capacity to achieve scale delivery.

4-Low-income people defined as those whose household income is below 750 per month. Income mix prescriptions for individual projects will specify desired percentages of participants for different income categories within this broadband and make sure a good spread across the range 1500 to 750.

The social housing definition refers to “anyone” who will enjoy the program rather than households, families or groups. The social housing choice will so cater for the housing needs of single anyone and families, and will therefore respond to the market demand within an area.

In Britain social housing covers the **rental** tenure choice and excludes immediate individual ownership by the residents. Social housing not intended to use by beneficiaries seeking immediate individual ownership as other options has created within the Housing Subsidy Scheme to accommodate such needs.

The social housing, allows for collective forms of ownership, on the rule that the anyone involved and being housed through collective ownership, are aware, understand and

subscribe to these forms of collective ownership options convert rental schemes into ownership options not excluded.

co-operatives registered under the cooperative Act of 1981 and accessing funding through this program will consider together with the social housing institutions and will have accredited as social housing institutions. Housing co-operatives and the co-operative tenure form will allow for and encourage members' contributions to invest into the projects as equity contributions to cut the overall debt funding required for the project. In these cases, the housing co-operative way must structure in such a way to leave out any individual members gain from the give funding provided to the project.

(3-3) THE QUALITY OF HOUSING ENVIRONMENT:

As noted in earlier sections government has become concerned about the quality and sustain the living environments it creates. Social housing is seen as an important contributor to achieving such quality environments. Of central importance, but, is the recognition that quality celebrated the housing units themselves

As far as the quality of housing units concerned, social housing must have seen in medium to higher density developments ranging from group housing to multiple level, multiple unit dwellings. So it is a much more complex building than the unit dwelling model and depending on many more needs on its structure, servicing, financing and quality standards. As noted above the quality of units is not the important focus, the housing environment is important. The total development encompasses the unit design, common areas such as walkways, staircases; services such as electricity and water reticulation and fire equipment; and the amenities that contribute to the social environment such as play areas, landscaping, parking, laundry and drying areas, and meeting rooms. In project developments where the units are small out of financial necessity, the overall environment is important in providing relief in this respect. There is the broader public environment (the neighborhood) within which the social housing project nests and interacts. The roles of neighborhood organizations and most local authorities are very important.

Fig (3-1) Khartoum Map (Source: HDF)

(3-4) HOUSING DEVELOPMENT FUND IN KHARTOUM IN SUDAN (HDF):

HDF is a unified ministry of planning and urban development in Khartoum state started in 1962 for providing cheap reasonable housing for limited income and poor citizens in Khartoum. The main target of this issue is to provide the healthy types adaptable with the climate for citizens to help them to contribute in the development process.

In the past HDF was a small department in ministry of Engineering Affairs, Now MPPPU and it was small in aspects, number of staff, volume of activities and so the ultimate output. As time passes this department developed to become HDF in the year 2001, send that department in its new format (HDF) was for that reasons the most important one was to give the fund more room/space to carry out its policies beside the need of a body that can compete in the market by providing high quality housing with the low cost.

The main target of HDF is providing low cost housing for low and limited income citizens in Khartoum state. So for the fund to catch this target it uses many policies, e.g. proper designs and use of quality control procedures aiming to reduce implementation costs, hence the fund by doing so it increases the number of housing units implemented and so the number of beneficiaries, fig (3-1) covering the location of the (HDF) projects in Khartoum.

(3-4-1) Housing development fund (HDF) house's types:

1- Public house (PH) units:

Housing represented the main mandate of HDF for low cost houses to low and limited income citizens, so these units are the major in the fund. The space of the house in these units' ranges between 280-340sq. meters has of a room, kitchen and a pit latrine unit.
The people have the house with many procedures which should get the house by it and then after having this right an advance payment shill paid 24% of construction cost.

2- Middle class (Economic) house units:

This house is one financial resource that the Fund established to push financing of the public houses. Have a house of this needs none right procedures with public houses
The space of the house in this unit ranges between 280-340sq. meter has of a room, kitchen and a pit latrine units plus this advantage having the house in the corner of the block or at the main road or even as a unit.

3- Investment housing units:

This unit is the major financial resource of HDF has to finance public housing units. Housing provided in this unit is in terms of an apartment towering with multi-flats and normal Villas. An apartment or villa does not need right procedures with public houses and the value of it depends on many factors occur, the flat number and space. And with villa depend on the space, constructed contents and the construction or building materials were cement blocks or red brick

(3-4-2) Housing development fund's house typologies:

Type (1):

House components:

Table (3-2) shows the house design and spatial configuration which components of the following spaces: a Bedroom, 1 Kitchen, Hall, and 2Toilets with built up area 45 and plot area 320 m squares

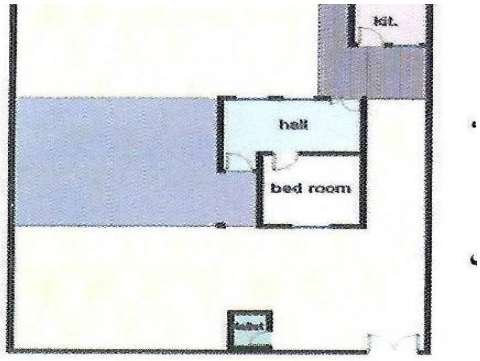
House type		House components	No.	House's Spaces Area
		Bedroom	1	12
		Kitchen	1	9
		Hall	1	24
		Toilet	2	3
		Plot Area	**Built up Area/M**	
		320	45	

Table (3-2) Type 1 House components (Source: Sudanese Housing Development Fund**)**

Type (2):

House components:

Table (3-3) shows the house design and spatial configuration which components of the following spaces; Bedroom, 1 Kitchen, Hall, and 2Toiletst with built up area 45 and plot area 320 m squares.

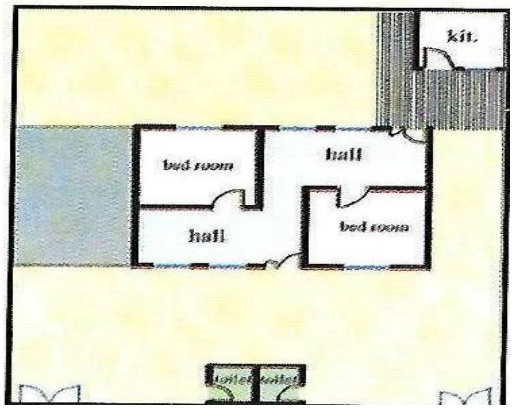
House type 2		House components	No.	House's Spaces Area
2		Bedroom	2	12
		Kitchen	1	9
		Living Room	1	35
		Hall	1	24
		Toilet	2	3
		**Plot Area**	**Built up Area/M 2**	
		320	80	

Table (3-3) Type 2 House components (Source: Sudanese Housing Development Fund)

Type (3):

House components:
Table (3-4) shows the house design and spatial configuration which components of the following spaces; Bedroom, 1 Kitchen, Hall, and 2Toilets with built up area 45 and plot area 320 m squares.

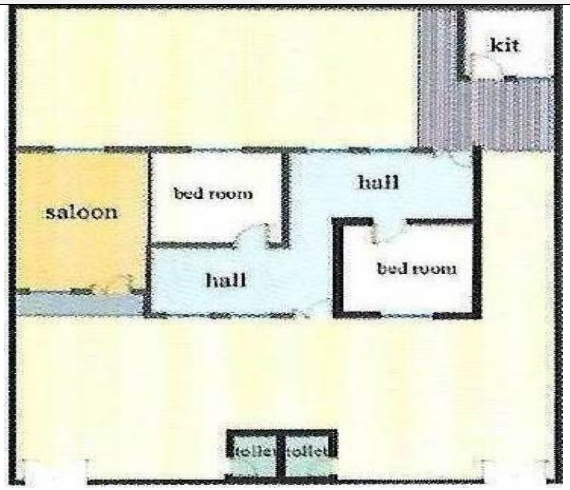
House type 3		House components	No.	House's Spaces Area
3		Bedroom	2	12
		Kitchen	1	9
		Living Room	1	35
		Hall	1	24
		Salon	1	30
		Toilet	2	3
		**Plot Area**	**Built up Area/M**	
		320	110	

Table (3-4) Type 3 House components (Source: Sudanese Housing Development Fund)

Type (4):

House components:
Table (3-5) shows the house design and spatial configuration which components of the following spaces; Bedroom, 1 Kitchen, Hall, and 2Toilets with built up area 45 and plot area 320 m squares

House type 4		House components	No.	House's Spaces Area
4		Bedroom	2	12
		Kitchen	1	9
		Living R.	1	35
		Stair	1	10
		Toilet	1	3
		**Plot Area**	**Built up Area/M**	
		250	70	

Table (3-5) Type 4 House components (Source: Sudanese Housing Development Fund)

Type (5):

House components:

Table (3-6) shows the house design and spatial configuration which components of the following spaces; Bedroom, 1 Kitchen, Hall, and 2Toilet with built up area 45 and plot area 320 m squares

House type 5		House components	No.	House's Spaces Area
5		Bedroom	3	12
		Kitchen	1	9
		Living R.	1	35
		Veranda	1	12
		Stair	1	10
		Bathroom	3	3
		Salon	1	
		**Plot Area**	**Built up Area/M**	
		570	160	

Table (3-6) Type 5 House components (Source: Sudanese Housing Development Fund)

Type (6):

Table (3-7) shows the house design and spatial configuration which components of the following spaces; Bedroom, 1 Kitchen, Hall, and 2Toiletst with built up area 45 and plot area 320 m squares.

House type 6		House components	No.	House's Spaces Area
6		Bedroom	3	12
		Kitchen	1	9
		Living R.	1	35
		Hall	1	12
		Stair	1	10
		Bathroom	2	3
		Salon	1	
		**Plot Area**	**Built up Area/M**	
		350	150	

Table (3-7) Type 6 House components (Source: Sudanese Housing Development Fund)

Type (7):

House components:
Table (3-8) shows the house design and spatial configuration which components of the following spaces; Bedroom, 1 Kitchen, Hall, and 2Toilets with built up area 45 and plot area 320 m squares

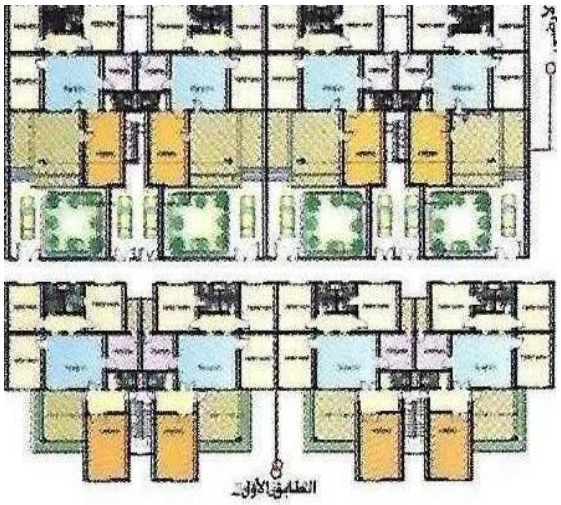
House type 7		House components	No.	House's Spaces Area
7		Bedroom	2	12
		Kitchen	1	9
		Living R.	1	35
		Hall	1	12
		Stair	1	10
		Bathroom	2	3
		Garden	1	
		**Plot Area**	**Built up Area/M**	
		275	95	

Table (3-8) Type 7 House components (Source: Housing Development Fund)

(3-5) SOCIAL HOUSING IN ARAB WORLD AND DEVELOPMENT COUNTRIES:

3-5-1 Social housing in Egypt:

As a growing source of social discontent, Egypt's multifaceted housing crisis is an urgent political concern. On the one hand, there is a glut of high-end housing, with over six million units standing empty. The shortage of affordable units for those who need them most with 18 percent of Egypt's families living in single-room dwellings, the million-unit project was welcome news. Egypt's low-income housing shortage has historically

generated more rhetoric than action. In the run-up to the 2005 presidential elections, former President Hosni Mubarak announced a 500,000-unit low-income housing project that as of February 2014 had delivered 360,000 units. Around 50,000 of these stay unconnected to utility grids and are not useable, according to Yahia, S, architect and housing expert for the Egyptian Initiative for Personal Rights (EIPR). Meanwhile, 40,000 Egyptians who applied for units and made a 5,000 EGP ($700) down payment have yet to receive their houses. "That's 200 million EGP [$28 million] from Egypt's poorest families that the government sat on for eight years collecting interest," Shawkat said. The people protested and told to apply for the more recent Social Housing Project, but the criteria are different and much may not qualify.

The Social Housing Project (SHP), started in 2011 by then Minister of Housing Mohamed Fathy el-Baradei, promised a million units for low income, earning between 1,400 and 2,500 EGP per month (between $200 and $350) see fig (3-9).

Fig (3-9) Egypt's low-income housing (Source: http://www.mei.edu/content/article/egypt%E2%80%99s-need-low-income-housing)

Successful applicants for the 70-square-meter units, priced at 135,000 EGP ($19,000), would receive a cash subsidy of 25,000 EGP ($3,500) and given a 20-year mortgage at seven percent interest. These terms, but reasonable, place the homes out of reach for the 20 percent of Egyptians who make less than 1,400 EGP per month. "'Low income' does not include the poor," says Shawkat. 60 percent of Egypt's work force used in the Egyptians accustomed to fending for themselves for putting a roof over their heads, and with population growth and urbanization proceeding at a rapid pace, a continued lack of affordable housing will not slow them. But unless the state's approach shifts to more considered ventures involving infrastructure-equipped land and accessible mortgage finance, its current efforts in housing production are likely to exacerbate than ease Egypt's growing housing crisis.

3-5-2 Social housing in Pakistan:

There has been interest from Government organizations such as Council of Works & Housing Research (CWHR) from the stand-point of providing low cost material. The proposed construction of low cost housing at Ibrahim Hydery at Karachi pegs rate per square feet at only Rs.

Companies and Maymar could evolve due to show an institution by the name of the Karachi Development Authority. It entrusted with making new development schemes for the city of Karachi and the institution established a wing by the name of the Public Housing Scheme, which entrusted with construction and selling finished housing in shape of flats/houses (see fig 3-10).

Fig (3-10) Pakistan Public housing (Source: Housing, Building and Urban Planning Research Center. Cairo 1992)

Since the housing needs increased in the city, that the Public Housing Scheme could not have fulfilled its own. This was the reason the Karachi Development Authority facilitated the builders like Al-Azam and Maymar with cheap lands to share its burden of providing finished housing to the people- the concept considered noble and there was no risk of losses. The chaos started when these cheap lands distributed by corrupt bureaucrats to non-professional builders.

These corrupt and non-professional builders not only damaged the industry, but they made the survival of companies making good quality housing difficult. The Public Housing

Scheme, which was still providing priced and quality housing in the city hit hard by the collapse of utility companies who didn't offer them utility connections in time, therefore the last hope of people getting good quality housing with safety of investment went down with the closure of the Public Housing Scheme.

Firms such as Al Azam are nowadays very rare as most construction firms still preoccupy themselves with traditional outdated modes of construction. As the public becomes knowledgeable and affluent, housing and construction are focusing on high -end and high-quality deluxe housing, where profits are better. Today, low-cost housing confined to remote city and town areas, and managed by the government.

3-5-3 Social housing in Irish experience:

The Government providence treat youth housing crisis for citizens of low-income people to live a dignified life under the roof of adequate housing and the lowest costs. And it made the Irish government get significant and tangible to ease young burdens, and provided them with a solution without Araqm, represented in the specific plan based on that paid young only 25% of the cost of the house, while donors private sector shall pay the rest under social responsibility see fig (3-11).

Fig (3-11) Social housing in Irish (Source: Housing, Building and Urban Planning Research Center. Cairo 1992)

And he offered the Minister for Housing and Planning Irish, Jean Le Sullivan, the experience of her country to support the cooperative housing during the Jeddah forum of the 13th Economic and raised experiment impressive participants as a solution an innovative housing crisis in most countries, and summed up the experience that the Government will say the land, and regulating construction operations at different levels under public housing strategy. The housing crisis in Ireland iajdzisa sleepless for the middle class, where house prices rose by only 5 years, by 64%, bringing the average family home price of 272 thousand Euros, equal house prices in New York, prompting Ireland to adopt this experience see photos.

3-5-4 Social housing in Tunisia:

The pollution growth in Tunisia is one of the largest percentages in the world, the Ministry of Housing projects increases the Housing Ministry budge increased, to create new housing integrated to enjoy low-income accommodation for meets the needs see fig (3-12).

It is worth mentioning that the category of target, the ministry said was the low-income category, their income does not exceed $ 100 per month, and, we find they have developed a national housing sector strategic plan in Tunis addressed the major challenges facing the sector, and the aim which the ministry would like to reach the citizen for right housing, and put through the programs map to reach.

Fig (3-12) Social housing in Tunisia (Source: Housing, Building and Urban Planning Research Center. Cairo 1992)

For this goal based on a thorough analysis of the reality of population, and housing through the available data. It found that the ministry is working within the organizational their role, while leaving the implementation work of the private sector, in the framework of the national housing strategy, stressing that the ministry is not a contractor, but contracts with engineering offices Consulting to oversee the implementation and the private sector companies (contractors), which holds construction work The distribution uses to divide 35% of the total area of the villages of the proposed housing and 10% of public services and 52% for roads 0.3% of open spaces, and includes every village of these 80 housing units .

3-5-5 Social housing in Addis Ababa:

The prominent current government approach to solving the low-income housing challenge is the Integrated Housing Development Program (IHDP), started by the Ministry of Works and Urban Development (MWUD) in 2005. The Program continued the 'Grand Addis Ababa Housing Program' which supported the endeavors of the Ethiopian Government in their sanitation and reliable service. Hence, as part of the effort to achieve the Millennium Development Goal (MDG) and carry out the Plan for Sped up and Sustainable Development to End Poverty (PASDEP) (Yewoineshet, 2007).

The Ethiopian experience in low cost housing based on International Development Association (IDA) assisted urban project. The main objectives of the project were to rebuild the capital formation of shelter. It also includes strengthening of the land change system. Besides this, it has improved health and environment conditions through upgrading services and sanitation, maintenance of urban infrastructure and housing. The project constructs a total 3,150 housing units with the cost of 33.7 million Birr. Second, German Technical Cooperation (GTZ) low cost housing project with the aim of helping the 50% the income curves, built around 2,093 houses with the total cost of 5.3 million Euro in two phases (Sisay, 2007).

The construction carried out on 130 hectares of land and service area to build 2,470 cores houses for beneficiaries who organized into 78 cooperatives and 21 million Birr availed to17 medium and high income group cooperatives that have 680 members for building one–storied apartment (G+1) residential housing.33.7 million Birr approved interpret 3,150 housing units with average unit cost of 5,000 Birr for low houses and 33,000 Birr for apartment dwellings

Condominium Houses:

According to Hyatt (2000) cited in Ebisa (2013), a condominium is a multiple home unit in which there is separate and distinct ownership of individual and joint ownership of common areas see fig (3-13). For example, in an apartment house, the individual owners would their own apartments the separate apartment owners together own the parts of the building common to all of them, such as the entrances, elevators, and hallways.
Because of its unique nature, every condominium governed by its own unique rules and regulations. These are necessary to make sure that condominiums operated and maintained and to define the rights and obligations of the individual owner's. A condominium may have restrictions about the number of occupants per unit, the age of occupants, pets, noise and parking and when certain amenities may use. Many condominiums have strict rules on the alteration of the unit space or its appearance (Ashrafedin, 2009).

Fig (3-13) Condominium Houses in Addis Ababa
(Source: Sascha,D, 2011**)**

There are several types of condominium such as residential condominium, non-residential condominium, and standard condominium and phase condominium. Residential condominium owned by the individual units which the owner will occupy for living

purposes. There is also a nonresidential condominium found in the property market such as hotel, service apartment, rental shop and office building. The structure is like residential condominium but difference in usage of the building. Standard condominium is just a general condominium found in any country.

This condominium subdivided into, a condominium is a multiple-unit home in which separate and distinct ownership of individual units and joint ownership of common areas. The building managed by the condominium association, either or through a professional manager.

A condominium can be an apartment, house, townhouse or a unit in an apartment house in which the units owned. Hence, there is always common property owned with others recreation areas, lawns, basement, garage and the individual units owned outright

The owners of the individual units are responsible for the costs of maintaining the building and common areas, but they handle the maintenance expenses of their particular units (Mehader, 2013)

(3-6) CONCLUSION:

Many countries consider social rental housing a key instrument, for instance the housing allowance system. The extent to which social rental housing is needed depends basically on how well the rest of the housing stock can satisfy social housing needs. In addition to social housing, the stock includes owner-occupied dwellings, cooperative housing and ordinary rental dwellings.

Egyptians government accustomed to fending for them for putting a roof over their heads, and with population growth and urbanization proceeding at a rapid pace, a continued lack of affordable housing will not slow them. The Public Housing Scheme, which was still providing priced and quality housing in the city hit hard by the collapse of utility companies who didn't offer them utility connections in time, therefore the last hope of people getting good quality housing with safety of investment went down with the closure of the Public Housing Scheme. While Tunis government is working within the

organizational their role, while leaving the implementation work of the private sector, in the framework of the national housing strategy, stressing that the ministry is not a contractor, but contracts with engineering offices Consulting to oversee the implementation and the private sector companies (contractors), which holds construction work.

The Ethiopian experience in low cost housing based on International Development Association (IDA) assisted urban project. The main objectives of the project were to rebuild the capital formation of shelter. It also includes strengthening of the land change system. Besides this, it has improved health and environment conditions through upgrading services and sanitation, maintenance of urban infrastructure and housing.
a condominium is a multiple home unit in which there is separate and distinct ownership of individual and joint ownership of common areas, and there are several types of condominium such as residential condominium, non-residential condominium, and standard condominium and phase condominium

The Government in the develop country like Irish providence to treat youth housing crisis for citizens of low-income people to live a dignified life under the roof of adequate housing and the lowest costs. And it made the Irish government get significant and tangible to ease young burdens, and provided them with a solution without Aram, represented in the specific plan based on that paid young only 25% of the cost of the house, while donors' private sector shall pay the rest under social responsibility.
From experiences the research conclude that the planner and designer must be benefits and improve the methods housing strategy which it take by countries' to solve the problem of low cost housing in Sudan.
Devise an expert system in judging housing competition and evaluating projects for low income families. In order to use the concept of the devised expert system, farther studies are needed for developing or creating a more flexible system that take o account other housing types and other dwellers groups.

(4-1) INTRODUCTION:

Housing is not a housing unit or walls deaf, but there are components and influences key influence in the composition that contribute to form housing, including dimensional behavioral and formulation induction of the house must take into account other changing factors as socially, behaviorally, economically and environmentally for all housing.

The house form is not the result of physical forces or any single causal factor, but is discourse a whole range of socio-cultural factors seen in their broadest terms. Form is changed by climatic conditions and by methods of construction, materials available, and the technology. Rapoport notes the socio-cultural forces as primary and all other forces as secondary or modifying. (Tucson, A, 2008).

The physical, social, cultural and economic characteristics of the houses can be affected by `the users' preferences. Physical, social and cultural characteristics of the houses are closely related to the socio-demographic structure, lifestyle, and spatial behavior, functional use of spaces and planned period of residency of the user. These parameters affect the user's spatial behavior, even though the syntactic characteristics of the house remain the same (Peter C. 2011)

The family is the basic unit of society and should be strengthened. It may receive comprehensive protection and support. In different cultural, political and social systems, various forms of the family exist. Human settlement planning should take into account the constructive role of the family in the design, development and management of such settlements. Here, as the main goal of the study, standing on the subject of culture is just the starting point of understanding home culture. Concerning the cultural effect on house form as a consequence of socio-cultural factors considered in their most general meaning while building a house is a cultural phenomenon in itself (Rapport, 1969).

This chapter provides the conceptual and theoretical framework for the study and reviews disciplines of built environment analysis represented in the after keyword:

- Socio-culture
- Household
- House design and spatial configuration
- House and User needs

(4-2) UURBAN ENVIRONMENT AND CULTUR

Rapoport is one researcher who attempted to relate culture to build environment. He suggests that culture is to give meaning to details and to define groups, however; he defines culture as a way of life typical of a group, and a system of schemata transmitted symbolically and set of adaptive strategies for survival, related to ecology and resources for survival related to ecology. Rapoport (1989) also argues that culture is too abstract and suggests the use of the term social variables instead of socio-cultural variables “Culture is expressed more in social variables, such as social structure, social networks and relation role, and the likes". For this study, the definition given by Rapport's adopted (1989) which interprets culture as a way of life. Such a definition suggested that culture is about a group of people who have a set of values and beliefs which embody ideals which transmitted to the members of the group, these values and beliefs create lifestyle and build their environment (fig 4-1).

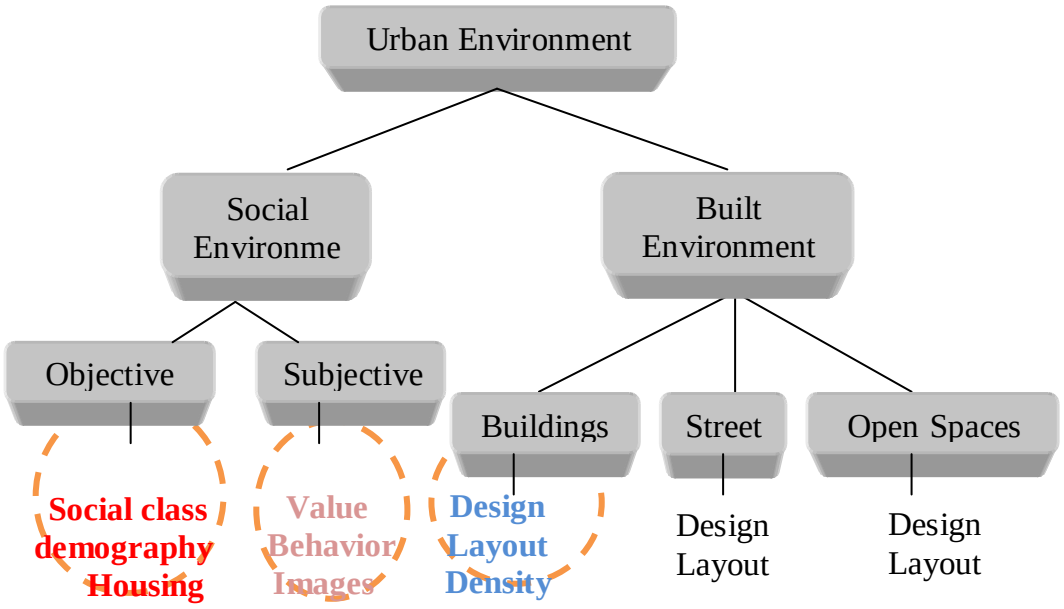


Fig (4-1) Typology of environment (Source Rapoport; 1989)

In traditional homes almost every space assigned to the individual, has to be relate the practical activities of his daily life. Therefore, an efficient planner should be conversant with the relations of activity with human parts, that there should methods to allow to commensurate their activities.

Rapoport (1969) suggests that one aspect that determines the form of the house is how 'need' is defined by a group, while what is significant about culture is the specific solutions to certain needs. The gap in social and various aspects of life between past and present is difficult to adopt traditional concepts of house design, but it represents an alternative for today's houses if they are changed in a way to satisfy the requirements of today's lifestyle.

The relationship between man and his built environment is complex: man builds his home, according to a variety of parameters, including relevant, economic, space and social values (see fig, 4-1) then, home by its walls, rooms and empty spaces would influence and regulate the daily pattern of man's life.

In traditional homes almost every space assigned to the individual, has to be relate the practical activities of his daily life. Therefore, an efficient planner should be conversant with the relations of activity with human parts, that there should methods to allow to commensurate their activities.

Rapoport (1969) suggests that one aspect that determines the form of the house is how 'needed' defined by a group, while what are significant about culture is the specific solutions to certain needs. The gap in social and various aspects of life between past and present is difficult to adopt traditional concepts of house design, but it represents an choice for today's houses if they changed in a way to satisfy the needs of today's lifestyle.

(4-3) SOCIO-CULTURAL FACTORS:

(4-3-1) Definition of culture:

The most definitions of culture focus on the cognitive ideal meaning of culture for example the definition which given by Low and Chambers (1989) defines culture as being: made up of observable social-structural pattern of human behavior described as those social

structures, socio-political and economic, which order and pattern behavior, according to cultural standards (see fig 4-2).

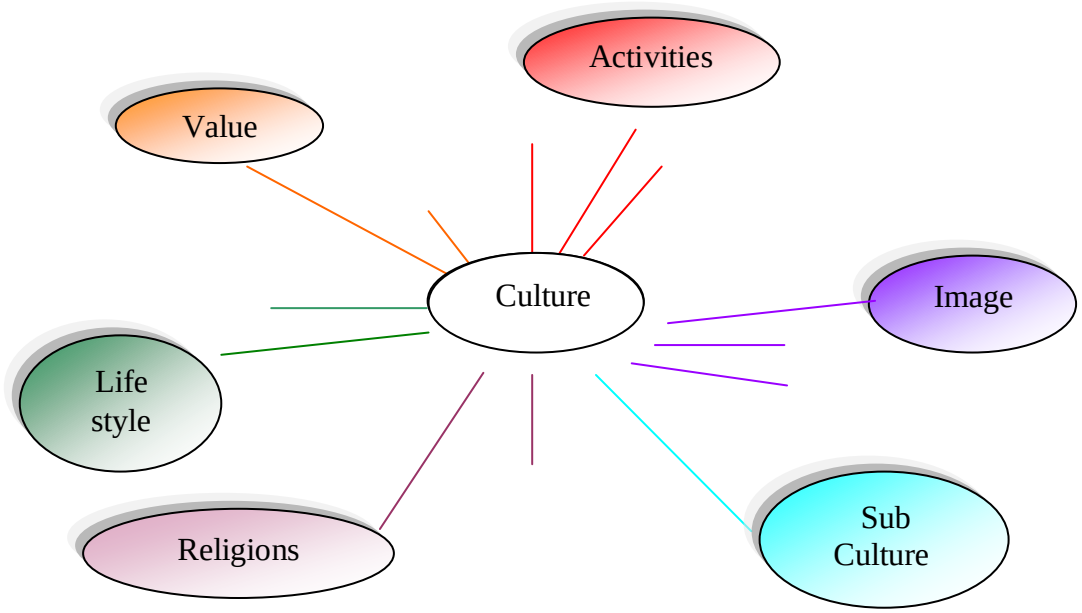


Fig (4-2) Aspects, culture and their relation to build environment

(Source: Rapoport; 1989)

They also define culture as a cognitive structure which is mostly represented by a set of rules, but these rules are in the mind, in coded in a language, and serve as a template of cultural ideas (Low, and Chambers; 1989).

Simplified below, are in their list showing a wide variety of conceptions among anthropologist and raises the need for a selection for specific. We have simplified below a few salient dimensions:

Topical: Culture comprises everything on a list of topics, or categories, such as social organization, religion, or economic.

Historical: Culture is social heritage or tradition that passed on to future generations.

Behavioral: Culture shared, learned human behavior, a way of life.

Normative: Culture is ideals, values, or rules for living, obedience or conformity to the norms

Functional: Culture is the way humans solve problems of adapting to the environment or living together

Mental: Culture is a complex of ideas, or learned habits, that inhibit impulses and distinguish people from animals.

Structural: Culture comprises patterned and interrelated ideas, symbols or behaviors.

Symbolic: Culture based on assigned meanings that shared by a society. If culture comprises patterned and interrelated ideas, symbols or behaviors, then it will to think of the house form that will evolve from the patterned (Noel, E, 2011)

(4-3-1-1) Domestic Routine:

The order in which activities occurred, by whom, for whom and with whom, where and at what time of day or night they occur, are all important components of domestic routine; Rapoport (1997) classifies the domestic environment as a system of activities (action patterns) occurs in the setting. The setting can identify with the activities that occur in them (e.g. Bedroom). *Domestic routines are defined by, and simultaneously define, relations of hierarchy, authoring and affection within the house," Parder E.J (1997)*

The term domestic routine refers to the daily–rationalized behavior-about eating, sleeping, socializing, and cooking around the home. Parder (1997) argued that people take for granted the behaviors which make up domestic routines as a natural, universal and neutral instead of cultural specific and implicated in the creation and transformation of social relations and world views. The micro level of domestic–routine allow household members to practice their daily needs, and at a certain time, While the macro level of the domestic routine affects the social life of the whole society.

Diffalah,M (1989) describes the daily life domestic routine Zuhair house (low cost house in Alshabia (see fig; 4-3): *"This household member starts their day at 5am mother praying, makes the tea for the household members and prepares the children for school. At 6 am she cooks until 10:00 am she is doing the laundry. She takes her breakfast round 10:00 am and afterward she relaxes in room no.1 until the children come back from school at 1:00 pm she then prepares lunch for the children who eat in the room no (1). The rest of the household members have lunch between 3:00-4:00 pm, also in room no (2) until 6:00 pm.*

Most of the household members are sleeping or relaxing in different rooms in the house. In the evening, the students do their homework, while the others watch television.

The male guests are received in the front Sala during the daytime in the front yard in the evening. The female guests are received in the family hall or room no.1 during the day and in the back yard in the evenings". (Diffala,M 1989)

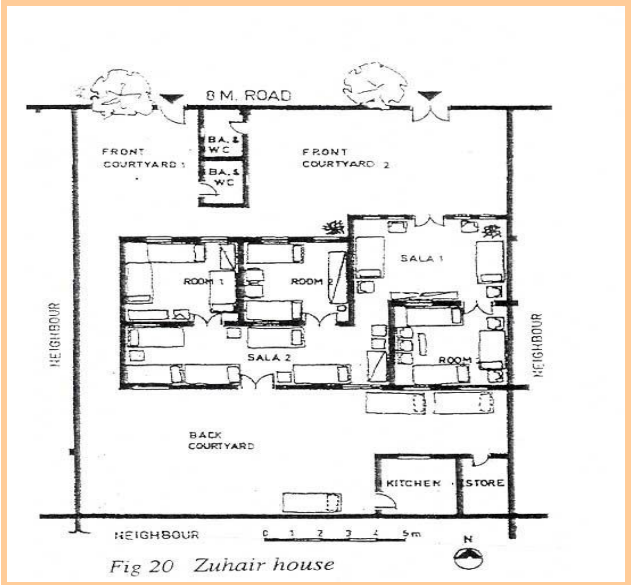


Fig (4-3) Zuhair house and use of spaces (low cost house in Alshabia)

(Source: Diffala,M 1989)

(4-3-1-2) Values and Norms:

1-Behavior:

Environment can either facilitate or inhibit certain behaviors, cognitive processes, and mood and so on (Rapoport, 2005). Behavior in relation to a physical setting is dynamically organized. Specific behaviors adapt to environmental constraints to create necessary equilibrium between the individual and his environment (Leboyer, 1982). **R**apoport (1969) Concluded that people demand for the specific dwelling type can be known through their behavior and aspirations. He also adds that *"the concept of behavior includes not only overtly visible actions, but also perceptions, cognition, affect preferences, social*

interactions, roles and also meaning which people attach to various components and attributes of the environment,".

Madibo (1981) classified the major factors of behavior that have marked effect on the spatial arrangements of the domestic units:

1- Psychological behavior
2- Cultural behavior
3- Playing behavior
4- Recreational behavior
5- Cognizance behavior
6- Climate behavior

A study by Zaiton (2000) found that housing designs not congruent with the culture of the people result in changes in behavioral patterns and aspects of culture, an indirect effect of the built environment on culture. The relationship between the environment and behavior is a cyclical and diabolical process where changes in one aspect will have a direct influence on the other (Zaiton ,A, and Hashim, A, H, 2011)

The activity pattern of the household members differs from one to another according to the role of house members; Mossier analyzed the role of the household members women as mothers and wives are the primary users of space in their houses. Adult men sleep and eat at home, but they work outside in the fields, old men who are no longer active, e.g. (in the village square). An Arab saying: the house is the kingdom of the wife, agreeing with him this statement. The social behavior related to the environmental behavior and culture environment (Altman & Chemers, 1980).

The Sudanese Context:

There are certain traditions govern the relations between family members and guests, and males and females, which reflected in conducting daily activities and the use of domestic spaces (See fig 4-3).

Osman and Suliman (1981) have detected a clear gender division in the way household conducts daily domestic activities in their study about Omdurman Houses:

" *The separation between males and females clearly reflected in spaces, separation between spaces used by males and females. All spaces in the house except the kitchen and bathroom used collectively and for various types of activities. Space usage determined by the nature of activities, the status and gender of the user and the circumstances. So at different times of day and night, different parts of a dwelling tend to be more or less heavily*

used, by different people for different purposes e.g. a bedroom can use for sleeping or socializing". Osman and Suliman (1981)

2. Privacy:

Rapoport noticed that *"privacy can be achieved without wall, doors or separate spaces, through behavior only by avoidance and organization of communication and activities in time".* Every culture has its own conception of privacy reflected on relative importance assigned to public and private spaces within the dwelling. The male domain is public in the front part of the house or at the ground level, while the female domain is private and at a deeper level, at the back of the houses or at upper floors and secluded by the Mashrabya on windows (Rapoport; 1997).

Rapoport (1969) explained that the need for privacy associated with people who have a sense of shame, territoriality, individual separation in space and public or private domains. This aspect of privacy needs has been applied in the MTD spatial organization. The internal division space follows to the religious and cultural beliefs proposed by Rapoport (2007).

The Western house has extreme internal privacy and decreased privacy from outside while the Japanese house has little internal privacy and extreme privacy from outside.

In Islamic world domestic intimacy must protected behind walls, closed doors, so keeping family life in and concealing it from outside view. This strong conception of privacy reflected at all levels of inhabitations: towns and old villages surrounded by walls and guarded by gates and defensive towers, roads and through fares within residential areas (neighborhoods) are narrow and windy to stop the intrusion of strangers and the living spaces within the dwelling divided into males/female domains.

Privacy also could be declared as a boundary between person, environment, restricted to strangers (Fahey, 1995) and also as a boundary for gender segregation and separation between the privacy life and public intercourse (Mortada, 2003).

(4-3-1-3) Islamic Traditions and Privacy:

The concepts of privacy and hospitality have had a great impact on home culture and housing formation. These cultural traditions come from a fundamental Islamic tradition, the

control of social interaction between the sexes (khatib,C, 1993). This issue role play of important patterns: pattern of privacy and pattern of hospitality. Two kinds of arrangements have developed according to these patterns. One is developed to separate the private and reception areas of the dwelling, which is a pattern of privacy; another provided a special area for guests (Memarian and Brown, 1996).

Islam is very demanding towards the position or seclusion of women and the segregation of domain for men or women (Rapoport, 1969). Reception area (birouni) is part of a house into which it is only acceptable for a male guest to enter. The women's world made up of a private realm is segregated from the men's world (Memarian and Brown, 2006).
Mazumdar (1997) claimed that the man's world and the woman's world should separate, the public world and the private world, the street and the home. The greatest emphasis of privacy on home culture and housing formation has had effects on social events such as move the inhabitant's and the spatial relations. Figure (4-4) shows the privacy gradient zoning in the Muslim MTD, divide into several spaces consisting public, semi-public, semi-private and private spaces which is the emphasis the concept of privacy in Islam (Mohd, N, , 2013). The public space receives and entertains non-Mahram guests, neighbors, relatives and friends (Mortada, 2003) on a specific occasion and time (Altman & Chemers, 1980; Altman, 1981).

To ensure the visual privacy, family spaces in the dwelling must hide from the sight of non-Mahram. Muslim scholars expose that the entrance door should not face the dwelling interior (Mortada, 2003; Abdul-Rahim, 2008) because it will affect the internal privacy of the dwellers. Windows function to view the environment and neighborhood also get natural light and fresh air. The window must build above the eye level of the dwellers, to maintain the internal privacy (Mortada, 2003; Abdul-Rahim, 2008). So, Muslim dwelling contains the Islamic principles and values that are compliant to their daily activities and lifestyle (Omer, 2011).

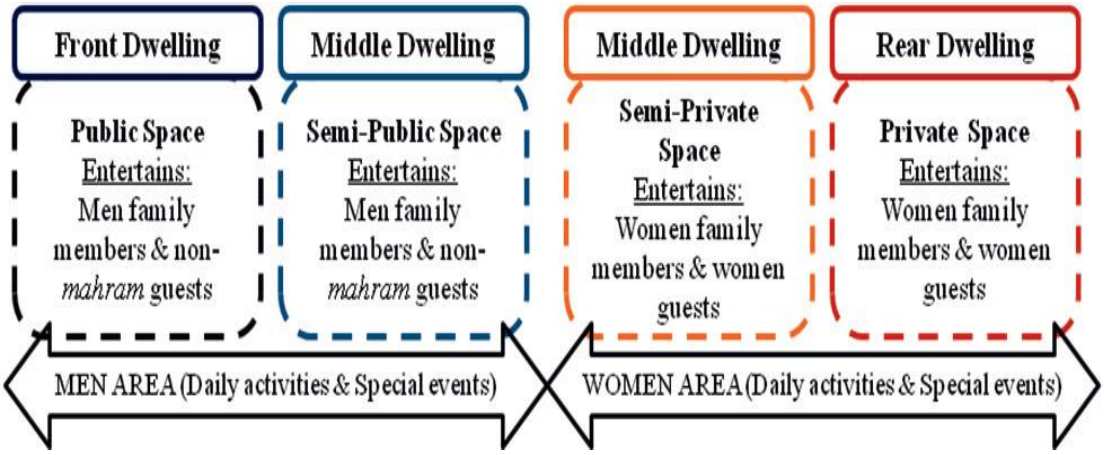


Fig (4-4) Privacy in the Islamic world, (Source:)

The Sudanese Context; the whole design of the house was an efficient and economic organizer of space and beauty and covers all needs like the society and cultural needs as in this design with the wide roles of Sudanese society as well as Muslim societies. This rule exists for this design as a Sudanese Islamic culture, and their influence is clearly visible in traditional dwelling Bahamma (1998); Alhassan, Z, 2012

(4-3-1-4) the spatial Interface Between Visitors and Inhabitances:

The spatial interface between visitors and inhabitance is essential for home environment and for each culture. In Arab communities, visitors are always welcome, hospitality towards visitors is one of the cultural and religious obligations, yet the spatial interface between visitors and inhabitants lies embedded in social and religious norms, which regulate the penetration and receiving of visitors in the house.

A visitor is a person who invited to enter the private territory of the inhabitant. He /she could be unshared inside the house by a single route or from alternative accesses, these accesses defined it as formal, /in formal, or front /back, main / side, social / service, male-female entrance, the visitors received, in particular or different functional rooms in the house depending on different factors the conceptual arrangement of domestic spaces in Talisman (Mexican) houses and U. S houses as illustrated in fig (4-5)

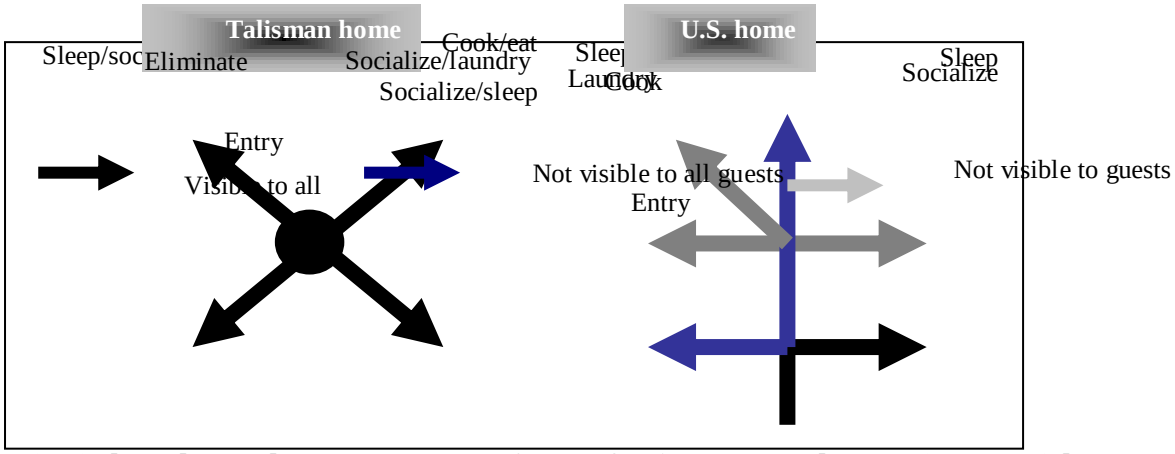


Fig (4-5) the relationship between guest's and family areas Talisman (Mexican) houses and U. S houses (Source: Padre, E.1993:137)

In U. S houses there is segregation between guest's and a family's areas with bedrooms in the back, while the Galician's house emphases families rather individualism and independence in positioning the common social area in the center used by family and friends (Pader, E; 1993:137).

In Arab Muslim culture, the identity of a visitor (as observed) to the house not only defined as male/ female, Muhairm /non Muharim, and then as formal/ informal, Maunder (1977:185), describing the Iran Muslim community has written: the house divided into two quarters, the Birun situated towards the outside of the house, for males and their male guests, and the Andeurm, situated towards the interior of the house, for female, and female guests, and domestic help. Even though the Birun-Anderum phenomenon varied according to the wealth of the households, it existed. Alexandra (1977) considers the socio-spatial phenomenon as an example of what he calls as intimacy gradient ' he sums up this detailed study of the Peruvian house by stating that (The intimacy gradient) is crucial at most Peruvian houses (see fig 4-6).

The Sudanese Context; The house in Northern Sudan there is separation of male guest and family occupation spatial zone exist over one entrance are the prime indicators of this separation.

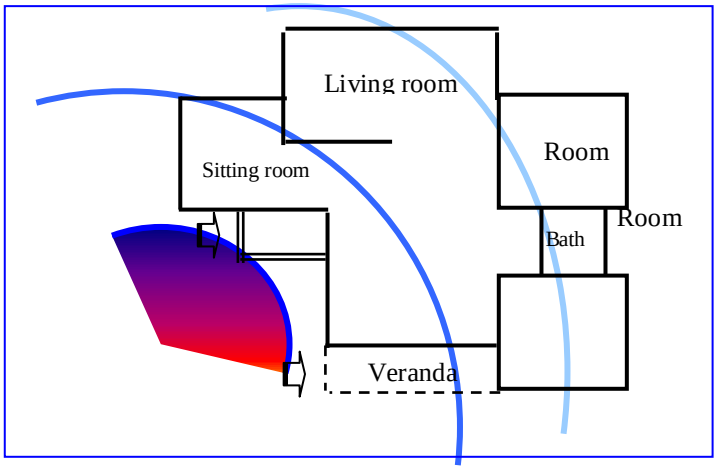


Fig (4-6) Intimacy gradient house in the house, gate entrances, out-door, sitting wall

(Source: Alexandar; 1977)

(4-3-1-5) Housing According to Islamic Religion:

Based on Islamic beliefs and what the Prophet Mohamad (peace and blessings of Allah be upon him) said frequently, a spacious house is considered a part of the Muslims happiness. So, it says in the Hadeeth narrated by Ahmad from Naafu; Ibn'Abd al-Haarith (may Allah be pleased with him) who said the messenger said *"part of a man's happiness includes a good neighbor, a comfortable mount, and a spacious abode,".*

(1) Separation between boys and girls in Islamic culture:

Al-Daaraqutni and Al-Haakim narrated by Sabrah Ibn Ma'bad that the prophet (peace and blessings of Allah be upon him) said*:" when your children reach the age of seven years, separate their beds and when they reach the age of ten, smack them if they do not pray"* 'this Hadeeth classed as Saheeh by al-Albanni in Saheeh al-Jaammi'.

When the siblings reach the age of ten years, whether are male or female, or both male and female, their guardian should separate them in their beds and give each one of them a bed of his or her own, because the prophet (peace and blessings of Alla be upon him) said:" and separate them in their beds".

In Sudanese context:

There are certain traditions govern the relations between family members and guests, and males and females, which are reflected in conducting daily activities and the use of domestic spaces (See fig 4-7). Mohammedani, E. (2007) have detected a clear gender division in the way household conducts daily domestic activities in their study about Omdurman Houses: *The mother used the living room to relax, watch Television, stay most of her time; she used the kitchen for cooking, and she received the female visitors in the veranda no (1), while the daughters used room no (1) to study and, sleep in the afternoon. The father uses the Saloon to receive his guests in the afternoon, and he uses the yard in the evening, while the sons use the veranda no (2) and guest room to receive their friends. The male yard is used only by the sons and their father's while the female yard is the use of the family members."*

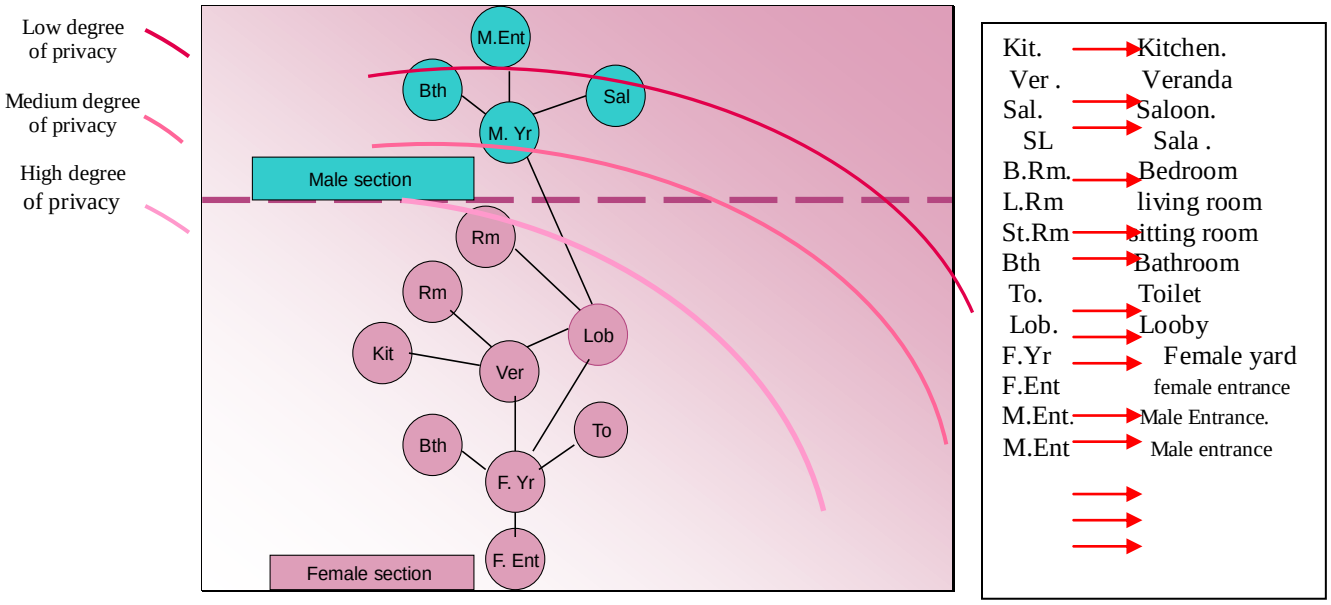


Fig (4-7) Iman house analysis diagrams (Source:Author 2007)

(2) Hosting Guest and Strangers:

In Arab communities, visitors are always welcome. Hospitality towards visitors is one of the cultural and religious obligations, yet the spatial interface between visitors and

inhabitants lies embedded in social and religious norms, which regulate the penetration and receiving of visitors into the house.

A visitor is a person who is invited to enter the private territory" of the inhabitants. He/she could be ushered inside the house by a single route or from alternative accesses. These accesses could be defined as formal/informal, or front/back, main/side, social/service, and male-female entrances. The visitor could be received in particular or different functional room of the house depending on different factors. The identity of the visitor is one of them. The identity of a visitor as an observer to the house is not only defined as formal or informal, it is defined foremost as male/female, Muhram/non Muhram, and then as formal/not formal "(Tahar,B, 2003).

She said "In *M'zabite [Berber] Muslim culture, as in Arab communities, visitors are always welcome. Hospitality towards visitors is one of the cultural and religious obligations, yet the spatial interface between visitors and inhabitants lies embedded in social and religious norms, which regulate the penetration and receiving of visitors into the house*".

With the British house (Scott, 1990:162) explains that, strangers and formal visitors required to approach the front door and pass through the hallway, while the family members and friends permitted, even encouraged, to come through the back door and to the kitchen. She *the different path or mode of entry would make a social distinction between formal and informal visitors*".

In her views, the different modes of question for entry, which exists in Britain nowadays, tell how close the relationship of the requester is to the households. Therefore, the entry itself is just an act of coming or going; it embeds certain social codes.

Alexander (1977) who discusses how visitors re received at a Peruvian home explain that penetration, or into which room the visitor received, reflect the identity of the visitor. For instance, casual neighborhood friends will never enter the house; formal friends will invited into the finished part of the house

The Sudanese Context;

To maintain the needed level of privacy between the sexes in the contemporary home with none multiple uses of rooms, several new elements such as the female guest reception and

dining room have become a permanent part of the house (Alhassan , Z, 2013). This design secures the privacy, sex's privacy in reception rooms and privacy of the family

(4-3-1-6) Family Members' Coherence|:

Home is dependent on social interactions with other people living there (e.g., family), people invited in (e.g., close friends), and people who live close by (e.g., neighbors) (Chad W. Gibbs, 2000). Family coherence is one of the main objectives for nurturing the family members. So, preserving the family coherence is the first step in preserving the community coherence at large. Gathering all the family for eating their daily meals is considered a clear social indicator for family coherence.

Family communication is a basic communication process of human being. It is through family communication we conveyed our thoughts, feelings, and connection to one another. Thames and Thomason, 1998 defined family communication as more than just the exchange of words between family members.

Peterson and Green, 2009 suggested seven keys to build effective family communication. These are (1) communicate frequently; (2) communicate clearly and directly; (3) be an active listener; (4) communicate openly and honestly; (5) think about the person with whom you are communicating; (6) pay attention to non-verbal messages; and (7) are positive. They further pointed out that clear, open, and frequent communication is a basic characteristic of a strong and healthy family. Family that communicates in healthy ways is more capable of problem-solving and tends to be more satisfied and peaceful with their relationships (Sakiroh YaeNA, 2013).

(4-3-1-7) Human Activities and the Usage of Space:

The activity pattern of the household members differs from one to another according to the role of house members; Mossier analyzed the role of the household members. Women as mothers and wives are the primary users of space in their houses. Adult men sleep and eat at home, but they work outside in the fields, old men who are no longer active e.g. (in the village square). An Arab saying: the house is the kingdom of the wife, agreeing with him this statement.

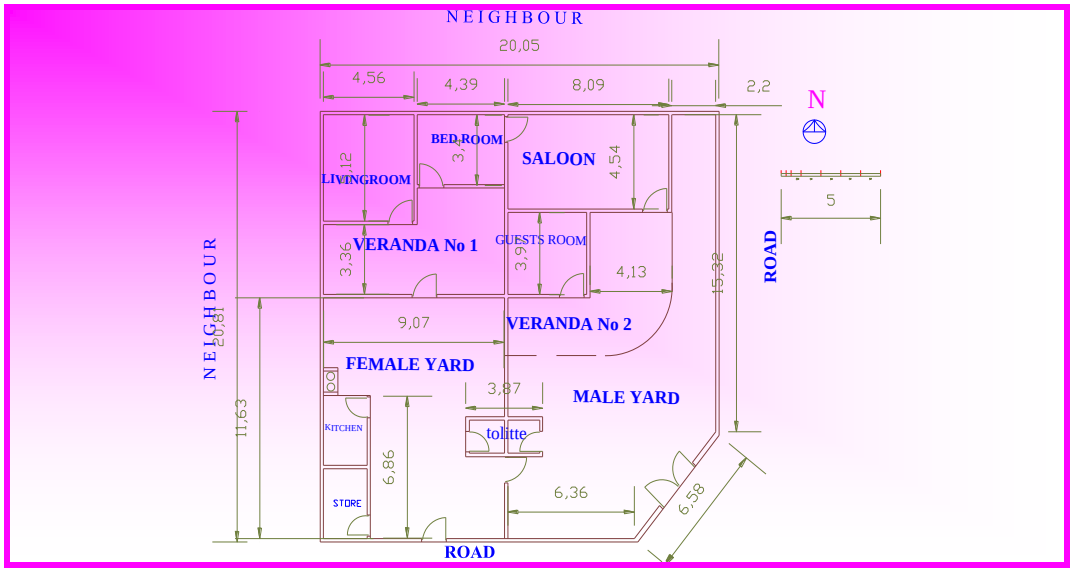


Fig (4-8) the use of spaces in nuclear family

(Source: Diffalah, M: 1989; 80)

The Sudanese Context:,

Mohammedani, E. (2007) gives a more detailed picture of a daily life and the use of spaces of Abdallah Almahi Household family, living in a traditional house in Omdurman. This household comprises 7 members: The head of household's, 55 years old, a man working in the public sector. His wife 43 years old, a housewife, they have two sons and three daughters, students, the eldest is a daughter 28 years, and the youngest is son 16 years old see fig (4-8) She described their domestic routine "*All the family members sleep in the female yard except two sons sleep in the male yard. The mother relaxing, sitting and, watching Television in the living room in the rest time, she receives some of the female guests like her friends in it while she receives specialized guests on the veranda. When all the family members come back from the school and their work, they eat Lunch together in the veranda at around 4:00 pm. 4:00-6:00 pm. And they spend the evenings in the house receiving guests, watching Television, or going to visit their friend's. Supper served in the yard at 11:00 pm.*

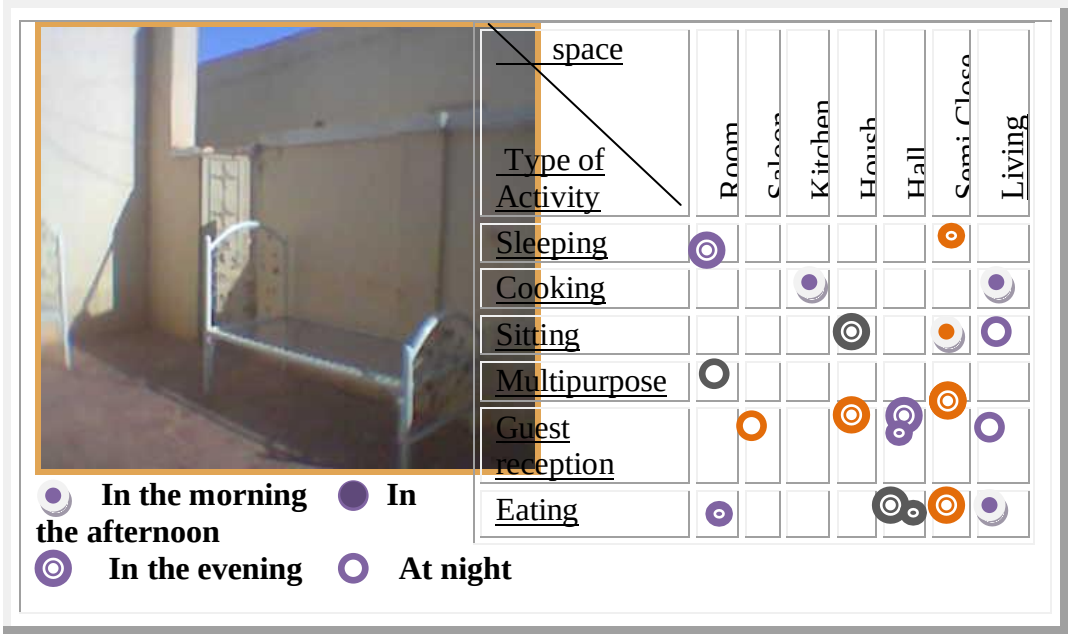


Fig (4-9) Human activities and the usage of space (Source: Author 2007)

(4-4) USER REQUIRES AND NEEDS:

User requirements provided the user with primary dwelling "needs" the second generation of user needs will have

1- Daily routine:

The term domestic routine refers to the daily–rationalized behavior-concerning eating, sleeping, socializing, cooking… ect around the home

2- Activity

Eating, sleeping, playing, working, communicating, avoiding, entertaining and the way we do these activities through cultural practice and individual choice determines how space used and claimed. Activities, what we do where, not only affects room function, but also spatial and social relations within the home.

In domestic architecture, the type and combination of activities affect spatial patterns resulting from practical considerations as to where specific activities can take Evaluating and Illustrating Domestic Space Use 5 places (Plimpton and Hassan, 1987). Labels assigned to rooms may presume a function specificity which does not exist.

A kitchen may use for many purposes, not only cooking or eating, but working, homework, playing, entertaining, hobbies and talking.

A bedroom is most associated with the activity of sleeping, but can also use for homework, playing, dressing, listening to music, reading, and playing musical instruments. Bathrooms may use not for personal hygiene, but also as places to retreat, read, listen to music and relax.

The label a room has, and its assigned function is not always indicative of the purpose for which the room unattended, some or most of the time.

Exist many rooms in a house does not mean they are all used as many activities may occur in one room, when others left, without clear use. Activities may occur, illustrating a pattern of space use under daily routine. Recur common activities could interpreted as establishing meaning and identity in the home, reflected in familiarity with common spaces and activities (Werner, Altman, Oxley, 1985).

3-Time and activities:

Time cannot change the nature of space, i.e. the way it is used, but can also control the relations between family members. Space and time have a dialectical relationship in the home. Often one responds to and influences the other and therefore it is necessary to examine the relationship between them in any analysis of the domestic spatial organization. If architecture is seen as a system of settings where social relations are played out, time is a fundamental part of the communication between social life and spatial form. As Lawrence states in architecture the relationship between space and time is a dialectical process between building form and social factors, between continuity and change, between permanence and flexibility. (Lawrence, 1985)

The analysis of time in relation to space use can also identify which rooms used the most, by whom, and for how long. It can also illustrate the spaces used by groups of people as opposed to those that are for single-person use and it may highlight areas of the home, which for whatever reason, used. Time analysis can also identify the times of the day, or which days, week or weekend, that rooms are busy or quiet families within the home.

In Sudanese context:

Time and space are seen as important structuring elements. In traditional agricultural societies the day starts early, due to the extreme heat. The men would leave the house after morning prayers at sunrise. They would return at noon for a siesta and lunch and leave again for their work after the sun cools late afternoon. After sunset prayers was the time for

socializing. The courtyards prepared sweep, sprayed with water and the '*Angaribs* (traditional wooden beds) and *Biroush* (palm leaf mats) are brought out and people find relief in the coolness after the harshness of the day.

- *Fajr-duqush* (Dawn) prayers
- *Sabah* (Morning) tea
- *Doha* (late morning) work time
- *Gayloola duhr* (Noon-afternoon) siesta- prayers- lunch
- *Asr/ duhriya* (late afternoon) work time
- *Maghrib* (Sunset) prayers, tea
- *Isha (Evening) prayers, meal and end of activities*

As seen above, female space is extended when men are away so, time acquires special significance. The *Daywan* becomes the domain of women at certain times when the man is supposed to be working outside the house (Osman, A.2000).

4- Adaptability Of Home spaces

The adaptability of homes, and therefore the long term utility of dwellings over the life course, has been a central theme in housing design in recent years. Milner and Madigan (2004) examine integrate lifetime homes standards into the general housing stock through the incremental raising of building standards. Additional space for storage makes for less cluttered living space, which may suited to people with mobility impairment. Homes with pitched roofs, for example, can make to accommodate an extra bedroom to cater for the needs of a growing family. Also, large floor spaces are more adaptable: they offer greater potential for rearrangement. This was one suggestion of the Parker Morris Commission (1961) and also a point raised by Italian respondents in recent work by Gallent (2010). Imrie (2004) argues that there has been too much focus on accesses and not enough on living conditions'. Broadening this out, Imrie suggests that future rule, if it materializes, should have a Broad.

(4-5) LIFE STYLE THEORES STYLE:

Lifestyle theories emerged from other disciplines and branches of science, such as ethnology, anthropology, and sociology. Ethnology defined as "the science that analyzes and compares human cultures, as in social structure, language, religion, and technology",

while anthropology defined as "the scientific study of the origin, the behavior, and the physical, social, and cultural development of humans." (American Heritage Dictionary, 1994). It should note in this context that ethnology is also defined as a branch of anthropology that addresses cultural issues, thereby is often referred to in the literature as "cultural anthropology." On the other hand, sociology is defined as "The study of human social behavior, especially the study of the origins, organization, institutions, and development of human society." (American Heritage Dictionary, 1994).Fig (4-10) illustrated Lifestyle theories.

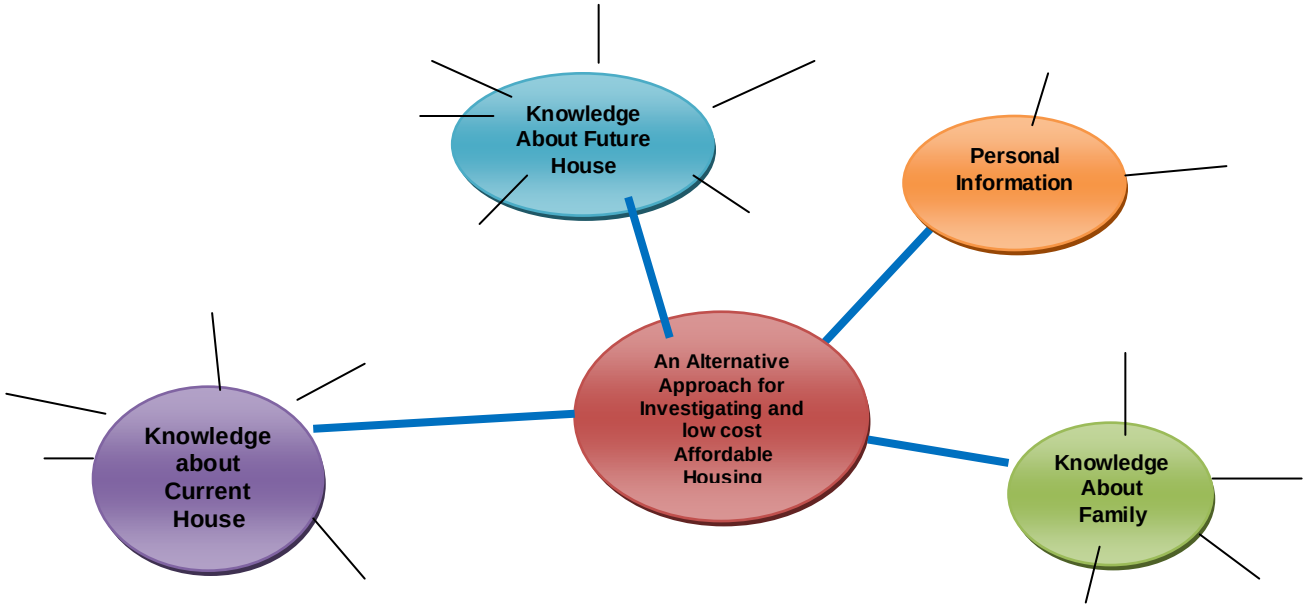


Fig (4-10) Framework for inquiry for the house Flexibility of Home spaces
(Source :Hojrup, T., 2003)

He argues that our values are constrained by cultural-relational dialectics, and the products of cultural life modes (Hojrup, T, 2003). He attempted to address the problem that different cultural values conflict when they are brought together.

Three major theories appear to have influenced recent conceptions about lifestyles and human preferences. These are of the Danish ethnologist: Thomas, H; the British anthropologist: Mary Douglas; and the French sociologist: Bourdieu, P and Hojrup, T introduced the concept of life mode in his book "State, Culture, and Life-Modes Foundations of Life Mode Analysis (2003)" see fig (4-11).

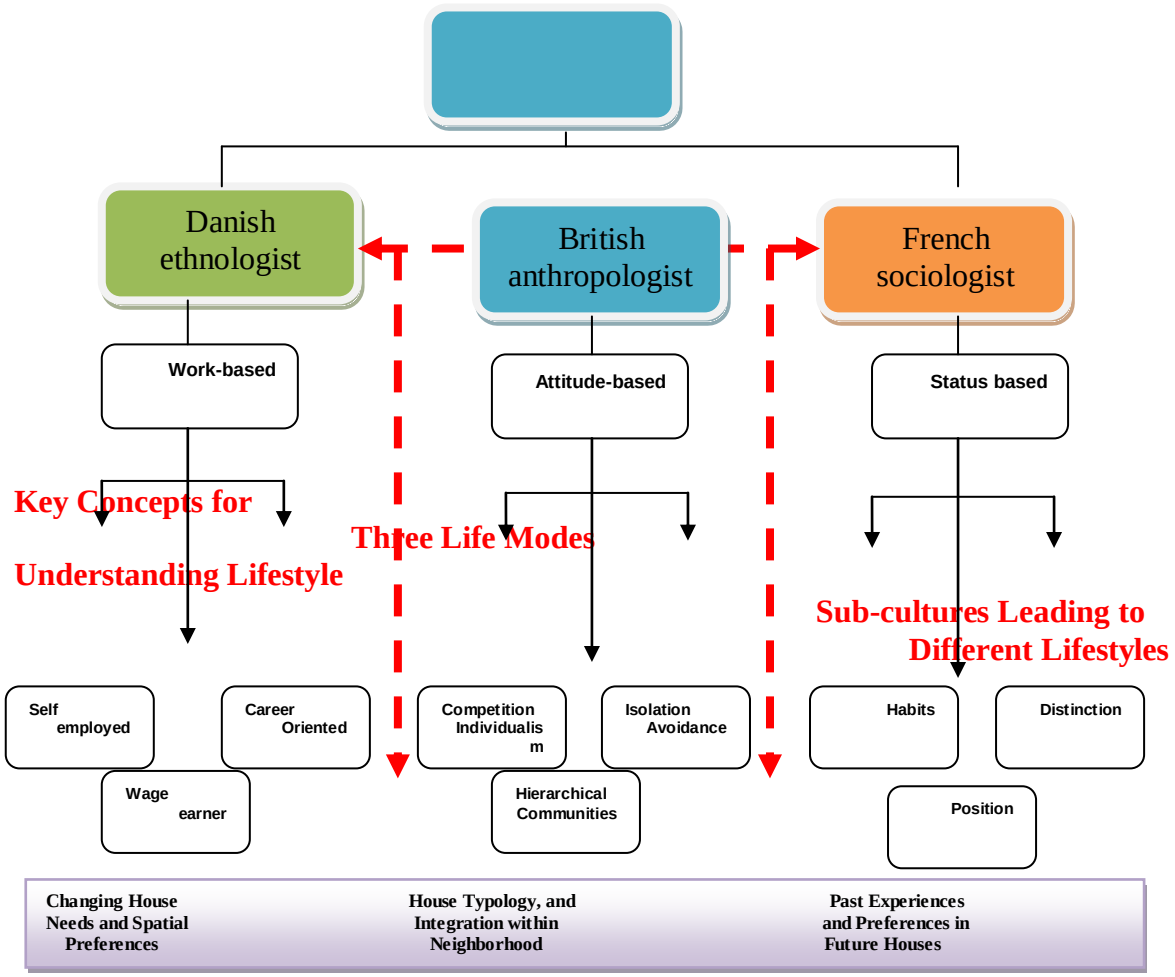


Fig (4-11) Life Style Theories (Source: Hojrup, T., 2003**)**

The three life modes he introduced are: self-employed life mode, wage earner life mode, and career oriented life mode.

In 1996, Mary Douglas introduced a similar life style theory. Four different sub-cultures stem from this theory; these are: competition and individualism; isolation and avoidance of social controls; equity and Pierre Bourdieu's theory write with Douglas's theory since he introduced in 1984 three key concepts for understanding the concept of lifestyle; these are: habits, position, and distinction (Bourdieu, P, 1984.). It is clear that the three theories depend on a different set of interests under different lifestyle aspects. Therefore, Hojrup's theory can be labeled as a work-based theory; Douglas's theory can be labeled as attitude based theory, while Bourdieu's theory can be labeled as status based theory. All are conceived to influence understand affordable housing in physical and social terms.

Therefore, they should be included in any inquiry aimed at knowledge production about affordable housing. Such understanding is illustrated in Figure (4-11).

(4-6) SOCIAL STRATIFICATION:

There are great debates among sociologist on stratification theories. Earlier sociologist however stratified the community into three classes, the upper class, the middle class and the lower class. More recent theories go up to as many as nine classes (with sub-classes included). Yet the approach of sociologist Lioyd, W may have been the most realistic, since his social stratification was based more upon social attitudes than upon the actual amount of money owned by individuals of different class (Hojrup, T, 2003).

Warner's stratification based on the works of social anthropologists, Warner stratifies the community into three classes (upper, middle, and lower), then further subdivided each of these into an "upper and "lower" segment, with the after postulates:

It is difficult to detect which dimensions subsumes or are parts of other dimensions, especially when these dimensions is not noted by the poor since households and individuals plan cross-sartorially (Navarro, 2001).

(4-7) SOCIAL STRUCTURE:

Social structure as defined by sociologists is the patterned relationship between elements of society, which are recurring in a permanent form. The concept of social structure has used to give a model of society for further comparative or evolutionary approaches and when considering the structure as a persisting set of elements it refers to a particular society in a particular place.

Social structure represents the primary influence on the organizational configuration of domestic space at the level of the community and the individual house. At the micro level, architecturally undifferentiated functional loci, where life occurs as social and religious

ritual and everyday activities, are contained within a single enclosed, semi-enclosed or open space. These loci are not necessarily separated.

The analysis of social structure (Synchronically and un-synchronically) helps to distinguish similarities and differences between societies in terms of building styles, skills and traditions. The spatial organization of people is considered as a model of social structure hence settlement and housing forms stand for identify of different groups, and any influence on the components of the social organization reflects on development or transformation of the housing types (Guerreio; 1997), therefore the house forms would be perceived in certain ways, some people respected and some stigmatized depending on the form of their house, which indicates their social status (Donley, R, 1990).

In Sudanese's Context:

It believed in the Sudanese context, these hierarchical relationships between and the importance assigned to people were present, but not so evident in the physical sense and so did not have the same impact on house designs after the Arabs. Maybe due to more subdivisions that these hierarchies were more evident in house layouts- this still needs to research. Houses seen to convey social structure from one generation to the other; they set up divisions and hierarchies that reinforce underlying principles of a culture (Osman, A, 2002).

(4-8) FAMILY TYPES:

The family considered the primary social institution in the society. It has a very important role in achieving personal satisfaction to each member of the family. (Mohammad, A, 2007). The family has a pivotal in the socialization of its members in terms of observing and maintaining customs and tradition and adherence to religious beliefs' among its members. Then, the family is the first bulwark in preventing delinquency and the deviation of its members and has a great role in evaluating delinquents, and guiding them in the right way. Therefore, giving a special attention to the family is very essential to maintaining the cohesion of society. Alkholy, S. 2009) see fig (4-12).

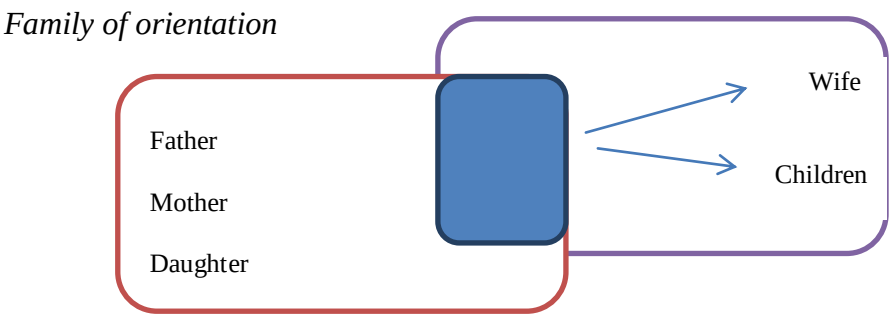


Fig (4-12) the relation between Family of orientation and Family of procreation
(Source: Mohammad, A, 2007)

(4-8-1) Family Types According To Social Role:

The household in every family unit connected physically, socially and especially in traditional areas in Sudanese context, defining 'household' by associating it to variables like economy, cooking together……. ect then the code for the concept of household in the Sudanese context is difficult to define. Laslett's households' classification is useful to define the different household in this study. He defines three types of households: simple, extended and multiple families' household (Laslett, 1974).

The main aim of any family is the production, enculturation, and socialization of children. Therefore, the family plays a primary social role in the growth and continuation of the community. In this sense; there are two consecutive types of the family, according to the social role to play.

- *Family of orientation:* producing a person, both physically and socially is one of the primary functions of the family. So from the perspective of socializing children, family is a family of orientation.
- *Family of procreation:* this family includes only the husband, the wife, and unmarried children are not of age. The most common form of this family referred to in sociology as a nuclear family

(4-8-2) Family Types According To Their Relationship:

There are three family types, classified according to their relationship to other social institution see fig (4-13). Those types explained as follows

1. Simple family household (conjugal family or nuclear):

This phrase used to cover the ‘nuclear’ or elementary, family. It comprises a married couple with their children ‘or a married couple without their children or widowed person. In Khartoum urban center nuclear center show 39, 2% of total families

2. An extended family households:

It used in a different sense than extended family it comprises a family with added one or more relatives other than offspring. Laslet illustrates this in a clear way: it is important that the whole phrase 'extended family household' used for this category of domestic group, because the phrase 'extended family' doesn't have a highly significant, but quite separate further meaning, which a person, despite whether they live with him "(Laslet, 1974:30)

3. Multiple families household:

It comprises all forms of domestic groups which include two or more simple family units connected by kinship or marriage. Such units can simple or extended.

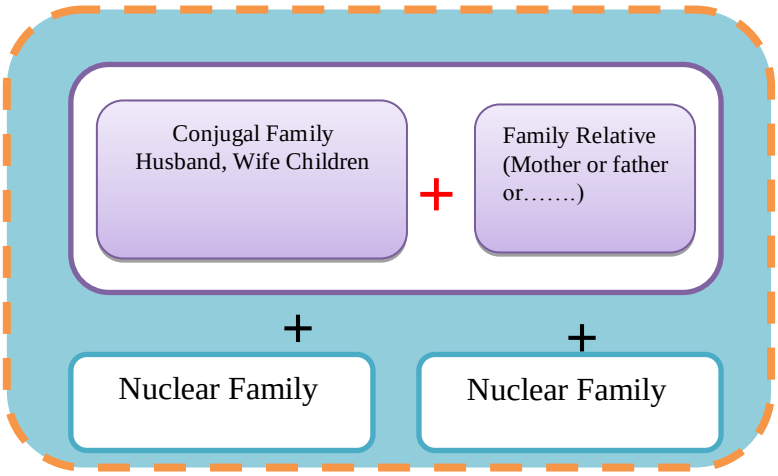


Fig (4-13) Family types according to their relationship

(Source: Mohammad, A, 2007)

The concept of family in Sudanese contexts:

In Sudan, the families take to be more than parents and their children. It can include the grandparents; young unmarried brothers and sisters, widowed or divorced kin women and their children. This definition of the family recognized. Governmental employees, for example, may include their parents and unmarried brothers and sisters as part of their family as they can prove their financial responsibility for them. So, applicants for land plots get points for their nuclear family and for the extended family members whom they are supporting. (See table 4-1). **"***Extended and nuclear families are the prevailing forms in the urban as well as the rural Sudanese societies. The extended household is very common.***"**

(4-8-3) Family Types According to the family Size:

1. The Family Size Average:

In Greater Khartoum the average of family size related to the family culture and the social factors, so that the family size of the 3rd class area is bigger than it in the first &second class areas (see table 4-1). The average of the Sudanese family number is 6 persons.

Family size varies as shown in Table (4-1). It forms a pyramid starting from households with one person and reaching the maximum at households with 4 persons, then descending units reaching households with 7 persons and a few households with more than 8 persons (El Agraa , 1985).

Average of households	Class
5.8	First Class
7.5	2nd Class
8.9	3rd Class

Table (4-1) The average of household's number
(Source: Population census; 1993)

(4-9) FAMILY CYCLE:

One of the basic factors in the housing design is changing family size, e.g. Organization, composition, age, and size. Because of this continuous change, the physical space requirements are also changeable. It is a gradual process over the years.

The conflict occurs with the ever-fluctuating family organization and the inflexible physical space they occupy at a particular period, for example, when a family needs an additional bedroom. This is possible with detached single–family houses, but becomes difficult to accomplish with any other living Unit., when the family is getting smaller, the physical space needs will contour substantive. Again, a situation exists where the physical space does not match the family needs see fig (4-14).

Keeble (1969) classified households, according to the family cycle into:

I- A growing household: A household, which may expect children or further children, based upon the age of the housewife and time of marriage.

II- A stationary, household: household, which has reached its maximum size and is likely to stay at this size for some time?

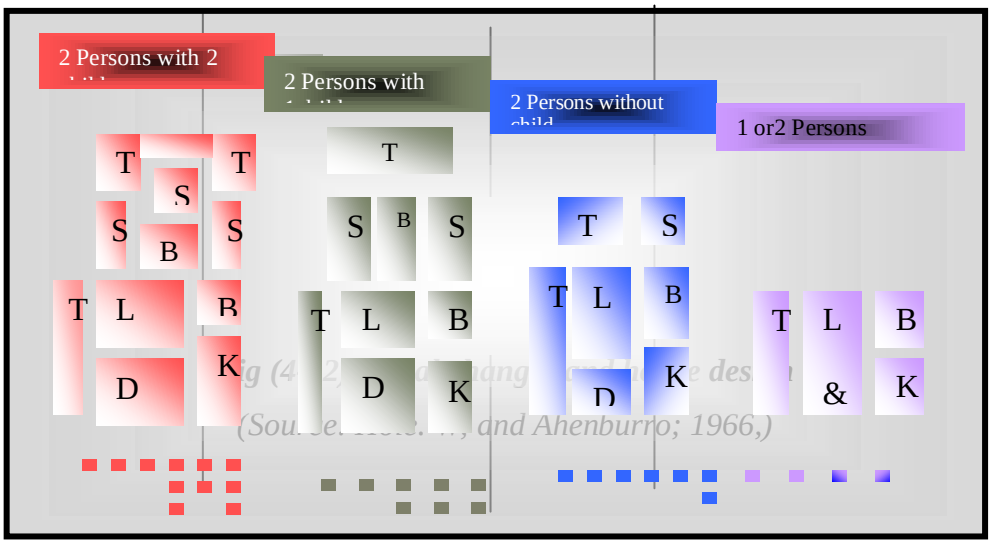


Fig (4-14) household life cycle and space organization

The Sudanese Context;

The household life cycle and gender play an important role in the organization of space within the dwelling. As a child's care moves outside the home to a nursery or a relative, also introduce of formal education change the situation of girls responsible for the care of younger children, running around helping with housework (Altaieb, Z ,2000).

Mohammedani, E ,2007 described the changes in the family and built up area in Ali Hammada house in Omdurman in the after statements; *"In 1986 this family was a nuclear family comprised 5 members, after 10 years from that time the eldest daughter married and she lived with her husband in the same house, they occupied room no (4) and a new room built in the front yard used as a guest room, after two years of the daughter's married a new baby and one child added to the family's members,"*.

(4-10) USER NEEDS AND SOCIAL CHANGE:

The socio-cultural force broken by Rapoport into five elements:

Some basic needs, family, position of women, activities, and social intercourse. The impacts of the socio-cultural forces on the housing form differ according to the way of the people, conceptualizing these forces and to the degrees of their existence and importance in each society. Rapoport continues to suggest that the nature of man and his institution contains elements of both constancy and change, which affect the subject of built form and can be about the biological nature of human beings and their behaviors and their perception. There has been great discussion amongst sociologists concerning certain long-term change in the family which have accompanied industrialization (see fig: 4-15).

In the traditional family, three or four generations inhabit the same house or lived close by, and the individual is enmeshed in an extensive network of obligations and mutual assistance, extending up and down and sideways through the generations. Now days the family, consisting only of the primary biological unit of parents and children, live separately and it is relatively isolated from more extended ties with kindred (Hole, W, and Ahenburro1966).

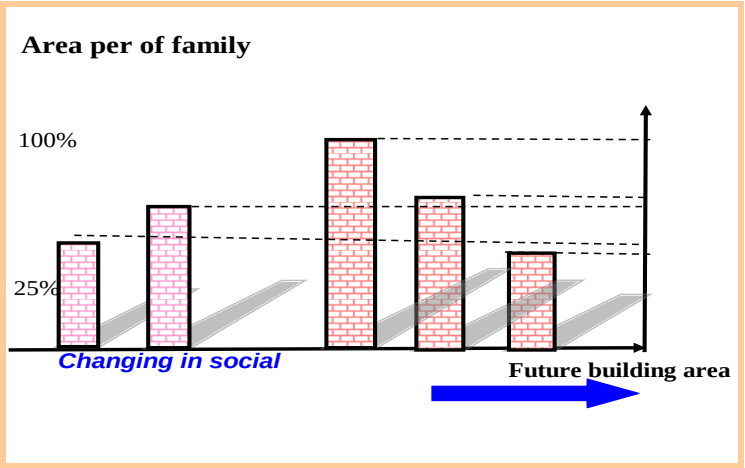


Fig (4-15) the relationship between changing social and Future building area

(Source: Hole. W, and Ahenburro; 1966,)

In the Sudanese context:

In Greater Khartoum, families comprise less than 50% of the total number of families. This phenomenon is a unique Sudanese family feature as tradition encourages daughters and sons to live in their parents' house after marriage, forming extended families as well as, financial problems and other reasons such as seeking work or education in the capital force other to live with their relatives forming composite families (El Agraa , O, 1985).

Alhassan ,Z, 2012 described the household structure in the Alazhari city as follows state "*A modern style with the local culture of the house design involved in the design and construction of the current dwelling viewed it as delivered complete to the user to pre-determined family size. Furthermore, it was required both to build a dwelling which exceeds their current needs and to be suitable in the future. Therefore, one type of those households build as large a house that they can afford, taking into account their family possible expansion and associated need for a number of years ahead* "similar to Bahammam(1998) and Elhassan, Z. (2012).

(4-11) HOUSE SPATIAL ONFIGRATION and LAY OUT:

There are four aspects determining the relational fix within a dwelling layout:

1. Relationship of usable area and general spatial configuration
2. Circulation about rest of spaces in a dwelling.
3. Accessible adjacencies (i.e, doors, openings, ect. Between rooms or spaces
4. Orientation and daylight relationships.

The above example (project "Adlikon" Switzerland, G-3 changed system), show a fixed relationship between the service spaces and the rest of the layout (i.e an authoritarian view of family organization), and would be difficult to change to achieve a new relationship of spaces and uses, with the expectation spatial relationships in Building Design (Penn, 2008 and Hanson, 1999). For instance, Penn (2008) suggested that the geometry and network topology of spatial patterns formed by the built environment has a direct impact on patterns of movement, and so co-presence and interactions between people. (Penn, 2008) (Check figure (4-16). Therefore, this shows how space and the layout of every home have a significant impact on the lifestyle of the inhabitants.

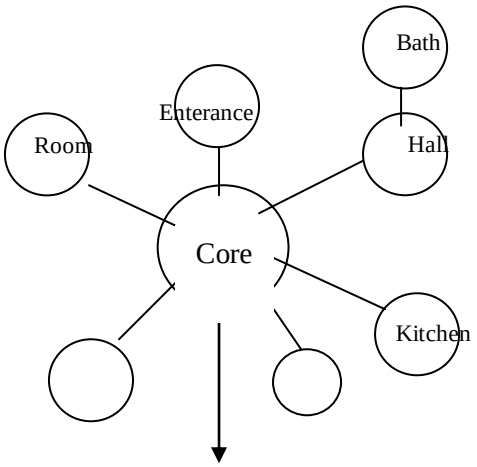


Fig (4-16) Space use linkage diagram (Source: Jan, E, D ;1975)

(4-11-1) Built Environment and Spatial Organization:

The term spatial organization means how the units of the built environment are connected to each other at various levels starting from the home; neighboring, district and urban agglomeration. The spatial organization can be analyzed using three different approaches:

- Morphological approach deals with the volumes of the spaces
- Phenomenological examines the living pattern of the user to understand the organizational principles of the build space.
- The third approach examines the living pattern of the users to understand the organization that can be identified at various levels.

There is a relation between the practical activities of household daily life and spaces. Individual and privacy are valued in the modern societies and clock time is a mean to organize the daily life while for Mexican the clock time has no importance and privacy means alienation.

The conceptual arrangements of domestic spaces regarding the everyday activities of Mexican house and a U.S house as illustrated in fig (4-17)

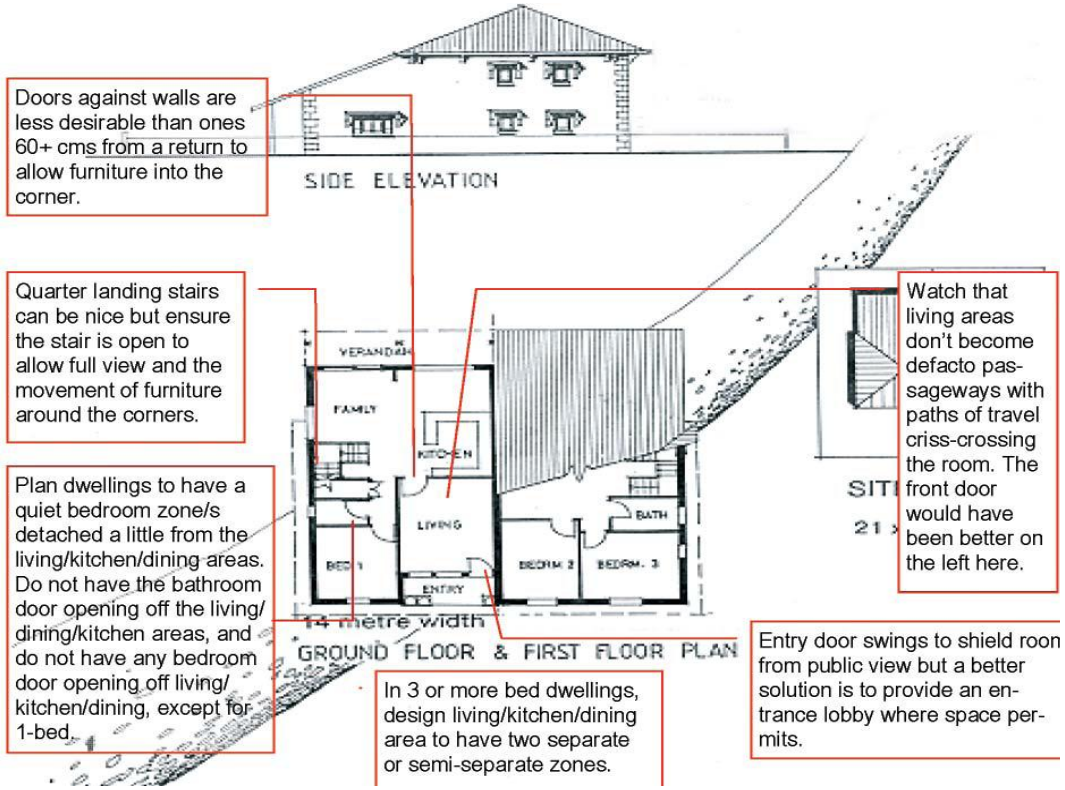


Fig (4-17) House design (Source: Lindgren & Mukherjee; 1987)

According to Asquith domestic space is usually either concentrating on spatial type, the physical boundaries that frame the spaces we use, or on the cultural and behavioral codes that decide the way space is organized, used, and claimed within the home (Asquith, 2008).

The Sudanese Context;

Altayieb, Z described that room positioning must reflect on the norms that govern domestic use of space in urban house in Sudan. This implies positioning of the guest's area at the front part of the flat and to be separated into males/female sections (fig4-18).

(3-11-2) House Design:

The design depends on the infrastructure pattern in the dwelling sector detailed fig (4-16).These reason values, family structure, religion, tradition, social structure, building relevant, technology climate role and methods of construction (Lindgren & Mukherjee 1987).

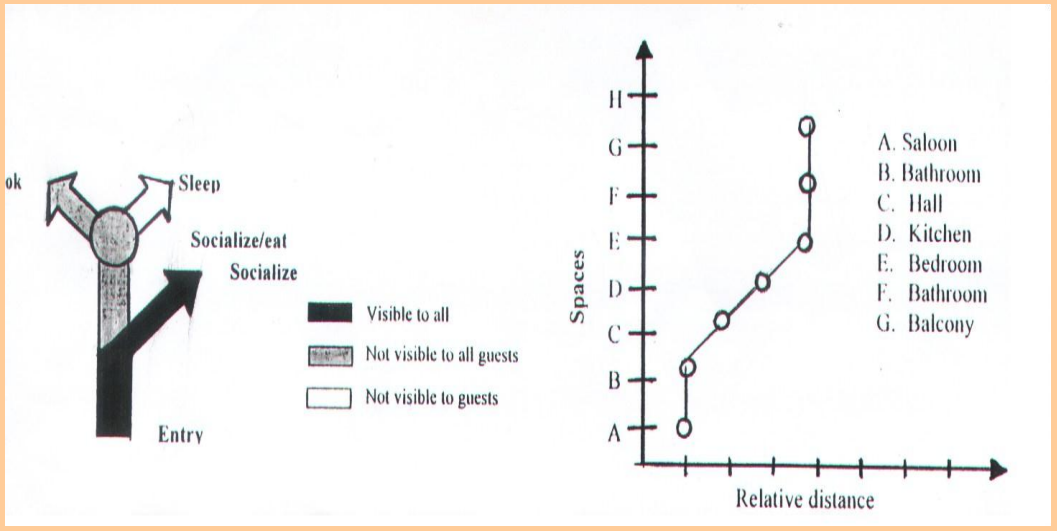


Fig (4-18) Domestic spatial arrange (Source: Altayiebr, Z. 2000)

(4-12) HOUSE FORM AND ARCHITECTURE MORPHOLOGY IN KHARTOUM:

Mahmmed, K (2000) described in Khartoum house has its basic characteristic was the rectangular plan form, which attached the boundary walls. Also, the courtyards and the boundary walls continued to define the house spatial Morphology. In Khartoum houses, privacy is of paramount importance where for females this amounts to absolute seclusion in

a house. In almost all the Omdurman traditional houses, the houses has two sections, one for family and female guests, while the other section, and is for guests the male guest. This concept of sex separation was clear in Omdurman house; it found that male guest has his own private area (Saloon). Also, he noted that" the house pattern on the stage of the design character of house in this stage has no special defined model character for architectural Morphology, But, the house of this stage compact of a building with a clear concept arrange of family and guests which reflected upon the especial configuration of the house, finds, the separate saloon or Sitting room for guests to keep the guests in privacy away from the family section."

In many cultures (except the western communities) the domestic space is multipurpose, there is no room identified for special functions (eating, sleeping, ect.) Even more in some groups, Alps, and Rural Egypt, people may cohabit with animals, e.g. cattle, either on a seasonal or permanent basis.

Sudanese Context:

Fhe traditional design of the built space divided into males/females domains. The male house as it's called, comprises one bedroom, a veranda and a courtyard with a pit latrine and a bathroom. The female's domain adds a kitchen and veranda. Every day Sudanese habits highlight conceives privacy e.g., male guests received at the male domain and don't see the women of the house.

Mahmmod, K,(2000 described the architectural morphology of house sections, he noticed that most houses have two sections, one for the family and the female guest, composed of a hall, rooms, and service units, while the other one, for male guests, composed of saloon and toilet (see fig, 4-19).

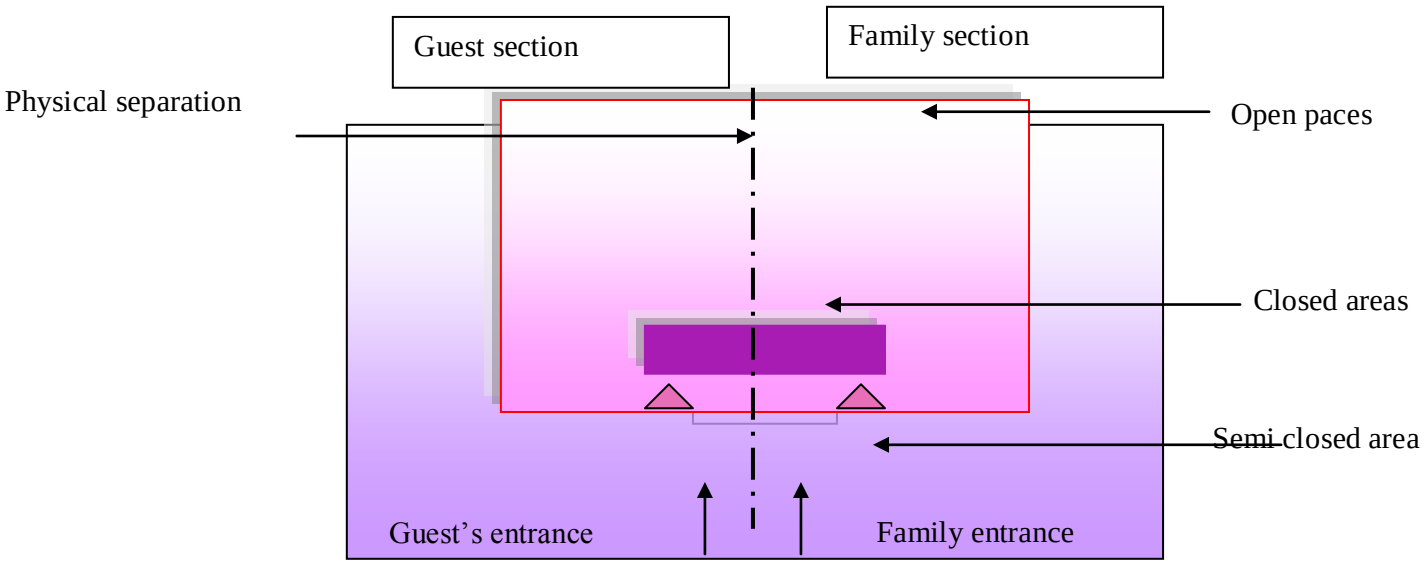


Fig (4-19) The separation between family and guest section

(Source: Mahmmed, K; 2000)

Alhassan, Z, 2013 described the urban planning in Alazhari City is based on the use of residential neighboring which is linking several residential houses of not more than 60 homes of different models.

El-khair, O (1981) arrived at two types about the prosperity of the courtyard. In the first type the courtyard plays a significant role in the configuration pattern of the house as the most or among integrated spaces, while the second type is the family hall in the core of the pattern of the house, the courtyard configuration found in the traditional Sudanese houses, while the family hall type found in the semi traditional houses

(4-13) HOUSE FORM AND SOCIAL NETWORKS:

Dioxides Consultants Group identified the main social elements which are affecting the private lives of the people and influencing the design of individual houses, the consultants have noticed that:

- The house divided into two separate parts, one for men and the other for women whom treated by their men.
- Privacy respected; high compound walls built around the courtyard are the most common feature of the house.

- People like to visit their relatives, and this means having a living room where friends may receive.
- People like to sleep outside their rooms, usually in the courtyard (Doxiadis; 1959: 54) during the hot season.

These same factors considered by Fawzi (1954), while conducting a study in two residential quarters, in Khartoum, the new Diems and Buri-Abuhashish to study the social reason which has marked effect on the designs of the Sudanese houses, Fawzi identified these factors:

- Women seclusion, which meant dividing the house into two parts.
- The provision for guest staying for short or long periods.
- The extended family way of living was the main way. A Household consisting of three generations plus some other relatives and acquaintance, mostly coming from the same village, is the norm.

(4-14) CONCLUSION:

The relationship between man and his built environment complicated. Man builds his home, according to a variety of parameters, one of them socio- cultural values represented as an important element in shaping interior home spaces, home by its walls, rooms and spaces would influence and regulate the daily pattern of man's life, thus the analysis of socio- cultural factors is a good basis for understanding the spatial pattern inside the home as each cultural trait implies specific role in arranging the different functional spaces.

Conceptual framework between household member's males/ female reflected in the daily activities created user zone and separation between males and females.

The spatial interface between visitor and inhabitants lies embedded in social and religious norms, which regulated the penetration and receiving of visitor in the house.

The main parameters that could use in this thesis are:

- **Space usage:**

The most prevailing family types are the monogamy and the polygamy. The latter implies duplication of some functional spaces within the home (e.g.Sleeping areas such as bedrooms and courtyards). And the extended family is a normal situation. Another unique feature of Sudanese society is the social structure, which has strong relation among people.

- **Social network:**

People demand for the specific home type can know through their behavior and aspirations factors of behavior that have marked effect on the spatial arrangements of the domestic.
"Privacy can achieve without wall, doors or separate spaces, through behavior by avoidance and organization of communication and activities in time,".
The male domain is public in the front part of the house or at the ground level while the female domain is private and at a deeper level.

- **Family structure:**

The household life cycle and gender play an important role in the organization of space within the home. As a child's care moves outside the home to a nursery or a relative, also introduce of formal education change the situation of girls responsible for the care of younger children, running around helping with housework. Rapoport continues to suggest that the nature of man and his institution contains elements of both constancy and change, which affect the subject of built form and can be about the biological nature of human beings and their behaviors and their perception.

(5-1) INTRODUCTION:

Standards-density housing used in the residential neighborhoods of Khartoum Distributed pattern site and services in the third strategy ranging between 40-60 people per hectare at a rate of ownership of an area of 200 per capita like that with the city of Riyadh, where a person per hectare at a rate of ownership of the 22, one of the low rates and cost. For comparison, the of the international standards set by the 65 people per hectare and the rate of ownership of 150 meters of the States, which controlled the traditional sector to the urban economy.

But, the solutions proposed and approved to increase by using housing and urban orientations of the structural plan adopt the new principle of redistribution of housing density in Khartoum and prompt increased urban development in the next plan, it will face a complex inherited from the third strategy. The principle of density means adapting vertical multi-storey building and introducing other types of patterns of residential property

(5-2) RESIDENTIAL DENSITY:

Density measures are useful tools for planning and development practitioners, to help ensure project objectives are met. This guide explains the different measures of density, what they describe, and how they should help achieve well-designed, sustainable places. Population density, in this study, refers to the number of persons per unit of an inhabited area within which inland water excluded. It measured in persons per square kilometer. (, Bushra, A. 2006).

'Population density' measure of any tangible item, but most often applied to living organisms. Population density is expressed in terms of items or organisms per unit space . It is useful to remark that population density measures depend on the scale of the sampling area under consideration. In principle, housing practitioners have assumed that the higher the population density, the better uses infrastructure and land (Acioly and Davidson, 1996). The planning system uses a variety of measures of residential density, none of which actually discuss the number of people likely to be using the building.

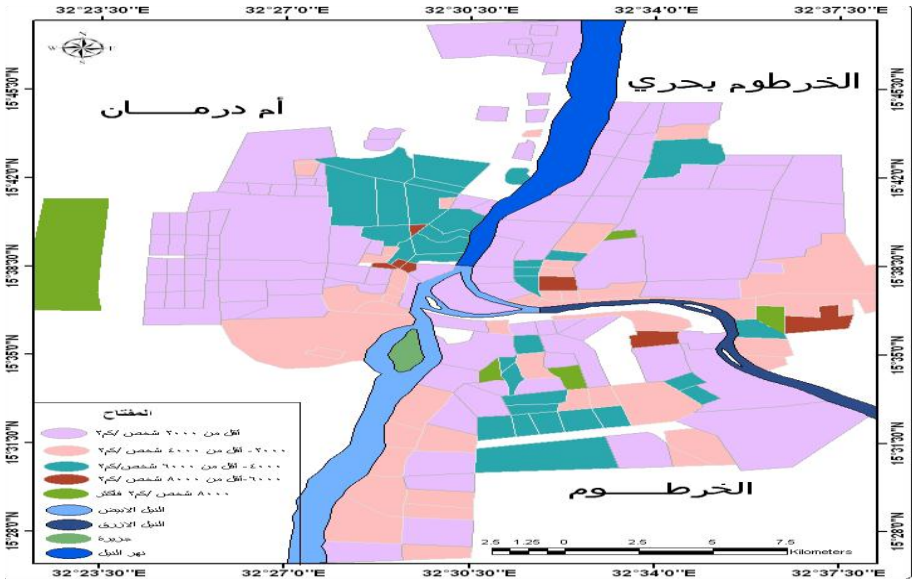


Fig (5-1) Khartoum Residential density

(Source:, Mohammed, K,2000)

Measures such as "habitable rooms" meant to be a proxy for the number of People likely to occupy the dwelling, but are a less well-targeted proxy than the design occupancy of the dwelling (i.e. Bed spaces), (Residential density guide For Landcom project teams, 2011). Overcrowding and densification of neighborhoods are sometimes argued to be one of the major negative effects of constrained land and housing markets, rather than the results of direct planning decisions (Jenks and Burgess, 2000).

Residential density can measured in many ways:

Site, net, gross, urban and metropolitan, all the residential density measures calculated using the same basic ratio formula: the number of dwellings divided by the area of land they occupy. It is the land uses included in the land area which decides the density being described;

- SITE density includes the residential part of the land area. It is the most concentrated measures of density.
- NET residential density includes the residential part plus local roads.
- GROSS residential density includes residential uses, local roads plus local non-residential land uses such as parks and schools.
- URBAN residential density includes all the above land uses plus regional land uses, such as employment, transport and regional open space.
- METROPOLITAN density is a macro measure, often used in international Comparisons and includes all land

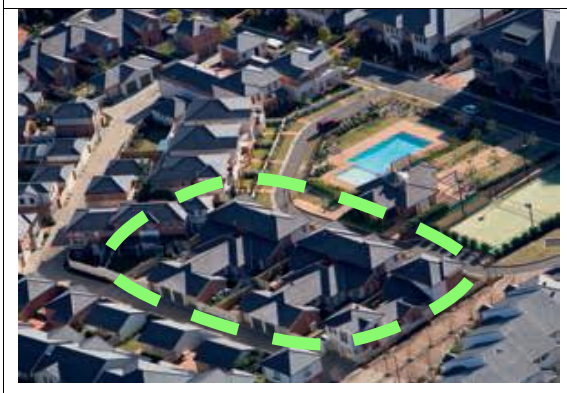
	**Urban residential density** 'The district," The ratio of the number of dwellings to the area of land they occupy including all the land areas included in gross residential density, plus regional issue such as education (universities, open space (regional parks, environmental protection reserves), larger scale commercial uses (employment, shopping centers) and transport (railways, arterial roads). source Based on Cardew (1996)
	**Gross residential density 'The place,"** The ratio of the number of dwellings on land they occupy. The area includes internal public streets, all areas of local open space (including parks, sports fields, drainage reserves, landscape buffers, bushfire asset protection zones) local or neighborhood shops, primary and secondary schools, local community services, local employment areas and half the width of adjoining arterial roads.
	**Net residential density 'The built form,"** The ratio of the number of dwellings in land they occupy including internal public streets, plus half the width of adjoining access roads that give vehicular access to dwellings.
	**Site density** The ratio of the dwellings in the site they occupy.

Table (5-1) Residential density at varying scales(Source: Residential density guide For Landcom project teams, May 2011)

Class	Plot size	Net population Density
First class area	Plots of 500 square meters	80 person per hectare
Second class area	Plots of 400 square meters	95person per hectare
Third class area	Plots of 200 square meters	190 person per hectare

Table (5-2) recommended size plot (Source: Doxiadis1960-1990)

In the Sudanese context:

Over 92% of Metropolitan Khartoum dwelling plots include low-density ground floor development of 300-500 sq meters per plot in size and inhabited by single families of 6 persons on average (Bushra, A, 2006)

The dwelling has a great effect upon the density and neighborhood layout, it might be a good idea if the control of density exercised by specifying for each unit of control a permitted number of dwelling per acre and a permissible amount of habitual floor space per acre and so a clear picture of the development which complies with them can draw.

Keeble (1969) made an example of a density of 60 habitable rooms per acre with different dwelling types it would be congested if development were in from of 20 small bungalows to the acre, acceptable if it would be as 12 houses, each 5 habitable rooms to the acre, and spacious (even through lack individual outdoor space).

(5-3)URBAN PLANNING PROBLEMS:

Haywood, 1985, summarized the urban planning problem of KM in three main points; the lack of effective mechanisms, for planning and control of the city's growth, which has resulted in a pattern of sprawling low-density land uses, with inadequate services and deteriorating environmental standards. Secondly, planning control, land-use zoning and building bylaws applied. Thirdly, planning problems exacerbated high population growth rates, and national economic problems. John, 1995 explained that urban planning in the Sudan fails to deal with the problems of rapid urbanization.

SCALE	MEASURE WHAT IT DESCRIBES	PURPOSE–	WHAT IT CAN BE USED FOR
		• The intensity of built form on site - a theoretical measure • A rule-of-thumb density figure for a single built form typology	Comparison tool (e.g. For detached housing it correlates with the lot size and for apartments it correlates with height) • Estimating yield (aligns closest to 'net developable area')
		• The intensity of built form in street context • The relationship between net residential density, development standards and typology • The average effect of residential mix in a precinct	Testing options for street design and built form typologies • Understanding the impacts of development standards • Securing a 'broad brush' understanding of precincts/ neighborhoods (e.g. For activity center analysis
		• Neighborhood intensity (Dwellings and non-residential land use) • The daily lived experience of a place	Meeting planning targets at the local level for neighborhood intensity • Estimating local population density or meeting least threshold targets (e.g. For public transport) as people experience a place
SUBURB		The overall picture of a place, including impacts of regional open space and uses	Providing a 'big picture' planning tool (e.g. Estimating population density for utilities, regional services) • Understanding existing places or testing the end product of regional planning (e.g. Is the vision achieved?)

Table (5-3) Recommended size plot (Source**:** Residential density guide For Landcom project teams, 2011*)*

People buy as large an area as possible (when buying land or occupying it. Fig (5-3) shows the chronological expansion of residential areas, with high rates in the middle and peripheral parts, the core and middle sections have been expanding outwards.

Despite the formal commitment to the present rule to Islamic principles and values, the urbanization process reflects western urban morphology and functions, classification of where you live on socioeconomic bases, increasing roles of urban women, and makes up a melting pot for different religious, ethnic and tribal communities.

There are several basic approaches to density planning in Greater Khartoum to restrict the horizontal expansion. The first and the most common is to restrict the size of each building plot through local zoning ordinance. This restricts the number of families allowed to occupy a specific area within residential zoned areas; there may also be restrictions about the number of multiple family dwellings or the size and capacity of an apartment building. The second approach involves clustering residents into fewer structures, such as row houses or semi attached houses fig (5-3), the third approach is mix plans. It involves zoning part of the area for single family residences, specifying other areas for row houses, and this area for others

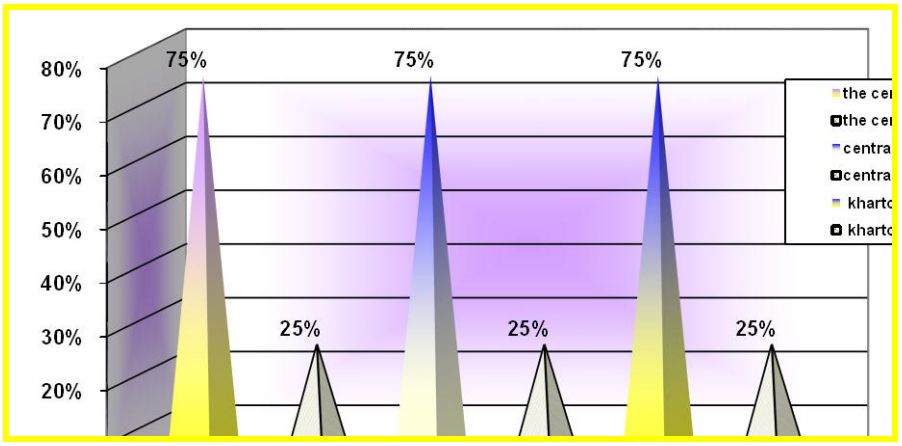


Fig (5-4) Horizontal expansion in Greater Khartoum

(Source: Nimer. S; 1999)

(5-4) PLANNING PHILOSOPHIES AND HORIZENTAL EXPANSION:

A large some the inhabitants in the Khartoum urban center did not prefer to live in flat, according to values and norms Nimer. S; 1999 analyzed the cause of not prefer Sudanese families to live in flats the conflict of social and environmental dimension.

The horizontal expansion of Greater Khartoum has been remarkable. Greatest expansion occurred during the last 30 years (figure5-5). The average annual rate of increase skyrocketed to 66.1 percent between 1970 and 1980 while it was 5.2 per cent between 1955 and 1970, but then dropped to 14.6 per cent during 1980-1998. The three towns have grown, with Khartoum makes up 43 per cent of the total area of Greater Khartoum.

Major reasons for this expansion include (besides those mentioned already) the high rate of population growth, abundance of flat land, availability of cheap building material (clay), the government policy of dividing a plot to every family, and natural and socio–cultural reasons (e.g. Sleeping in the open air because of hot weather, separate compartments for males and women, the extended family, and high frequency of guests).

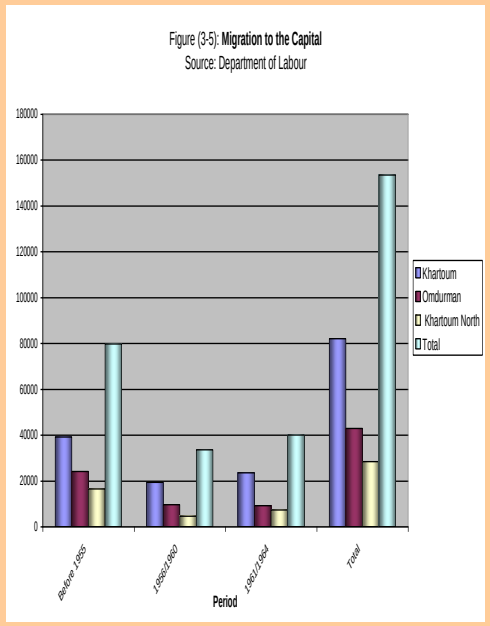


Fig (5-5) Migration to the capital

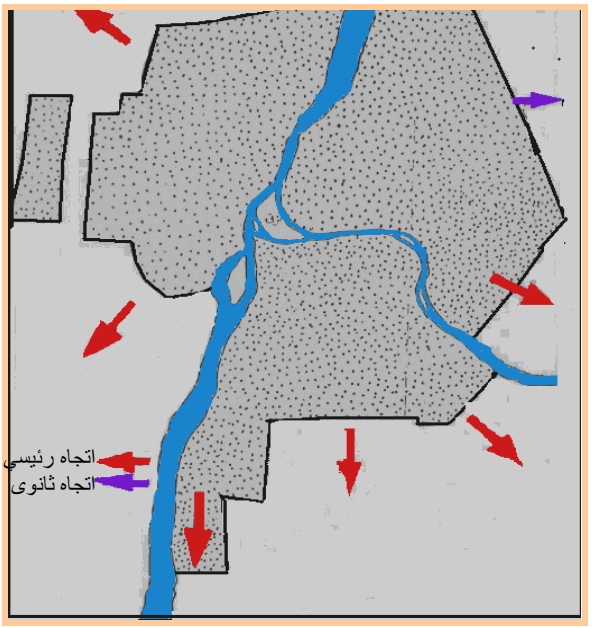


Fig (5-6) Expectations of horizontal expansion in Greater Khartoum *(Source: Nimier, S; 1999)*

(5-4-1) Problem Of Horizontal Expansion & Control of Density:

The control of density in a specific neighborhood connected with different items within the neighborhood as like

1-The dwelling and their distribution within the neighborhood

2-The people and their distribution within the dwelling

The dwellings are ranging regarding the dwelling, the amount and some- what is the accommodation in it and the amount and somewhat out -door spaces associated with it (i.e. Plot size).

Keeble (1969) classifies residential accommodations into:

1-Houses: They have ground floor accommodation, individual out-door space and don't have other dwellings above or below them. They may divided into detached, semi-detached and terrace houses.

Increase in density means that a smaller area of housing can support communal facilitates. He gave an example of a one mile square of 250 persons per acre which would contain over 40,000 persons, the furthest 7, 5 minutes' walk from a large center, at this density a car is a choice.

2- Flats: They have not ground floor accommodations (unless they are on the ground floor) or outdoors.

In Sudanese context:

Sudan is the lowest country in terms of such densities comparison with other countries in Africa countries (150-300) person per acre, while in Sudan in the early nineties the average gross density stands at, 46 persons per acre (about 115 persons per hectare), compared with densities got in other large metropolitan areas of the 3rd world, this density is low *"The low residential density in Sudan is one shortage of housing polices allocation of inadequate official dwelling standard (space and type had been the main reason for the residential land, increasing services cost and aggravation of transportation problems". (Altayieb, Z; 2000)*

According to Doxiadis (2000) a district was sufficiently large to be inhabited. It was something like cities within a city. A district is subdivided into a number of large neighborhoods of some 10,000- 15,000 persons. These neighborhoods were constituted with 5-8 local communities of 250-300 houses respectively. The district will become a largely self-contained unit of an optimum size of some 25,000-30,000 persons (Ahmad et al. 2002).

Doxiadis(2000) revised the plan and stated that the overall population density of the Khartoum metropolitan area is at present rather low at about 53 persons per hectare this is due to the existence of large open areas within the metropolitan limits (such as airport, large tract of agricultural lands, military areas, green belt, river course, ect.) as well as large tracts of undeveloped land at various locations within the city.
Leslie at al. (2012) reported that the gross residential density is 115 persons per hectare. The plan proposed to increase this density be 30 %. The desirable increase in density took into consideration particular characteristics of each district the present level of density, availability of vacant land, income levels and related pre-demographic indications such as the expected drop in the average drop in the average household size and family size.

The desirable increase in density took into consideration particular characteristic of each district the present level of density, availability of vacant land, income level and related predominant use of building materials. It also changes in the demographic indications such as the expected drop in the average household size and family size.

Table (5-4) compeering with the Plots sizes in Arab countries and Sudan, I accepted that the plots area in Sudan are too big compeering with the Plots sizes in other countries especially in the first and second class

Country	**Parcel area in m^2**			
	High income	**Medium income**	**Low income**	**Lower income**
Jordon	120	85	70	45
Magrib	High income	Medium income	Low income	
	200	160	100	
Egypt	High income	Medium income	Small income	
	100-120	70-80	45-50	
Tunis	High income	Medium income	Small income	
	200	125	50	
Sudan	First class	Second class	Third class	Fourth class
	500-600	400-500	300-400	100-200

Table (5-4) Plots sizes in Arab countries (Source: Doxiadis,1962)

(5-4-2) Plot Area and Size:

The World Health Organization determined the suitable gross area for family form 3-5 persons by 260.3 m2, the built up area represented areas about 123.3 m2, and the surplus of area represented 53% of the gross area, and these areas increases by the amount of families.

In the world context:

Over the last 90 years, several attempts have made to define smallest space. Has become more sophisticated over the years, developers (both public and private sector) will reduce the size of dwellings being developed whilst trying to method any reduction in value. Studies show a pattern of increased "cramming" of rooms (such as added bathrooms) into dwellings, leading to smaller habitable rooms and significant reductions in storage space.

Standards in public sector provision in the worldwide plot area for site and service project, e.g. in the South America the plot area is 50 m2, and between (50-70) m2 in South-East Asia, also in Arab countries, Jordan, Tunis... ect. The plot area is between (70-200) m2, table (5-4) illustrates this.

In Sudanese context:

Khartoum center plot size up to 4000 $m^{2.}$ The plot area in Khartoum 1 is in between (1500-2000) m^2, and in Khartoum 2 is in between (400-900) $m^{2.}$ Nowadays the plot area for the so-called fourth class is (200-100) m^2, third class is between (350-300) m2, second class is between (450-350), and in the first class is between (550-450) m2, (Shaddad, A, 2005).

(5-5) SPACE AND HOME:

Couples and families running a business can face many challenges of balancing work and family, when there is physical overlap between home and space devoted to the guests (Getz, 2005). It may be difficult keeping family life separate from the business, because of spatial issues, and this will so impact the guest's experience.

Ram (1997) suggests that through management of space and time people will create and keep different identities. Hosts may have designated parts of the home or for work or for personal use. The host's bedroom may be private and they may feel 'at home' there. How space generated within the home can be very significant.
Wise (2000) suggests that space is in continual motion, composed of vectors, speeds. It is 'the simultaneous coexistence of social interrelations at all geographical scales, from the intimacy of the household to the wide space of trans global connections (Massey, 1994:168).

A space marked out to the hosts may want space for them somewhere they feel comfortable. Goffman's (1959) argument of front-back regions may identify here but, not that the hosts put on a performance when they are in the front region. They may act the same in all areas of the home, but have their own places of comfort. Wise (2000) also identifies symbols as a mark of space. The symbols we use affect the surrounding space, 'it attracts or repels others, drawing this together around the same time'. They could reflect the host, as Marcus (1996:48) argues that 'home reflects self.'
Annual (1998) identifies secure having your own space. Home needs not seen as a place of boredom and limitation (woman as a housewife) but, it also as a site of possibility and pleasure.

(5-5-1) Home Space Standards:

Spaces can affect human behavior and communal organizations, regardless of their scales. Besides being a physical shelter, home environments are spaces possessing many symbolic, cultural and behavioral dimensions (Erincik Edg.1 and Alper, 2003). Houses also have an economy-based structure realize the ideals (Miles, 1996). This research explores the preference criteria of houses; considering the change and adaptability of the houses to lifestyles and the behavioral inclinations of users.
Over the last 90 years, several attempts have made to define smallest space standards in public sector provide. The approach has become more sophisticated over the years, progressing through the number of rooms, less floor space for rooms and the dwelling to

functional/activity based requirements. (HATC limited report - Greater London Authority, 2006).

Space standards set in other countries, through the local equal of the Building Control/planning permission system. Sometimes, space standards expressed as floor area, either of the dwelling or habitable rooms. When properties are being marketed, the norm in most European countries is to define dwelling size of floor area, because in the UK by the number of bedrooms. Space standards are significant are:

1. To propose "safety-net" standards rather than "best practice" standards, i.e. to set standards that would impede developed dwellings of such low space
2. Standards that there is significant concern about their long-term sustainability and suitability for the designed level of occupancy.
3. Standards should not inhibit the designers' ability to respond to market demand in terms of how space in the home is–or can use.
4. Design efficiency determined by the designer; space standards should not impose inefficiencies
5. Least standards should discuss functionality issues. Decisions on whether to give higher standards (such as added insight bathrooms, utility rooms, etc) are commercial decisions.
6. Proposals should be easy for the designer to understand and for the planning officer to start.

'Form follows role'–that is all rooms should designed according to their use. They should have an adequate area, width, length, shape, door arrangement, and height, insulation for noise and natural lighting and ventilation. There should be adequate circulation space, as a hallway or lobby, so possible to enter or leave one habitable room without passing through another habitable room.

The standards have prepared as possible, by considering how the space in the various rooms will use. We believe by focusing on the functionality of the key areas of the dwelling, from the residents' perspective, our proposals built on the firm foundations available. We have so drawn from the anthropometric data and furniture schedules included in the Building Research.

(5-5-2) The Arguments For and Against Space Standards:

There is a wide range of views about space standards, and also how these interrelate with access standards. Proponents of space standards argue that they needed to make sure that homes offer adequate space to undertake typical day-to-day activities, and to avoid the health and social costs that arise where space is inadequate. In particular, space standards seen as a way of ensuring that there is enough room to carry out normal daily activities, socialize with family and friends, work from home or study in private and give storage for general household goods and belongings. There is a view (supported by the evidence Leishman, C., Aspinall, P., Munro, M. And Warren, F. (2004) that across all tenures, the average size of new homes in Sudan has reduced over time giving rise to concern about their ability to support these routine activities, when homes occupied.

Unit area	Standard				Dual aspect requirement
	5 person 3 bedroom	**4 person 2 bedroom**	**3 person 2bedroom**	**2 person 1 bedroom**	
Parker Marris	79.0	69.7	56.7	44.6	No
Tower Hamlets	79	70	57	44.5	No
Redbridge	85	70	53	43	No
Wandsworth	79	60	57	45	No
Barnet Affordable Housing	75	67	57	45	Part
English Partnerships 2007(Govt Sponsored Schemes Only)	93	77	66	51	Part
Irish DoE 1995(National Form 1999	70	-	55	38	Yes
Irish DoE 2007(National)	90	73	-	45	Yes
Dublin City Council 2007(Dublin only)	100	80	-	55	

Table (5-5) How to make room
(Source: Housing Design Standards, Evidence Summary, 2010).

(5-5-3) Home space standards international Comparisons:

A 2003 study comparing the technical building requirements of eight European countries51 found that there are considerable variations in requirements and that a broad variety of systems and formulations used, including:

• Generalized "functional" requirements combine "deemed-to-satisfy" practical design solutions;

• Generalized "functional" requirements with design guidance or reference to external sources of design guidance;

• "Prescriptive" requirements about solutions; and

• Quantitative "performance" requirements without reference to practical design solutions.

It also found that each country has requirements for the size of homes, ceiling heights and day lighting In terms of size, there are also further accessibility requirements in the countries that have implications for the size of the rooms (Housing Design Standards, Evidence Summary, 2010).

Family		Number of House's Spaces and Area										
	Family size	Total space area	Circulation space area			Bath		Kitchen	Salon		Salla	Room
				Area	Nu.	Area	Nu.		Area	Nu.		
Very small	**Minimum (A1)**	39.83	2.75	24.92	1	4.41	1	12.6	-		-	17.04
	Medium**(A2)**	70.27	9.17	61.11	1	4.41	1	12.6	-		26.46	17.04
	Comfortable **(A3)**	110.83	14.46	96.39	1	4.41	1	12.6	35.28		26.46	17.04
Small(1-3)	**Minimum (A1)**	90.56	11.81	78.75	1	4.41	1	12.6	-		26.46	35.28
	Medium**(A2)**	131.13	17.10	114.03	2	8.82	1	12.6	35.28		26.46	35.28
	Comfortable **(A3)**	156.49	26.41	136.08	2	8.82	1	12.6	35.28		26.46	52.92
Medium(3-5)	**Minimum (A1)**	90.50	11.18	78.75	1	4.41	1	12.6	-		26.46	35.28
	Medium**(A2)**	156.59	20.41	136.08	2	8.82	1	12.6	35.28		26.46	52.92
	Comfortable **(A3)**	176.78	26.66	153.72	2	8.82	1	12.6	35.28		26.46	70.56
Large(5-7)	**Minimum (A1)**	88.94	11.60	77.34	2	8.82	1	12.6	-		-	52.92
	Medium**(A2)**	156.49	26.41	136.08	2	8.82	1	12.6	35.28		26.46	52.29
	Comfortable **(A3)**	181.85	23.72	158.13	3	13.23	1	12.6	35.28		26.46	70.56
Very large	**Minimum (A1)**	115.92	15.12	160.8	2	8.82	1	12.6	-		26.46	52.92
	Medium**(A2)**	176.76	23.06	153.72	2	8.82	1	12.6	35.28		26.46	70.56
	Comfortable **(A3)**	202.14	16.37	175.77	3	13.23	1	12.6	35.28		26.46	88.20

Table (5-6) How to make room (Source: Shelter and habitat in Sudan, 2003)

Space standards in Sudanese context:

Shelter and habitat in Sudan, 2003 report division (3) proposed space area for house space units, according to the social aspects o suit all family size and type and give alternatives of it, see table (5-6) in addition to the report proposed alternatives to the type of house according to the economic situation of the family.

Although the average household consists of more than 6 persons, 72.9% of families have one or two rooms in the house, about 24% have 3-4 rooms, and only 3% have 5 or more

rooms. The poor constitute 54% of those who have one or two rooms, while the rich constitute 25% .

(5-5-4)The need for space standards:

Space is one of the key factors in defining how comfortable residents feel within a home and how much privacy achieved within it this argue space within dwellings is one of the greatest concerns for many residents, and that there is no effective compensation for inadequate space.

At a basic level, these functional requirements still decide the space needs of a home regardless of household size. Space needed for residents to cook, eat, bathe and sleep, with enough space for furniture and the ability to access and use it, and a space to move around the home and access doors and windows. Homes are also places to relax study or work, keep fit, and enjoy time with friends and family. Today's home environment has to do even harder with people expecting to work at home, facilitated through IT communications. (Housing Design Standards, and Evidence Summary, 2010).

(5-5-5) Spaces demands and Standards:

Homes sensibly planned and functional; designed to meet the demands of everyday life, providing enough space and facilities such as privacy and storage, will better enable residents to live (See Appendix I). As new housing built at higher densities, there is pressure on the quality of both indoor and outdoor spaces. But it is the provision of this space that can make higher density living more tolerable. (Housing Design Standards, Evidence Summary, 2010)

This chapter sets out essential least standards for the gross internal floor area (GIA) and private outdoor space of general needs housing, and it provides guidance on the size and layout of rooms and storage areas. This guidance aims to make more generous housing that can allow people to live a full life in the city.

Living space

The amount of living space has implications for the energy required to heat (or cool) the space and the number and size of appliances that can fit into the dwelling. On average,

personal living space has arisen because of dwelling numbers of people per household– from 38 m2 per person in 1991 to 43 m2 in 1996 and 44 m2 in 2001 (ODPM 2003). Table (5-6) shows the range of personal living space, from single retired people to those in large households When they can afford to, people buy themselves more living space: among single people in the private sector who moved house between 1996 and 2001. The highest earners bought or rented accommodation that was 17 m2 larger on average than that for the lowest earners for households of four or more, the difference was still 11 m2 per person (ODPM 2003a). This supports the contention that *'demand for small dwellings will generally be restricted to those on low incomes, including many first-time buyers… and the elderly trading down from a family home* (HBF 2003).

(5-5-6) The Relationship between Space and Well-Being:

Research on the effects of space standards on residents had had focused on overcrowding. Altman (1975) outlines the effects:

The Guide articulates the Mayor's case for leased space standards and drew heavily on Shelter's 2004 study Crowded House, which brought to light levels of overcrowding in London that are above the national average. It gave evidence of the serious long-term effects of overcrowding on families. For children, it means an increased risk of infection and a lack of space and privacy that can affect how they do at school. For parents, a barrier to providing opportunities for their children as well as a constant cause of anxiety and stress (Mayor of London, 2009).

(5-6) RESIDENTIOAL ACTIVITIES AND SPACE STANDARDS:

(5-6-1) Layout and adaptability

The sections that follow give guidance on the design of different rooms of a home. They show how the smallest space requirements for furniture and circulation can meet, taking into account the number of occupants and the range of activities each room may accommodate.

Designers should offer dwelling plans with dimensions illustrated to show the design meets these requirements. Dwelling plans should also illustrate, think furniture, activity zones and turning circles that scheduled in Appendix 2. If rooms of smaller dimensions proposed, the onus will be on the designer to show that the dwelling accommodates all the furniture, access and activity space requirements for the intended number of occupants, and meeting Lifetime homes standards.

Flexibility and adaptability are also key considerations in the design of the layout of the home. Flexibility is the potential to use the rooms of a home in a variety of ways; for example, the ability to rearrange furniture in a room, make space to put up guests, convert a double bedroom into a twin bedroom, or create suitable spaces for work and study. Flexibility is determined by space and room layout, and also by the number of rooms in a home. Homes where the living areas and circulation spaces are open plan will not create the greatest flexibility when the home is in use see fig (5-7).

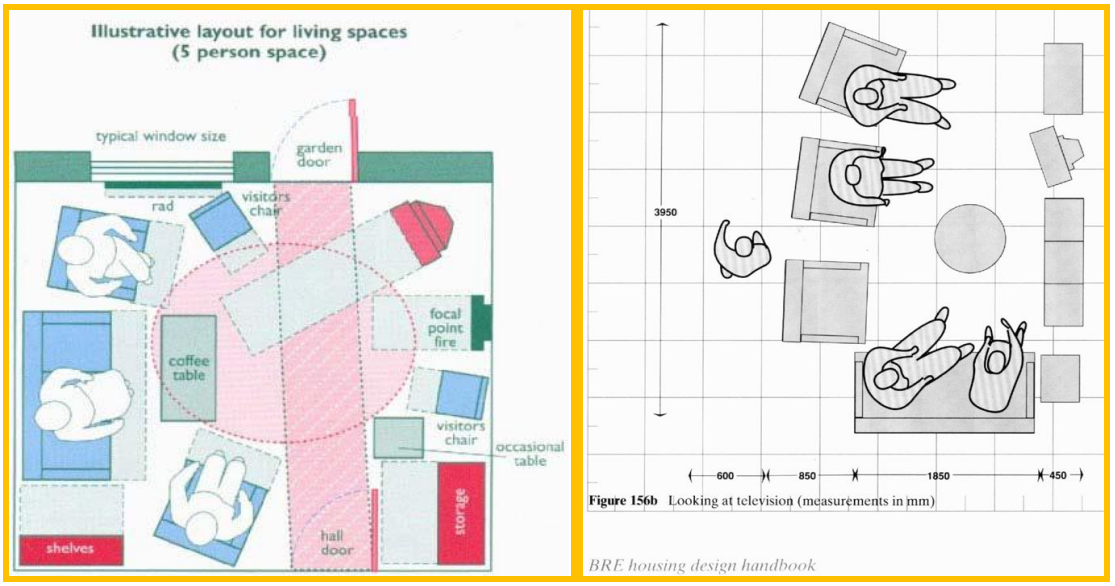


Fig (5-7) Space standard and housing design

(Source: Housing design handbook)

(5-6-2) Space as Configuration:

Giorgi, P, and Pontecorvo (2007) recognized the need to analyze how domestic spaces, change in meaning and household members‘ relationships using the concept of appropriation, thus the concept of domestic space considered multi-dimensional with a set

of definitions and leading categorizations describing representations and practice with several limitations (Mallet, 2004).

All social activities are not attributes of individuals, but patterns, or configurations, formed by a group. They depend on an engineering pattern of co- presence, and co-absence. Few of the purposes for which buildings built and environment are not and space will found at the level of the configuration of space. In the most reasonable spaces, most human activities can carry out. In this sense, any habitable space defined at configuration formed by performing several activities by a group of user in a recognized space.

(5-6-3) House spatial area:

The following table, present ten- year average models and the average general model of space areas for the most components that have experienced changes in Khartoum house, these spatial components are:

- ***Built up area***
- ***Semi–closed area***
- ***Plot area***
- ***open area***

Plot areas experience little changes that because of the regular attitudes in planning residential areas in Khartoum.

It is seen that reduce the built-up area and as a result the increase of the open area in the plots after the 60's. Those due to the gardens in the house also new construction materials in the few cases after the late 60's (see table 5-7). One of the most important features was reduced the semi-closed area in the plot, the post 60's, which refers to appear the closed family Sala instead of the open veranda sometimes, it’s also seen that the plots sizes in large. The service unit's area has reduced due to integrating services to the main building block, but by the late 60's. This new service considered for the housing unit, such as the garage, servant room, which increased the model area for services after the 60's.

Average models	*Plot area*	*Built up area*	*Open area*	*Veranda*	*Guest-setting*	*Rooms*	*Services*
1920-30	430 m^2	272 m^2	158 m^2	46 m^2	21 m^2	70 m^2	34 m^2
1930-40	410	257	153	46	19	65	31
1940-50	432	226	206	63	13	81	32
1950-60	476	246	230	34	35	84	27
1960-70	480	121	369	21	40	46	47
General	**460**	**182**	**278**	**44**	**22**	**68**	**34**

Table (5-7) Model of space and areas in Khartoum

(Source: Altayieb, Z; 2000)

(5-6-4) Room sizes:

The smallest standards based on overall dwellings sizes, as the first assumptions about dwelling size have to make very early in a project table (5-8) illustrated Floor area (m2) by housing type, before detailed room arrangements tested. Architects have to test site capacity by 'drawing boxes', and the client and QS have to test the financial viability by establishing a construction cost, based on floor area. The figures used should be more in line with good practice', rather than the 'least acceptable'110 (Housing Design Standards, Evidence Summary, 2010).

1- Living /Dining/Kitchen:

The least floor areas for living room, kitchen and dining areas joint in this guide as a set of aggregate living areas for different occupancy levels. The intention is to allow the designer the freedom to organize and combine these spaces in different ways. Where housing is being designed for specific cultural needs, this flexibility will be important.

When choosing the combination and layout of rooms, designers should consider a variety of situations of the rooms in use by family members, as a group or, with and without guests. An open-plan layout will often be less satisfactory than two separate rooms, or interlocking spaces that achieve separation for one living space and for the work area of the kitchen. Families help when children and adults can occupy separate living spaces, and two

separate rooms should provide in all larger family homes.

The usefulness of the room affects by the width and floor's area of it. To allow enough space for circulation around furniture and adequate daylight in deeper rooms, the guide requires that the least width of a room used as a living room is 3.2m at the narrowest point.

People should be able to see out of living room windows while seated by providing largest glazing height of 800mm from the floor though care should give to keep privacy. Wheelchair users should be able to use at least one window in each room.

The following aggregate floor areas for living/kitchen/dining areas should met Floor area for the aggregate of the living/dining area are:

1 person 2 persons, 23(Sq.m) 3 persons, 25(Sq.m) 4 persons, 27(Sq.m) 5 persons, 29 (Sq.m) 6 persons, 31 (Sq.m)

Dwellings with three bedrooms or more should have two living spaces, e.g. living room and kitchen-dining room.

There should be space for turning a wheelchair in dining areas and living rooms and adequate circulation space for wheelchairs elsewhere.

A living room or kitchen-dining room should be at entrance level.

The smallest width of a living area should be 3.2 metros at the narrowest point.

Living room window glazing should begin at 800mm or lower and windows should be easy to open and work.

Floor area (m2) by housing type	1B 2P (Flat)	2B 3P (Flat or Bungalow)	2B 3P 2-storey house)	2B 4P Flat or Bungalow	2B 4P 2-storey house	3B 5P Flat or Bungalow	3B 5P 2-storey house)	3B 5P 3 storey house	4B 6P Flat / Bungalow	4B 6P 2-storey house	4B 6P 3-storey house
Draft Replacement London Plan Policy 3.5 (2009)	50	61	x	70	83	86	96	102	99	107	113
Parker Morris, Homes for Today & Tomorrow (1961) 117	45	60	x	73	79	82	89	98	89	97	102
HCA proposed national standards (2010)	48	61	71	70	80	86	96	102	99	108	114
Housing Corporation - ranges from HQI v4 (2008)	45-50	57-67	57-67	67-75	67-75	75-85	82-85	85-95	85-95	95-100	100-105
English Partnerships Quality Standards (2007)	51	66	66	77	77	93	93	93	106	106	106
NHF Standards and Quality in Development (2008)	50	61	x	70	82	86	96	102	x	108	114
Mid Sussex District Council, Dwelling Space Standards SPD (2009)	51	66	77	66	77	93	93	93	111	111	111
Royal Borough of Kensington & Chelsea Housing Standards SPG (2002)	44.5	57	x	57	x	70	72-74.5	x	80.5	82-85	94
London Borough of Southwark Residential Design Standards SPD (2008)	45	60	x	60	x	75	x	x	90	x	x
Dublin City Development Plan (2007)	55	80-90	80-90	80-90	80-90	100	100	100	x	x	x

Table (5-8) Housing space standards
(Source: Housing Design Standards, Evidence Summary, 2014).

2- Bedroom:

Where space allows, a bedroom may use for home working or relaxing in quiet, away from the social spaces of the home. Children and young people need space in a bedroom for homework and private study, play and hobbies, entertaining friends, and spending time alone.

The smallest floor areas–8.4 Sq.m. for a single bedroom and 12.8 Sq.m. for double and twin bedrooms(fig 5-6) allow for a variety of activities and give space for the access of wheelchair users. Double and twin bedrooms have the same smallest floor area and both

should have a least width of 3m to allow the rooms to either of the bedroom. It should note, the floor space occupied by built-in wardrobes will count towards the floor area of the bedroom.

All homes should be able to expect the changing needs of residents. If a home is over one story, the layout of the home should capable of providing space for a bed at entrance level to help with a temporary change in circumstances, e.g. a household member with a broken leg or recovering from a hip operation. The design of all homes should also make allowance for a reasonable route for a potential tracking hoist from a main bedroom to the bathroom.

Bedroom Requirements:

- The least area of a single bedroom should be 8.4 sq.m. The least area of a double bedroom should be 12.8 sq.m.
- The least width of double and twin bedrooms should be 3 meters at the narrowest point.
- In homes, over one story, there should be space on the entrance level that could a convenient bed-space.
- The design should offer a reasonable route for a potential heist from a main bedroom to the bathroom.

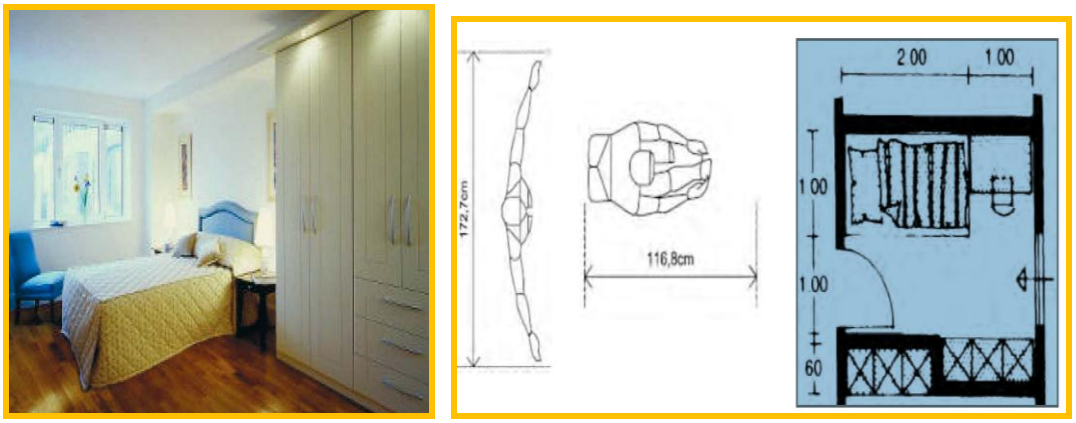


Fig (5-8) Bedroom requirements and minimum space standards
(Source: Ernst and Peter Nufert, Architecture's data. Black well since)

3- Bathroom:

Introducing extra bathrooms often results in the loss of space from habitable rooms. The smallest gross internal areas (GIA) say space for one bathroom in dwellings occupied by up to five people and one bathroom and another WC in dwellings occupied by over five people. As per the Lifetime Homes standard, the GIA also allows for an accessible WC in all flats, and including a WC at entrance level for homes that are 2 stores and above. Floor space for bathrooms not included in the requirements will need to provide besides the least

GIA. The bathrooms must design for adaptation to meet the needs of future occupants. WCs should have a clear space of 1100mm in front and 700mm to one side to allow for a wheelchair user to maneuver.

Lifetime homes standards also need that the build-up of the bathroom floor (for flats on one level or for an entrance level WC if a home is 2 stories or above) should allow installing a level access shower. Bathroom layouts should show an area of 1000mm x 1000mm for a shower (which may overlap with a bath) to allow an accessible shower installs. Walls in bathrooms and WCs should also capable of taking handrails, and wall reinforcements should provide between 300 and 1500mm from the floor.4.6oom.

Requirements:

- Dwellings designed for 5 persons or more should say a small of one bathroom and one added WC.
- All dwellings should offer wheelchair accessible entrance level WC, with drainage provision enabling a shower to be fitted.
- Bathrooms should incorporate ease of access to the bath, WC and wash basin.
- Walls in bathrooms and WCs should capable of taking adaptations such as handrails. Wall reinforcements should be between 300 and 1500mm from the floor.

4- Study and work:

Flexible working patterns, wider access to home computing and developments in internet technology are making it possible for more people to work from home. Occupants of all ages will also need space in the home to study.

Space for work and study may include within bedrooms, living rooms, extended landings and broad corridors. Consider where power and data sockets located with potential spaces for desks.

Requirements:

Dwelling plans should show that all homes provided with adequate space and services to work from home.

5-Storage and Space Utilities:

Many people consider the lack of storage to be a major problem in new homes. Smallest areas for storage cupboards set out in the adjacent need. The space has included in the least

GIA. Storage cupboards should provide besides the furniture listed in Appendix 2 and may be in any room or circulation area.

Flat layouts should make suitable provision for waste and recycling bins, washing machines and drying clothes. Space for a washing machine and recycling bins included in the furniture schedule in the kitchen.

Clothes drying may accommodated in circulation areas, bathrooms and bedrooms. In larger flats and houses, a separate utility room for washing and drying clothes may be more desirable.

Requirements:

A storage cupboard with a smaller floor area of 0.8 sq.m. should provide for 1-2 person dwellings. For each added occupant, a smallest of 0.15 sq.m. for the storage area should provide.

Dwelling plans should show that suitable space provided for a washing machine, for drying clothes, and for waste and recycling bins within the home.

(4-7) CIRCULATION IN THE HOME:

Corridors, hallways and stairs within the home should be designed for ease of access for all potential residents and visitors. To expect the changing needs of occupants, stairs in dwellings over one story should allow installing a stair lift, and space should be provided within circulation areas or habitable rooms give a through-floor lift (see fig 5-9)

A well planned home will have a small of space used for circulation. The aim should be to plan layouts and consider how circulation areas can accommodate other functions, including storage, study or utility uses where fire escape requirements allow.

Circulation should allow space near the entrance for off-loading outdoor items–Prams, umbrellas, coats and boots–without the need to pass through habitable rooms. It recognized that this recommendation may lead to including corridors in the flats, which could compromise space in habitable rooms. These considerations should balance with care.

Circulation areas should be lit where possible. Circulation spaces can serve an important

role in natural ventilation, passive winter heating and thermal regulation. Consider how circulation spaces can give stack ventilation or act as sun spaces or thermal buffers.

Requirements:

The width of the doorways and hallways should conform to the specifications below:

• The clear opening width of the front door should be at least 800mm. 40

• A 300mm required beside the leading edge (latch side) of all doors at entrance level.

• All internal doors should have a clear opening width of at least 775mm.

• All hallways and corridors inside a dwelling should have a clear width of at least 1050mm. see fig (5-9)

The design of dwellings over one story should offer space for (a) provision of a stair lift, and (b) an identified space for a through-the-floor lift from the ground to the first floor.

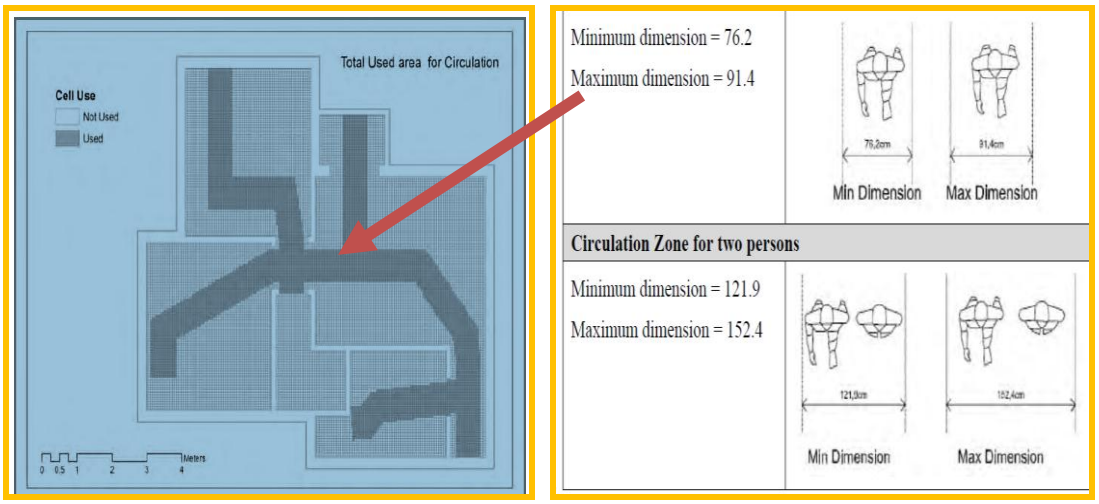


Fig (5-9) Total area used for circulation in the home and circulation zone dimensions
(Source:Aseem, A, 2007)

(5-8) THE PROPORSION ROOM AND GOLDEN RATIO:

Proportions of rooms are considered one of the main architects concerns. In the Four Books of Architecture, published in 1570. Andrea Palladio, (1508, 1580), suggest seven sets of the most beautiful and harmonious proportions to be used generally in generating rooms, He suggests six proportions of the rectangular room in addition to a circle which is rarely used in the design of dwelling rooms. These six propos ions are illustrated in the table see fig (5-10)

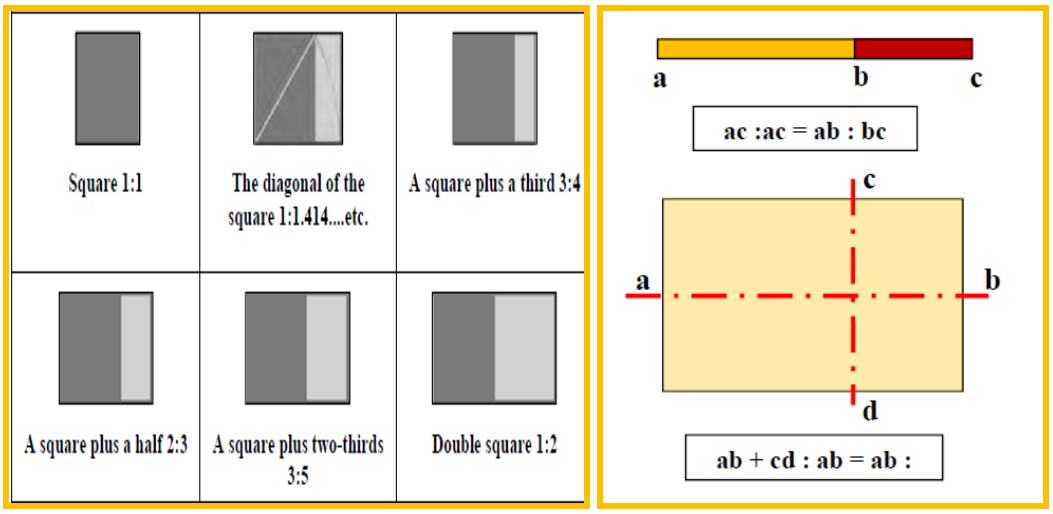


Fig (5-10) The room proportion suggested by Palladio (Source: Palladio, 1570)

The golden ratio:

This ratio is based on the division of any whole into two parts such that the whole is for larger is to the smaller. Thus, in the line(ac) in the following figure (ac:ab + ab:ac),whereas in the rectangle the sum of the two diameters is to the longer diameter as the length is to the shorter. Worked out arithmetically, this ratio is almost equivalent to five to three). Previously, The golden section was thought that satisfies the requirements of the mind, and may be accepted as an approximate ideal. As long as side any rooms are expressible in small ratio, like 1:1 or 1:2, they are easily perceptible. As the number of sides increased the ratio becomes more difficult to perceive and the proportion more subtle, up to the point where the mind is unable to percept the ratio. Thus to ratio 2:3 more subtle and more interesting than the ratio: 1:1 yet it is easily sensed by the mind. On the other hand ratio like 4:7, 7:12, or 9:14 involve a number of divisions beyond the power.

.(5-9) FURNTURE SPACE:

The purpose of any piece of furniture is to provide stable bodily support in a posture that is

1- comfortable over time.
2- Physiologically satisfactory.
3- Appropriate to the desired task or activity.

Comfort may also influence by task or activity that the user engaged in. Comfort will depend upon the interaction of activity characteristics, user characteristics, and task characteristics, see table (5-9).

Room Type	Beds	Furniture	Plan **dimensions (mm)**
Main bed	All dwellings	Queen size double is being (mattress)	1550 x 2050 (min)
		Wardrobe–full height with full height opening door sets full height opening door sets..	600 x 1800 (min) Studio – 600 x 1200
		2 x bed side tables (1 in Studio apartments)	450 x 450
2nd bed		King size single bed(mattress)	1100 x 2050 (min)
		Wardrobe - (as above)	600 x 1200 (min)
		1 x bedside table	450 x 450
Additional bed		2 x single beds	1100 x 2050 (min)
		Wardrobe - (as above)	600 x 1200 (min)
		2 x bedside table	450 x 450
1-2 bed dwelling	Studio	1 arm chair 1 x coffee table	900 x 900 Armchair 600 diam. Coffee table
		2 x 2 seat sofa OR 1 x 2 Seat sofa & 2 x armchairs	900 x 1800 sofa 900 x 900 armchair
		Low shelf unit	450 x 1200
	3 beds Dwellings	1 x 2 seat sofa	
		1 x 3 seat sofa	
		Low shelf unit	450 x 1800
	4 beds Dwellings	1 x 2 seat sofa	
		1 x 3 seat sofa	
		2 x low shelf units	
Dining		Dining table, 2 chairs.	
		Dining table, 3-4 chairs.	

Table (5-9) Furniture sizes exclude circulation spaces (Source: LAHC Design Standards 2014 – Revision 1)

(5-10) INTERNAL SPACE STANDARDS:

Given enough space within new homes is an important element of good residential design and new. General Provision of External Amenity Space sets out a flexible, criteria based approach to decide adequate provision of external amenity space for houses and flats see table (5-10).

All new residential units will expect to have direct access to an area of private amenity space. The form of amenity space will depend on the form of housing and could include a

private garden, roof garden, balcony, glazed winter garden or ground level patio with defensible space from any shared amenity areas. The following criteria will consider when assessing whether proper amenity space has provided:
Location and context of the development, including the character of the surrounding area; Orientation with the sun at different times of year; Level of overlooking and enclosure impacting on the proposed dwelling and any neighboring dwellings; Shape and size of the amenity space, including the access to that space and the practical usability of the space.

In terms of usable space, the policy will also need to refer to the need to allow enough external amenity space to accommodate a table and chairs suitable for the size of the dwelling; and where relevant, provision of a garden shed for general storage (including bicycles where no garage provision or cycle storage to the frontage of the dwelling is possible) and space for refuse and recycling bins; an area to dry washing; circulation space and an area for children to play in. In calculating how much space might require, this will based on bed spaces. External amenity space would not include car parking or turning areas.

One bedroom dwelling would not expect to provide space for children to play, due to the low likelihood of children occupying these units. Larger dwellings would need to take space for children to play into account. Besides private amenity space, developments with flats will need to provide high quality shared amenity areas on site to meet the needs of residents. **(**Cambridge City Council Affordable Housing Supplementary Planning Document, January 2013).

Eating
Minimum dimension for eating space (one person) using the dining table
Minimum dimension=76.2cm Maximum dimension= 91.4cm
Maximum dimension for eating space (one person) using the dining table
Maximum dimension=121.9cm Maximum dimension= 152.4cm
Sleeping
Single bed Minimum dimension=198. 1*121.9cm **Optimum dimension=213. 4*137.2cm** **Maximum dimension=213. 4*152.4 cm** **Double bed Minimum dimension=198. 1*91.4 cm** **Clearance between beds=91. 4cm- working zone beside the bed 116.8 cm** **Maximum dimension**
Dressing
Minimum width 172.7cm- minimum depth 116.8 cm
Kitchen activities
Kitchen preparation center **Furniture dimension =61cm - accessible area =45. 7** **Working zone 45.7cm- minimum width =91. 4** **Sink center** **Sink dimension= 61cm- working zone=101.6 cm** **Circulation clearance =76. 2 cm**
Bathroom activities
Bathtub dimension **Showering space** **Closet minimum clearance**

Table (5-10) House Internal activities Space Standards (Source: Aseem, A ,2007)

(5-11) PLOT AREA AND SPACE STANDARDS IN KHARTOUM:

(5-11-1) *Colonial space standards in Khartoum:*

Introducing land classification in Sudan came with British colonization. The colonial authorities introduced building regulations and put laws in Khartoum city at begin the century. Regulations based on personal experiences by the governor and other British staffs, the criteria forming these regulations were paid health, climate and security.

The first written law “regulate division of housing land" registered in 1906this of the

clauses of building regulations were

1- Dividing residential areas into three classes, first, second and third.
2-Specifying the minimum standard of construction, material and cost of the house in each class
3- Defining the minimum lot size.
4-Specifying the minimum standard of construction, material and cost of the house in each class
5-Setting maximum built up areas together with setbacks from neighbors
6- Specifying the heights of buildings, Setting Street and road width in each class area, (Doxiadis and Fawzi; 1954).

(5-11-2) ONGOING POLICY OF SPACE STANDARDS IN KHARTOUM:

The sizes of plots in site and services schemes are:
The first class (400-800 sq. m) for the higher income groups, the second (3oo-400 sq .m)for the middle income groups and the third (200-300 sq .m for low income groups. Plots sold with the subsidized cost, most of the government subsidies went to higher income groups, although the low income groups make up around 80% of the population It is also clear that lower income groups with bigger households received the smaller plots (see table 5-11).

Khartoum & Khartoum-North				
Area Class	**Person/plot**	**Average rate of occupancy P/R**	**Person/plot**	**Average rate of occupancy P/R**
First class	4	1.1	4.6	1.1
Second class	6	3.0	6.8	3.6

Table (5-11) Person/plot ratio and the average rate of Occupancy per/room In the 1st and 2nd classes at Khartoum &Khartoum North (Source: Madibo: 1989*)*

In 1992 site and services scheme reduced the plots sizes, even more: 400 to 500 sq. m. for the first class, 400 to 450 sq. m. for the second class, and 300 for the third class. Reduce residential plot sizes recommended by all the four master plans designed for Khartoum.
The main motive for the reduction is commercial as land prices exploded in the last decade. The main reasons found in the official document (Khartoum province, 1992), are rationalized land and reduce the cost of the basic.

(5-11-2-1) Doxiadis plan (1960-1990):

Proposed plot size ranging from 252 $m^{2,}$ -760 m^2 as shown in details in table (5-12) the program analyzed the existing of the relationship between houses, rooms and persons, see table (5-12) but didn't propose further relationships for the future.

	Khartoum	**Omdurman**	**Khartoum North**
Min plot size	252 m^2	252 m^2	25 m^2
Max. plot size	760 m^2	760 m^2	720 m^2
Total net area	2500 hectare	1450 hectare	1000 hectares
Total gross residential area	5000 hectares	2900 hectare	2000 hectare
Average family size	6 persons	8 persons	7 persons
No. of population	359,000 persons	267,000 persons	167,000 persons
Residential units	59,800 units	33,000 units	23,976 units

Table (5-12) Proposed plot size and residential units
(Source: Doxiadis 1960-1990)

(5-11-2-2) Doxiadis plan (1960-1990):

Aggravated that situation, as they had stated certain measurements for density control, and they accepted existing condition of dwelling and layout within neighborhoods (see table 5-12). The plan proposed to increase the residential density by 30%, the plan also, like the two earlier ones, didn't state measurements for density control. It reduced the gap between plot sizes of low income group, 200 m2 and high-income group, 300 m2 but their role limited to reduction of plot size.

(5-11-2-3) Mefit plan (1975):

Stated two approaches to increase gross residential density:

1-Regarding areas of public use

2- Regarding private dwelling.

The aim regarding the dwelling is to achieve the minimum surface per head, but with due regard to the fundamental social need that each dwelling must include an open-air yard. In new areas the plan proposed building typologies differentiated according to plot category and size, important that reduction plot size should be implemented in such a way as to reduce differentiation between residential classes, but the recommended plot sizes did not satisfy that purpose as shown in table (5-13), So that the plan has located the total increase in the residential density to the new areas: 50 persons per hectare in residential zone in proximity to already developed areas and 100 persons per hectare for the others.

	Khartoum	**Omdurman**	**Khartoum North**	**Average of the three towns**
Persons per family	4.4	7.1	5.7	5.6
Persons per house	3.3	3.9	3.2	3.5
Persons per house	1.6	1.3	1.5	1.4
Persons per room	2.1	2. 3	2.6	2.3
Persons per house	6.9	8.9	8.5	8.1

Table (5-13) The relation between houses, rooms, and persons

(Source: Mefit 1975- 1990)

(5-12)CODE, STANDARDS, AND GUIDE LINE:

Standards for dwellings were first established by the Dudley Report in 1944, like its predecessor, the second major report on housing standards concentrated on houses, for which it established new space standards based on room size.

The Dudley Report was accompanied by the 1944 Housing Manual with fleshed out these standards. These standards were further refined and developed by the 1949 Housing Manual. The standards were raised once more by the Parker Morris Report of 1961. This report was chiefly concerned with houses. Flats were essentially treated as stacked-up houses (table 5-14).

	8th & Howard Family Apartments - affordable housing San Francisco, CA
	Net area: 56.45 m^2 | No. of habitable rooms: 3
	Reference: Ben Gates. "Enterprise, financing and solution for housing and communities." http://www.rosefellowship.org/images/uploads/2006-11-05_CCC-Urban_Family_Living_Precedents.pdf (accessed 9 15, 2010).
	Izola Social Housing, Izola, Slovenia, Slovenian Housing Fund and Community of Izola
	Net area: 50.64 m^2 | No. of habitable rooms: 3
	Reference: Nico Saieh. Arch Daily. http://www.archdaily.com/3245/izola-social-housing-ofis-arhitekti/ (accessed 3 20, 2011).
	AHMM's mixed-tenure housing on the Grand Union Canal's Adelaide Wharf in Hackney, east London
	Net area: 66.1 m^2 | No. of habitable rooms: 3
	Reference: Matthew Turner. PD The architects' website. http://www.bdonline.co.uk/how-ahmm-delivered-housing-with-real-value-at-adelaide-wharf/3127796.article (accessed 10 15, 2010).
	Carabanchel Housing, Madrid, Spain, EMVS. Empresa Municipal de la Vivienda y Suelo de Madrid.
	Net area: 62 m^2 | No. of habitable rooms: 3
	Reference: Nico Saieh. Arch Daily. http://www.archdaily.com/4750/carabanchel-housing-dosmasuno-arquitectos/ (accessed 2 20, 2011).

Table (5-14) Social housing area, room number example

Following the example of these early standards, all nations have established their own codes, see table (5-14). In every country today there is a housing guideline or code upheld by its state to ensure the essential requirements for the residents and to control the quality of their life.

The following table illustrates the housing guidelines and standards which will be taken into account by the researcher only in the matters related to the basic needs that do not seem to depend on socio-cultural characteristics.
Table (5-15) illustrates example in different countries of Social housing in term of habitable rooms' number and net area.

Ref No.	References Name
H (1)	Metric Handbook –planning and Design data(Book)/ed. Littlefield David-(s.i):Elsevier Ltd,2008-Third Edition
H (2)	Housing Space Standards, A report by HATC Limited for the Greater London Authority (Report)- London: Greater London Authority, 2006
H (3)	International Residential Code, For one and two Family Dwellings (Book)-(S.1) INTERNATIONAL CODE COUNCIL, INC, 2006
H (4)	Affordable housing Design Guidelines (Online)//Queensland Government, Department of Communities -September 2004-127,2010.http://www,qchc.asn.au/portals/o/Uploads/Affordable %20Housing/aff_ hsg_des _guidelines.pdf
H (5)	Egyptian Regulations for the Unified Construction(Report) Official Gazette-Cairo: (Elwaqae Elmasria),2009

Table (5-15) Housing code, standards and guidelines

SUDANESE HOUSING CODE AND STANDARDS:

Table (5-16) illustrates housing spaces standards code in term of habitable rooms' number , the minimum width and net area, the rooms area between 9-16 mm while the services spaces in b(9-1.1.50) mm , the storage area was not taken in the table

item	Spaces	Min width (m)	Area (mm)
1	Bedroom	3.00	9.00
2	Eating room	3.00	9.00
3	Sitting room	4.00	16.00
4	Livining room	4.00	16.00
5	Khitchen	3.00	9.00
6	Bathroom	1.50	5.50
7	Tolit	1.00	1.50
8	Corridors	1.20	-

Table (5-16) Sudanese housing space standards code

(5-13) CONCLUSION:

Residential density can measured in five ways: Site, net, gross, urban and metropolitan. All five residential density measures calculated using the same basic ratio formula.

There are several basic approaches to density planning. The first is to restrict the size of each building plot through local zoning ordinance. This method restricts the number of families allowed to occupy a specific area within residential zoned areas; there may also be restrictions on the number of multiple family dwellings or the size and capacity of an apartment building. The second approach involves clustering residents into fewer structures, such as row houses or semi attached houses. The third approach combines plans; it involves zoning part of t0he area for single family residences, specifying other areas for row houses, and this area for others.

The World Health Organization determined the suitable gross area for families include 3-5 persons by 260.3 m2, the built up area represented areas about 123.3 m2, and the surplus of area represented 53% of the gross area, and these areas increases by the amount of families.

Sudan was the low country in terms of such densities. At the end of the sixties the densities increased to: 24- 36 persons per acre for the first class residential areas and 60-80 persons

per acre for the 3rd class residential areas. The control of density in a specific neighborhood connected with two different items:

1-The dwelling and their distribution within the neighborhood

2- The people and their distribution within the dwelling.

In my view of point I think that to control the horizontal expansion in the Grater Khartoum connected with the social connected with the average of Sudanese families numbers beside that it also connected with the culture of families to have and own a big size of house area in spite of that they did not used this area and spaces daily but they be pleasure by it , if the planning authorities opposed small size and change the polices of building law to own a small plot area .

(6-1) INTRODUCTION:

The case study of this research is the KM, in Khartoum State, Sudan (Figure 6.1). This comprises Khartoum, Khartoum North and Omdurman. It has an area of 22,000 km. sq. at a latitude 15°33.01N, and longitude 32°31.93E. It situated around combine the White and Blue Niles.

According to Abou Salim (1991) Khartoum was the first recognized when it is chosen to be the capital of the Turco-Egyptian rule during the 1830s. During this same period, locate Omdurman and Khartoum North continued as a mere village. The capital shifted to Omdurman in 1885 after the fall of Khartoum under the influence of the Mahadits. Omdurman then became the focus of the nation and the other neighboring African countries. The Plan of the capital Khartoum took place in 1898 with the start of the Anglo-Egyptian condominium which lasted until independence in 1956.

During this period, Khartoum increased in administrates, commercial and industrial importance, while Khartoum North and Omdurman was growing. Construe the Blue Nile and White Nile Bridge in 1910 and 1928 respectively, linked the three towns which now known as Greater Khartoum.

Urbanization is not a matter of an individual or a group changing residence or their work, but involves changes in patterns of behavior and thinking, in attitudes towards work in a community that characterized by an ever changing division of labor and work patterns. As in the words of an urban sociologist: *"The urban style of life, with varying degrees, characterized by rapid change, rapid social mobility, weakening of the ties and intimate personal relations that characterize life in traditional primary or kinship groups, secondary controls, conflict of values and norms and considerable changes in the structure and function of the family, a materialistic approach of living, and a higher rate of deviant behavior,",* (Younis, 1972).

(6-2) THE CHOICES OF GREATER KHARTOUM AS CASE STUDY:

Although Khartoum has been the center of many studies, so it choice as a case study area considered to be the sensible one because:

- Firstly combine different example of houses is difficult to find in other towns.
- Secondly the residential density in town is low compared with other countries.
- Thirdly, many kinds of housing schemes implemented in Khartoum.

Khartoum, when chosen for the first time as a capital in the Turk Egyptian period in 1838 had a population less than 30,000. The fall of Khartoum to the national Mahadiest rule shifted the importance to Omdurman, which became the capital city and one of the most important Affrications towns in the 1887. Omdurman which was a village with 240 persons flourished and in 1887 had a population of 150,000. Omdurman continued to be the capital until 1898 when the Anglo- Egyptians re-conquered the Sudan, and Khartoum became the capital. Khartoum continued to grow, and in 1956, the independence year for Sudan, its population was 350,000. The last scenes in 1993 estimated the population of Greater Khartoum to be 3, 8 million. The increasing in population reflected on urban form and structure and followed by expansion in the city planning (see fig 6-1)

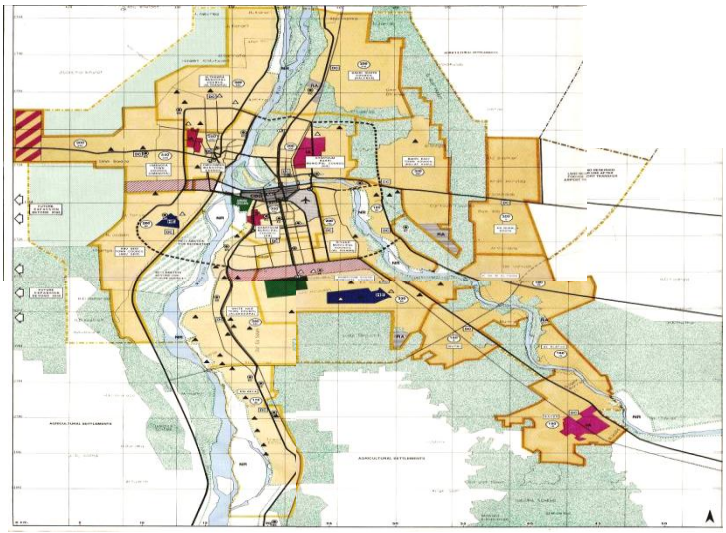


Fig (6-1) Khartoum map (Source: Ministry of Planning)

(6-3) DEMOGRAPHICS:

Sudan is the largest country in Africa. Dominated by the Nile and its tributaries, it borders Egypt, Libya, Chad, the Central African Republic, the Democratic Republic of the Congo, Uganda, Kenya, Ethiopia and Eritrea (Table 6.1). It has over 800km of coastline along its northeastern border, providing access to the Red Sea. Sudan has a tropical south and arid desert in the north. It is flat, with mountains to the east and west (Sudan, 2008).

According to the latest census of 2008, the total number of inhabitants in Sudan reached 39.154 million (CBS, 2009). About 30% of the population are urban, concentrated in Khartoum Metropolitan, Sudan divided into 26 states, of which Khartoum is the Capital and the most attractive in terms of services. It covers an area of 22,000 Km² and in the last decades, many reason leads to make it a metropolitan city, of a population more than 8 million inhabitants.

State	%	Population (000)
Sudan	**100**	**35056**
Northern	2.3	789
Nahr Alnil	3.6	1269
Red Sea	3.8	1346
Algedarif	4.7	1655
Kassala	5.9	2061
Khartoum	17.9	6268
Algezira	11.8	4133
Sinnar	4.3	1518
White Nile	5.7	2012
Blue Nile	2.7	936
N. Kordofan	8.7	3046
S. Kordofan	5.0	1756
N. Dafur	6.3	2208
W. Dafur	4.2	1483
S. Dafur	13.1	4575

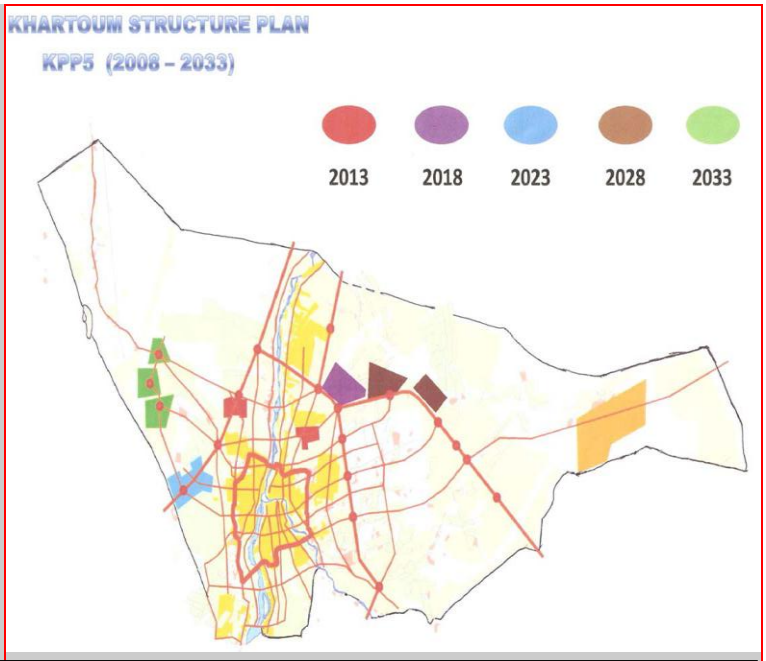


Fig (6-2) Khartoum Structure Plan KPP5 2008-2035

Table (6-1) Estimate of population Distribution by state2012 (Source central Bureau of statistics)

The national growth rate, plus move from rural to urban area, and from other states help in increasing the area of living and congestions in socioeconomic and health services. The drought in decades, which hit many of regions, plus the long wars in the Sudan (which now stopped due to a series of peace agreements) is also another factor which makes Khartoum State a destination of many of the migrants with different cultures (Etahir,M 2008). Fig (6-2) show Khartoum expects Structure Plan KPP5 2008-2035.

(6-4) CLIMATE CONSIDERATION:

Khartoum, the Sudan's Capital extending from latitude 15°10 N to 16°30 N, characterized by four well marked seasons (Perry, 1991):

i. Winter season stable, dry air with low relative humidity (sometimes as 20%) covers the region.
ii. Hot, dry season through the period March to June, where daily mean maximum temperatures top 40°C. Temperatures peak by the continual beginning 23 May at 44.1°C. Relative humidity remains below 30%.

iii. Rainy season in July characterized, increasing clouds, higher humilities, and occasional rainstorms. Average rainfall ranges from north to south from 100mm to 200mm.

A second, shorter period of a high temperature from mid in September in which daily maximal dose doesn't reach as high as earlier in the year, but the figures of over 40°C must also expect.

Khartoum, like many other hot desert cities, experiences, Zami & Lee (2011) and Omer (2011) state that climate of Greater Khartoum, which lies on the southern fringe of the Sahara desert, has classified as a hot desert, It's hot and dry.

Between November and May with a three month was cooler season between December and February. A three–month rainy season prevails between June and October, at least 60 percent of the annual rainfall is so low and considerable erosion can take place on sloping land. With evaporation rates in the region 3000 mm/year, the annual rainfall is only 150 mm. Wind direction follows a standard pattern. There are Prevailing winds from the north during the dry season and from the south during the wet season. Strong north winds are the main cause of corrugations found in the soils west of Omdurman. During the instability period of May-June, a "Haboob" wind saw. In those months, the sunshine is about 95% of the daily hours.

(6-6) THE C ASE STUDY SELECTION CRITERIAS:

Regarding the case study GK, statistics show that the population of GK increases with annual rate 8%. The number of the internet users increases by 23%. This means that transform traditional societies towards virtual societies in GK is going quick (Table 6.2).

As argued by Abler; 1970, and Mitchell, 1999; the size of the city determined by the amounts and kinds of information, flowing into and out of it. And its connection with other cities, in the national network flow. A big difference in urban development between GK and other urban areas in Sudan could observe (Table 6.1)

The researcher selected GK as the case study because:

1. It is the most developed area in activities and societies;
2. It has a dominant population with different culture;

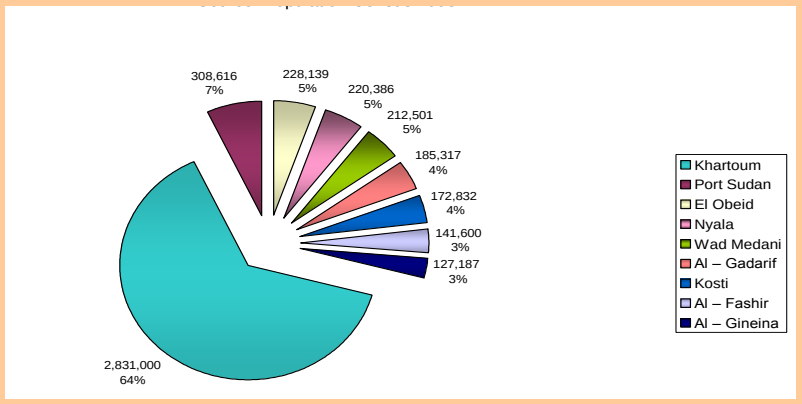


Fig (6-3) Urban Growth and population of the Sudan's Nine largest Urban Censuses (Source Population census; 1993*)*

The dominated of the Greater Khartoum urban area over the next largest urban centers' has increased as well. In 1956 it was 4.7 times the second largest, and by 1983 it had become 6.5 times the size of Port Sudan (Davis, 1991). By the year 1993 Khartoum had accommodated over 64% of the national population as its population was equivalent to the total population of the next 32 largest urban centers'.

(6-7) STATUSE OF URBAN GROWTH IN GREATER KHARTOUM:

Greater Khartoum's population growth is influence by the high rates of rural-urban migration. The latest census of 2008 depicted that the annual population growth rate of Greater Khartoum is 3.5 percent, while the annual rate of migration is 4.6 percent, giving a total growth rate of 8 percent. The census also has shown that, the rural-urban migration rate exceeds 2 percent for the large cities in Sudan (Table 6.2).

The city	*P0pulation 2008*	*Annual rate of growth*
KM	**5274321**	**8%**
Wadi Madani	**423863**	**3.9%**
Port Sudan	**283953**	**4.1%**

Table (6-2) Population Growth Rate (Source: WWW.CBS.gov.sd)

The decades since Sudan gained its independence in 1956 have seen the emerge of a process of rapid urban growth, characterized by an uneven distribution of urban populations

over the various regions, the dominance of a few major cities and the concentrate of population on the conurbation of Greater Khartoum in particular (Gore, 1998).

Hassan, 1996, described how the city of Khartoum in the 1980's developed into a microcosm containing Pastoralism, Ruralism and mitigated Urbanism because of the rural–urban drift mentioned earlier in this study (see fig 6-3). He sketched the urbanization of Khartoum out in the following statement:

"Urbanism conceived as an interactive aggregation of people and resources with service and economic roles of individuals, groups and institutions within a defined spatial and location of domain. This notion of Urbanism held true for the urbanization of Khartoum until the 60's when heterogeneity intensified and a strong social and economic differentiation of urban space developed. This continued with a further influx of migrants and evolved into spatially defined groups and subcultures constantly reinforcing their intra–cultural existence," (Hassan; 1996)

(6-7)CASE STUDY PLANE, TECHNIQUES AND STAGES:

The technique which is used to collect data concerning dwellings and their inhabitants is the field survey and site observation for recording the use of houses spaces in conducting domestic routine by using a questionnaire to test resident's adaptability.

The first major consideration in observational studies is household characteristics

The second consideration in observational studies is the type of behavior, the daily life and use of spaces, timing and recording.

The observation study converted the activities such as:

- Meals (eating, food preparation).
- Home work (studying, hobbies, looking after children, cleaning house, laundry and ironing).
- Socializing and entertainment (receiving guests, watching television or video, playing, visiting relatives and friends)
- Sleeping and relaxing.
- Away (at work, at school, shopping ect.)

The third consideration in observational studies is the areas of the house's spaces in sq .m and spatial arrangements

The fourth consideration in observational studies is the change in built up area (time and

development)

The research covered all the type of housing Villa type, Court-yard type, and Apartment types.

Conceptual frameworks are a type of intermediate theory that has the potential to connect to all aspects of inquiry (e.g., problem definition, purpose, literature review, methodology, data collection and analysis)

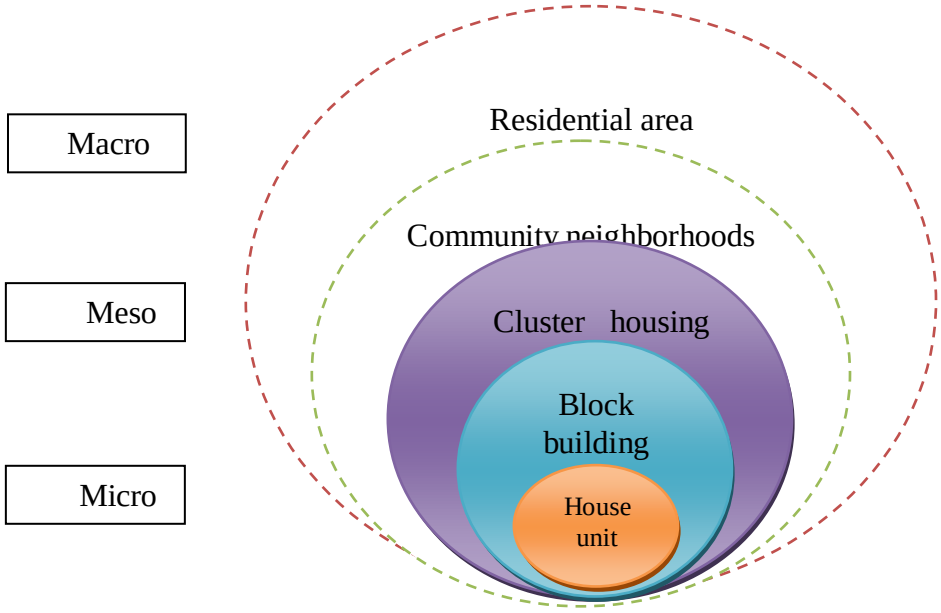


Fig (6- 4) Working across scale Limits of survey (source: Author)

(6-8) CASE STUDY'S TARGET GROUP:

- I took in this study 230samples sed as case studies The research focus on the housing in Greater Khartoum, which are organized and built by the Government sector (Housing Development Fund) at the both levels of house and cluster, focusing on low income housing groups.
- Omdurman : Aliscan Dar Alslam,Hai Alomda , Althoura Hara 103,38,72, and 76)
- Khartoum: Alamal , Alriad, Almogran (AlnilynTower, Alnuzha
- Khartoum North: Al wadi AlakhdaI present in this study 20 case studies covered all projects and house types.

(6-8-1) House Types and Typologies in the target group:

(6-8-1-1) According to the house type:

Table (6-3) illustrated the percentages and numbers of house types according to neighboring relation.

	Types	Number	Percentage %
	Detached	**65**	**33**
	Semi-detached	**23**	**29**
	Row	**62**	**10.1**
	Residential complex	**224**	**27.9**
	Total	**74**	**100**

Table (6-3) Target group house types (Source: Author)

(6-8-1-2) According to the design types and locality:

1- Villa type districts

Table (6-4) illustrated the percentages Villa type districts which are selected in the case study , the total number of the selection sample represented 25% of the total numbers were covered located in 4 districts.

No	District	Villas units No.	Apartments units no.
1	**Omdurman**	**75**	**32**
2	**Khartoum**	**225**	**216**
3	**Khartoum North**	**0**	**0**
4	**Total**	**300**	

Table (6-4) Target group Villa type districts (Source: Author)

2- Apartments type districts:

Table (6-5) illustrated the percentages Villa type districts which are selected in the case study, the total number of the selection sample 15%of the total numbers were covered, located in 4 districts

No	District	Villas Units No.	Apartments Units No.
1	Omdurman	75	32
2	Khartoum	225	216
3	Khartoum North	0	0
4	Total	300	248

Table (6-5) Target group Apartments type districts (Source: Author)

3- Courtyards' house type districts:

Table (6-6) illustrated the numbers of house units and districts in courtyard type, there 10 districts were covered Greater Khartoum from year 2000 to 2013 which are implemented and dwell by residents located in 7 districts

Residential area	District	Year	Units No
Alandalus B.17	Khartoum	2000	2500
Alamal B20+23	Khartoum	2000	2100+950
Tilal	Khartoum	2003	950
Alwadi Alakhdar	Khartoum North	2004	3000
Althawrah Hara 72,73,76	Omdurman	2006-2007	2200
Dar Alsalam	Omdurman	2009	16000
Alfath	Omdurman	2011	4000
Alsarha	Omdurman	2013	7000

Table (6-6) courtyard type districts selected in the case study (Source: Author)

4- (6-8-3) Target group study work stages:

There were two stages to the study work:

- **Stage 1**: The first stage was to sift and select schemes and then identify standard dwelling typologies from a selection of housing schemes. This comprised over 250 housing schemes submitted to CABE in 2009 and for which detailed information was available(fig 6-7)
- **Stage 2**: The second stage was the sampling and measurement of 200 different standard dwelling types.

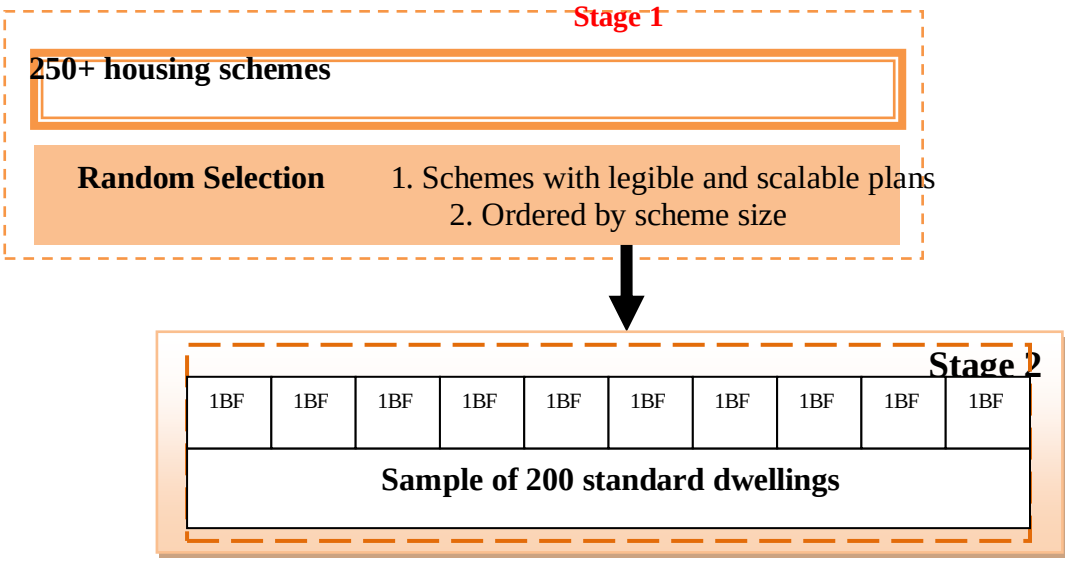


Fig (6-7) Stages of the case study (Source: Author)

(6-9) DESCRIPTIVE SELECTION OF THE CASE STUDY SAMPLES:

(6-9-1) Alamal District project

Alamal Housing(2) located in Khartoum Distance from Khartoum Center: 22 km.
Date created: 2002
Location: Southeast Alkalakla Street and south of Hope 20

Fig (6-8) Alamal district image

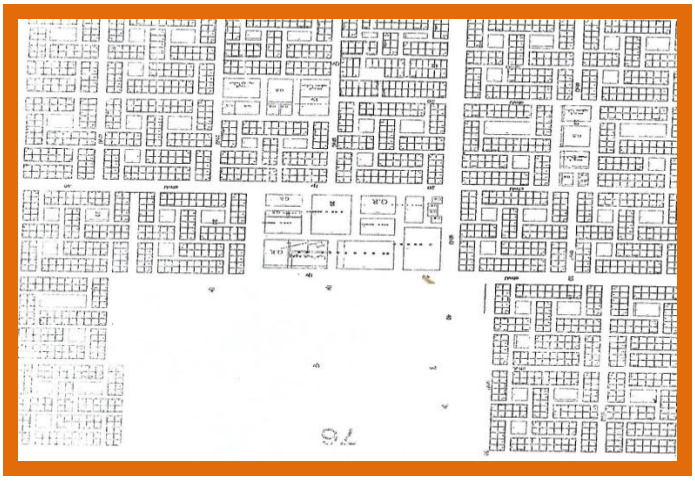
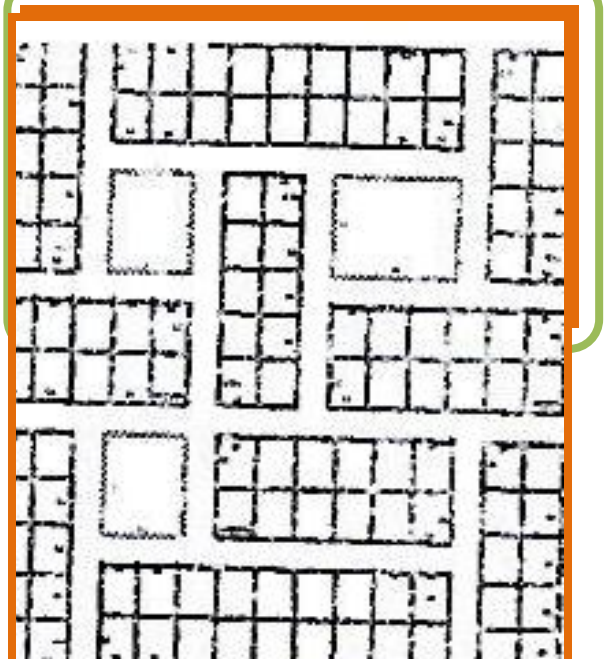


Fig (6-9)Alamal residential area cluster design

Services: electricity and water services are available, Add to the existence of the basis of schools and Healthy centers, mosques and small local markets, and the Police Department



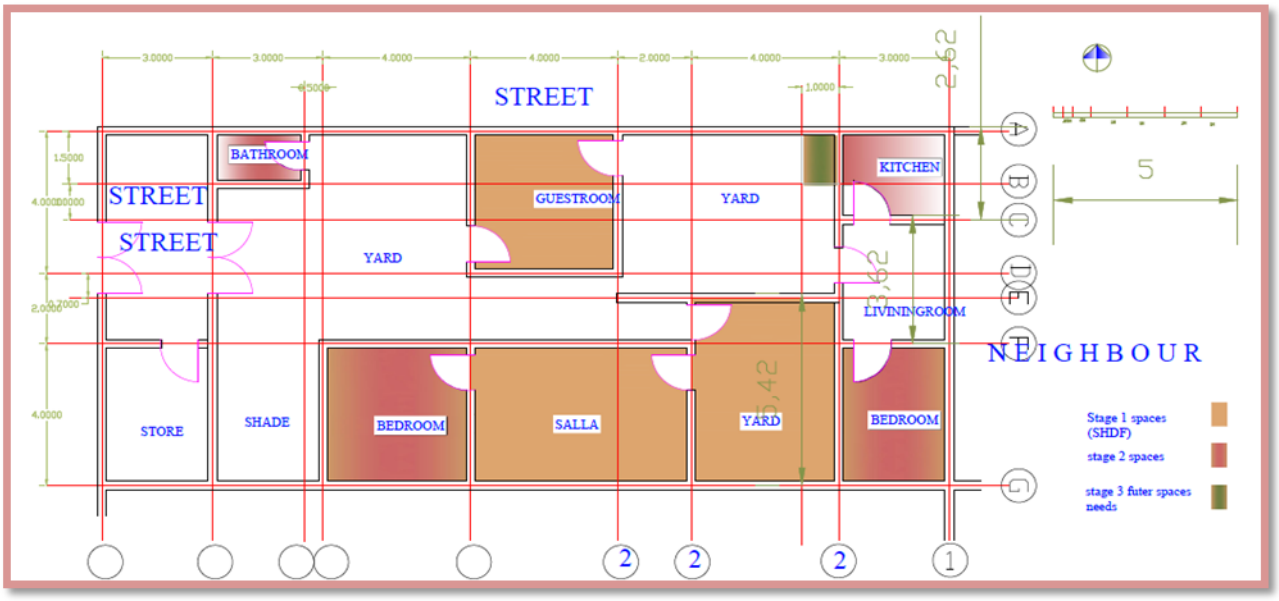


Fig (6-10) Seif Mohammed house (Source: Author)

(6-9-1-1)Seif Mohammed house

1- Classification Data:

House types	House Aguirre	Plot No.	Block No.	Residential area	District Area
Court yard	By Government	23	10	Alamal	Jabal Aulia

Table (6-7) **Seif Mohammed house classification data** (Source: Author)

2- Household Composition:

The household consists of 4 persons, the head of household; at 51-60 years, a widowed woman and housewife. This family was extended family; it consisted of a son and one daughter between (15-25 years) university's students, another daughter of (25-40 years), High secondary in education level and did not work.

Figure (6-11) Time and activity zone in the house (Source: Author)

Fig (6-12) Sief Aldeen house living-room (Source: Author, 2016)

3- Socio- cultural and economic of Household:

Socializing male guest area located in the ground floor (salon) which uses by the sons for receiving their friends and male guests. There is a yard of the house; which is used by the family members for sleeping, guests' reception in the evening. Sleeping activities arrangements were affected when the guests come to the house.

4- The house components and the use of spaces:

A/Form and Physical Features :

Type	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**		**(6)**	**(7)**	**(8)**
Semi-detached	Bed- R	Saloon	Hall	Kitchen	Store	Bath	Balcony	Veranda	Yard
	2	1	1	1	2	2	0	0	3
	Sleeping	Reception		Living	Services		Multi- activities		

Table (6-8) House space configuration, numbers and activities(Source: Author)

B/Spatial Organization and configuration:

The size and layout of the home and entrance not injured, it allows having enough privacy. Despite of the house has a Physical Separation between male &female section, and have a private space to entertain family's guests, but washing activities in the house affected by the guests.

The family eats the daily meals in the living room and they agree with is important in the dwelling, it has the ability of a multiuse space in the house.

The children haven't especial room with enough space in which they can play on their own

G/ House and spaces area:

Plot area	Built up area	Room Occupancy	House expansion	Plot frontage dimension	Type of house
204 m^2	100-200 m^2	2	Horizontal	10 m	Courtyard

Table (6-9) Areas of the house in sq .m in Sief Aldeen house (Source: Author)

The kitchen has sufficient workshop space to prepare meals conveniently but doesn't have sufficient space for small children to play safety in the kitchen when the mother using it also; the bathrooms have not enough in the area.

5. **Option about user attitude:**

The change in the house:

The house was remodeled, resulting in changing sizes or uses of rooms because family size was growing up so that, they live in this house more than 8 years.
The head of household plan to remodel this home in the bathroom size and built additional bathroom. He finds that it is better for the family members to divide spaces and residential unit.

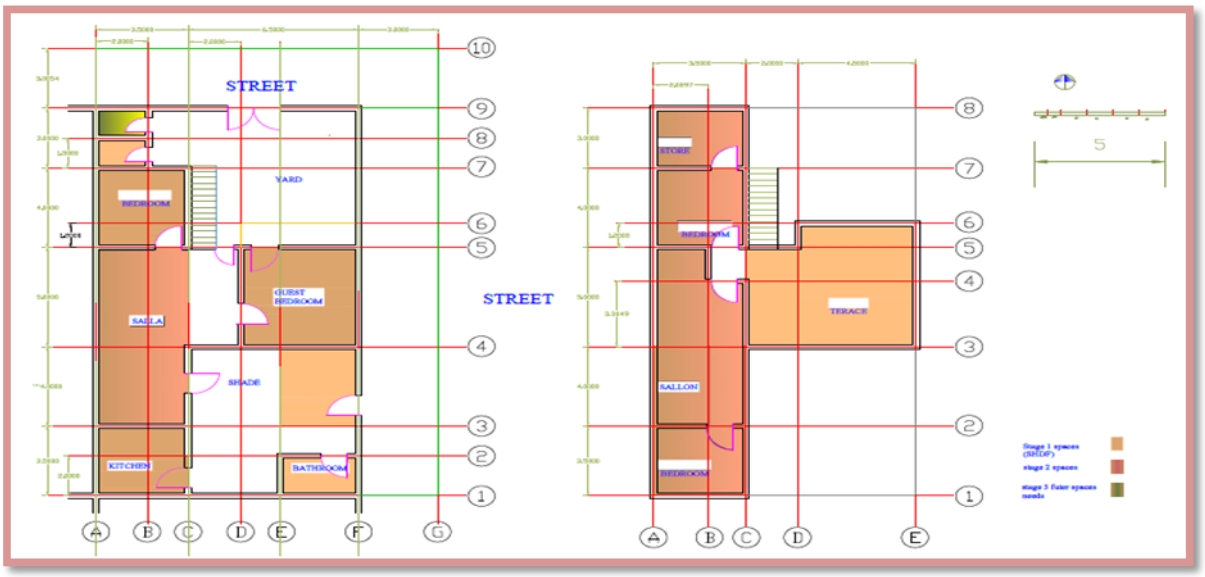


Fig (6-13) Alshafie Abdelwahab house Ground floor plan (Source: Author)

(6-9-1-2)Alshafie Abdelwahab house

1- Classification Data:

House types	House acquires	Plot No.	Block No.	Residential area	District Area
Court yard type	By government	147	7	Amal	Jabal Aulia

Table (6-10) Alshafie house Clasification Data(Source: Author)

2- **Household Composition***:*

The household consists of 7 persons, the head of the household, divorced man in age above60 years, his family was extended family, it comprises of a son between (15-25 years) university's student, and tow daughter between (1-6 years) the oldest daughter (25-40 years).

Fig (6-14) Sief Aldeen kitchen and livening room space (Source: Author)

3- Socio- cultural and economic of Household:

Most of the house guests are female (widowed woman) so, that the socializing female guests are more important than socializing male guest's area. The family is using a shade as a multiuse space in the house always and, they used bedrooms for sleeping and storage their belongs. There is a yard of the house; which is used by the family members, in the evenings for playing, and sleeping at night.

4- The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Semi-detached	**Bed R**	**Saloon**	**Hall**	**Kitchen**	**Store**	**Yard**	**Shad**	**Balcony**	**Veranda**
	3	1	1	1	1	1	1	0	0
	Sleeping	Reception		Services			Multi-activities		

Table (6-11) House space configuration, numbers and activities (Source: Author)

B/Spatial Organization and configuration:

The size and layout of the home and entrance not injured, so that it allows having enough privacy. The house has a partial Separation between male &female section and it have a private space to entertain guests from other members of the household. The family eats the daily meals in the shade and they agree with is important in the dwelling. Shad e has the ability of a multiuse space in the house, and when they receive guests, washing activities was affected. The children haven't a room with enough space in which they can play on their own, also the room space area was not allowed for movement around furniture.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
204 m^2	100-200 m^2	Horizontal	10 m	Courtyard

Table (6-12) Areas of the house in sq .m in house (Source: Author)

The kitchen has not sufficient workshop space to prepare meals conveniently but it doesn't have sufficient space for small children to play safety in the kitchen when the mother using it also the bathrooms have not enough. The storage area is not enough to suit the household needs, they store their possessions (closets, garage, attic, storage lockers, etc.) in the bedrooms, also the area of the bathroom is not enough and the family plan to add additional one. There is no space in the house use an insufficiently by the residents, therefore they furniture did provide a lot of space area to move around it.

Fig (6-15) Alshafie Abdelwahab Activities

5- Option about user attitude:

The change in the house: Resulting in changing sizes and uses of rooms the house has a new building. The household plan also to remodel this home by build additional bathroom, they also plan to add another salon. They agree to add the number of bedrooms conversely decreasing the area of it He finds that it is better for the family members to divide spaces and residential unit with them self.

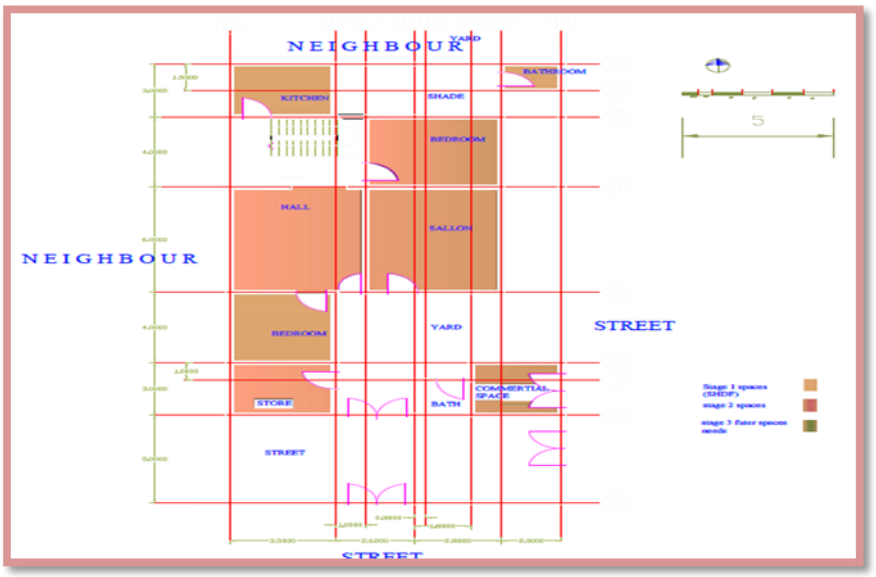


Fig (6-16) Mohammed Hassan house Ground floor plan (Source: Author)

(6-9-1-3)Mohammed Hassan house:

1- Classification Data:

House types	House	Plot No.	Block No.	Residential area	District Area
Court yard		547	9	Amal	Jabal Aulia

Table (6-13) Areas of Mohammed Hassan house in sq .m (Source: Author)

2- Household Composition:

The household consists of 10 persons, the head of household worked in the Governmental sector (60-51) years old, and his wife 41 years old, a housewife, they bought the house since 10 years ago. This family was extended family three sons between (20-25 years) university's students, four daughters between (1-6 years), the oldest daughter 41 years old was marriage, lived in the house with their children.

Fig (6-17) Mohammed Hassan guest's room

Fig (6-18) Mohammed Hassan houses the used of shade as multi activities

Socio- cultural and economic of Household:

The mother and her daughter were cooking every day in the kitchen between 9 to 11 o'clock Am. The family is using the Salla as a multiuse space in the house always (for eating, watching TV, and for family socializing). The house has a Physical Separation between male &female section, and have a private space to entertain guests from other members of the household.

3- The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Semi-detached	**Bed R**	**Hall**	**Saloon**	**Kitchen**	**Store**	**Shad**	**Veranda**	**Yard**	**Balcony**
	3	1	1	1	2	1	1	2	1
	Sleeping	Reception		Services			Multi-activities		

Table (6-14) House space configuration, numbers and activities (Source: Author)

B/Spatial Organization and configuration:

The size and layout of the home and entrances are not injured, its allow having enough privacy. The house has a full Separation between male &female section and it have a private space to entertain guests from other members of the household. The family eats the daily meals in the Living room and they agree that it is important in the dwelling. Living room has ability of a multiuse space in the house.

The children haven't a room with enough space in which they can play on their own, but the house has enough space area for storage also, the house has a good arrangement or gust's space therefore all activities in the house does not affected by them when they came.

***G/* House and spaces area:**

13.5	Built up area	House expansion	Plot frontage dimension	Type of house
204 m^2	More than 200 m^2	Vertical	10 m	Courtyard

Table (6-15) Mohammed Hassan house space areas in sq .m (Source: Author)

The kitchen has not sufficient workshop space to prepare meals conveniently, but the bathrooms have t enough in spaces area and numbers. Bathroom and storage area is enough to suit the household needs so that, there are two storages in the house. All the spaces in the house are used an insufficiently by the residents.

4- Option about user attitude:

The change in the house:

The house has a new building of spaces, resulting in changing in family's sizes. They disagree to add the number of bedrooms conversely than decreasing the area of it. The head of household disagrees to divide spaces and residential unit by family members them self.

(6-9-1-4)Awad NorAldieen Mohammed house

1- Classification Data:

House types	House acquires	Plot No.	Block No.	Residential area	District Area
Court yard	By bought	144	10	Amal	Jabal Aulia

Table (6-16) Awad NorAldieen data classification (Source: Author)

2- Household composition:

Nuclear family, the head of household (41-50) years old, his work as Govern sector, and his wife (41-50) years old, a housewife high secondary level, they acquire the house by bought more than 8 years and, they lived in Khartoum more than 16 years old. This family consists of 6 persons, two (son and daughter) between (1-6) years old, kindergarten level a son between (7-14) years in Elementary school, a daughter between(25-40 years) Student, at high secondary school.

Fig (6-19) Awad NorALdieen female guests' room


Fig (6-20) Awad NorAldieen Mohammed house bedroom (Source: Author)

3- Socio- cultural and economic of Household:

The mother was cooking every day in the week in the kitchen between 9 to 11 o'clock Am. The family is using a living room as a multiuse space in the house always (for eating, watching TV, and for family socializing). The house has a Physical Separation between male &female section, and have a private space to entertain guests from the other members of the household

4- The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Semi-detached 1 story	**Bed R**	**Saloon**	**Hall**	**Kitchen**	**Store**	**yard**	**Shad**	**Veranda**	**Balcony**	**Garden**
	4	1	1	1	1	1	1	0	0	0
	Sleeping	Reception		Services		Multi-activities			Entertainment	

Table (6-17) Awad NorAldieen house (Source: Author)

B/Spatial Organization and configuration:

The size and layout of the home and entrance not injured, allow having enough privacy. The house has a full Separation between male &female section and it have a private space to entertain guests from the other members of the household, there are no activities affected and done by the family members when guests at the house. The family eats the daily meals in the living room and they agree with is important in the dwelling. The children haven't a room with enough space in which they can play on their own. The kitchen doesn't have sufficient workshop space to prepare meals conveniently (allowing for preparing meals

conveniently, allowing for appliances such as microwave, toaster, also it doesn't have sufficient space for small children to play safety in the kitchen when you are using it.

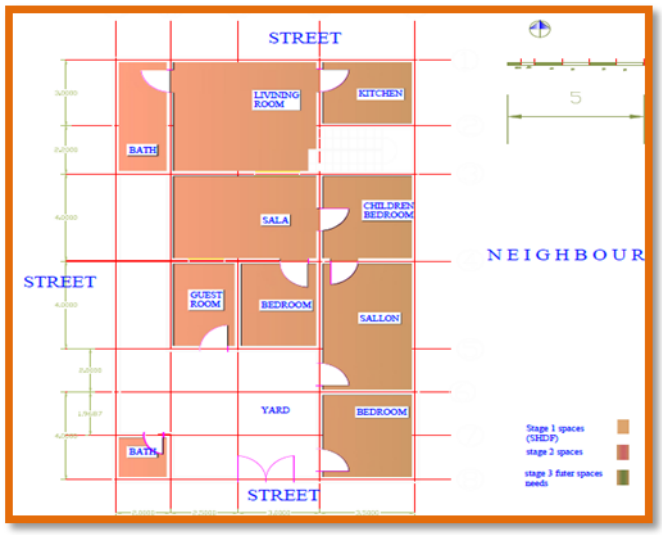


***Fig* (6-21) Awad NorAldieen Mohammed house Ground floor plan**

***G/* <u>House and spaces area:</u>**

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
204 m^2	≥200 m^2	Vertical	10 m	Courtyard

Table (6-18) Areas of the house in sq .m (Source: Author)

The storage area has not enough to suit the household needs so that they store their possessions (closets, garage, attic, storage lockers, etc. in the bedrooms, while the bathrooms have enough in spaces area and numbers. All the spaces in the house are used an insufficiently by the residents.

5- Option about user attitude:

The change in the house:

The house was remodeled, resulting in, for increased homework growing, through out of 18 years The family did not plan again to remolding space or making change in the uses of space .They disagree to divide spaces and residential unit by family members, also he disagree to add the number of bedrooms Conversely than decreasing the area of it.

(6-9-1) Alamal District project:

(6-9-2) Alwadi Alakhdar District project:

Alwadi Alakhdar housing :

sea east of the Nile. It is far from of Khartoum Center30 km Date created: 2004

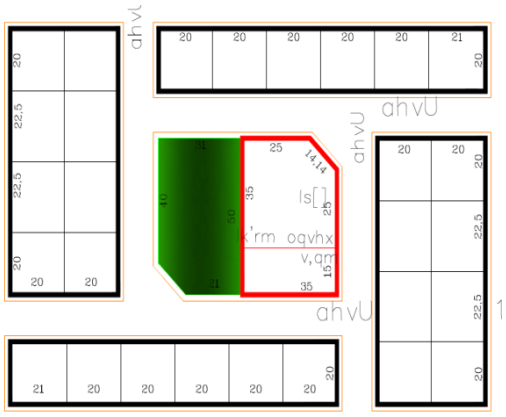
Location: sea east of the Nile, north-east of the Ring Road and North Hills Housing.

Consists of two categories: residential and popular housing economist

Fig (6-22) Alwadi Alakhdar Neighborhood

.

.



Fig(6-23) Alwadi Alakhdar cluster

Number of units: 3,000 housing units.360 square meters.

Residential Unit Area: 300

Services: electricity and water services are available, Add to the existence of the basis of schools and Healthy center, mosques and small local markets, and the Police Department

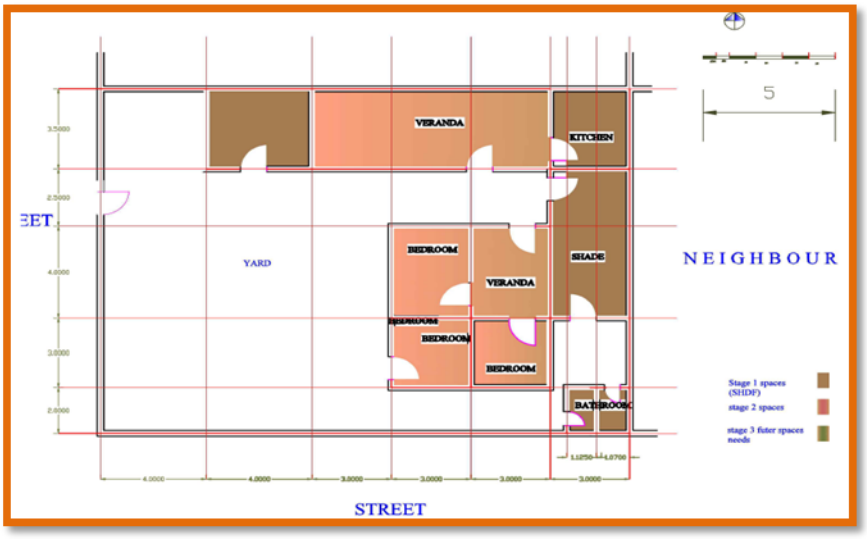


Fig (6-24) Naiema Ahmed Hasan house Ground floor plan(Source: Author)

(6-9-2-1)Naiema Ahmed Hasan house

1- Classification Data:

House types	House acquires	Plot No.	Block No.	Residential area	District Area
Court yard	Bought	701	20	Alwadi Alakdar	Sharg Alnil

Table (6-19) Naiema Ahmed Hasan house classification house(Source: Author)

2- - Household Composition:

The household is a nuclear family, the head of household more than 60 years old, he retired because for Pensions, and his wife (41-50) years old, a housewife, they acquire the house by buying it not more than 5 years when they migrated from another province to Khartoum. This family consists of 11 persons, four daughters between (1-6) years old, kindergarten level two (son and daughter between (15-25) years in High secondary level, and two sons between (25-40 years) university 's student.

Fig (6-25) kitchen space in Naiema Ahmed
(Source: Author)

Fig (6-26) Hosh usage in Naiema Ahmed Hasan house(Source: Author)

3- Socio- cultural and economic of Household:

The mother prepared the meals the kitchen between 9 to 10 o'clock Am. The family is using a shade for a multi-use space in the house always (for eating, watching TV, and for family socializing). They used the yard for eating activity, especially in the lunch and dinner. The house has a Physical Separation between male &female section, and have a private space to entertain guests from other members of the household. The kitchen has enough space area for preparing meals and for children to play in the corner while the mother does her work.

4- - The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Semi-detached 2 stories	**Bed R**	**Saloon**	**Hall**	**kitchen**	**Store**	**Veranda**	**Yard**	**Shade**	**Balcony**	**Garden**
	4	0	0	1	0	2	2	1	0	0
	Sleeping	Reception		Services		Multi-activities			Entertainment	

Table (8-20) Areas of the house and activities (Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. The house has a full Separation between male &female section. The family eats the daily meals in the yard or in the shade and they agree with is important in the dwelling. The children haven't a room with enough space in which they can play on their own. They have a corner in the kitchen to play in it while their mother does her work in it.

***G/* House and spaces area:**

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200	Horizontal	10 m	Courtyard

Table (8-21) Naiema Ahmed Hasan's Areas of the house in sq .m (Source: Author)

The kitchen sufficient workshop space to prepare meals conveniently, because the head of household made change by increasing the size of it. The storage area is not enough to suit the household needs. All the spaces in the house are used an insufficiently by the residents.

5- Option about user attitude:

The change in the house:

The house was remodeled, resulting in, for increased household growing .Also, he disagrees to add the number of bedrooms Conversely than decreasing the area of it if the family member is high in density, but if the average of the household few he preferred Conversely. The kitchen sufficient workshop space area to prepare meals conveniently, or for children to play while their mother cooking. The family did not plan again to remold or increase extra space or making changes in the uses of the spaces. They disagree to divide spaces and residential unit by family members.

(6-9-2-1)Mukhatar Mustafa house

1- Classification Data:

House types	House	Plot No.	Block No.	Residential area	District Area
Court yard	761	-	21	Alwadi Alakdar	Sharg Alnil

Table (8-22) Mukhatar Mustafa house classification data(Source: Author)5

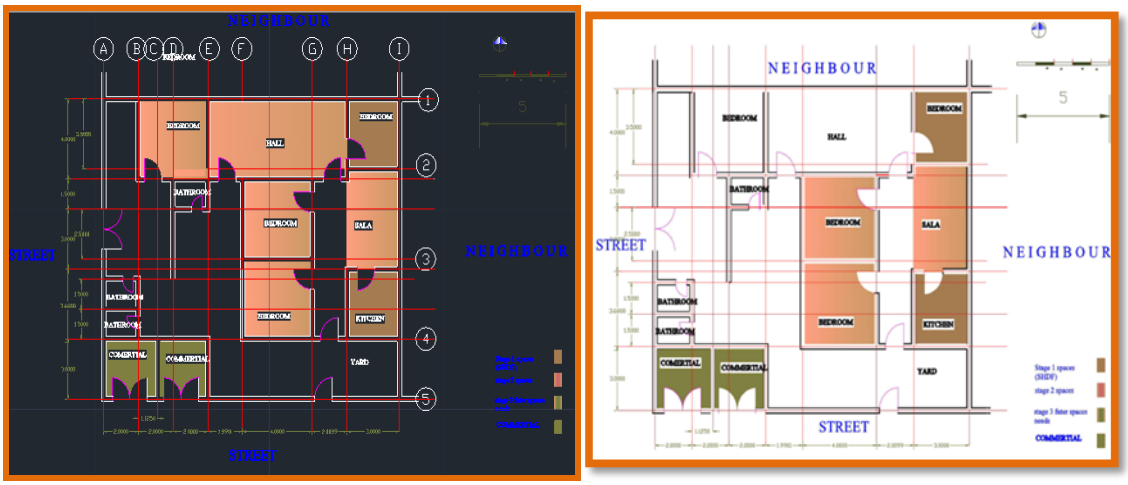


Fig (6-27) Mukhatar Mustafa house Ground floor plan (Source: Author)

2- Household Composition:

The household is a nuclear family, the head of household more than 53 years old, has worked self-employed since 3 years ago, but now he is retired because he disabled, and his wife (41-50) years old, a self-employed. This family consists of 6 persons, tow (son and daughter) between (15-25) years old, tow (son and daughter) between (25-40 years) a university's students.

Fig (6-28) Mukhatar Mustafa activities members

3- Socio- cultural and economic of Household:

The family is using a shade for a multi-use space in the house always (for eating, watching TV, and for family socializing). The house have not separation between male &female section, and have a private space to entertain guests from other members of the household and, when they came all the activities were affected with them in the house

Fig (6-29) The used of Hosh Mukhatar Mustafa house(Source: Author)

4 - The house components and the use of spaces:
A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Semi-detached 1 story	**Bed R**	**Salon**	**Hall**	**Kitchen**	**Store**	**Shade**	**Veranda**	**Yard**	**Balcony**	**Garden**
	2	0	0	1	0	0	1	2	0	0
	Sleeping	Reception		Services		Multi-activities		Entertainment		

Table (8-23) Mukhatar Mustafa house's spaces, numbers and activities (Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. But the spatial configuration not allowed when guests received.
The house has a partly Separation between male &female section and it have a private space to entertain guests from other members of the household. The family eats the daily r in the shade and they agree with is important in the dwelling.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200	Horizontal	10 m	Courtyard

Table (8-24) Areas of the house in sq .m (Source: Author)

The kitchen sufficient workshop space to prepare meals conveniently, but the storage area is not enough to suit the household needs. There is t enough space in all of the rooms to be able to move easily around the furniture, but space in all of the rooms limited and did to be able to arrange furniture. All the spaces in the house are used an insufficiently by the residents

5-Option about user attitude

The change in the house*:*

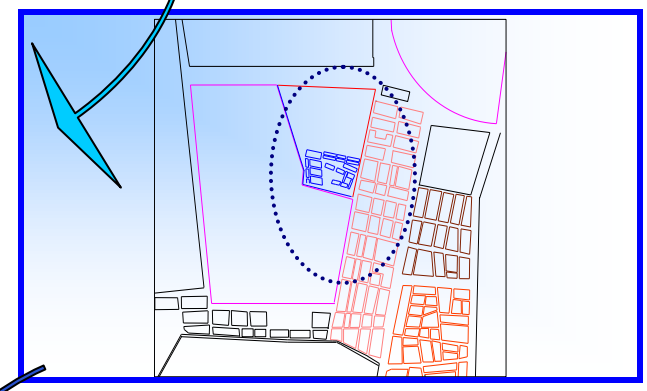
The house was remodeled, resulting in, for increased household growing. Also, he disagrees to add the number of bedrooms conversely than decreasing the area of it if the family member is high in density, but if the average of the household few he preferred conversely.

The family did not plan again to remold or increase extra space or making changes in the uses of the spaces. Disagree to divide spaces and residential unit by family members.

(6-9-3) Hai Alomda District project:

This residential part located between Wad-Nubaui Street in the East, Al-Nus Street in the West, Almasalma Street (Alkobri Street) in the South and, Ebrahim Awad Street in the North

Fig **(6-30) Hai Alomda image**



Date created: 2004

Location:
consists of three categories:
residential and popular housing
economist, investement housing
Vila type and appartement building
(Algamariek)

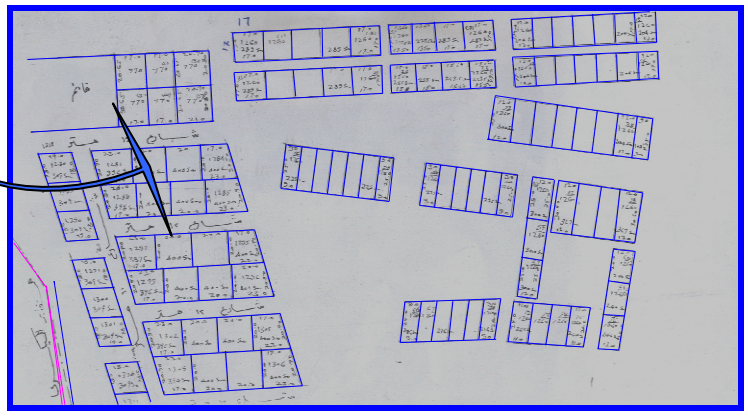


Fig (6-31) Hai Alomda cluster

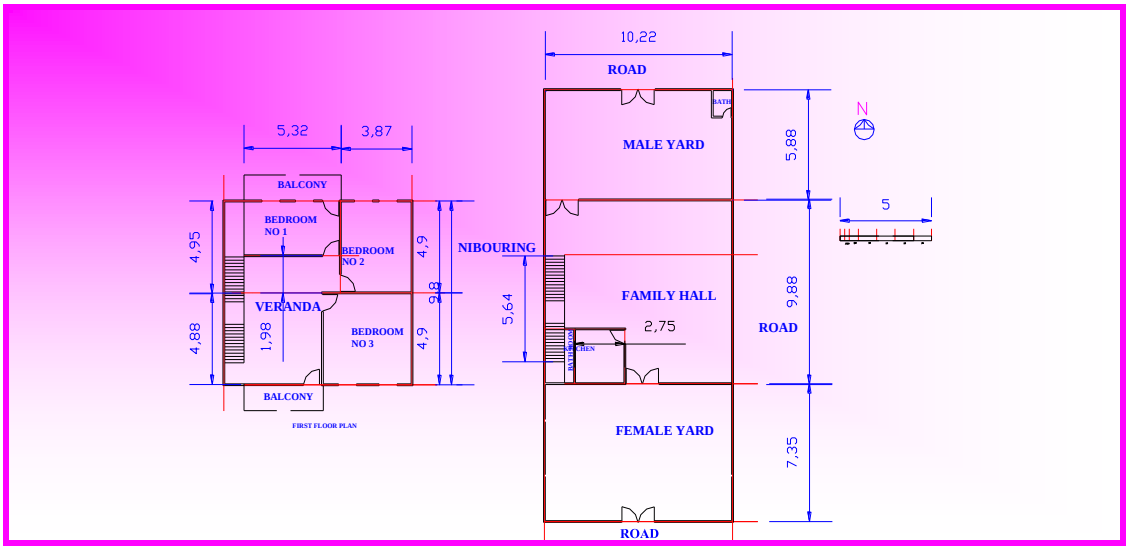


Fig (6-32) Ommer Suleiman house ground floor & first floor plan(Source: Author)

(6-9-3-1)Ommer Suleiman house:

1- Classification Data:

House types	House	Plot No.	Block No.	Residential area	District Area
Court yard	-	1	8	Wad Nubawi	Karari

Table (6-25) **Ommer Suleiman classification data *sq .m*** (Source: Author)

2- Household Composition:

The household is a nuclear family, the head of household more than 53 years old, he worked self-employed, and his wife (41-50) years old, a self-employed also live in this house less than 5 years. This family consists of 6 persons, two, daughter and son and) between (7-14) years old, a son and daughter) between (15-25) years at secondary schools.

Fig (6-33) Storage washing machine under the Stair

3- The previous day and the daily member's activities:

The mother started her day at 6 o'clock in the morning, then she prayed and prepared Morning Tea ironed the children's clothes in between 7:00-7:30 am. After her husband went to his work she cleaned the house and did her work in the house in between 8:00-9:00 am. , at 9 o'clock she started cooking at 10:00 am. , when finished, she had Breakfast around 11:30 am., after that she relaxed for some time watched Television, lessened to News around 11:00 am. She went to visit her friend's till 12:30 am. , then returned back to receive her children (the school bus reached around 12:30 am). The head of the household returned back from his work at 4:00 pm, the mother prepared the Dinner and they eat together in the hall (dining corner).The father studied and checked the lessons with his children, students in between 5:00-7:00 o'clock in the evening. They visit their relative's between 7:00-9:00 pm, after they returned back the children had Supper and slept at 9:00 pm. While the mother and her husband had Supper, and slept on the veranda with their children.

Fig (6-34) Omer Suliman house indoor and outdoor spaces

4- Socio- cultural and economic of Household:

The mother was cooking daily in the kitchen between 8 to 10 o'clock Am. The family is using a bedroom for a multi-use space in the house always. The house has no separation between male &female section, they received guest in the yard in the evening or in the male guest room and when they come to the house sleeping and eating activities were affected by them.

4 - The house components and the use of spaces:
A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Semi-detached 2 stories	**Bed R**	**Hall**	**Saloon**	**Kitchen**	**Store**	**Veranda**	**Yard**	**Balcony**	**Garden**
	23	2	0	1	1	0	2	3	1
	Sleeping	Guests's Re		Services		Multi-activities		Entertainment	

Table(6-26) House's space configuration, numbers and activities(Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home not injured, so that there are two entrances
The house has not a private space to entertain male guests from other members of the household, so that female and male are reception in the hall. The family eats the daily in the yard and they agree with is important in the dwelling.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200	Horizontal	10 m	Courtyard

Table (6-27) Areas of the house in sq .m (Source: Author)

The kitchen have not sufficient workshop space to prepare meals conveniently ,also the storage area is not enough to suit the household needs so that, they store their possessions in the bedrooms and under the stair also the bathrooms have not enough area (1.5meters square).
There is not enough space in all of the rooms to be able to move easily around the furniture and space in all of the rooms limited and did to be able to arrange furniture. The corridors and stairs within your home provide sufficient space to move around the home with area but, it is obstructed by furniture, stored items or decorative objectives also the amount of spaces in the corridors and stairs within your home makes it difficult to move furniture around. Balconies in the house does not use or have been badly arranged, it has been used efficiently by the designer. All the spaces in the house are used an insufficiently by the residents.

5- Option about user attitude:
The change in the house built up area: No change took a place or detected by the users or family residents in the house.

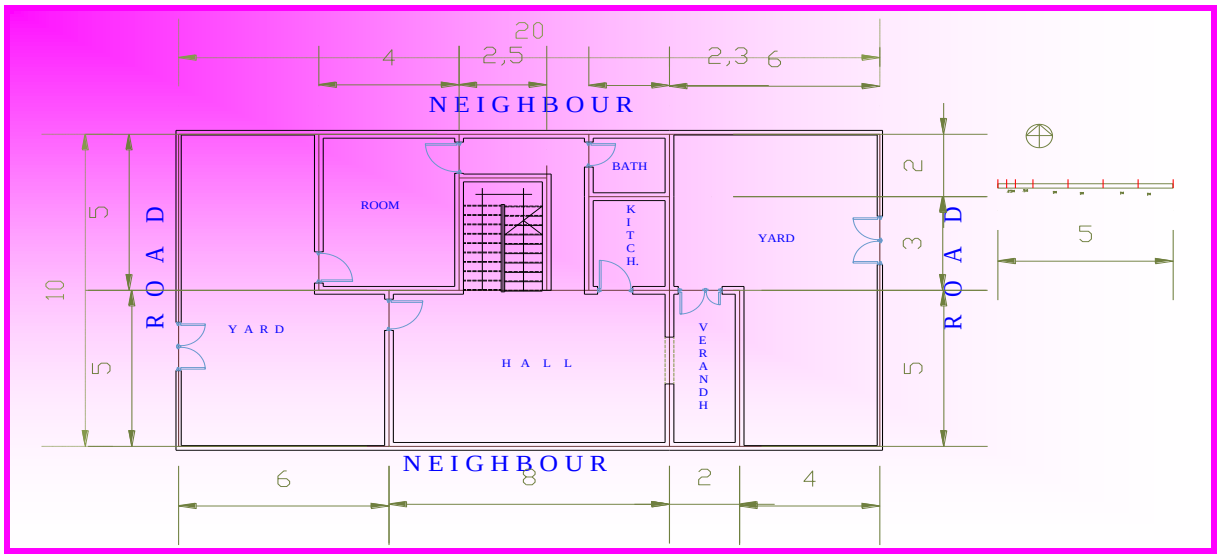


Fig (6-35) Egbal house Ground floor plan(Source: Author)

(6-9-3-2)- Egbal house

1- Household characteristics:

The household consists of 4 persons, the head of household; at 45 years, a widowed woman, and a housewife. Two sons, one is a 23 years, university student, the other is 10 years old, a student, and one daughter at 20 years, student.

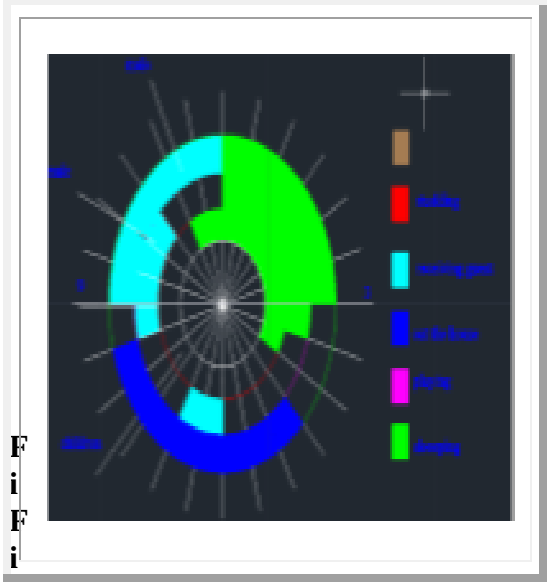


Fig (6-36) Table of activities members in Egbal house

Fig (6-37) dining area in Egbal house

Fig (6-38) yard used by the daughter for sleeping(Source: Author)

2- The daily life and the use of spaces:

The mother starts her day preparing the tea and Breakfast for her family at 7:00 am. She cooks the food and dose her house works in between 11:00-1:00 am. , she visits her friends in between 11:00-1:00 am. , or watches Television and relaxes till her siblings return back, then they have Lunch together at 4:00 pm. in the veranda no (1). The mother receives her guests in the hall. All the family members sleep in the rooms, especially the daughter sleeps in the balcony. Sometimes they use the yard to receive guests in the evenings or by her smallest sons for playing. Supper is served around 10:00 pm. in the yard; they sleep in the room except in obligatory cases (lack of electricity supply).

3- Area of the house in sq. m :

Plot area	Built up area	Courtyard	Plot frontage dimension	Type of house
200 m^2	200 m^2	300 m^2	10 m	Villa type

Table (6-28) Areas of the house in sq .m in Egbal house (Source: Author)

+

4- 3-The daily life and the use of spaces:

The mother starts her day preparing the tea and Breakfast for her family at 7:00 am. She cooks the food and dose socializing female guests are more important than socializing male guest area located in the ground floor while the sleeping area located in the first floor. They used the dining corner near the kitchen on the ground floor for eating Meals.

There are two yards of the house; the front yard which is used by the family members, the backyard uses by the child in the evenings she house works in between 11:00-1:00 am. , she visits her friends in between 11:00-1:00 am. , or watches Television and relaxes till her siblings return back, then they have Lunch together at 4:00 pm. in the veranda no (1).

5- The house components and the use of spaces:

A/Form and Physical Features:

House type	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**()**
Semi-detached 2 Stories	**Bed R**	**Hall**	**Saloon**	**Kitchen**	**Store**	**Balcony**	**Yard**	**Balcony**	**Garden**
	3	2	0	1	1	3	2	3	1
	Sleeping	Guests' Re		Services		Multi- activities		Entertainment	

Table (6-29) House's spaces, numbers and activities (Source: Author)

6- The change in the house:

There are no changes in the house, but the head of household plan to add salon for female guests in the front yard because of the reasons of non-private reception for male

Fig (6-39) Guests' room in Fatima house

Place / Type of Activity	Room	Saloon	Kitchen	Housh	Hall	Living R	Guest
Sleeping	○						
Cooking							
Sitting							
Multipurpose	○			○			
Guest reception							
Eating					○		

Table (6-24) Fatima house's table of activities members (Source: Author)

(6-9-3-3) Fatima Ali house

1-Household characteristics:

The household consists of 8 members are: The head of household; a65 year, man, he is a Teacher in abroad, His wife is 50 years old, a housewife, Three sons, one is 11 years old, a

student and the two sons are students, the eldest is 23 years and the youngest is 18 years, three daughters one of them is married and lives in her house. The two other daughters are students. The head of household lives in abroad for a long period, and they stay in this house less than 5 years.

3- -Area of the house in sq. m:

Plot area	Built up area	Courtyard	Plot frontage dimensions	Type of house
560 m^2	110 m^2	359 m^2	20 m	Villa type

Table (6-30) Areas of the house in sq .m in Fatima house (Source: Author)

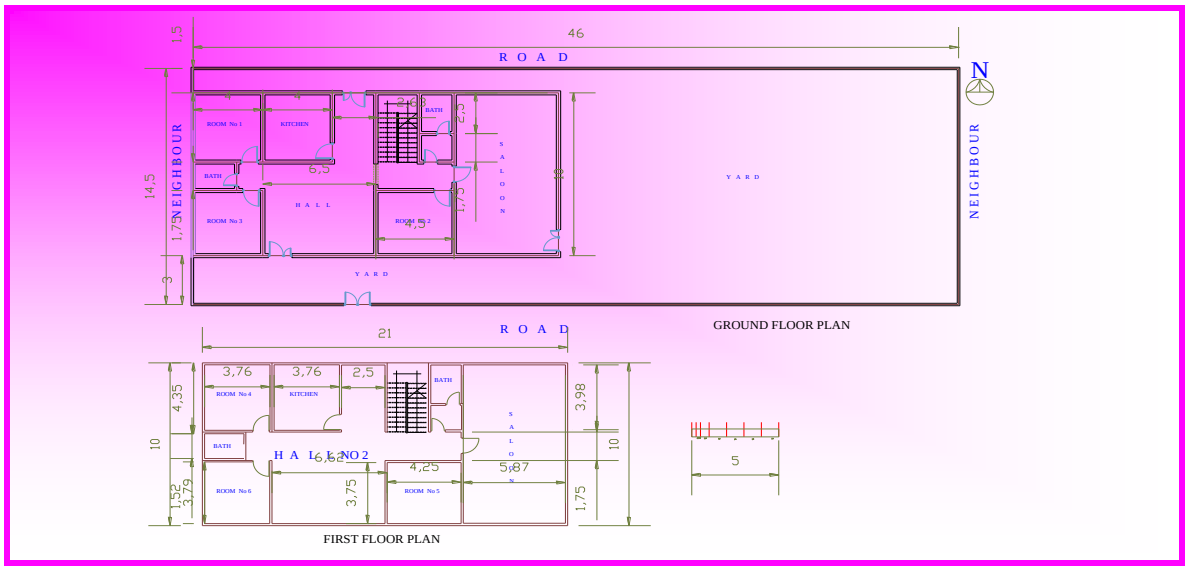


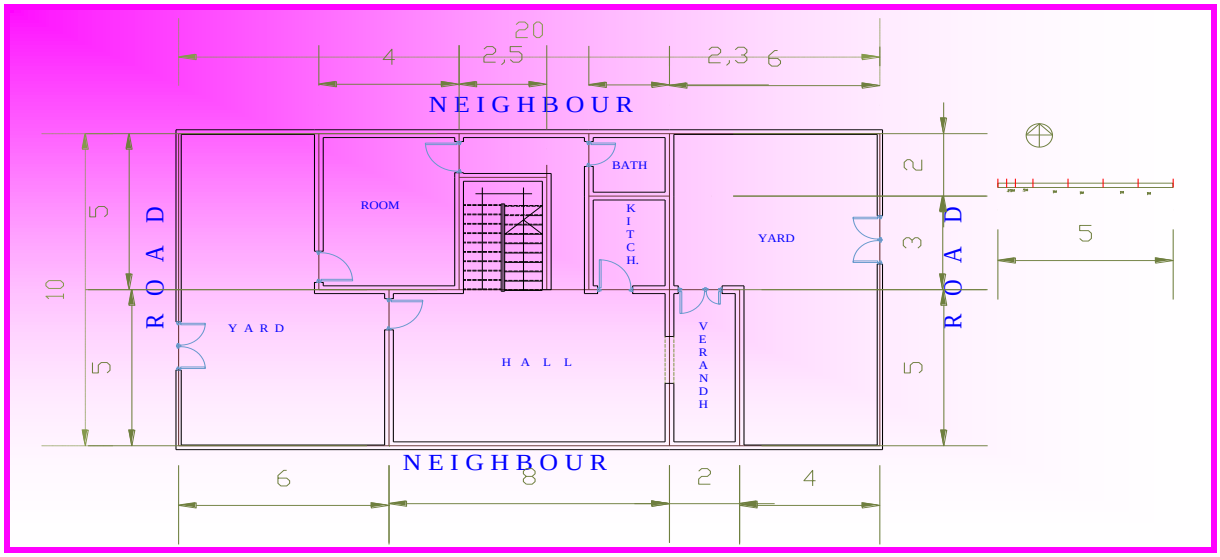
Fig (6-40) Fatima house floors plan(Source: Author)

4- The daily life and the use of spaces:

During the day all the household members are out at work and schools, the housekeeper cleans the dwelling. The mother starts her day at 6:00 am. preparing the tea for her family, observes for the housekeeper while she cooks the food and does the house works. The mother relaxes in the living room in between 11:00-1:00 am., but sometimes she visits her friends. They have lunch together around 4:00 pm., after the family member's return from their schools and works, and then they relax. The mother receives female guests in the hall or in the saloon if they are males, they don't receive guests in the yard, and they sleep in the rooms all the time in all seasons except in obligatory cases (lack of electricity supply).They use the yards only in cases of washing clothes or on occasions.

The family lived along period in abroad, they returned back to the Sudan about 5 years ago by a new culture reflected directly on their activities and the use of spaces (e.g. Opening

kitchen). The parents occupied two plot area and constructed it to responding their family's needs and changes in the future. The location of a guest's room in this house is very important to receive their relatives from Western Sudan because they stay a long period. The courtyard also was important to them for occasions, washing, and ironing clothes.



***F*ig (6-41) - Fatima Mahmmoud house Ground floor plan**(Source: Author)

(6-9-3-4)Fatima Mahmmoud house:

1- Classification Data:

House types	House	Plot No.	Block No.	Residential area	District Area
Court yard		23	10	Amal	Jabal Aulia

Table (6-31) House classification data

2- Household Composition:

The household consists of 4 persons, the head of household; at 51-60 years, a widowed woman, housewife .This family was extended family a son and one daughter between (15-25 years) university students, other daughter at (25-40 years) not work High secondary in education level.

Fig (6-42) living room in Fatima Mahmmoud house

3-Socio- cultural and economic of Household:

Most of the house guests are female (widowed woman) so, that the socializing female guests are more important than socializing male guest area located in the ground floor. The salon uses by the sons for receiving their friends and male guests. There are three yards of the house; the front yard which is used by the family members, the backyard uses by the child in the evenings for playing, and the third uses by her son for sleeping at night.

4 - The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Semi-detached	Bed R	Hall	Saloon	Kitchen	Store	Bath	Yard	Veranda
	2	1	1	1	2	2	3	0
	Sleeping	Guests' Re		Services			Multi- activities	

Table (6-32) Areas of the house in sq .m in the house (Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. despite of The house has a Physical Separation between male &female section, and have a private space to entertain guests from other members of the household, but washing activities in the house affected by the guests. The family eats the daily meals in the Living room and they agree with is important in the dwelling, it has the ability of a multiuse space in the house. The children haven't a room with enough space in which they can play on their own.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
204 m^2	100-200 m^2	Horizontal	10 m	Courtyard

Table (6-33) Areas of the house in sq .m in the house (Source: Author)

The kitchen has sufficient workshop space to prepare meals conveniently but doesn't have sufficient space for small children to play safety in the kitchen when you are using it also; the bathrooms have not enough in areas of it.

5- Option about user attitude:
The change in the house:

The house was remodeled, resulting in changing sizes or uses of rooms because family size growing. They plan to remodel this home in ways that would change sizes or uses of space in the bathroom size and built additional bathroom. He finds that it is better that you and your family members to divide spaces and residential unit.

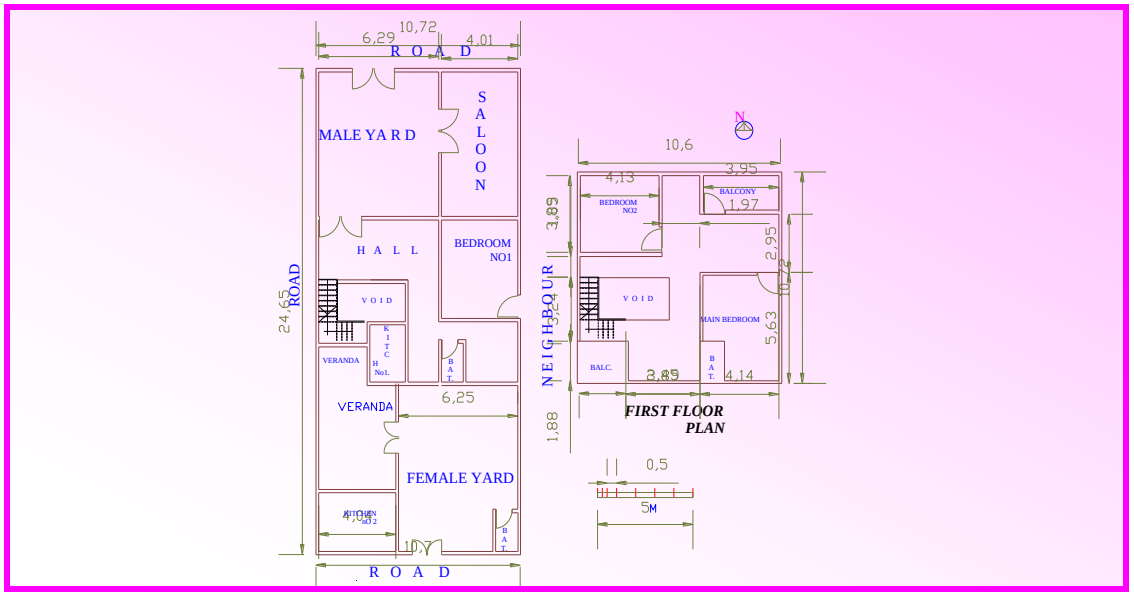


Fig (6-43) Ali Hammada house floors plan (Source: Author)

(6-9-3-5)-Ali Hammada house:

1*- Household characteristics*:

The head of household is, 78 years old, his wife 58 years old, work in the public sector, two daughters are married, living in the same house with their husbands' and children, they are housewives, one son works in aboard.
The mother started her day at 5 o'clock in the morning by braying and preparing the Tea for her family, she spent most of her time outside the home in between 7:00-4:00 pm. in the work, after the mother returns back, she is preparing Lunch and they eat together around 5:00 pm, while the children eat together at 3:00 pm. in the hall, the mother receiving female guests in guestroom's, sometimes in the front yard in the evenings, and they receive male guests in the saloon.
The mother had Supper with her husband's alone around 10:00 pm. while her daughters eat with their families' also around 10:00 pm. The mother ending her day after she cooks the next day food in the kitchen in between 10:00-11:00 pm., then she goes to sleep. All the family members sleep in the rooms, except some time (lack of electricity).

***F*ig (6-44) Female reception area in Ali Hammada house** (Source: Author)

The mother receives her guests in the hall. All the family members sleep in the rooms, especially the daughter sleeps in the balcony. Sometimes they use the yard to receive guests in the evenings or by her smallest sons for playing. Supper is served around 10:00 pm. in the yard; they sleep in the room except in obligatory cases (lack of electricity supply).

B/Spatial Organization and configuration:

Most of the house guests are female (widowed woman) so, that the socializing female guests are more important than socializing male guest area located in the ground floor while the sleeping area located in the first floor. They used the dining corner near the kitchen on the ground floor for eating Meals.
The salon uses by the sons for receiving their friends and male guests. There are three yards of the house; the front yard which is used by the family members, the backyard uses by the child in the evenings for playing, and the third yard in the upper floor uses by his sister for sleeping at night.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
204 m^2	100-200 m^2	Horizontal	10 m	Courtyard

Table (6-34) Areas of the house in sq .m in the house (Source: Author)

5- The change in the house:

In 1986 this family was a nuclear family consisted of 5 members, after 10 years from that time the eldest daughter was married and she lived with her husband in the same house, they occupied room no (4) and a new room was built in the front yard used as guests room, after two years of the daughter's married a new baby and one child were added to the family's members.

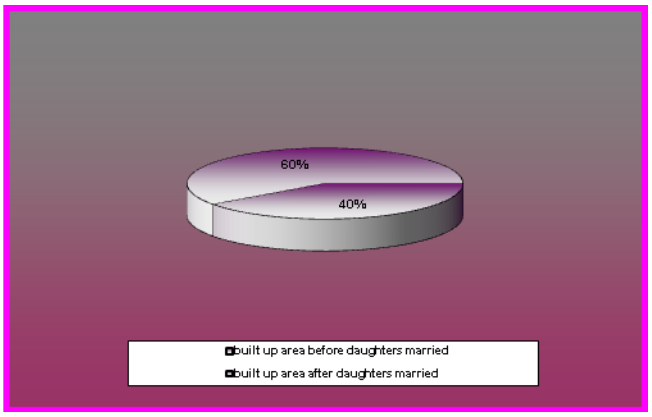


Fig (6-45) Increasing of built up area in Ali Hammada house after 10 years

(6-9-3-4) Iman Babeker house:

1-Household characteristics:

A nuclear family consist of 5 members are, the head of household; a 45 years old, man, he is a university lecturer, his wife is 37years old, a housewife Three children, two of them are student and the other is at a kindergarten.

2- Area of the house in sq. m:

Plot area	Built up area	Courtyard	Plot frontage dimensions	Type of house
230 m^2	110 m^2	120 m^2	10 m	Traditional type

Table (6-35) Areas of the house in sq .m in Iman house (Source: Author)

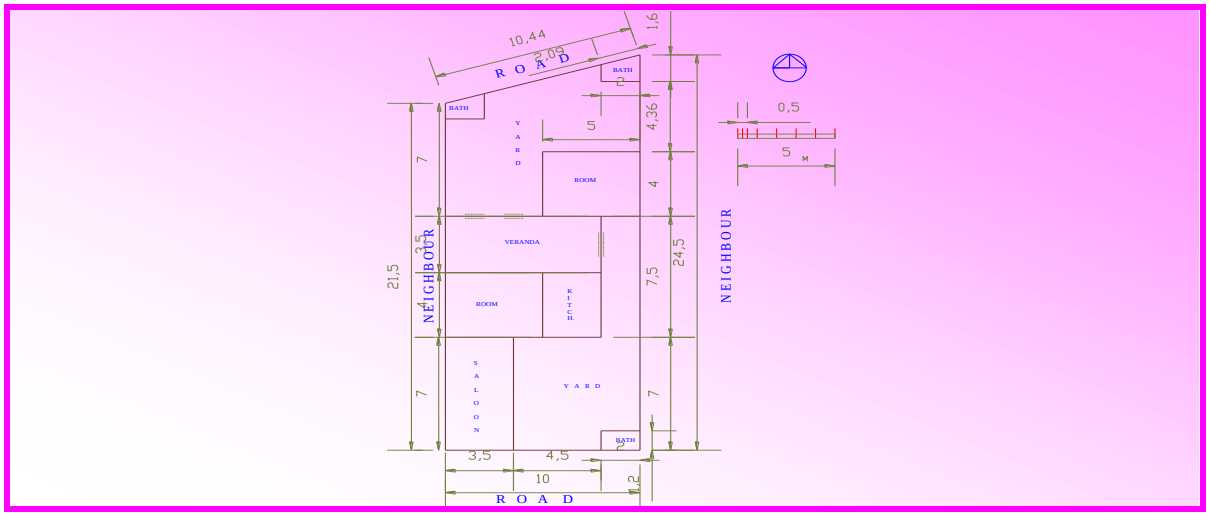


Fig (6-46) ground floor plan in Iman house(Source: Author)

3- The daily life and the use of spaces:

The mother does the housework in the morning, then she watches Television in between 9:00-10:00 am. , She cooks the food in between 11:00-1:00 am. The mother spends most of her time on the veranda relaxing, watching Television, and receiving female guests. The children playing in the child's room when they return back from schools. The head of household rest for a while after he returns back from his work in the room no 1, they eat Lunch together at 5:00 pm. The evenings are spent in the house, receiving guests in the yard, watching Television or going to visit their friends. Supper is served around 10:00 pm. All the family members sleep in the yard or on the veranda.

Fig (6-47) the use of the yard by children in Iman house

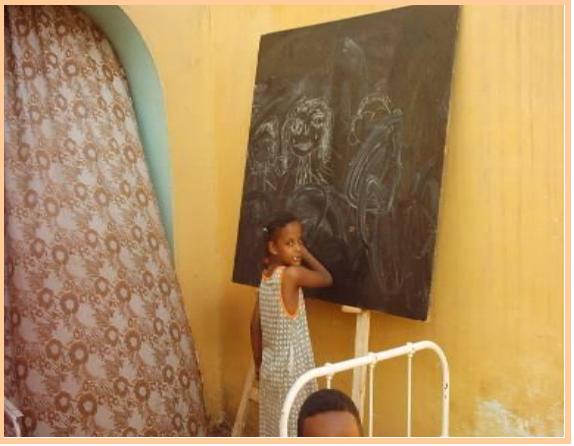


Fig (6-48) Iman house's table of activities members

4-The change in the house:

In 1990 when the head of household was newly married, the house consists only of one room, kitchen, veranda, and bathroom. They received guests in the veranda or in the yard; in 1998 the saloon and bathroom were built in the front yard. The family extended by adding three children to the family, in 2003 they added a new room to the house building, used as a main bedroom, and they used room no (2) as a children room.

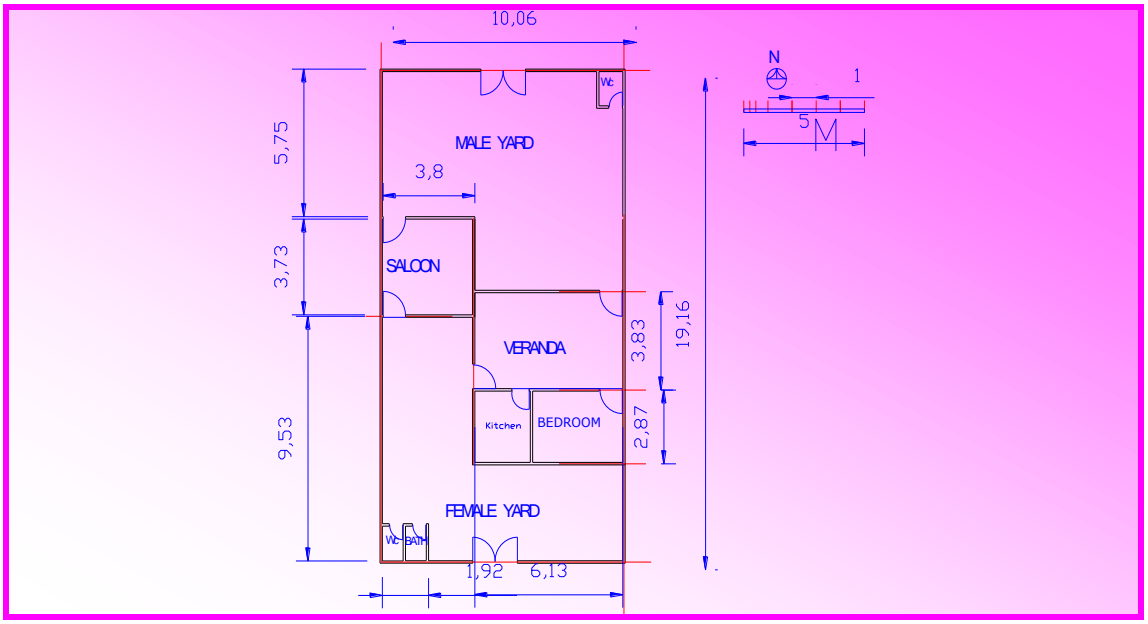


Fig (6-49) ground floor plan in Mahasin house(Source: Author)

(6-9-3-5)-Mahasin House:

1-Household characteristics:

This Family consists of 7 members ; The head of household is a 60 years old man , his wife is 52 years old , a housewife, two daughters , and three sons is working in the public sector , and the others are students .

The mother spent most of her time in the veranda; the family used the veranda as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests. The mother does her work and cooking the food in between 9:00-11:00 am. , she eats the Breakfast with her husband around 11:00 am. , after that she visits her friends in the neighboring in between 2:00-1:00 am., they have Lunch together around 4:00 pm. the rest of the family in the veranda watching Television in between 5:00-7:00 pm. ,they receiving guests in the veranda if they are female, or in saloon and in the yard evenings if are male . Supper is served in the yard around 10:00 pm. All the family members sleep in the yard.

Fig (6-50) male and female reception in the yard in the evening in Mahasin house

2-Previous day activities and the use of spaces:

The mother started her day at 6 o'clock by preparing the Morning Tea and Coffee to her family, after the siblings went to their universities and work, the mother drunk Coffee with her husband in the veranda around 8:00 am., then she cleaned the house while her husband went to make the shopping around 9:00 am, in between 9:00-10:30 am. , she cooked the food in the kitchen, and then they eat Breakfast together in the veranda around 11:00 am. . At 12:00 in the afternoon she went to Dar –Almuminat with her neighbors, she returns to her house around 1:00 in the afternoon, the head of the household went to pray in the Mosque around 1.5 am stayed with her friends till 2:00 o'clock. All the family members return back from their schools and university between 3:00 to 4:00 pm., the eldest daughter assisted her mother in the kitchen prepared the Lunch around 5:00 pm., they have Lunch together around 4:00 pm. in the veranda. The sons used the saloon as the main room to stay, relax and receive their friends.
The head of the household received his friends in the front yard in between 6:00to7:00 pm. while the others watched Television in the yard in between 5:00-7:00 pm. the smallest daughters used the veranda to study in between 7:00-10:00 pm. They had Supper in the yard around 10:00 pm, and they sleep in the yard.

(6-9-6) Hajeer house:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Court yard	Villa type	2	2	1	Hai Alomda	Wad Nubawi

Table (6-36) Hajeer house classification data(Source: Author)

2- Household Composition:

The household consists of 3 persons, the head of household more than 60 years, worked in the private sector, his wife 45 years old, a housewife. This family was nuclear family a son (15-25 years) university student,

Table (6-51) Storage in the yard Hajeer house

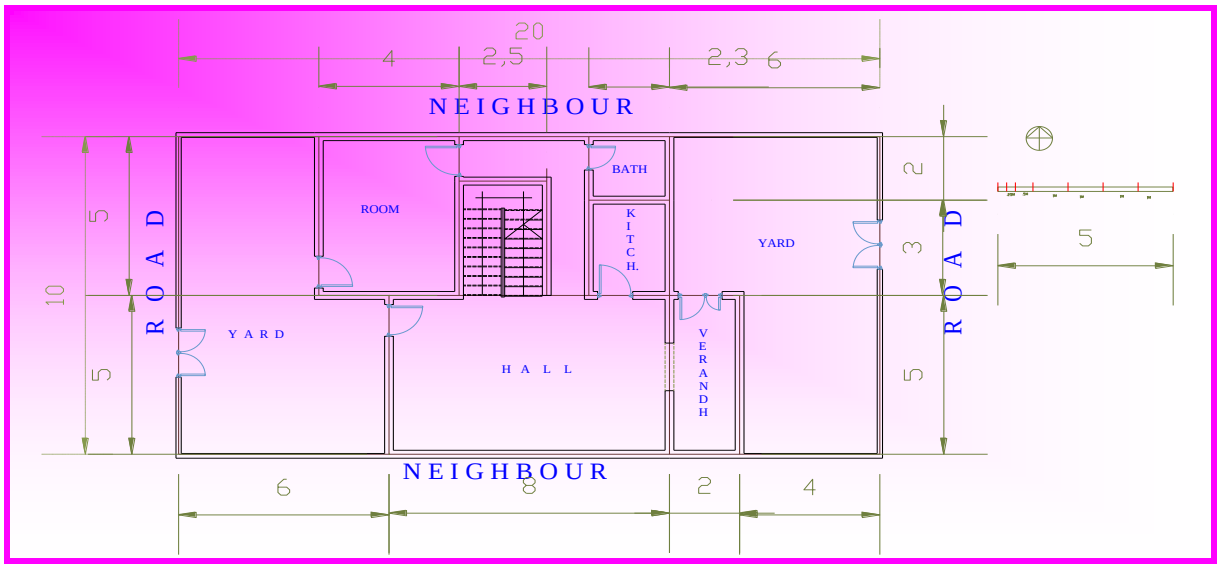


Fig (6-52) - Hajeer house Ground floor plan(Source: Author)

3- Socio- cultural and economic of Household:

Socializing male guest area located in the ground floor (Salon) which uses by the son for receiving their friends and male guests. There are two yards of the house; the front yard which is used by the family members, the backyard uses the servant of the house

Fig (6-53) - Hajeer house Ground floor plan

4 - The house components and the use of spaces:
A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
Raw house	Bed Room	Saloon	Hall	Kitchen	Store	Bath	Veranda	Yard	Balcony
	3	1	1	1	1	2	1	2	2
	Sleeping	Guests' Rec		Services			Multi-activities		Entertainment

Table(6-37) - Hajeer house Ground floor plan

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. The house has a Physical Separation between male &female section, and have a private space to entertain guests from other members of the household. The family eats the daily meals in the dining room and they agree with is important in the dwelling, it has the ability of a multiuse space in the house.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200 m^2	Vertical	10 m	Courtyard

Table (4-38) Areas of the house in sq .m in Egbal house (Source: Author)

The kitchen has sufficient workshop space to prepare meals conveniently and has sufficient space for small children to play safety in the kitchen when you are using it also; the bathrooms have enough in areas of it

5- Option about user attitude:

The change in the house:

The house was remodeled, resulting in changing sizes or uses of rooms so that, and they built additional bathroom and additional shade area. The kitchen has sufficient workshop space to prepare meals conveniently (allowing for prepare meals conveniently, allowing for appliances such as microwave, toaster, there are two kitchen one for traditional foods it so large built by the household of the family house have enough Storage space where they can tore their possessions (closets, garage, attic, storage lockers, also they used bedrooms for storage. The corridors and stairs in your home are obstructed by furniture, stored items or decorative objectives; therefore there is not enough space in all of the rooms to be able to move easily around the furniture. The balcony and yards in the r house does not use or have been badly arranged it has been used efficiently by the designer plan to remodel this home in ways that would change sizes or uses of space to add in the first level Hall and kitchen. He finds that it is better that you and your family members to divide spaces and residential unit.

(6-9-3-7)-Abdelkader Mohammed Hashim house:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Court yard	Court yard	1	1260	73	Hai Alomda	Wad Nubawi

Table (6-39) Mohammed Hashim house classification data

2- Household Composition:

This family was extended family, the head of household more than 60 years widowed, worked in the private sector.
The household consists of 8 persons 5 sons and 2 daughters (25-40 years) university student or graduated.

3- Household characteristics:

The family used the veranda as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests. The daughter does her work and cooking the food in between 9:00-11:00 pm., they have Lunch together around 4:00 pm, the rest of the family on the veranda watching Television in between 5:00-7:00 pm, they receive guests in

the veranda if they are female, or in the saloon and in the yard evenings if are male. Supper is served in the yard around 10:00 pm. All the family members sleep in the yard. The head of the household received his friends in the front yard in between 6:00to7:00 pm, while the others watched Television in the yard in between 5:00-7:00 pm, the smallest daughters used the veranda to study in between 7:00-10:00 pm. They had Supper in the yard around 10:00 pm, and they sleep in the yard.

4- Socio- cultural and economic of Household:

Socializing male guest area located in the ground floor (salon) which uses by the sons for receiving their friends and male guests. There is a yard of the house; which is used by the family members for sleeping, guests reception in the evening, the sleeping activities arrangements was affected when the guests come to the house.

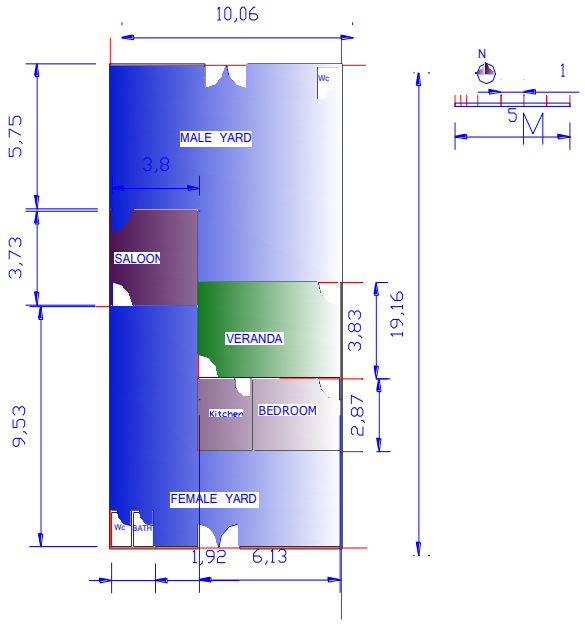


Fig (6-54) ground floor plan in Mohammed Hashim House (Source: Author)

4 - The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
Raw house	Bed R	Hall	Saloon	Kitchen	Store	Veranda	Yard	Garden	Balcony
	3	1	1	1	1	1	1	0	2
	Sleeping	Guests' Rec.		Services		Multi-activities		Entertainment	

Table (6-40) House space configuration, usage, and Number(Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. The house has a Partly Separation between male &female section, and have a private space to entertain guests from other members of the household.

The family eats the daily meals in the living room and they agree with is important in the dwelling, it has the ability of a multiuse space in the house, the kitchen has sufficient workshop space to prepare meals conveniently and have sufficient

. G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200 m^2	Vertical	10 m	Courtyard

Table (6-41) Areas of the house in sq .m in the house (Source: Author)

5- Option about user attitude:

The change in the house:

The house was remodeled, resulting in changing sizes or uses of rooms so that, and they built additional bathroom and additional shade area. The kitchen has sufficient worktop space to prepare meals conveniently (allowing for prepare meals conveniently, allowing for appliances such as microwave, toaster. house have not Storage space where they can tore their possessions (closets, garage, attic, storage lockers, they used bedrooms and living room for storage the balcony and yards in the r house does not use or have been badly arranged it has been used efficiently by the designer.

He finds that it is better that you and your family members to divide spaces and residential unit.

(6-9-3-8) Mashaer Ahmed House:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Residential Complex	Flat	3-5	5	B	Hai Alomda	Wad Nubawi

Table (6-42) Mashaer Ahmed house classification data(Source: Author)

.

2- Household Composition:

This family was the nuclear family, the head of household more than 55 years, works in the public sector and his wife 43 years a housewife live in Khartoum not more than 5 years. The household consists of 5persons 2 son and daughter (7-14) in the primary school and the other son (15-25) at the secondary school, the other daughter (25-40 years) university's student.

3- Socio- cultural and economic of Household:

Socializing male guest area (salon) which is used by the male for receiving their friends and male guests while, the hall is used by female receiving their friends. Eating activities arrangements were affected when the guests come to the house.

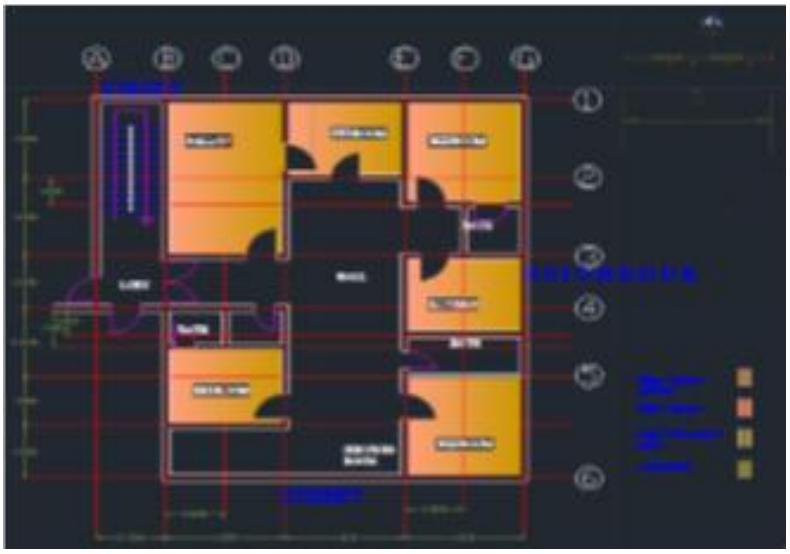


Fig (6-55) ground floor plan in Masher house(Source: Author)

4 - The house components and the use of spaces:
A/Form and Physical Features:

House type	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Raw house	**Bed R**	**Hall**	**Saloon**	**Kitchen**	**Store**	**Bath**	**Balcony**	**Yard**	**Veranda**
	3	1	1	1	0	2	4	1	0
	Sleeping	Guests; Res.		Services			Multi-activities		

Table (6-43) Mashaer Ahmed house classification data (Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. The house has a Partly Separation between male &female section, and have a private space to entertain guests from other members of the household.
The family eats the daily meals in the living room and they agree with is important in the dwelling, it has the ability of a multiuse space in the house.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200 m^2	Vertical	10 m	

Table (6-44) Areas of the house in sq .m (Source: Author)

The kitchen has a sufficient workshop space to prepare meals conveniently and it haven't sufficient space for small children to play safety in the kitchen when you are using it but, bathrooms and storage space in the not enough for storage possessions (closets, garage, attic, storage lockers, etcs. so that, bedrooms. She is, agreed the importance of it in the house. The head of household agrees the corridors and stairs within your home provide sufficient space to move around the home with area. There is enough space in all of the rooms to be able to move easily around the furniture. All space in the house does not use or have been badly arranged and he agreed that it has been used efficiently by the designer

4- Option about user attitude:
The change in the house:

No change and there the no plan to change in the use of spaces all the spaces in the house it has been used efficiently by the designer. He finds that it is better that you and your family members to divide spaces and residential unit.

(6-9-4) Apraj Alnilien Tower project:

Apraj Alnilien Tower :

The core of Khartoum Center km

Date created: 2013

Location: West Kubri Almuslamia , and Southern Civil Defense

Consists of one categories:

Apparetment residential building

Apartments Numbers : 324 apartments

Fig (6-56) Alniline Tower Location plan

Consists of 9 towers, a basement and a ground floor in addition to 9 floors and parking lot and fields and places of entertainment and each tower contains two elevators capacity of 8 people and a special power station and a generator self-operating

The floor contains: 4 apartments with an area of 128 square meters per apartment t

Fig (6-57) Alniline Tower

(6-9-4-1)- Mohammed Muntaser Ismaeel

1-Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Residential Complex	Flat	9	8	304	Almugran	Khartoum

Table (6-45) Mohammed Muntaser Ismaeeil classification data (Source: Author)

2-Household Composition:

This family was the nuclear family, the head of household more than 60 years worked in the public sector, but now he are and his wife 43 years a housewife works in the public sector live in this flat less than 5 years.
The household consists of 5persons 1 son less than 1 a year, another son and daughter (15-25) is university's student.

3-Household characteristics:

The family used the living room as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests. The mother does her work and cooking the food in between 9:00-11:00 pm or in the weak end because she work., they have Lunch together around 4:00 pm, the rest of the family in the veranda watching Television in between 5:00-7:00 pm., they receive guests in the veranda if they are female, or in saloon and in the yard evenings if are male. Supper is served in the yard around 10:00 pm. All the family members sleep in the yard. The head of the household received his friends in the Salon in between 7:00to9:00 pm, while the others watched Television in the yard in between 7:00-9:00 pm, the smallest daughters used the bedroom to study in between 7:00-10:00 pm. They had Supper in the yard around 11:00 pm.

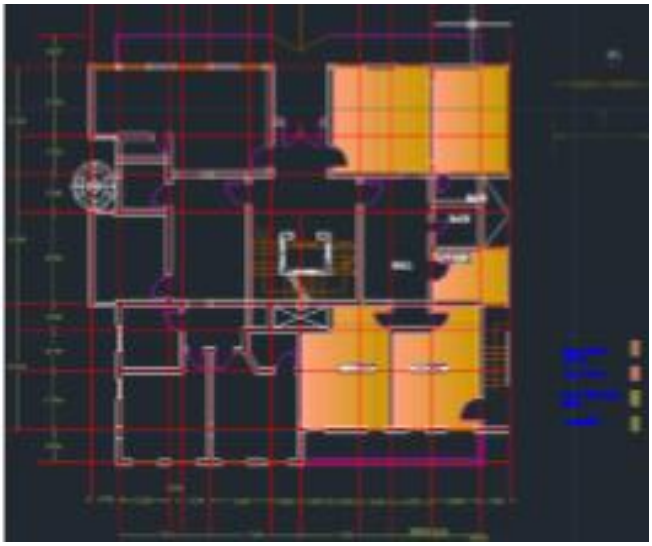


Fig (6-58) Mohammed Muntaser Ismaeeil house plan (Source: Author)

3-Socio- cultural and economic of Household:

Socializing male guest area (salon) which is used by the male to receiving their friends and male guests, while the hall is used by female receiving their friends .Eating activities arrangements were affected when the guests come to the house

4 - The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
Raw house	**Bed R**	**Hall**	**Saloon**	**Kitchen**	**Store**	**Yard**	**Balcony**	**Yard**	**Ver**
	2	1	1	1	0	0	2	0	0
	Sleeping	Guest rec		Services & utilities					

Table(6-46) Mohammed Muntaser Ismaeeil classification data (Source: Author)

B/Spatial Organization and configuration:

The entrance injured privacy when open the door, also the layout of the home does not allow having enough privacy. The house has a Partly Separation between male &female section, and have not a private space to entertain guests from other members of the household. The family eats the daily meals in the dining corner in the hall

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	100-200 m^2	Vertical	10 m	

Table (6-47) Areas of the house in sq .m (Source: Author)

The kitchen has a sufficient workshop space to prepare meals conveniently and it haven't sufficient space for small children to play safety in the kitchen when you are using it but, the house did not contain Storage space, so that the family Storage possessions (closets, garage, attic, storage lockers, etc. so that, bedrooms. She is agreed the importance of it in the house, also the bathroom

The head of household agrees The corridors and stairs within your home provide sufficient space to move around the home with area, there is not enough space in all of the rooms to be able to move easily around the furniture all space in the house does not use or have been badly arranged and he agreed that it has not been used efficiently by the designer

5- Option about user attitude:

The change in the house: no change and there the no plan to change in the use of spaces all the spaces in the house has been used efficiently by the designer

He finds that it is better that you and your family members to divide spaces and residential unit.

Alryad apartment :

Date created: 2013

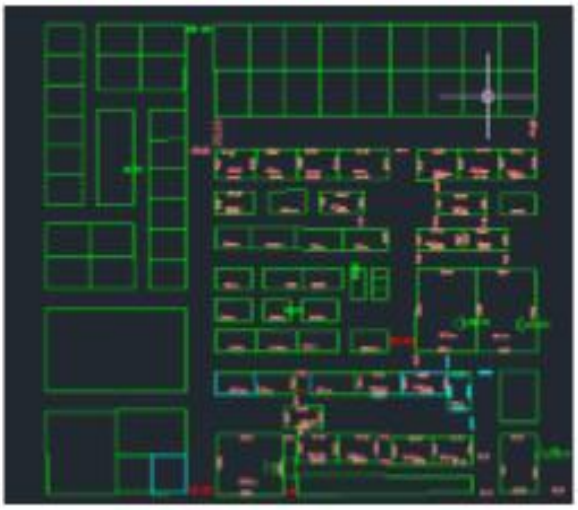
Location: Alryad

Consists of one categories:

Apparetment residential building

Apartments Numbers : 2116 apartments

Fig (8-56)Alriad N



Consists of 7 building a generator self-operating

The floor contains: 4 apartments with an area of 128 square meters per apartment t

Fig (8-57)Alriad Appartment

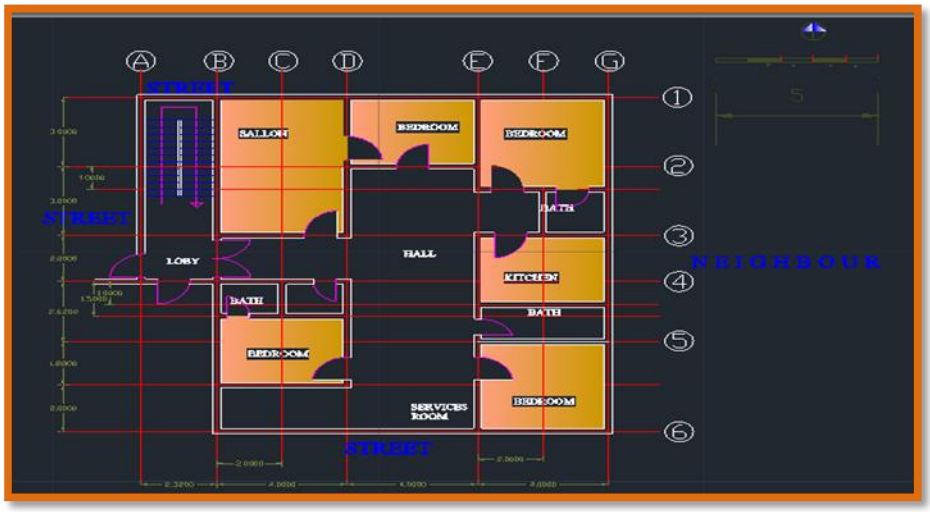


Fig (6-59) ground floor plan in Eilham Ahmed Babeker house(Source: Author)

(6-9-4-2)- Eilham Ahmed Babeker house:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Residential Complex	Flat	-	8	13	AlRiad	Khartoum

Table (6-48) Eilham Ahmed Babeker house classification data (Source: Author)

2- Household Composition:

The head of household more than 60 years worked in the public sector and his wife 40 years a housewife live in this flat less than 5 years and he acquire this plot or house by bought. The household consists of 5persons 1 son less than 1 a year, another son and daughter (15-25) is university's student.

Fig(6-60) Eilham Ahmed Babeker 's Kitchen

3- Household characteristics:

The family used the living room as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests. The mother does her work and cooking the food in between 9:00-11:00 pm or in the weak end because she works, they have Lunch together around 4:00 pm. the rest of the family on the veranda watching Television in between 5:00-7:00 pm., they receive guests in the hall if they are female, or in saloon.

Fig (6-61) Eilham Ahmed Babeker 's Guest room (Source: Author)

4- Socio- cultural and economic of Household:

Socializing male guest area (salon) which is used by the male to receiving their friends and male guests, while, hall is used by female receiving their friends sleeping activity arrangements was affected when the guests come to the house

5- The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Raw house	Bed R	Hall	Saloon	Kitchen	Store	Bath	Yard	Veranda	Balcony
	3	1	1	1	0	2	0	0	2
	Sleeping	Guest res.		Services & utilities			Multi-Activities		

Table (6-49) Eilham Ahmed Babeker space configuration, activities and numbers

B/Spatial Organization and configuration:

The entrance not injured privacy when open the door, also layout of the home does not allow having enough privacy.
The house has a Partly Separation between male &female section, and have not a private space to entertain guests from other members of the household.
The family eats the daily meals in the dining corner in the kitchen

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	More than 200 m^2	Not	10 m	

Table (6-50)Areas of the house in sq .m (Source: Author)

The kitchen has sufficient workshop space to prepare meals conveniently, but it haven't sufficient space for small children to play safety in the kitchen when you are using it but, the house did not contain Storage space, so that the family Storage possessions (closets, garage, attic, storage lockers, etc. so that, bedrooms are used for the storage. she is agreed the importance of it in the house, also the bathroom, the head of household agree. The corridors and stairs within your home provide sufficient space to move around the home There is enough space in all of the rooms to be able to move easily around the furniture but it hasn't enough space in all of the rooms to give alternatives for furniture arrangement. All space in the house does not use or have been badly arranged and he agreed that it has not been used efficiently by the designer.

6- Option about user attitude:

The change in the house: no change and there the no plan to change in the use of spaces he agreed that all the spaces in the house it hasn't been used efficiently by the designer He finds that it is better that you and your family members to divide spaces and residential unit

(6-9-4-3)- Alla Mohammed House:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Residential Complex	Flat	-	13	3	AlRiad	Khartoum

Table (6-51) Alla Mohammed classification data(Source: Author)

2- Household Composition*:*

The head of household more than 54 years worked in the public sector and his wife 40 years a housewife live in this flat 5 year ago and he acquire this plot or house by Govern Distributed. The household consists of 6 persons 1 daughter and son (1-6) year old in kindergarten another son 8 years old a student in the primary school and another two daughter in the secondary school

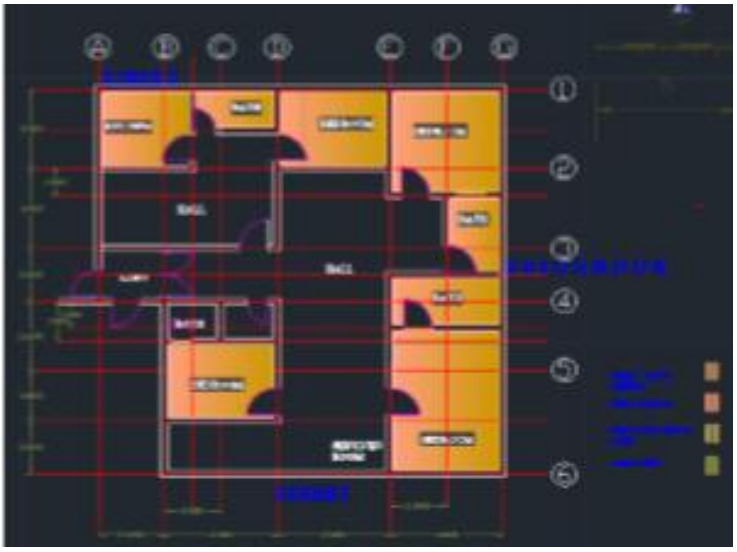


Fig (6-62)Alla Mohammed House plan (Source: Author)

2- 1-Household characteristics:

The family used bedroom as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests but sometime they used children room for eating. The mother does her work and cooking the food in between 9:00-11:00 pm or in the weak end because she works, they have Lunch together around 4:00 pm, the rest of the family in the bedroom watching Television in between 5:00-7:00 pm., they receive guests in the Hall if they are female, or in saloon.

All the family members sleep in the bedrooms and they didn't use the balcony. The head of the household received his friends in the Salon in between 7:00to9:00 pm, while the others studied in the room in between 7:00-9:00 pm.

3- Socio- cultural and economic of Household:

Socializing male guest area (salon) is used by the male to receiving their friends and male guests, while the hall is used by female receiving their friends. Studying activity arrangements were affected when the guests come to the house. The children have a room with enough space in which they can play on their but they didn't have sufficient space for small children to play safety in the kitchen when the mother using it.

4 - The house components and the use of spaces:

A/Form and Physical Features :

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Raw house	Bed R	Hall	Saloon	Kitchen	Store	Bath	Balcony	Yard	Veranda
	3	2	1	1	0	2	1	0	0
	Sleeping	Guest's Res		Services and utilities				Mult- activities	

Table (6-52) Alla Mohammed space configuration, activities and numbers

B/Spatial Organization and configuration:

The entrance injured privacy when open the door, also the layout of the home does not allow having enough privacy. The house has a Partly Separation between male &female section, and have not a private space to entertain guests from other members of the household.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	More than 200 m^2	Not	10 m	

Table (6-53) Alla Mohammed Areas of the house in sq .m (Source: Author)

The kitchen has sufficient workshop space to prepare meals conveniently , but it haven't sufficient space for small children to play safety in the kitchen when you are using it but, the house did not contain Storage space, so that the family Storage possessions (closets, garage, attic, storage lockers, etc. so that, bedrooms are used for the storage and balcony . and she is agreed the importance of it in the house, also the bathroom 2 meter squares haven't enough area for washing machine, the head of household agree The corridors and stairs within your home provide sufficient space to move around the home with area There is not enough space in all of the rooms to be able to move easily around the furniture, also it haven't enough space in all of the rooms to gives alternatives for furniture arrangement.

All space in the house does not use or have been badly arranged and it has not been used efficiently by the designer he agreed 20% that and he think that the designer is better than the family members to divide spaces and residential unit.

(6-9-3) Dar Alsalam District project:

Dar Alsalam :

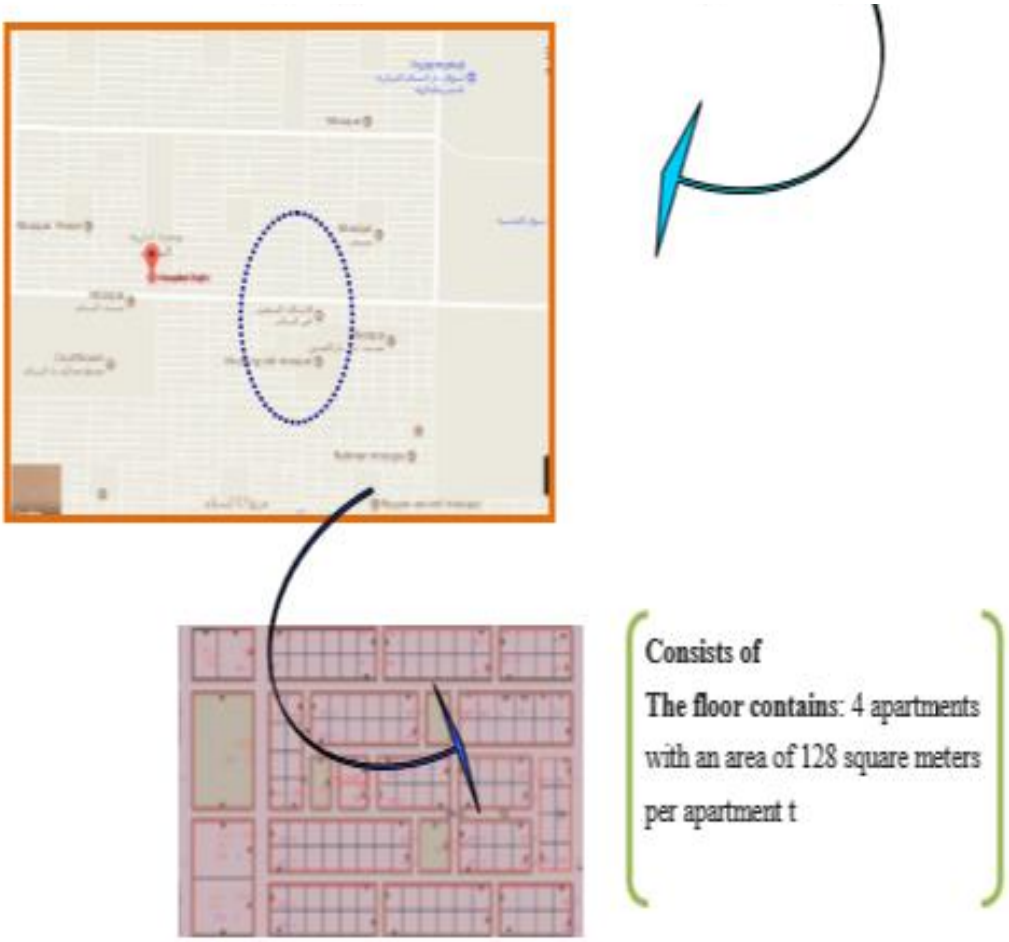
Date created: 2009

Location: Omdurman, Ombada

Consists of one categories: low cost housing

Units Numbers : 324 house

Fig (6-63) Dar Alsalam low cost housing Location plan



Consists of

The floor contains: 4 apartments with an area of 128 square meters per apartment t

Fig (6-64) Dar Alsalam low cost housing

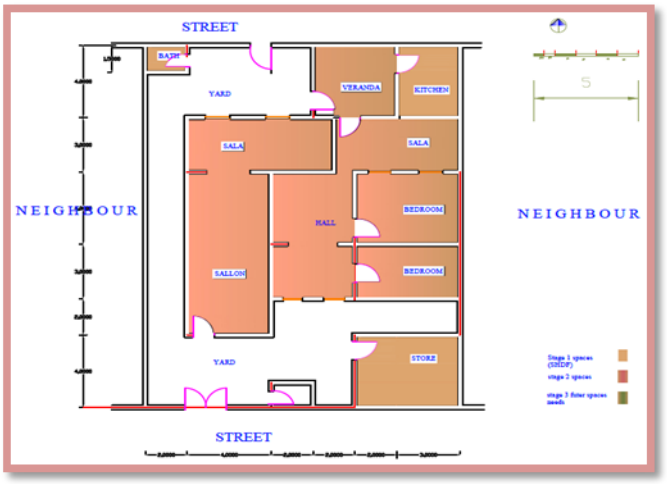


Fig (6-65)Eglas Ibraheim house Ground floor plan(Source: Author)

(6-9-5-1)Eglas Ibraheim House

1- Classification Data:

House types	House	Plot No.	Block No.	Residential area	District Area
Court yard		296	5/6	Amal	Jabal Aulia

Table(6-54) Eglas Ibraheim House Classification Data(Source: Author)

2- Household Composition:

The household is nuclear family, the head of household (45) years old, an employee man, his wife 385 years old ,a house wife , they acquire the house by Government distribution since 2006 it since 2009.This family consists of 10 persons tow of them are relatives (Aunt) ,three sons between (1-6 years) old , kindergarten level and one of them in elementary school two(son and daughter) between (15-25) years old at university, a son between (7-14 years) in elementary school , and the oldest daughter

Fig (8-66) furniture and circulation in the room in Eglas Ibraheim house

3- Socio- cultural and economic of Household:

The mother was cooking every day in the kitchen between 9 to 11 o'clock Am. The family is using a shade as a multiuse space in the house always (for eating, watching TV, and for family socializing).The house has a Physical Separation between male &female section, and have a private space to entertain guests from other members of the household.


Fig (6-67) the used of Hosh in Eglas Ibraheim house(Source: Author)

4 - The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Semi-detached 2 story	Bed R	Hall	Saloon	Kitchen	Store	Shad	Veranda	Yard	Balcony	Garden
	4	1	1	1	1	1	1	1	2	1
	Sleeping	Reception		Services		Multi-activities			Entertainment	

Table (6-55) Eglas Ibraheim House(Source: Author)

B/Spatial Organization and configuration:

The size and layout of your home and entrance not injured, allow having enough privacy. The house has a full Separation between male &female section and it have a private space to entertain guests from other members of the household, they welcoming every time and this did not affect the activities in the house. The family eats the daily meals in the shade they agree with is important of it in the dwelling. The children haven a room with enough space in which they can play on their own.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
204 m^2	More than 200 m^2	Vertical	10 m	Courtyard

Table (6-56) Areas of the house in sq .m (Source: Author)

The kitchen has not sufficient workshop space to prepare meals conveniently or extra space. The bathrooms and storing area have enough in spaces area and numbers to suit the household, All the spaces in the house are used an insufficiently by the residents and all the rooms have enough space for being able to move easily around the furniture

6- Option about user attitude:

The change in the house:

The house was remodeled, resulting in for family growing. The kitchen has not sufficient workshop space to prepare meals conveniently or for children to play while the mother cooking. The family remolding the house design by designer that the head of household disagrees to divide spaces and residential by family members, also he disagrees to add the number of bedrooms conversely than decreasing the area of it

(6-9-5-2)-Elfatih Ali Adam House:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Court yard		144	296	2	Dar Alsalam 5	Ombada Janoob

Table (6-57) Elfatih Ali Adam House classification data(Source: Author)

2- **Household Composition***:*

The head of the household more than 49years worked in the private sector and his wife 39 years a housewife live in this house 8 years ago and he acquire this plot or house by bought . The household consists of 4 persons 1 daughter and (7-14) year old in primary, the other daughter (25-15) years old a student in secondary school.

Fig (6-68)Alfatih house's kitchen space

3- Household characteristics:

The family used shad as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests but sometime they used children room for eating. The mother does her work and cooking the food in between 9:00-11:00 pm or in the weak end because she works, they have Lunch together around 4:00 pm, the rest of the family in the bedroom watching Television in between 5:00-7:00 pm., they receive guests in the Hall if they are female, or in saloon.. All the family members sleep in the bedrooms and they didn't use the balcony. The head of the household received his friends in the Salon in between 7:00to9:00 pm, while the others studied in the room in between 7:00-9:00 pm.

Socializing male guest area which is used by the male to receiving their friends and male guest, while the hall is used by female receiving their friends'. When the guests come to the house eating and sleeping activities arrangements were affected. The children have a room with enough space in which they can play on their but they didn't have sufficient space for small children to play safety in the kitchen when the mother using it.

Fig (6-69) ground floor plan in Elfatih Ali Adam house(Source: Author)

4 - The house components and the use of spaces:
A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Semi detached	Bed R	Hall	Saloon	Store	Kitchen	Bath	Veranda	Yard	Store
	2	1	1	1	1	1	1	0	1
	Sleeping	Guest Res		Services utilities					

Table (6-58) Space configuration, usage and numbers (Source: Author)

B/Spatial Organization and configuration:

The entrance doesn't injure privacy when open the door, also the layout of the home does not allow having enough privacy. The house has a Physical Separation between male &female section. The head of household plan to remodel this house for the reasons of keeping up with trends.

***G/* House and spaces area:**

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	More than 200 m^2	Not	10 m	

Table (6-59) Elfatih Ali Adam Areas of the house in sq .m house

The kitchen has sufficient workshop space to prepare meals conveniently, also it has sufficient space for small children to play safety in the kitchen when you are using it Despite of the house contain one Storage space, but also the family Storage possessions (closets, garage, attic, storage lockers, etc. in bedrooms. The head of household is agreed the importance of it in the house, also the bathroom squares have enough area.

There is enough space in all of the rooms to be able to move easily around the furniture, also it have enough space in all of the rooms to gives alternatives for furniture arrangement.

All space in the house does not use or have been badly arranged and it has not been used efficiently by the designer, he disagreed that the designer is better than the family members to divide spaces and residential unit. They plan to remodel this home by adding salon

(6-9-5-3)-Mohammed Ali Mohammed House:

1- Classification Data:

House types	House type	No. of Stories	Plot No.	Block No.	Residential area	District Area
Court yard		0	304	5/6	Dar Alsalam 5	Ombada Janoob

Table (6-60) Mohammed Ali classification data (Source: Author)

2- Household Composition:

The head of household more than 47years, Self-employed and his wife 38 years a housewife live in this house 8 years ago and he acquires this plot by Grant from their relatives. The household was extended family, consists of 10 persons, 2 daughters and (1-6) in kindergarten, 3 sons at age between (7-14) years old in primary, 2 daughters the older one is married and 2 sons (25-40) years old a student in secondary school while the other in the university

Fig (6-70) Mohammed Ali Mohammed House ground floor plan (Source: Author)

3- Household characteristics:

The family used shad as multiple purposes for eating, sleeping, sitting, watching Television, and receiving female guests but sometime they used children room for eating. The mother does her work and cooking the food in between 9:00-11:00 pm or in the weak end because she works, they have Lunch together around 4:00 pm. the rest of the family in the bedroom watching Television in between 5:00-7:00 pm. the family eats the daily meals in the shade or in the yard
They receive guests in the guest's room if they are female, or in saloon. All the family members sleep in the yard. The head of the household received his friends in the Salon in between 7:00to9:00 pm. while the others studied in the room in between 7:00-9:00 pm.

4- Socio- cultural and economic of Household:

Socializing male guest room which is used by the male to receiving their friends and male guests while, Veranda is used by female receiving their friends, also they using Hosh in the evening for both male and female gust for receiving. When the guests come to the house eating activity arrangements was affected the children have a room with enough space in which they can play on their but they didn't have sufficient space for small children to play safety in the kitchen when the mother using it.

5- The house components and the use of spaces:

A/Form and Physical Features:

House type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Raw house	Bed R	Hall	Saloon	Kitchen	Store	Shade	Yard	Ver	Balcony	
	4	0	0	1	1	1	2	0	0	1
	Sleeping	Guest Res		Services and utilities			Multi-			

Table (6-61) Space configuration, usage and numbers(Source: Author)

B/Spatial Organization and configuration:

The entrance doesn't injure privacy when open the door, also the layout of the home does not allow having enough privacy. The house has a Partly Separation between male &female section. The head of household planned to remodel this home for the because family size growing, but now he did not plan for any new extension.

G/ House and spaces area:

Plot area	Built up area	House expansion	Plot frontage dimension	Type of house
300 m^2	200 m^2	Horizental	10 m	

Table (6-62 Areas of the house in sq .m (Source: Author)

The kitchen has sufficient workshop space to prepare meals conveniently, also it has sufficient space for small children to play safety in the kitchen when you are using it. Despite of the house contain one Storage space, but also the family Storage possessions (closets, garage, attic, storage lockers, etc. in bedrooms. The head of household is agreed the importance of it in the house, also the bathroom squares have enough area. There is enough space in all of the rooms to be able to move easily around the furniture, also it have enough space in all of the rooms to give alternatives for furniture arrangement.

All space in the house does not use or have been badly arranged and it has not been used efficiently by the designer, he disagreed that the designer is better than the family members to divide spaces and residential unit.

(6-10)CONCLUSION:

The main choice of selection Khartoum as a case study area considered to be the sensible one Firstly combine different example of houses is difficult to find in other towns, Secondly the residential density in town is low compared with other countries and thirdly, many kinds of housing schemes implemented in Khartoum.

The national growth rate, plus move from rural to urban area, and from other states help in increasing the area of living and congestions in socioeconomic and health services so that the demand of house units which built and organized by Sudanese housing development fund . Field survey and site observation for recording the use of houses spaces in conducting domestic routine by using a questionnaire to test resident's adaptability. The observation study converted the activities such as meals, homework, Socializing and entertainment, Sleeping and relaxing.

The study takes 230samples used as case studies focus on the housing in Greater Khartoum, which are organized and built by the Government sector (Housing Development Fund) at the both levels of house and cluster, focusing on low income housing groups covered all projects and house types. These cases are:

- Omdurman : Aliscan Dar Alslam,Hai Alomda , Althoura Hara 103,38,72, and 76)
- Khartoum: Alamal , Alriad, Almogran (AlnilynTower, Alnuzha
- Khartoum North : Al wadi AlakhdaI present in this study 20 case studies

Most of the family used shad as multiple purposes for eating, sleeping, sitting, when the guests come to the house eating and sleeping activities arrangements were affected.

The house components of spaces to three according to their activities such as sleeping, guest reception, and services utilities. It has a Separation between male &female section physical or partial separation.

The kitchen has un sufficient workshop space to prepare meals conveniently, also it has sufficient space for small children to play safety in the kitchen when you are using it Despite of the house contain one Storage space, but also the family Storage possessions (closets, garage, attic, storage lockers, etc. in bedrooms. There is not enough space in all of the rooms to be able to move easily around the furniture, also it have enough space in all of the rooms to gives alternatives for furniture arrangement.

All space in the house does not use or have been badly arranged and it has not been used efficiently by the designer, he disagreed that the designer is better than the family members to divide spaces and residential unit. Most of Household members plan to remodel the home for the reasons of keeping up with trends or they plan to add some spaces or area.

(7-1) INTRODUCTIONS:

This chapter draw on the fact that significant changes in the life style of families who lived in housing which are built and implemented by Housing Development Fund in Greater Khartoum, and have come to influence their needs and desires in designing their housing. The case study is composed of two staged interviews and questionnaire open-ended questions, which were applied to randomly select voluntary participants. The interviews aim to gather information about the family status, lifestyle and spatial Preferences. The results of this second phase of interviews provide data about the social, demographic background of the users, space area size and layout and their lifestyles. Spatial data acquired with mapping techniques are supplemented with a digital library of photographs for each home. A minimum of four photographs (one for each cardinal direction) is collected for each numerically-labeled space.

(7-1)DATA ANALYSIS METHODS:

(7-1-1) Spatial Analysis:

The analysis is carried out at two levels which are integrated together:

1-Space analysis; which based on the physical features of individual space functions within the special pattern and its relation to the socio- cultural factors.

2-*Spatial logic analysis*; it studies the built environment at different levels relating a house to its larger context –city, city sector, neighborhood, cluster and, house.

1-Space Analysis:

Comprises analysis of spatial pattern of each house in term of:

- Room positioning and use. Study the allocation of different space in the house, especially the relation between family area and guest receiving area
- Family structure; study the suitability of house spaces and layout of family structure in term of classification of families according to the type of household.
- Privacy gradient; study the allocation of different space inside the house pattern in terms of conception of privacy concerning male/female domain.
- Domestic routine; study the daily rationalized behavior concerning a system of activities and system of setting, and analyzed the way in which space, time and

people organized in the house. Domestic routine is connected with deeper concepts of social values concerning gender relations, age relations and beliefs.

***2-Spatial Logic**:*

The issue: it studies the built environment at different scale levels, relating a house to its larger context- city, city sector, neighborhood, cluster, house, ect. The tissue here is a key word.

Themes of urban analysis: urban analysis is a process reinterpreting architecture in order to overcome the problems of modernism, in following ways:

- Reintroduction of architectural types as the units of theory and practice.
- Rediscovery a variety of morphological structures within a settlement and a variety of typologies that constitute those structures.
- Rediscovery of settlement as an 'issue' underling the essentially integrated character of the built environment, as against the notion of the form as a "machine" for functional accommodation.
- Introduction of design as the process of typological transformation of the existing types.

The researcher used Fuzzy logic and spatial analysis to analyze spaces

Each dwelling has to be analyzed at two levels as follows:

-Block level: design aspect at block level and planning aspects at neighborhood level is to be analyzed in terms of the area and block layout.

-Dwelling level: design aspect at this level, the flat plan is analyzed to understand the spatial pattern of organization domestic space.

3-Space Syntax:

Is elementary theory and method Space syntax, the analytical tool for this study, is a set of techniques for representing and quantification of spatial patterns of buildings. The main proposition of the theory is that, social relations express themselves through spatial configuration.

Spatial configuration is the relationship between two spaces, taking into account all other spaces in the complex building (Hillier and Hasons ;1987) 'explain spatial' configuration is

thus a more complex idea than spatial relationship, which need invoke no more than a pair of related spaces.

(7-1-2) Criteria for Analysis:

Elaborating further, the concept of type at various scale levels includes the following criteria:

1-Dwelling types

- Plan organization- dimensions, standards, space use.
- Position in the city tissue and the upper levels of cluster, square, street.
- Range of costs, income bracket
- Development capacity extension, upgrading,
- Dwelling capacity, and density.
- Mode of tenure

(7-2) Software Used In the Research:

1- ***Arch-Cad 17:*** Arch-Cad 17 introduces workflow solutions that help bridge the different requirements between architects and various engineering disciplines (Szuba et, al. 2000)

2- ***SPSS:*** SPSS Statistical Software Model is designed to provide an introductory le

3- vel, interactive lesson that operates with SPSS.

3- PHP language:

1.Server-side scripting language

2.An interpreted language like JavaScript

3.Developed by Rasmus Lerdorfin 1994

4.Open source

5.Most web servers have PHP processors.

(7-3) CASE STUDY ANALYSIS:

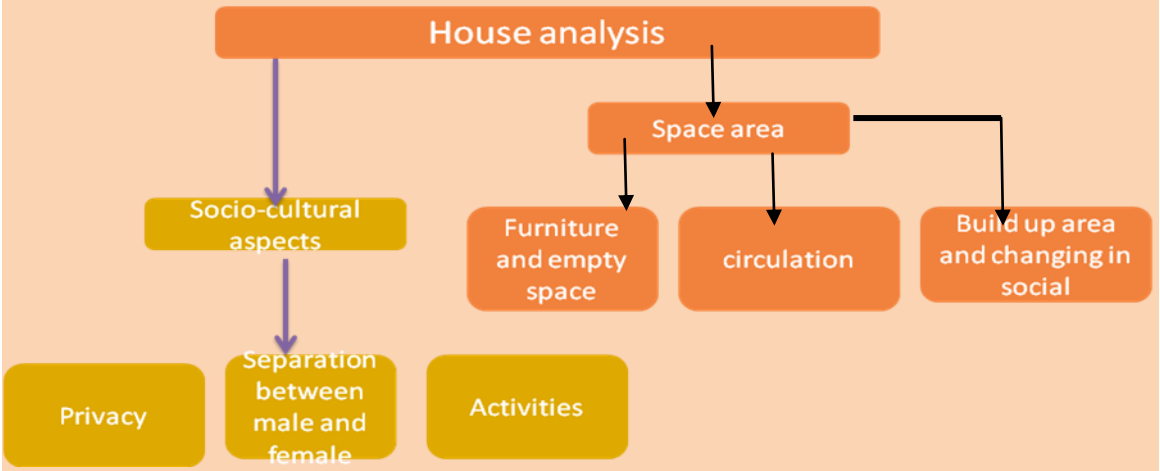


Fig (7-1) Case study house analysis (Source: Author*)*

(7-3-1) *SPATIAL ANALYSIS AT THE DEWELLING LEVEL*

(7-3-1-1)Dwellings analysis Experimental Type(Raw house)

Privacy:

The organization of domestic spaces according to Depth value levels that the positioning of the saloon and family hall at the same level, which means male and female guest receiving area have the same Depth values. In this respect the bed- rooms; the balcony has the highest level of privacy, at a lower level of privacy the kitchen and the family bathroom. The spaces with the lowest level of privacy are the family hall and the guest toilet.

Organization of domestic spaces:

The organization of domestic spaces in this house is shown in the Permeability diagram. It connects most of the principal spaces, the family hall, and the kitchen.

Spatial configuration:

Room positioning indicates a careful and intentional segregation of guest and family areas as represented in the diagram spatial arrangement. Independence in the house design is objectified by positioning social area (i.e. family hall) which used by household members and selected guests then the housewife working area (i.e. kitchen) opening onto the family hall and finally sleeping spaces (bedroom and balcony) which proposed to be used by family members only at the upper level of house

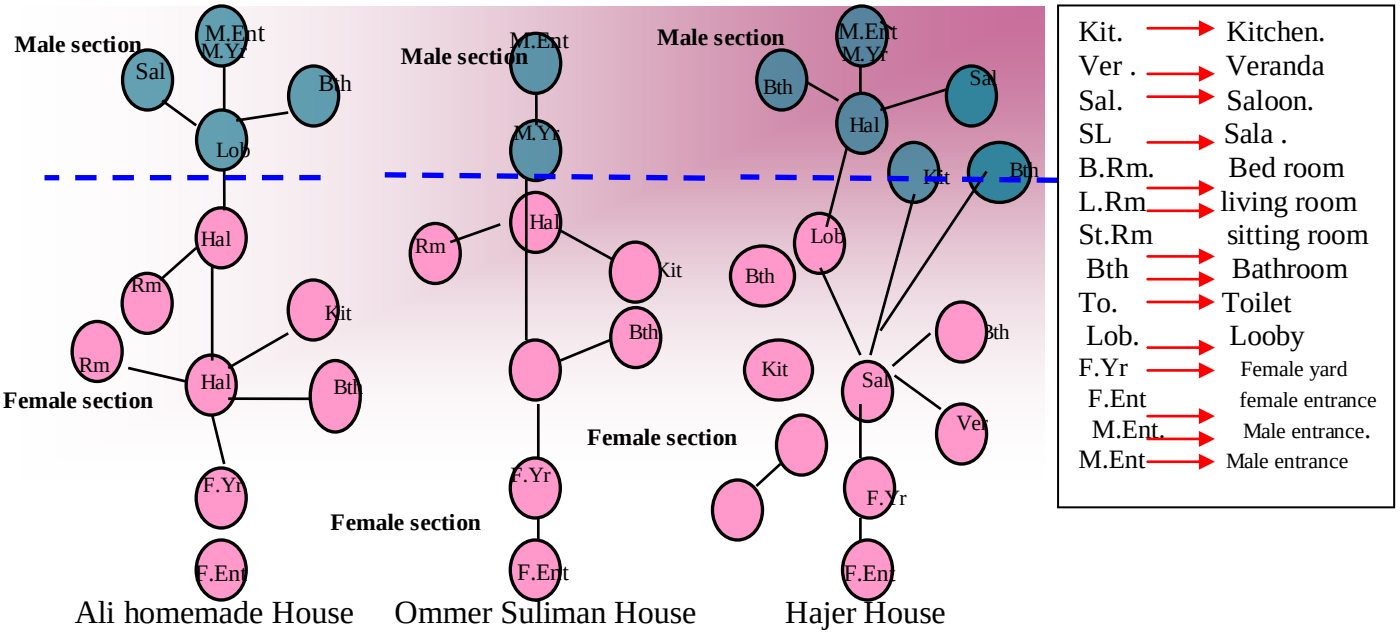


Fig (7-2) Permeability Diagram *semi-detached house*

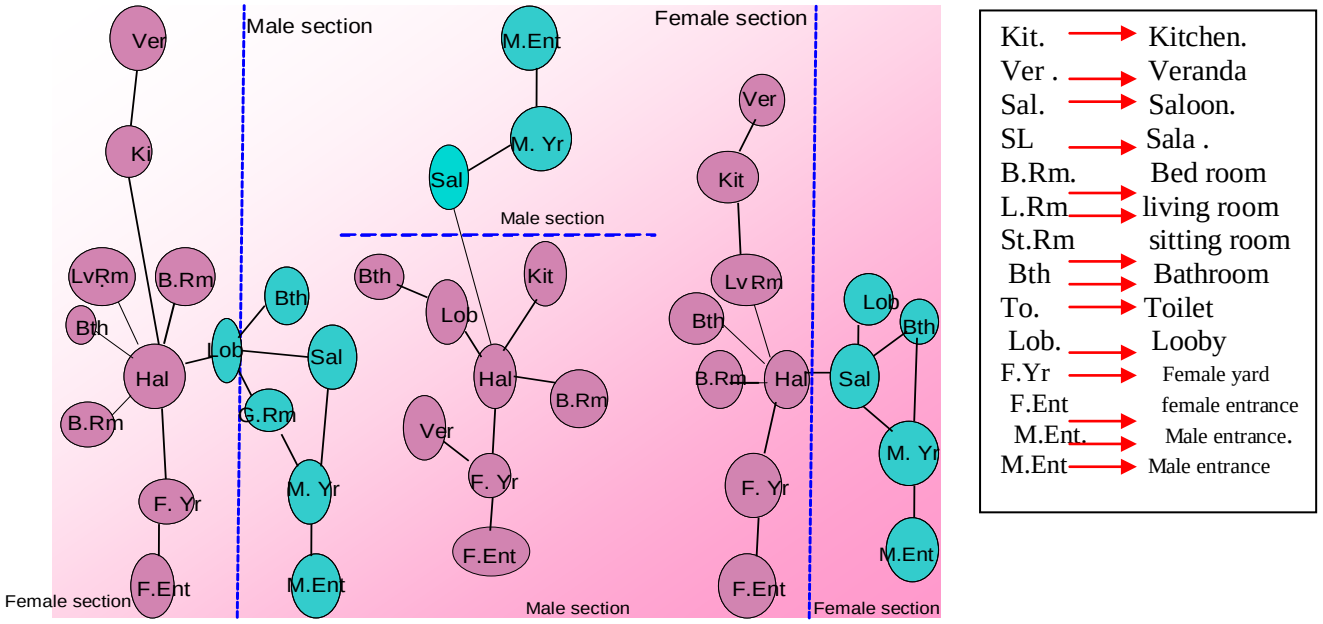
(7-3 -1-2)Dwellings analysis Villa type (semi-detached)

Privacy:

The organization of domestic spaces reveals that the positioning of the family hall has the deeper level; this Depth value can be considered at a high level of privacy of spaces in regard to their position. The space with the highest level of privacy is the kitchen, and the veranda near the kitchen, and the spaces with the lowest level of privacy are the saloon and guest bathroom.

Organization of domestic spaces:

The organizations of domestic spaces in these houses are shown in the Permeability diagram. The design of these houses is objectified by positioning socialized public guest receiving area (i.e. Saloon) which used by any visitor entering the dwellings.



Abd Elmajeed House Egbal House Fatima House

Fig (7-3) Permeability Diagrams apartment house

(7-3-1-3) Dwellings analysis apartment house

Privacy:

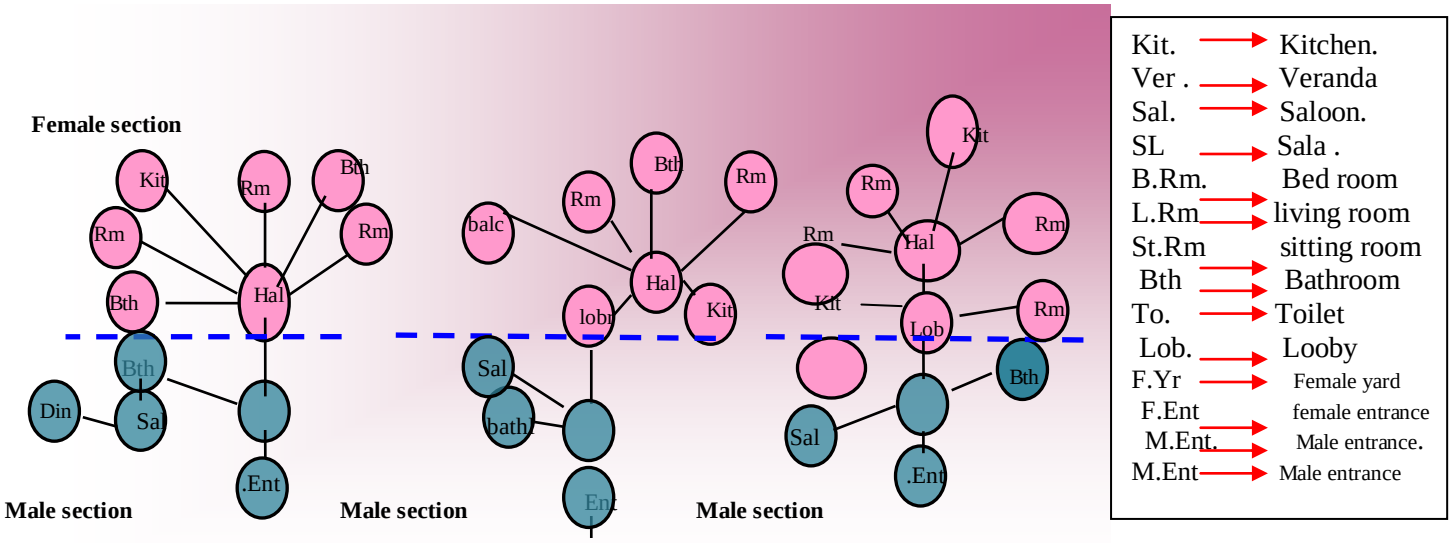
The organization of domestic spaces according to Depth value levels that the positioning of the saloon in deeper level than the family hall. In this respect the bed- rooms; the balcony has the highest level of privacy, at a lower level of privacy the kitchen and the family bathroom. The spaces with the lowest level of privacy are the family hall and the guest toilet.

Organization of domestic spaces:

The organization of domestic spaces in this house is shown in the Permeability diagram. It connects most of the principal spaces, the family hall, and the kitchen.

Spatial configuration:

Room positioning indicates a careful and intentional segregation of guest and family areas as represented in the diagram spatial arrangement. Independence in the house design is objectified by positioning social area (i.e. Family hall) which used by household members and selected guests then the housewife working area (i.e. kitchen) opening onto the family hall and finally sleeping spaces (bedroom and balcony) which proposed to be used by family members only at the upper level of house.



Mohammed Albader Alla Mohammoud Elham Ahmed

Fig (7-4) Permeability Diagrams

(7-3-2) SPATIAL ANALYSIS AT THE CLUSTER LEVEL:

Urban level: this is located in the old part in Omdurman town (Hai- Alomda) as shown in the location plan.

Community level:

Neighborhood: the residential area comprises of low density housing:

1- Raw housing
   - I- ground floor → low cost housing
   - II- Two floors → Experimental low cost housing.
   - III- Two-three floors → Investment housing scheme

2- One floor single detached houses (court yard house)

3- Two or three floors, single detached houses (Villa)

6- 5 floors residential complex building (Apartments)

Cluster level:

I compared between cluster type layout in Aliscan and in the other cluster n Alamal, Dar Alsam and others. I can observe in Aliscan raw house type and semi-detached type houses a very big circulation length compared to the area served, this means important infrastructure more costs, maintenance problems, etc. due to frontage lengths.

The less plot frontage dimensions the more gain in initial, maintenance and running costs for services e.g.:

- Roads and asphalt roads.
- Connections line for Electricity, Telephone, Water supply, and Drainage.
- Overall the accessibility and walking distances.

Dwelling group:

In Aliscan area the raw houses are of course the best solution for the cost- gain by using one wall instead of 3 walls, also the valuable land gain by using a wall instead of lost areas in between in addition to the total isolation of the west and east wall for sun radiation and external air condition.

Semi-detached housing, spatial analysis:

The lengths of the plot are 20m*20m, and the house has two separate buildings, the main building represented the spaces of living activities and sleeping activities while the other is a small share by walls with another 3 neighboring.

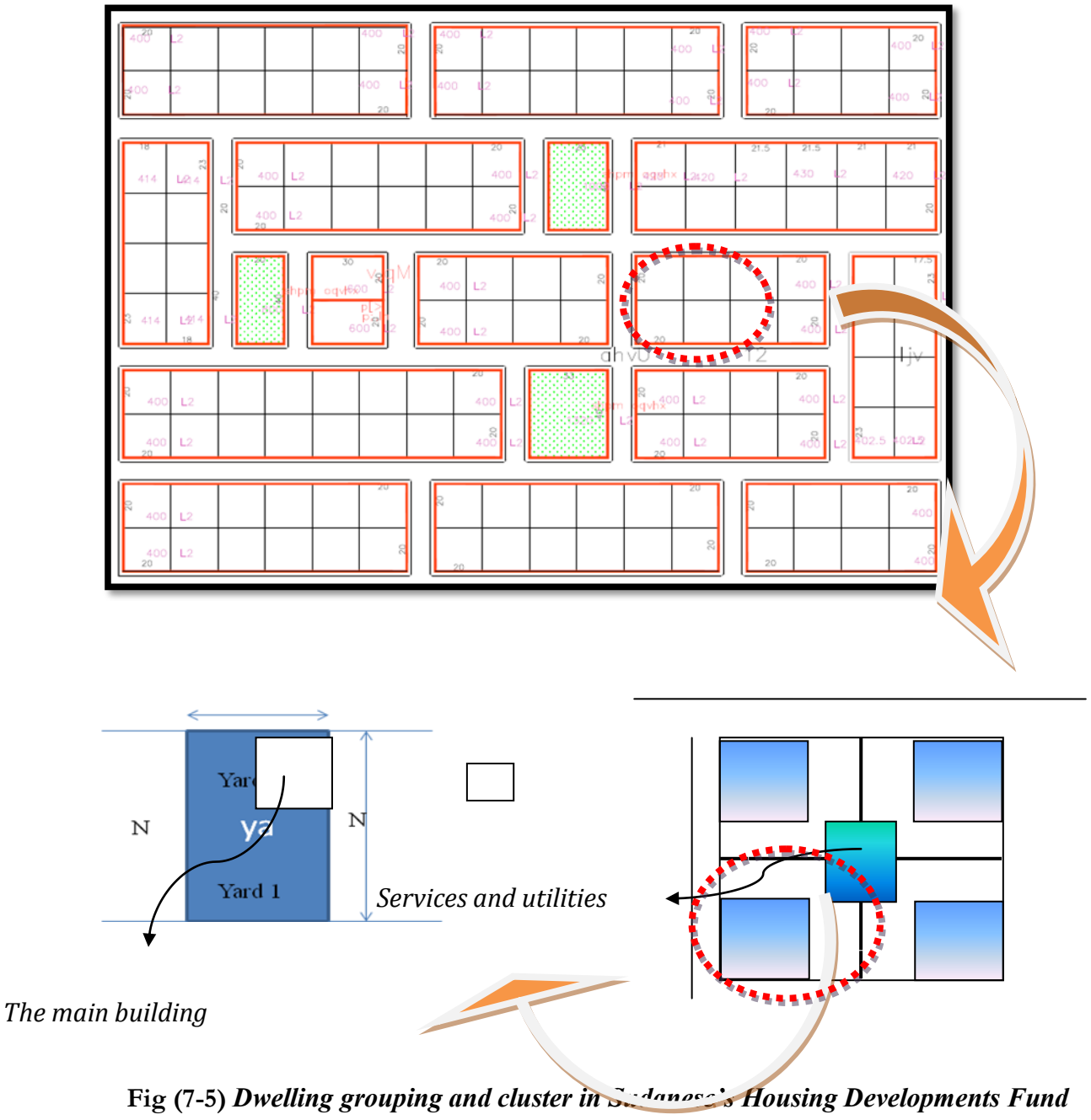


Fig (7-5) ***Dwelling grouping and cluster in Sudanese's Housing Developments Fund (Semi-detached housing-courtyard)***

(7-3-2-1) Semi-detached housing, spatial analysis:

The lengths of the plot are difference, and the building have 5-7 floors, each floor have 4 flats with difference area(170- 194)m.sq

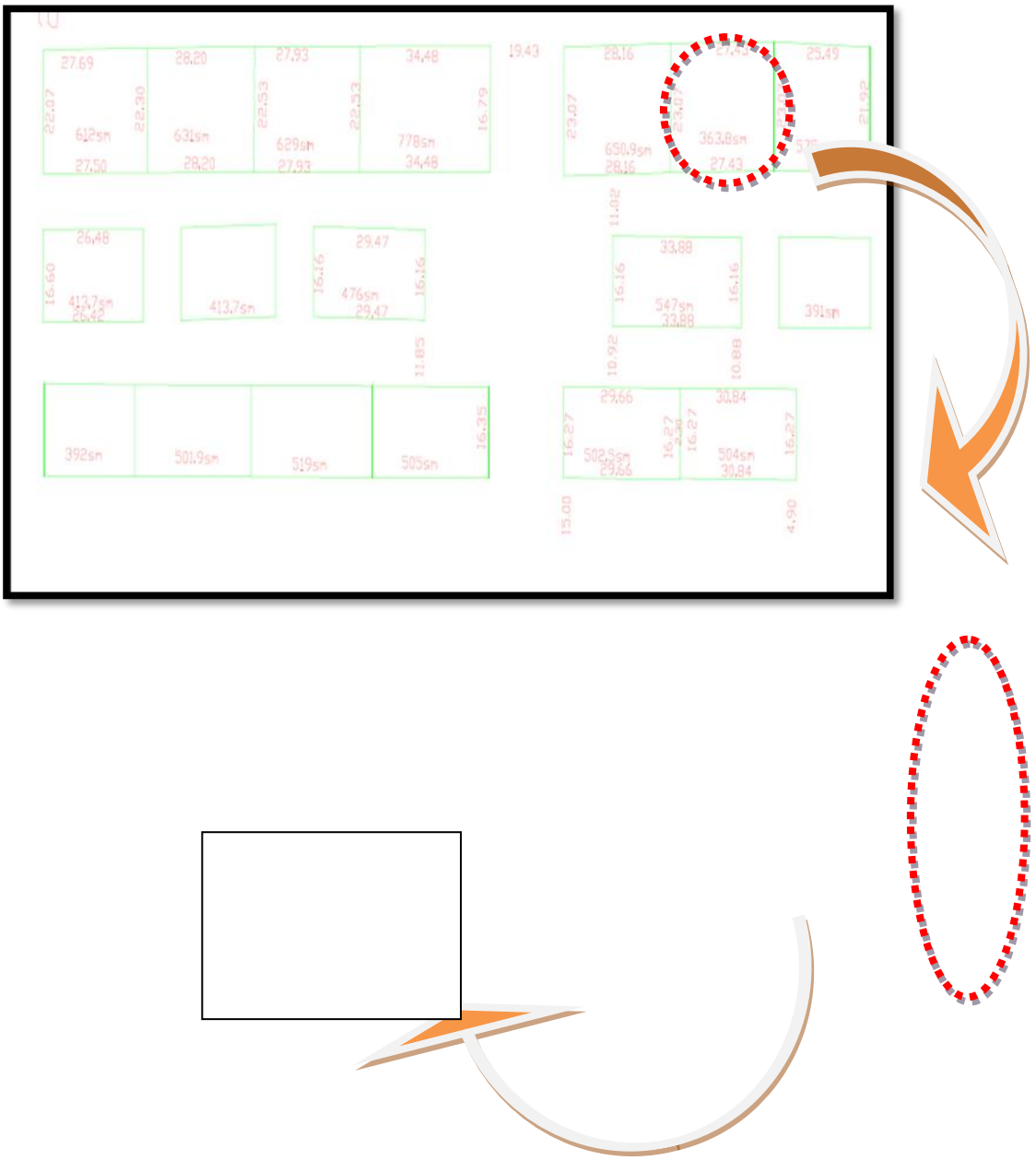
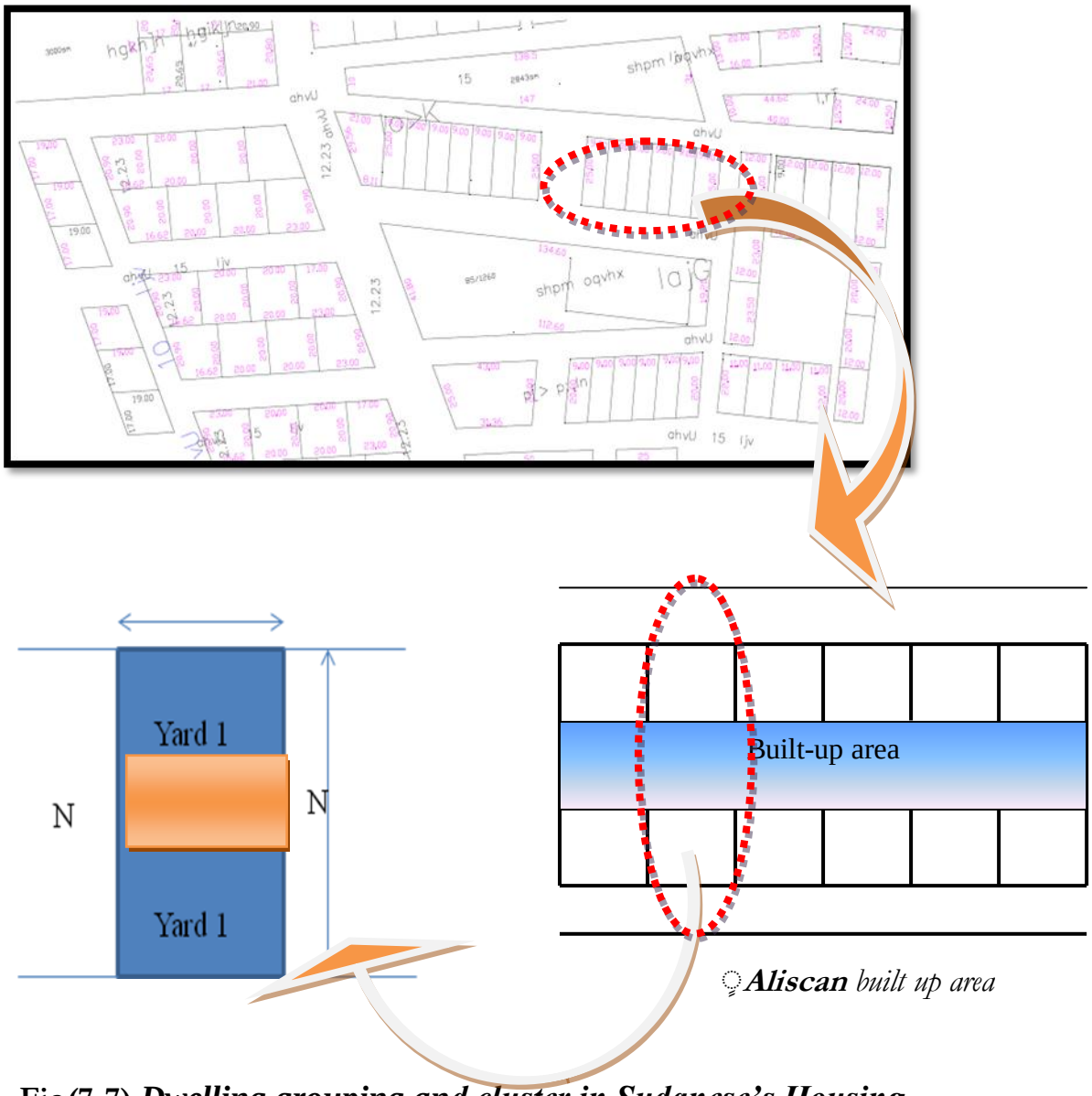


Fig (7-6) Dwelling grouping and cluster in Sudanese's Housing Developments Fund (Semi-detached housing-Apartment)

(7-3-2-1) Raw housing, spatial analysis:

The lengths of the plot are 10m*20m, and the houses have one building with two floors share by walls with other two neighboring, the reception area in the ground floor while the area for the family concentrated on the first floor, the house has two yard did not connect together to pass one for male and the other for female.



Fig(7-7) ***Dwelling grouping and cluster in Sudanese's Housing Developments Fund (Raw housing- Hai Alomda)***

Issue	Number	Percentages %
Questionnaires were returned after a full package	**224**	**97%**
Questionnaires were not returned	**6**	**3%**
Total	**230**	**100%**

Table (7-1) Questionnaires Distributed & Returned

(7-4) QUESTINNAIRE ANALYSIS:

(7-4-1) Research Application Process:

7-4-1-1 Sample of the Study:

The sample was selected intentionally and is one of non – probability sample chosen by the researcher to obtain the information from the specific vocabulary of the population under study. It was distributed (230) questionnaire cover all the population under study. It was received back (224) questionnaires by retrieving reached 97% stated as follows:-

(7-4-1-2) Evaluation of Measurement Tool:

The truth or validity of the measurement tool is defined as the performance ability to measure what was designed for and based on correct measurement theory dealing with free tool of measurement errors, whether random or systematic. The study in the first phase based on evaluating the appropriateness of the measures used in the measurement of the study phrases using consistency and honesty tests to exclude non – moral term of study metrics and verify that the phrases that have been used to measure the concept of certain actually measure this concept and warded other dimensions and features of these tests its ability to provide a set of metrics that determine the applicability of the data to the model that has been detected and the exclusion of any other alternative models can explain the relationship between the scale phrases based on the response of the study sample vocabulary. In the following the researcher presents the results of analysis of the measures used in the study:

(7-4-1-2) The Sincerity of the Scale Content Test:

After the completion of the preparation of the initial version of the standards, the study was presented in the form of a questionnaire to a group of arbitrators and experts (five professors). The experts were asked to express their views about the study tool and validity of the statement to represent the hypotheses, also they were asked to amend, porcelain and add what they see suitable for the purpose of measuring the sincerity of the study. As stated by Ebel that the best way to make sure the virtual honesty of performance measurement that the number of specialists reports about to what extent the statements represented by the formula to be measured. After the questionnaire has been retrieved from the experts, it has been analyzed and taking their observations and made adjustments that they have suggested and then it was the design of the questionnaire in its final form (see Appendix II).

2/Reliability of the measurement Instruments:

A number of writers assert the importance of the reliability concept, among these writers is Drost1 who defines reliability as" the extent to which measurements are repeatable – when different persons perform the measurements, on different occasions, under different conditions, with supposedly alternative instruments which measure the same thing". The same author goes on to illustrate that there are many ways and techniques to estimate the reliability of a scale, among the most widely used techniques is the Cronbach Alpha coefficient. Also, there is no agreement among the scholars on the level of acceptance of the reliability of an assessment. Some like, Dawn and Adam2 argue that the Cronbach alpha coefficient level ranges between (0,1), where 0 indicates no internal consistency and I indicates the maximum degree of interrelatedness. In reality, the acceptance level may range from 0.3 to 0.7 in some cases.

Phrases	**Cornbach's Alpha**
Total	**88**

Table (7-2)Cornbach's Tests (Source: Author , 2016)

1- Cornbach's Tests

To test to what extend there is a consistency among the study question answering by the respondents, the author calculated the degree of significance (Alpha –cronbach) and the accepted statistical value of the coefficient of Alpha- cronbach is 60%, so the author performed the procedure of significant test for the answers of all respondents for whom the questionnaire was distributed randomly in all its pillars and the results explained as follow:

From table (7/2) showed a high degree of internal consistency among the answers of statement wording which enable us to rely on, in attaining the objectives of the study.

2- Analytical Statistics Tools used in the Study:

To analyze the results and to test the hypotheses of the study, the researcher used the following tools:

a) Reliability Test for the questions of the questionnaire by using:

(i) Virtual Honesty Test: to ensure that the phrases are measure specific meaning exactly based on the response of the sample of the study.

(ii) Cornbach"s Alpha: it was used to measure the internal Stability for the phrases of the questionnaire.

B) Descriptive Statistics Methods: to describe the characters of the sample of the study using the following tools:-

(i) Frequency Distribution for the Phrases of the Questionnaire recognize the frequency distribution for the result of the sample.

(ii) The Weighted Mean: it is used to describe the opinions of the sample about the hypotheses of the study as it is one of the measures of central tendency.

(iii) Standard Deviation: it is used to measure the dispersion in the result of the arithmetic mean.

3- Data analysis:

The author was aimed to analyze the primary data that saw to what extent the sample size represent the population one, then from that the author performed an statistical description for the primary random sample, the author made a number of tables that explain the value of every variable that showed the basic features of the sample size and the author used the frequency distribution to explained the number of respondents to the

one value inside the variable in kind of percentages &numbers, here below the frequency distribution for all the answers for all questionnaire.

7-4-2: Questionnaire result:

7-4-2-1 Section one: Household Composition:

1. Household Age (Year)

From the figure (7-8) Shows that: the respondents' **household** ages between (51-60) year represents (37.1%) as a high ratio. And those between age 41-50 year were accounted for (27.7%). Whereas the respondents' **household** ages between 20-30 years were (1.8%), as lower ratio, and lastly, the respondents ages above than (60) year were represented (18.8%).

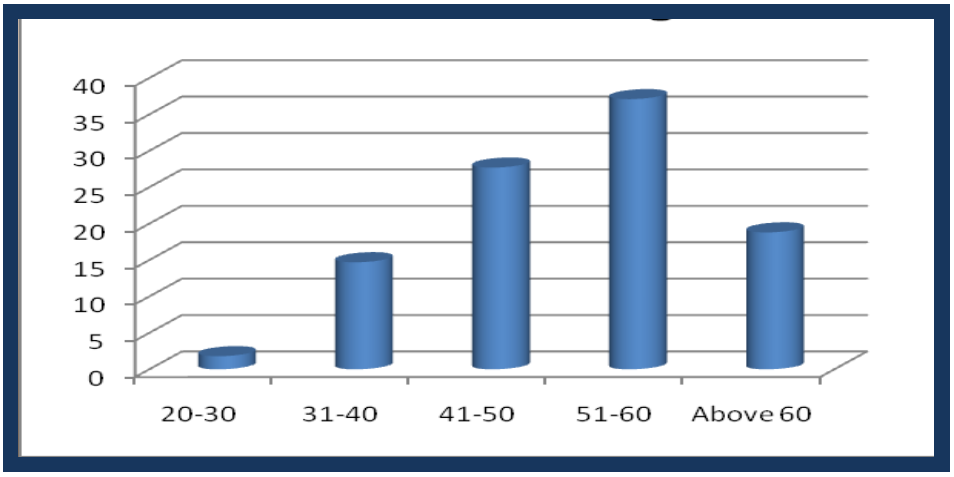


Fig (7-8) **household Age (Year)**
(Source: The Author survey – questionnaire results)

2. Gender;

From the fig (7-9), shows that: the respondents'. Most of the respondents' sex was males (80.8%).the female are (19.2)% of the total sample of the study.

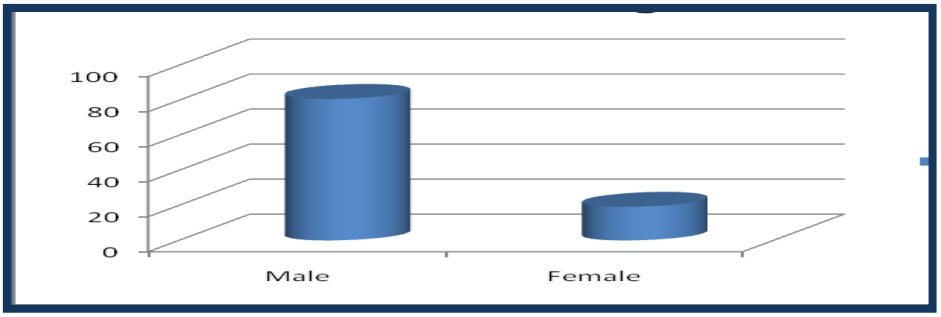


Fig (7-9) **Gender**: **Frequency distribution according to Gender**
(Source: The Author survey – questionnaire results)

3. Status:

The respondent's social status, the majority of them were married (79.9%) as a high ratio, followed by (8.9%) of the respondents were singles respectively as lower percentage figure (7-10)

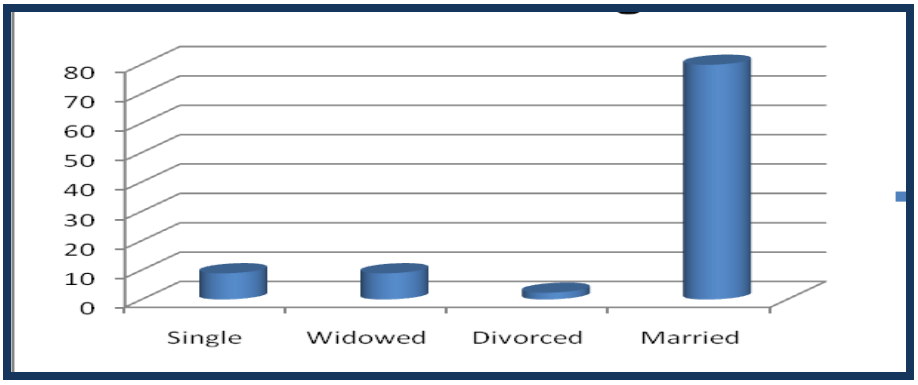


Fig (7-10) **Frequency distribution according to social status**

(Source: The Author survey – questionnaire results)

4. Education level:

From the figure (7-11):

Concerning for the respondents' educational level that fill up the questionnaires, the majority of them were university education level account for BCs (41.5%), followed by the level of the High institute (6.3%); and respectively as lower ratios; whereas, respondents who have High second were accounted for (31.7%). While, those with level (Gen second, Elementary) were accounted for (20.6%).

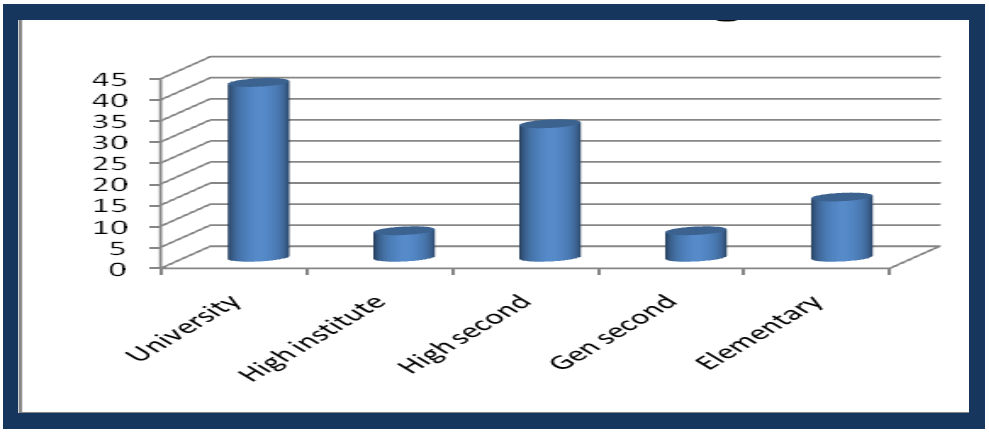


Fig (7-11) **Education level**

(Source: The Author survey – questionnaire results)

5. Occupation of household;

Figure (7-12) shows that, the percentage of **households' occupation** in the Public sector was a high ratio (38.8%), and it was (20.5) in the private sector. Whereas, respondents who have Self-employed were accounted for (29.9%).

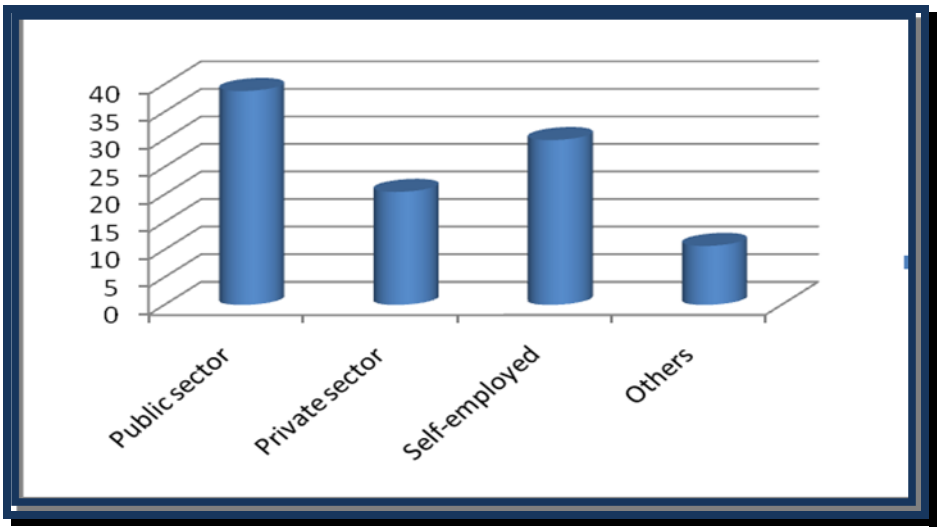


Fig (7-12) The **Occupation of household**:
Source: The Author survey – questionnaire results

5. Monthly income of household head in Sudanese pound:

From the figure (7-13) it is obvious that the majority of the sample size **Monthly income of household head in Sudanese pound** More than 2000 accounts (33.5%), followed by the **Monthly income 1000-1999** (32.5%); and respondents who have monthly income less than 450 were accounted (14.4).

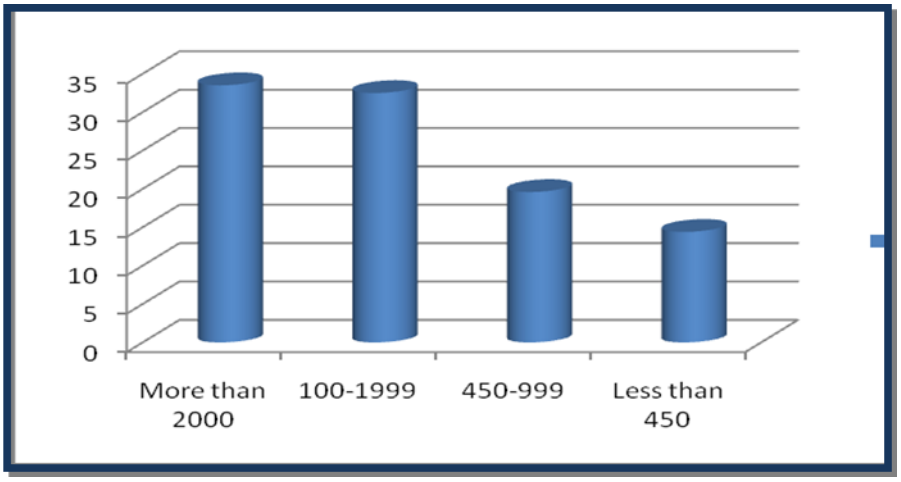


Fig (7-13) **Monthly income of household head in Sudanese pound**
(Source: The Author survey – questionnaire results)

. **7. Occupation of the wife of the household head:**

Figure (7-14) shows that: the **Occupation of the wife of the household head**, Housewife (72.3%) as a high ratio, and only (8%) private sector. Whereas, respondents who have Self-employed were accounted for (4.5%).

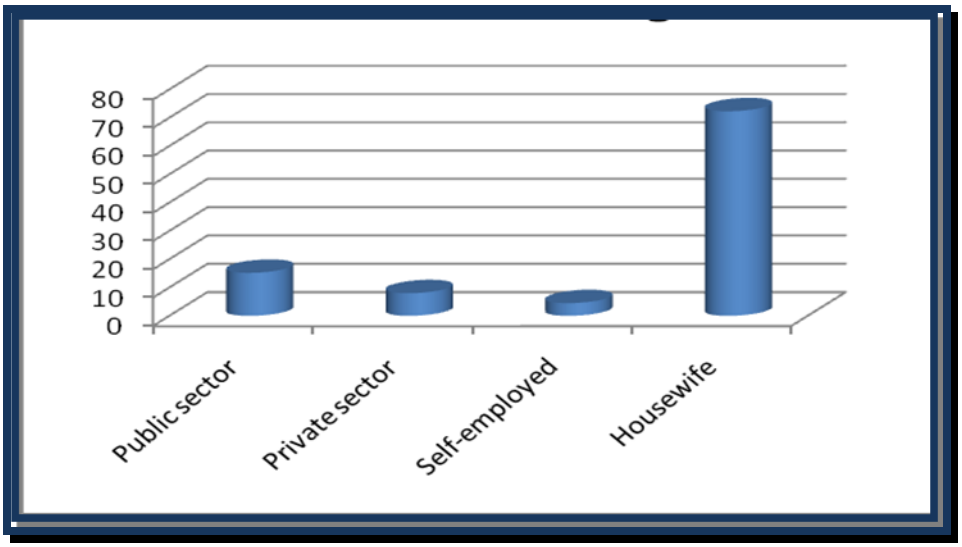


Figure (7-14) Occupation of **the wife of the household head**
(Source: The Author survey – questionnaire results)

8.; How did you acquire this plot or house:

Figure (7-15) shows that the Majority of the sample (39.7%) acquires **this plot or house from (**Bought**)** and (33.9%) Distributed by Govern and (7.5%) (Grant, Inherited)

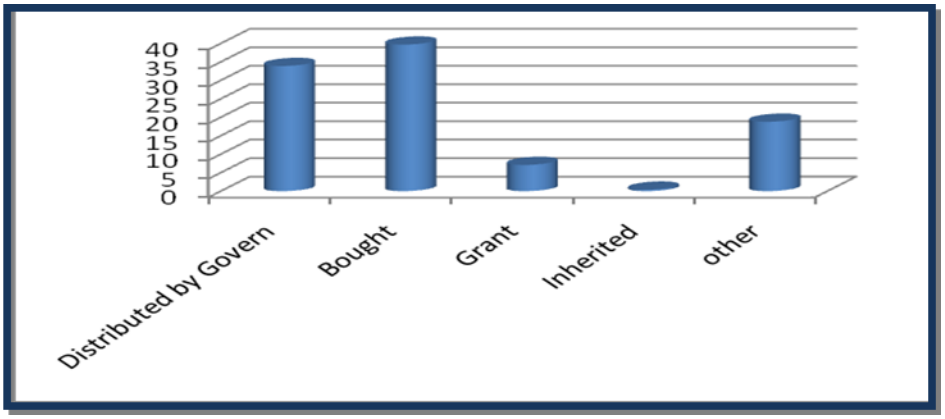


Fig (7-15) how did you acquire this plot or house:
(Source: The Author survey – questionnaire results)

9.**; Urban experience of the household in capital :**

Figure (7-16) Shows that the majority of the sample; **Urban experience of the household in capital** (16-20 year), (57.1%), as a high ratio. And those between 11-15 year accounted for (14.7%). Whereas the respondents' **Urban experience of the household in the capital** between 5-10 years were (12.1%), as lower ratio, and lastly, the respondents' **urban experience of the household in capital** less than 5 years were represented (16.1%).

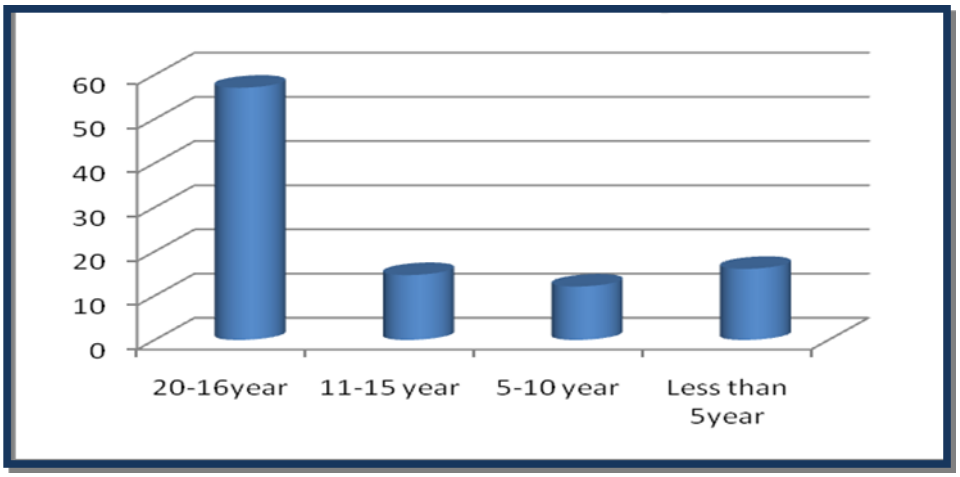


Fig (7-16) **Urban experience of the household in the capital**
(Source: The Author survey – questionnaire results)

10. Length in living in the dwelling:

From the figure (7-17)

Shows that: the Majority of the sample size**: Length in living in the dwelling ranged** (1-5 year), (62.45%), as a high ratio. And those between 5-15 year accounted for (25%). Whereas the respondents' above 15 years were (12.5%), as lower ratio

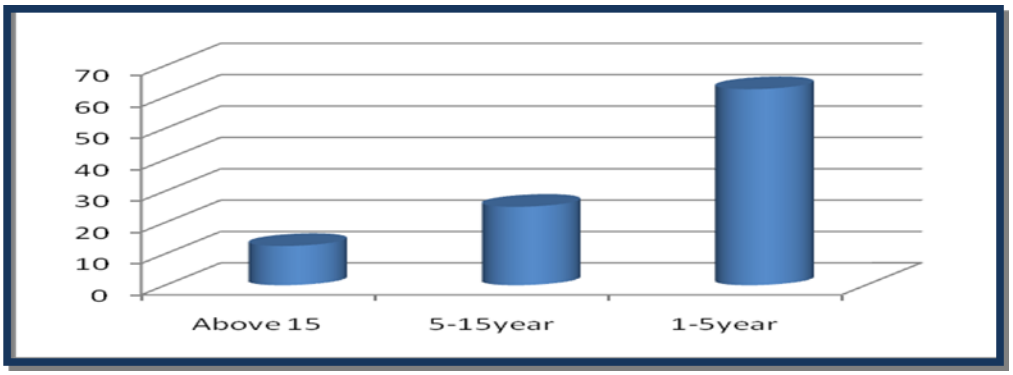


Figure (7-17) Length in living in the dwelling

Section (3):

Socio- cultural and economic of Household:

A- Household social factors:

1. Family type

From the d figure (7-18) it is obvious that the majority of the sample size (65.7) % **Family type are** (Nuclear) and (14.3)% (Composite) and (20)% (Extend)

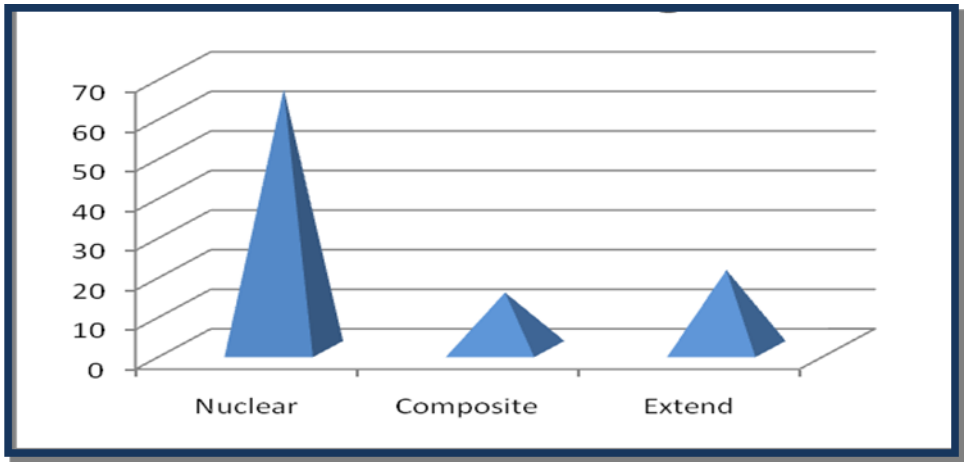


Fig (7-18) Family type:

(Source: The Author survey – questionnaire results)

2.; Number of family members living in the house:

From the figure (7-19) shows that the majority of the sample size (46) % **Number of family members living in the house** between (5-7) and those between 2-4 was accounted for (22.8%). Whereas the respondents' more than 10 were (8.9%), as lower ratio and (22.3)% between (8-10).

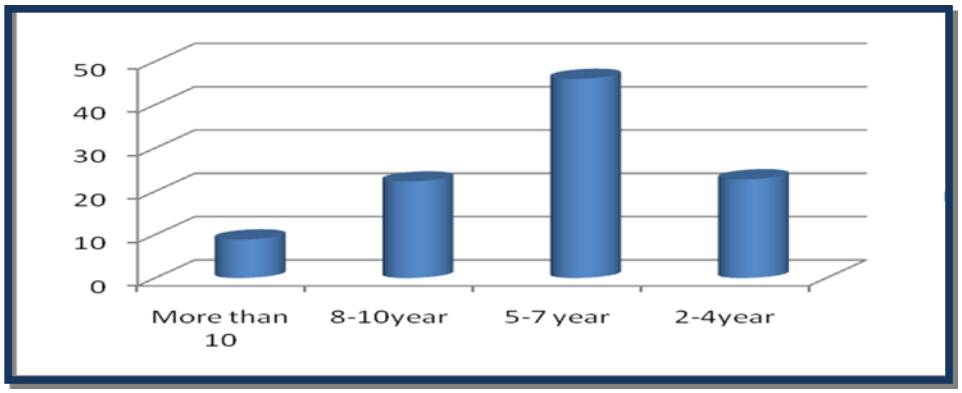


Fig (7-19) Number of family members living in the house

3.; Is it others people living in the house:

From figure (7-20) **it is obvious that the majority of the sample size (%72. 8) disagrees with the ;(Others people living in the house) while (%27. 2) were agree**

B/ Household Cultural factors:

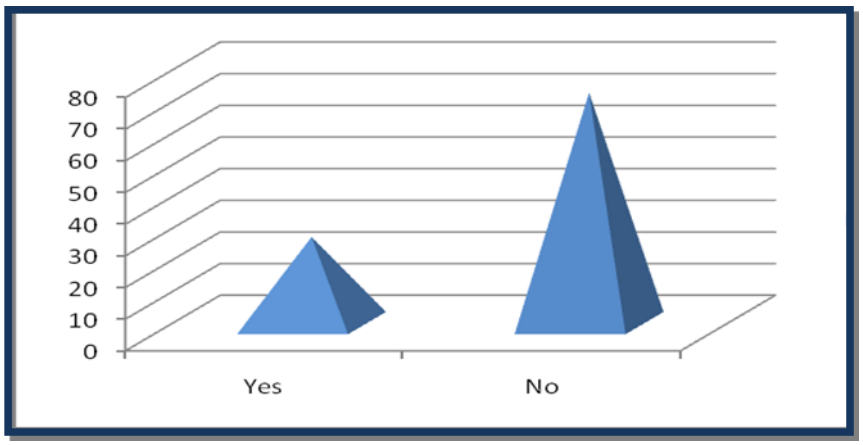


Fig (7-20): Is it others people living in the house

(Source: The Author survey – questionnaire results)

4.; Determine the ability of having a multiuse space in the house:

From the figure (7-21) it is obvious that the majority of the sample size (41.2) % the **multiuse space in the house** (others) and (27.7)% (Living room) and (20.1)% Bedroom .

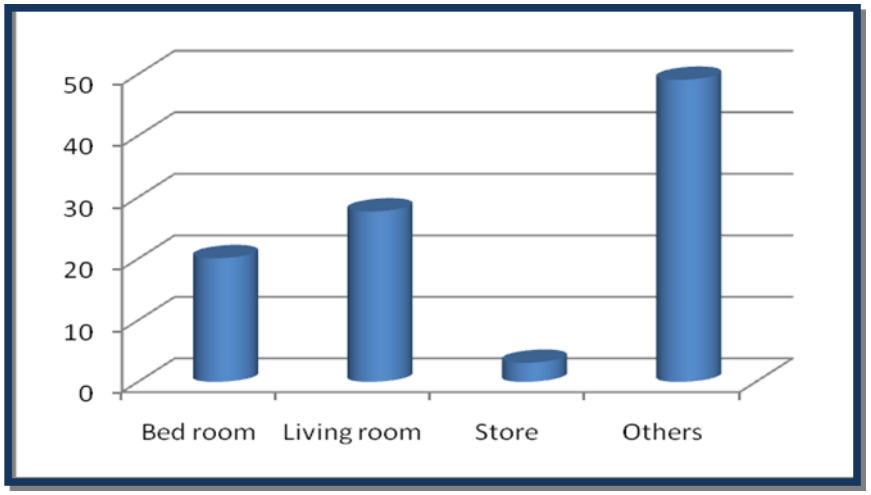


Fig (7-21): Determine the ability of having a multiuse space in the house

(Source: The Author survey – questionnaire results)

15.; When you receive guests, do this effect:

From the figure (7-22) it is obvious that the majority of the sample size (36.6) % the receive guest affect (Sleeping arrangement) and (32.1)% (Eating and (31.3)% Any other activities.

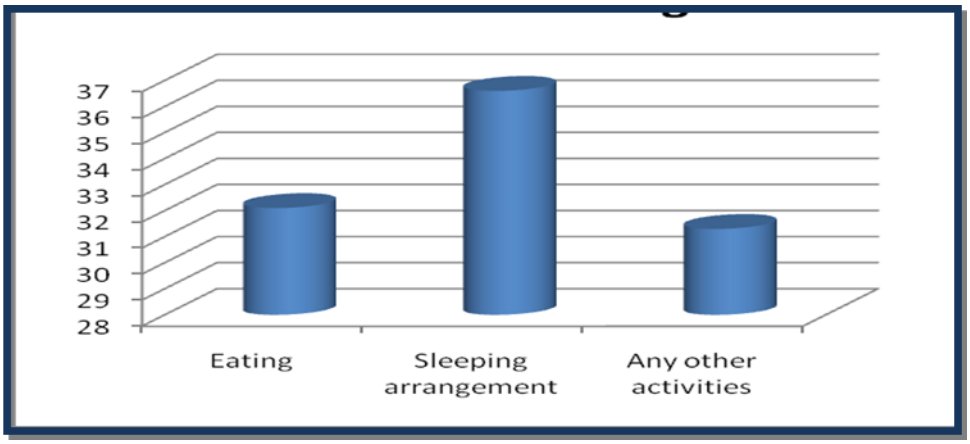


Fig (7-22) Effected activities when receiving guests

Section (4) Characteristic of the Dwelling:

A/Form and Physical Features:

1. Type of house

From the t figure (7-23) it is obvious that the majority of the sample size (33) % type of house (Detached) and (29)% (Semi-detached) and (10.1)% (Row). And (27.9)% Residential complex.

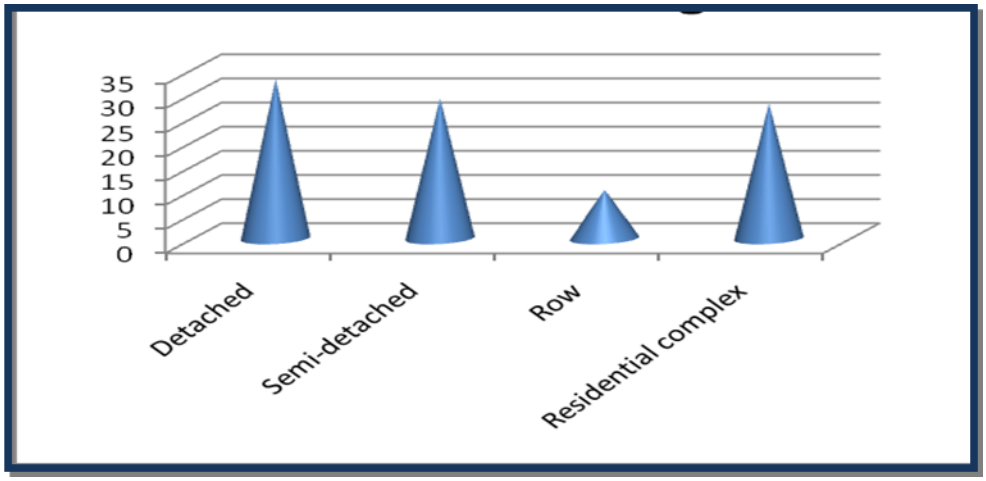


Fig (7-23); Type of house

(Source: the Author survey – questionnaire results)

2.; If you habit in complex building what is the number of building floors:

From the figure (7-24) it is obvious that the majority of the sample size (61.3) % **the number of buildings between** (3-5 floors) and those between (1.3 floors) was accounted for (27.4%). Whereas the respondents' more than 5- Floors were (9.7%), as lower ratio.

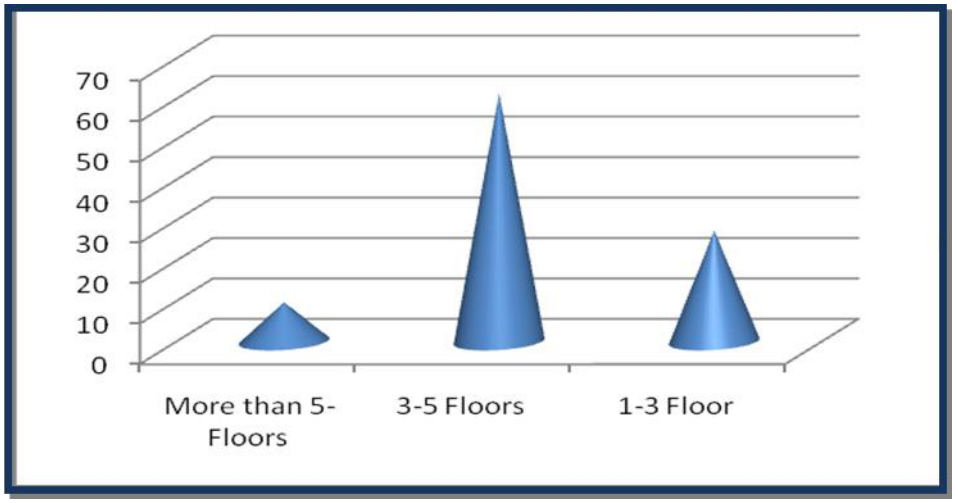


Fig (7-24): The number of building floors
(Source: The Author survey – questionnaire results)

3.; If you habit in complex building what is the number of housing unit on the floor

From the figure (7-25) it is obvious that the majority of the sample size (38.7) % the number of housing unit in the floor (1-2) and those between (more than 4) was accounted for (37.1%). Whereas the respondents' between (3-4) floors were (24.2%), has a lower ratio.

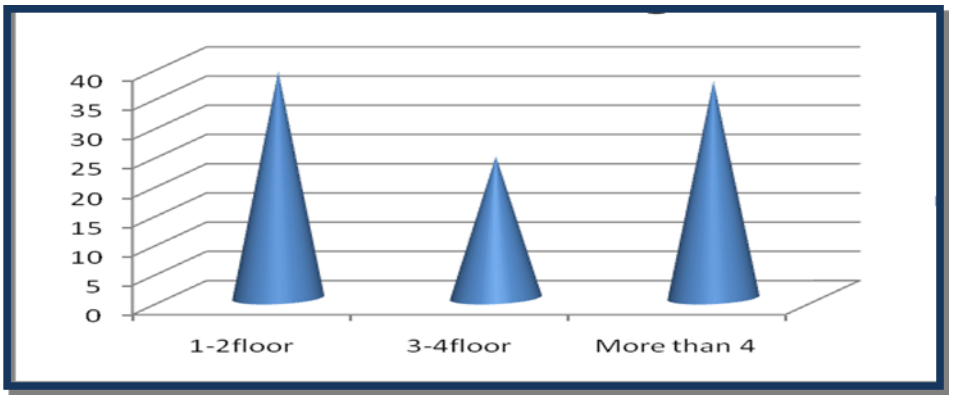


Fig (7-25): The number of housing unit on the floor
(Source: The Author survey – questionnaire results)

B/Spatial Organization and configuration:

Is the entrance injured or reveal the spaces in your house

From the figure (7-26) it is obvious that the majority of the sample size (%80. 8) agrees with the ;(entrance injured or reveal the spaces in your house) while (%19. 2) were disagree.

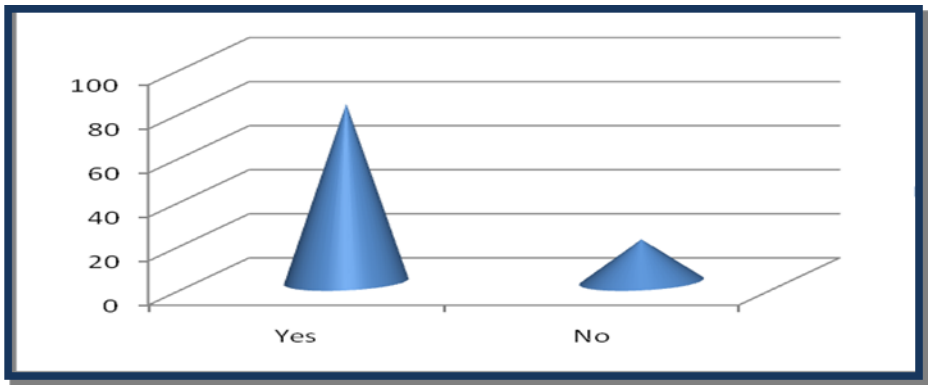


Fig (7-26): Is the entrance injured or reveal the spaces in your house Source: The Author survey – questionnaire results

5.; The size and layout of your home doesn't allow you enough privacy.

From the figure (7-27) the majority of the sample size agree that **The size and layout of your home doesn't allow you enough privacy where the proportion is** (66.5) % while the percentage of agree (33.5)%.

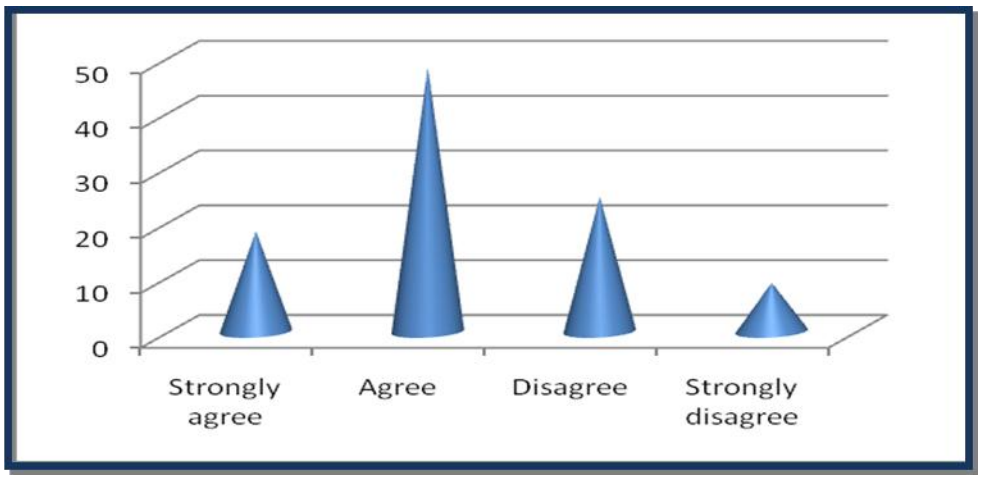


Fig (7-27): **The size and layout of your home doesn't allow you enough privacy.** (Source: The Author survey – questionnaire results)

6.; Does the house have a private space to entertain guests from other members of the household.

From the figure (7-28) it is obvious that the majority of the sample size (%75>4) agrees with ;(**the house has a private space to entertain guests from other members of the household**) while (%24.6) were disagree.

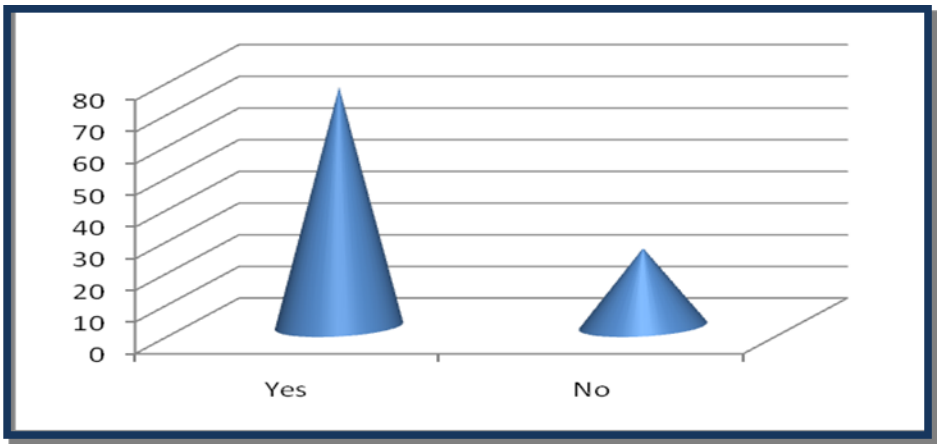


Figure (7-28): **Dose the house has a private space to entertain guests from other members of the household** (Source: The Author survey – questionnaire results)

7.; When you receive guests in the house which of these spaces are affected by

From the figure (7-29) it is obvious that the majority of the sample size (48.7) %is **receiving guests in the house which of these spaces are affected by** (Other) and (23.8)% (32.6) **affected by** Sleeping and (18.8)% **affected by** Eating.

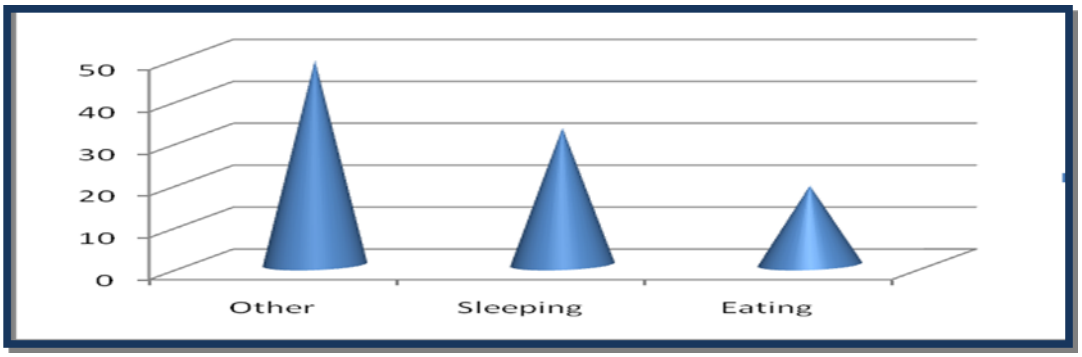


Fig (7-29) The Occupation of household:
(Source: The Author survey – questionnaire results)

7. **Separation between male &female section:**

From the figure (7-30) it is obvious that the majority of the sample size (43.3) % **Separation between male &female section** (Physical Separate) and (32.1)% (Partly Separate) and (24.6)% No Separate.

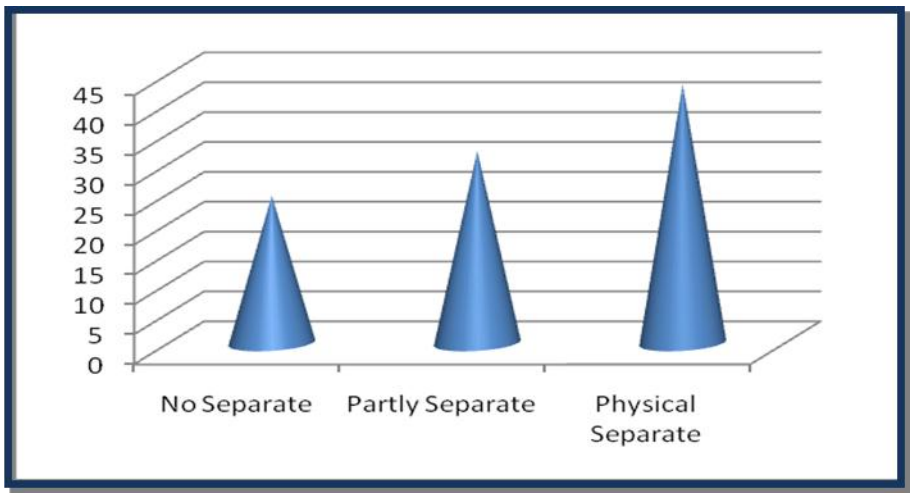


Fig (7-30) Separation between male &female section
(Source: The Author survey – questionnaire results)

8. Your children have a room with enough space in which they can play on their own.

From the figure (7-31) it is obvious that the majority of the sample size (54.9%) degree with ;(**children have a room with enough space in which they can play on their own**) while (%45.1) were agree.

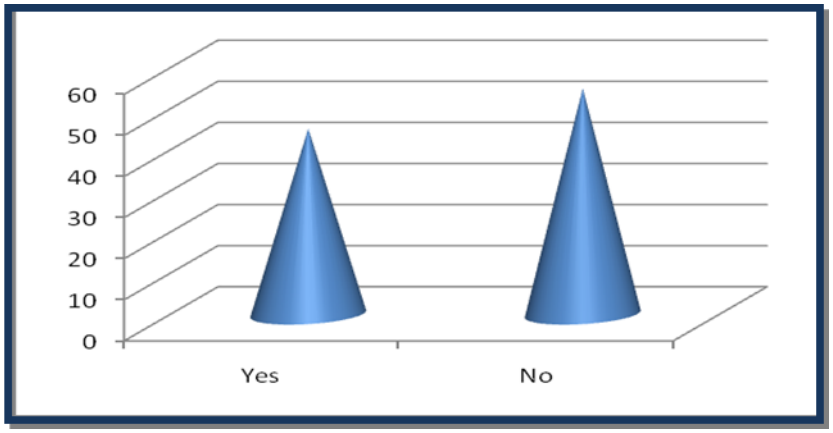


Fig (7-31) Your children have a room with enough space in which they can play on their own.(Source: The Author survey – questionnaire results)

9. Where does the family eat the daily meals:

From the figure (7-32) it is obvious that the majority of the sample size (39.3) % **the family eat the daily meals** for (Other) and (29.9)% (Living room) and only (14.3)% in The kitchen.

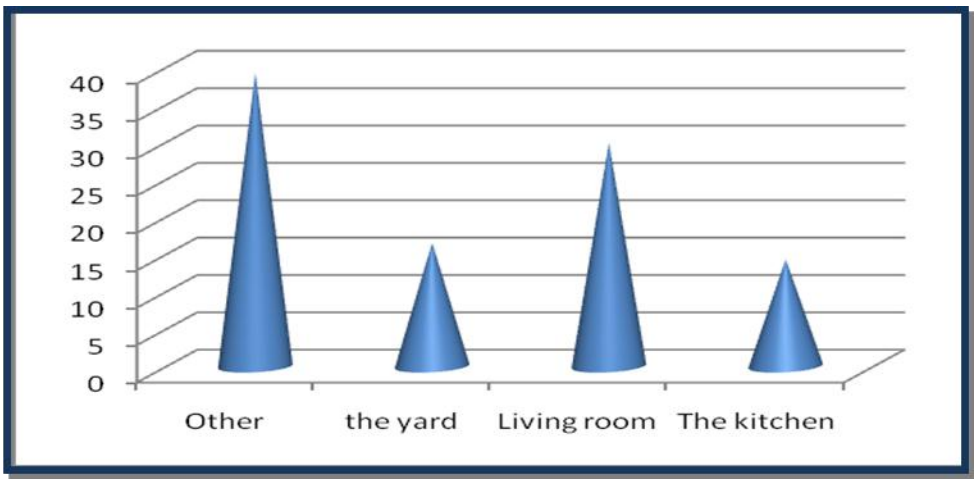


Fig (7-32) Where does the family eat the daily meals?
(Source: The Author survey – questionnaire results)

11. Are you finding that eating room is important in the dwelling?

From the figure (7-33) it is obvious that the majority of the sample size (78.)% disagree with ;(the **eating room is important in the dwelling**) while (%21.4) were agreed.

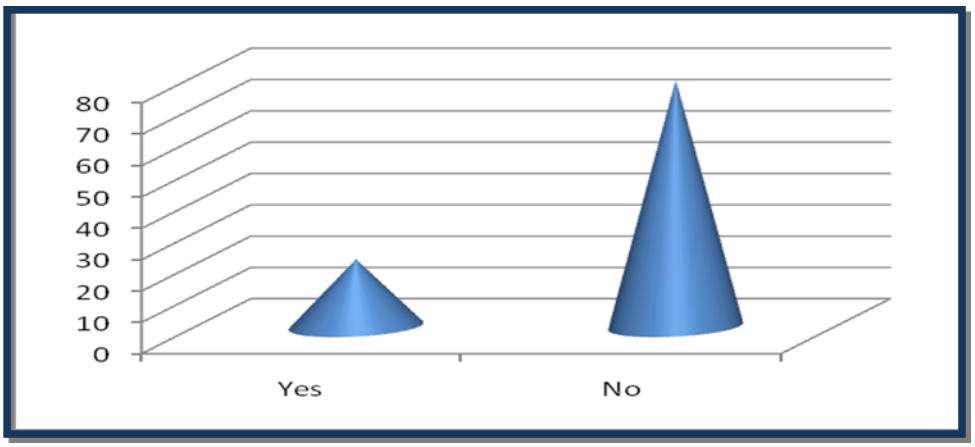


Fig (7-33) **Separation between male &female section**
(Source: The Author survey – questionnaire results)

C/ House and spaces area:

12. Doweling Total Area

From the figure (7-34) shows that: the Majority of the sample; **Doweling Total Area** (300-400) where **the proportion is** (42) % and (33)% **Doweling Total Area between (200-300) and (9.8)% more than 400.**

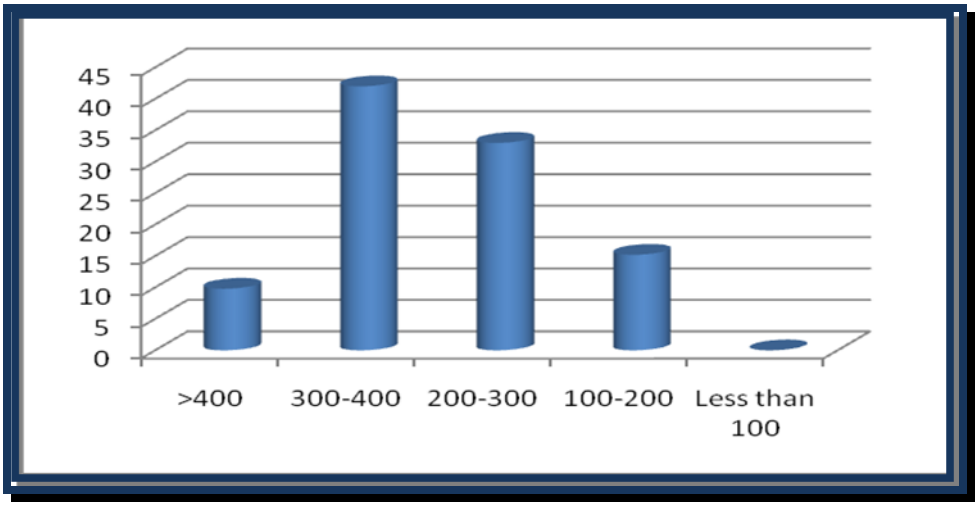


Fig (7-34) Doweling Total Area

(Source: The Author survey – questionnaire results)

13. The built up Area

From the figure (7-35) it is obvious that the majority of the sample size (62.9) % **The built up Area ranged** (100-200) and (16.9) % less than 100 and (20.1)% above 200.

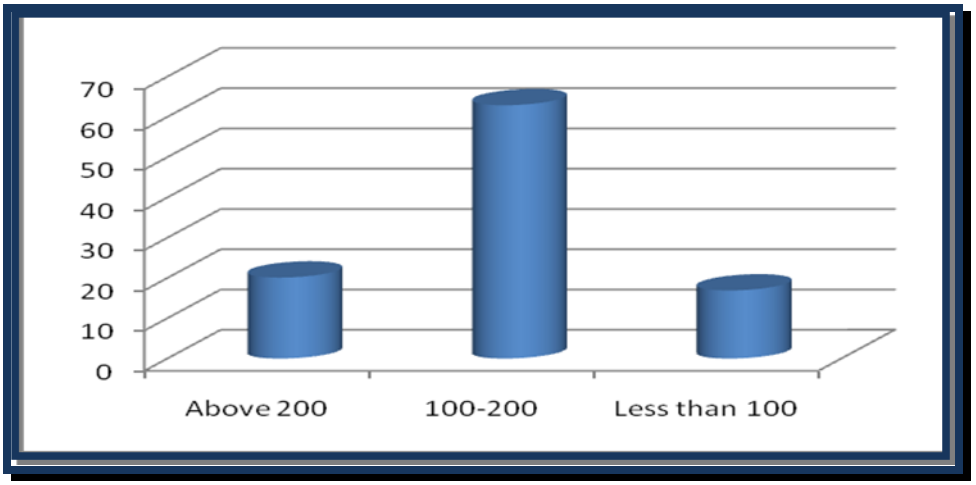


Fig (7-35) The built up Area

(Source: The Author survey – questionnaire results)

14. When you chose to live in the property, did you know the size of the property in square meters.

From the figure (7-36) it is obvious that the majority of the sample size (33) % **the size of the property in square meters** (Not very important).

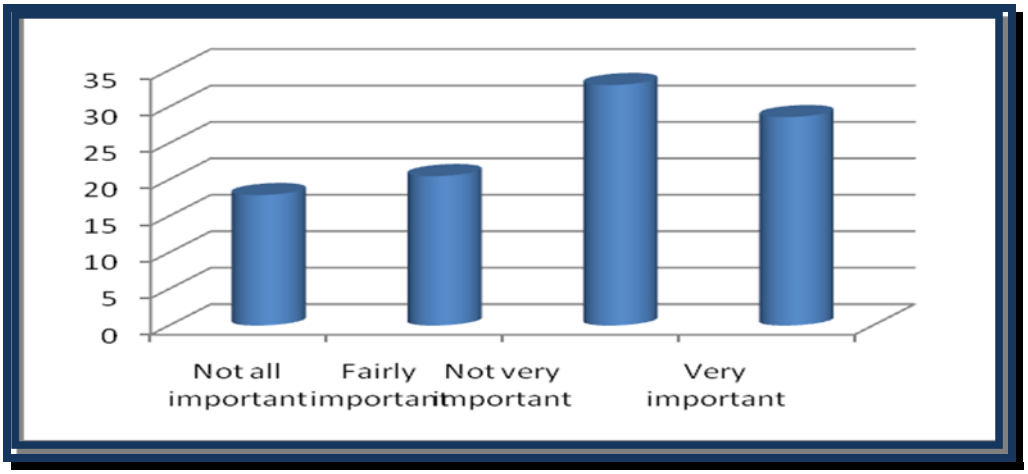


Fig (7-36) the size of the property in square meters
(Source: The Author survey – questionnaire results)

15. Types of house expansion:

From the figure (7-37) it is obvious that the majority of the sample size (46) % shows that the **Types of house expansion (**Horizontal**)** and (28.6)% say (Vertical) and (25.4)% no one.

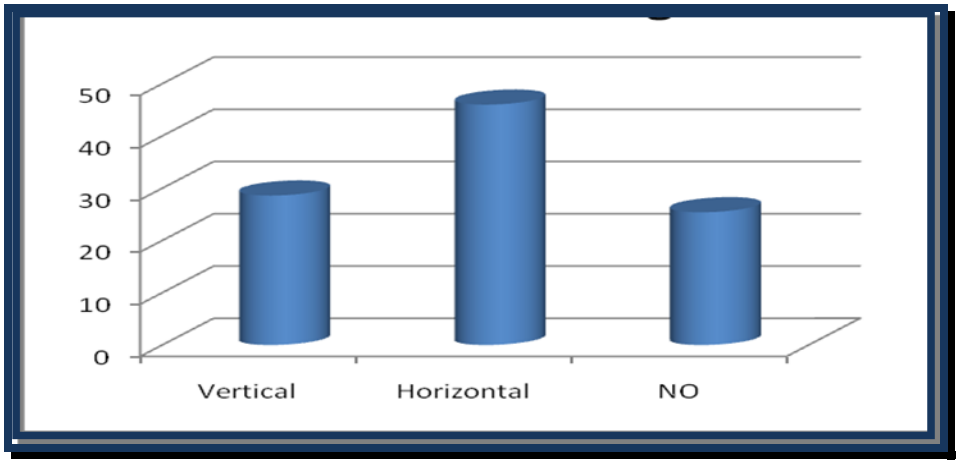


Fig (7-37) Types of house expansion
(Source: The Author survey – questionnaire results)

16. The kitchen doesn't have sufficient workshop space to prepare meals conveniently (allowing for preparing meals conveniently, allowing for appliances such as microwave, toaster ect

From the figure (7-38) it is obvious that the majority of the sample size (53.1%) disagrees with ;(**The kitchen doesn't have sufficient workshop space to prepare meals conveniently (allowing for preparing meals conveniently, allowing for appliances such as microwave, toaster ect**) while (46.9%) were agreed

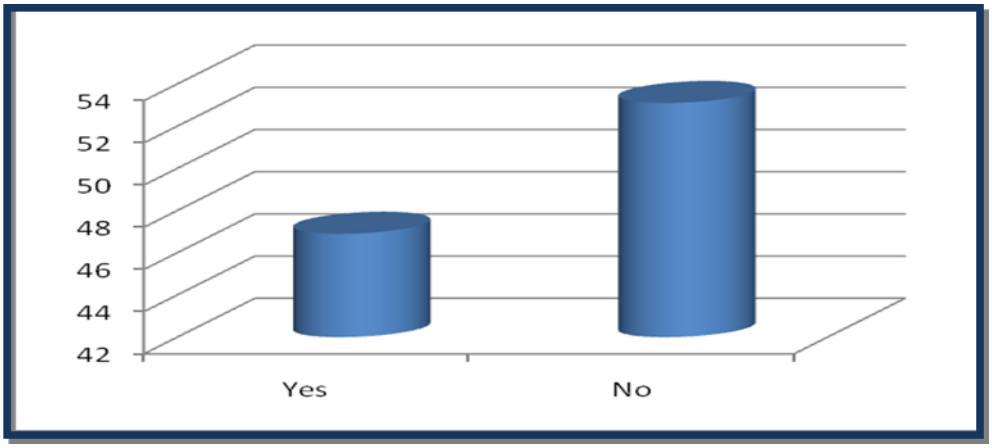


Fig.(7-38) kitchen sufficient space

(Source: The Author survey – questionnaire results)

17. The kitchen doesn't have sufficient space for small children to play safety in the kitchen when you are using it

From the figure (7-39) it is obvious that the majority of the sample size (53.1%) disagree with ;(**The kitchen doesn't has sufficient space for small children to play safety in the kitchen when you are using it**) while (46.9%) were agreed

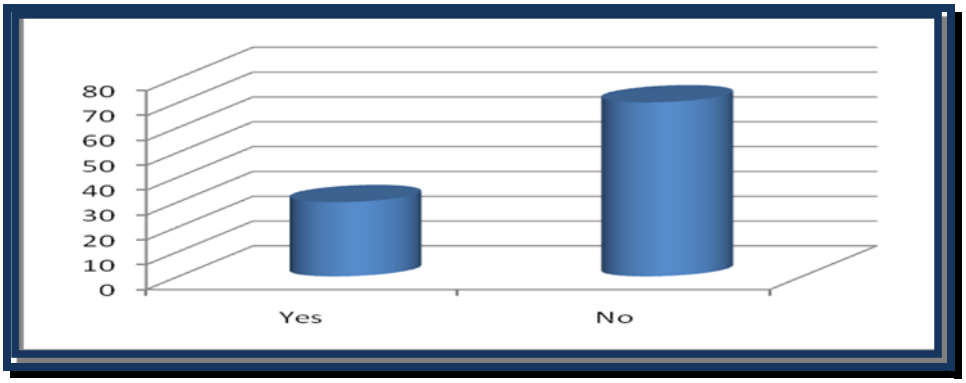
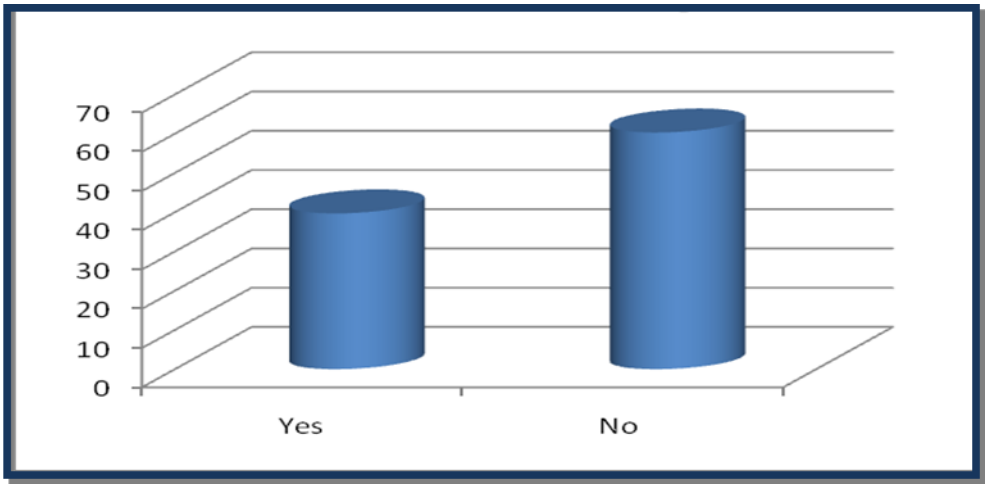


Figure (7-39) kitchen un sufficient space for small children

18. Does your house have enough Storage Space?

From the figure (7-40) it is obvious that the majority of the sample size (60.3) disagrees with ;(**your house has enough Storage space**) while (39.7%) were agreed.



Fig(7-40) does your house have enough Storage space
(Source: The Author survey – questionnaire results)

19. Where do you store your possessions (closets, garage, attic, storage lockers, etc.)?

From the figure (7-41) it is obvious that the majority of the sample size (54.9) % (Bed rooms) and (21%) (Store) and (10.3%) (living room) while (13.8) others.

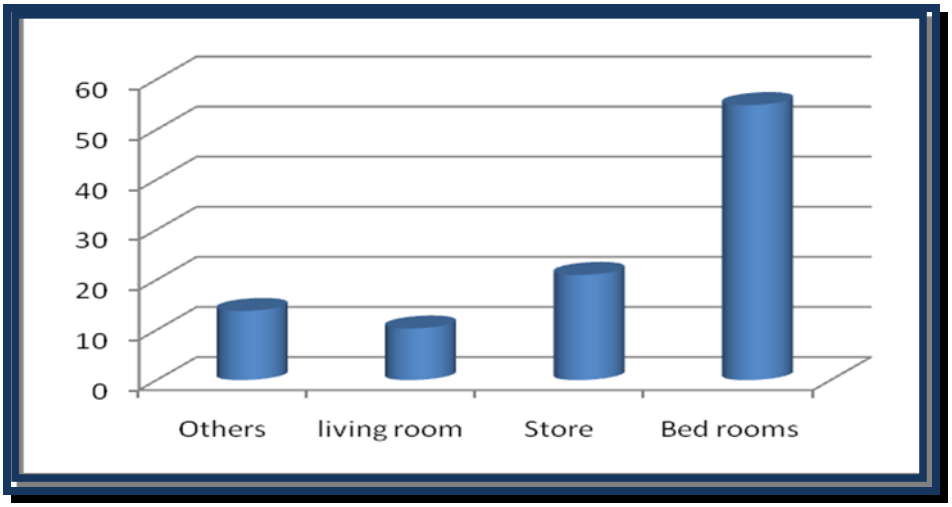


Fig (7-41) **store possessions (**Source: The Author survey – questionnaire results)

20: Is it important to have constant space for storage in your house?

From the figure (7-42) it is obvious that the majority of the sample size (89.8%) disagree with ;(important to have constant space for storage in your house) while (10.3%) were agreed.

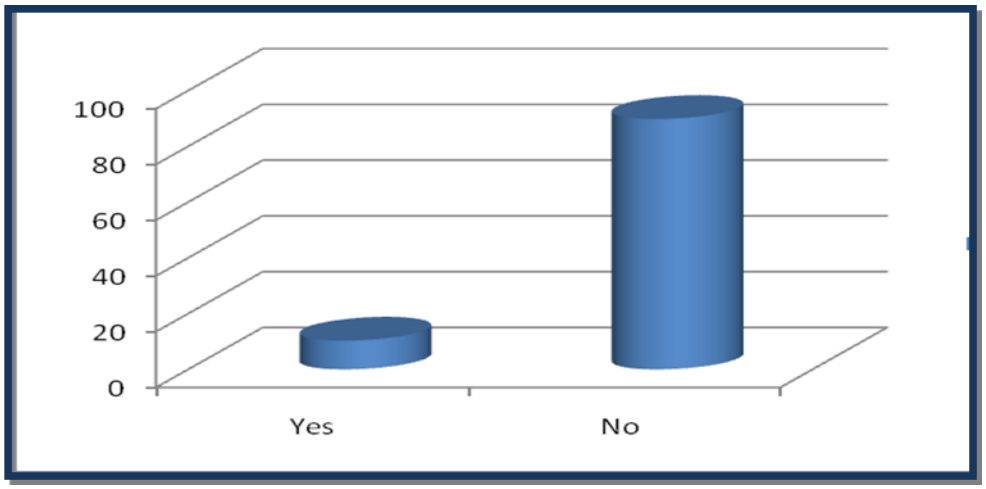
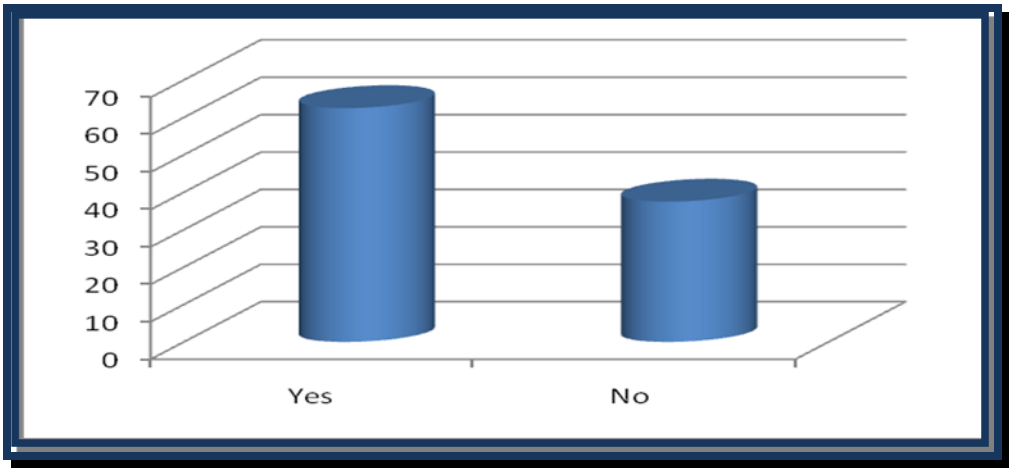


Fig (7-42) storage spaces

(Source: The Author survey – questionnaire results)

21. Is it your bathrooms have enough area:

From the figure (7-43) it is obvious that the majority of the sample size (62.5%) agrees with ;(**The bathrooms have enough area**) while (37.5%) were disagree.

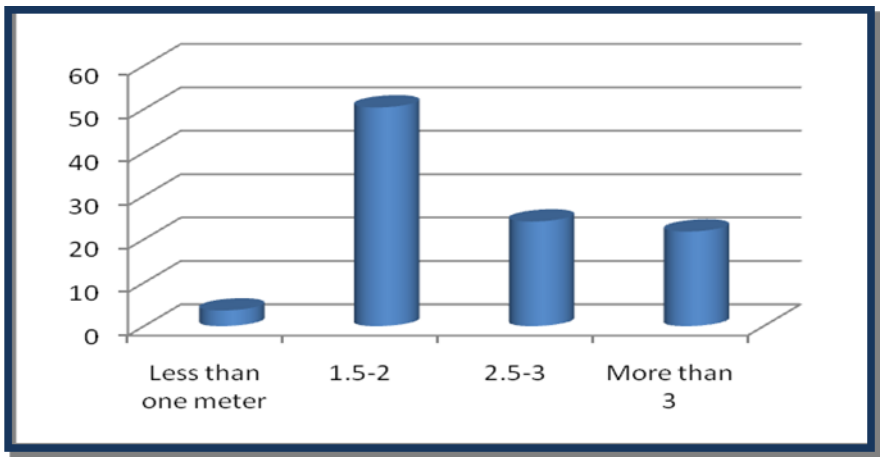


Fig(7-43) is it your bathrooms have enough area

(Source: The Author survey – questionnaire results)

22. How many meters square is there in the bathroom

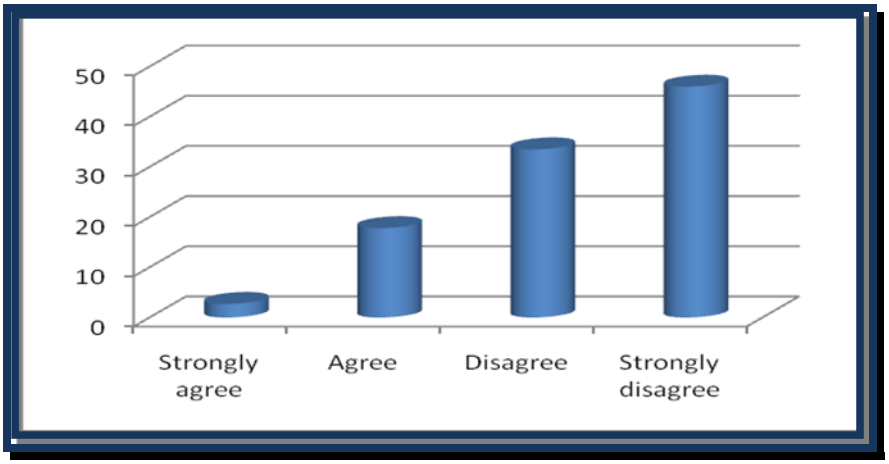
From the figure (7-44) it is obvious that the majority of the sample size (50.4) % **meters square are there in the bathroom about** (1.5 to 2 meters) and (24>1)% about (2.5 to 3 meters) **s** and (21.8)% more than 3 meters.



Fig(7-44) How many meters squares are there in the bathroom
(Source: The Author survey – questionnaire results)

23. The corridors and stairs within your home provide sufficient space to move around the home with area

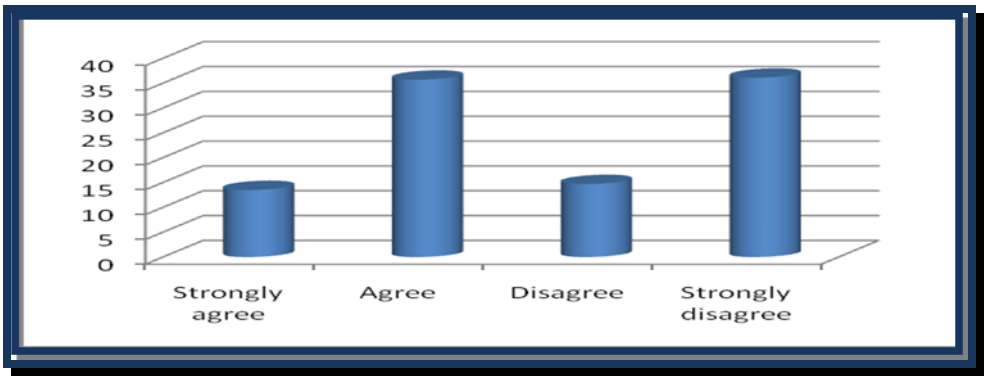
From the figure (7-45) it is obvious that the majority of the sample size (79.5%) disagrees with ;(**The corridors and stairs within your home provide sufficient space to move around the home with area**) while (20.5%) were agree.



Fig(7-45) The corridors and stairs within your home provide sufficient space to move around the home with area (Source: The Author survey – questionnaire results)

10. The corridors and stairs in your home are obstructed by furniture, stored items or decorative objectives

From the figure (7-46) it is obvious that the majority of the sample size (50.8%) disagrees with ;(**The corridors and stairs in your home are obstructed by furniture, stored items or decorative objectives**) while (49.2%) were agreed.



Fig(7-46)The corridors and stairs in your home are obstructed by furniture, stored items or decorative objective (Source: The Author survey – questionnaire results)

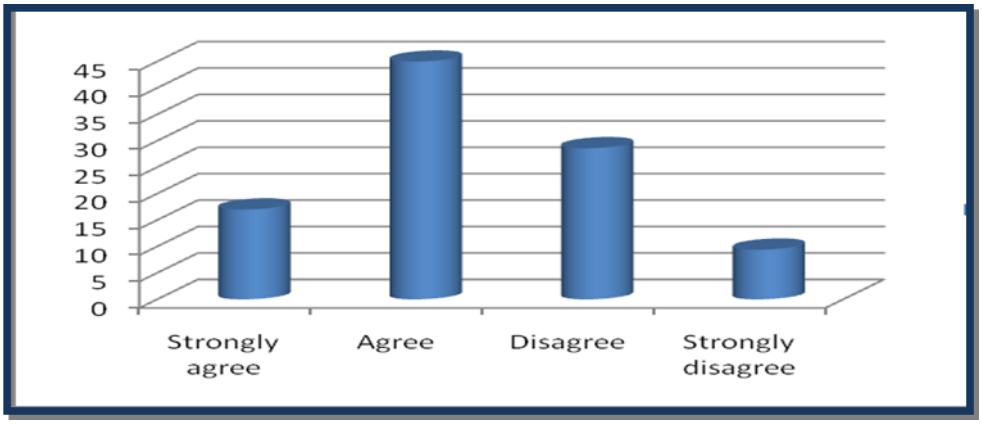
25. The amount of spaces in the corridors and stairs within your home makes it difficult to move furniture around

From the figure (7-47) it is obvious that the majority of the sample size (66.1%) agrees with ;(**The amount of spaces in the corridors and stairs within your home makes it difficult to move furniture around**) while (33.9%) were disagreeing.

Fig (7-47) The amount of spaces in the corridors and stairs within your home makes it difficult to move furniture around (Source: The Author survey – questionnaire results)

26. There is not enough space in all of the rooms to be able to move easily around the furniture

From the figure (7-48) it is obvious that the majority of the sample size (62%) agrees with ;(**There is not enough space in all of the rooms to be able to move easily around the furniture**) while (38%) were disagreed.



Fig(7-48) There is not enough space in all of the rooms to be able to move easily around the furniture Source: The Author survey – questionnaire results

27. Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer?

From the figure (7-49) it is obvious that the majority of the sample size (69.6%) agrees with;(**The space in your house does not use or have been badly arranged it has been used efficiently by the designer**) while (30.4%) were disagreed.

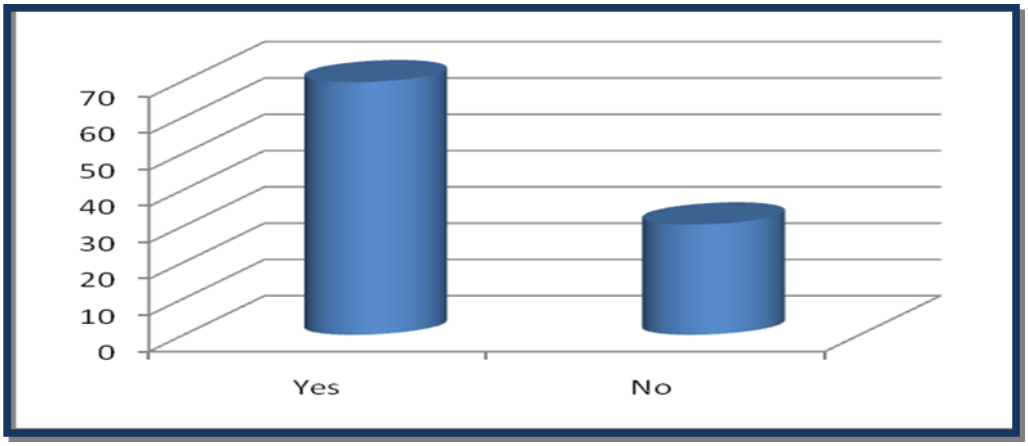


Fig (7-49) Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer?

(Source: The Author survey – questionnaire results)

28. Is it the removable and furniture provide a lot of space area

From the figure (7-50) it is obvious that the majority of the sample size (78.5%) disagrees with; (**The removable and furniture provide a lot of space area**) while (21.4%) were agreed.

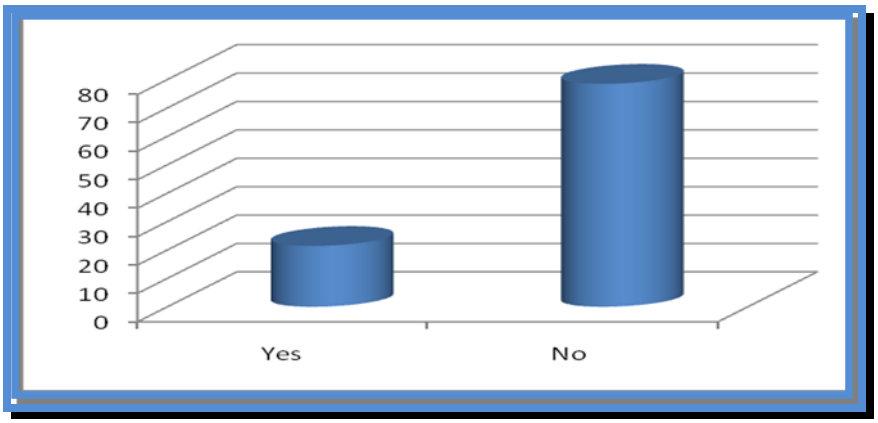


Fig (7-50) Is it the removable and furniture provides a lot of space area
(Source: The Author survey – questionnaire results)

29. Which type of dining furniture do you prefer the fixed or movable?

From the figure (7-51) it is obvious that the majority of the sample size (58 %) **dining furniture prefers movable** and (42%) **prefer the fixed.**

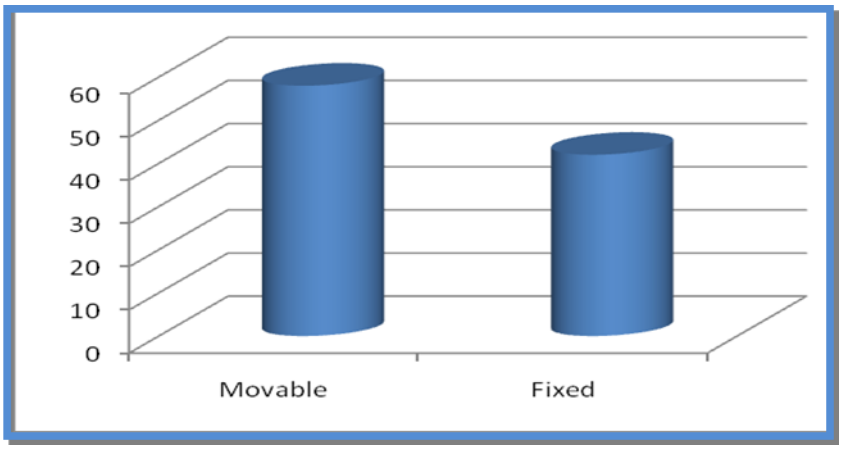


Figure (7-51) which type of dining furniture do you prefer the fixed or movable?

30. What are the activities that can be performed through movable furniture?

From the figure (7-52) it is obvious that the majority of the sample size (38.8%) **the activities that can be performed through movable furniture** (eating), (23.2%) (Reading) and, (16.1%) (Sleeping)

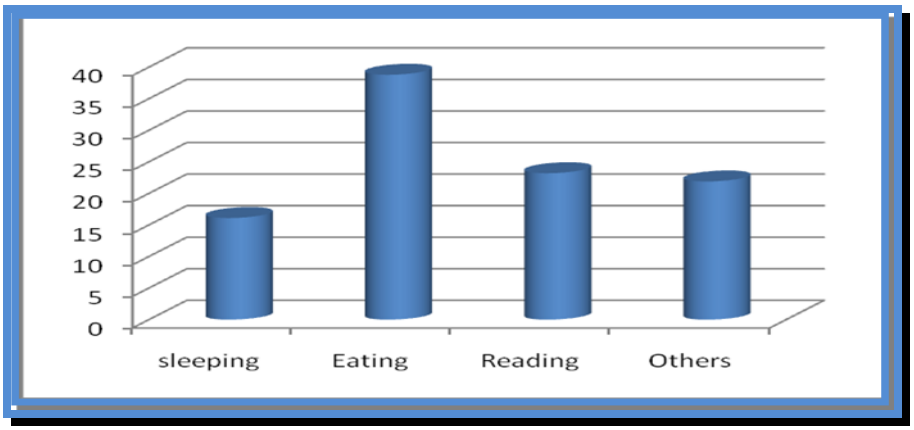


Figure (7-52) what are the activities that can be performed through movable furniture.

Section (5) Option about user attitude:

1. **Have you remodeled this home, resulting in changing sizes or uses of rooms?**

From the figure (7-53) it is obvious that the majority of the sample size (66.5%) disagrees with (**Remodeled this home, resulting in changing sizes or uses of rooms**) while, (33.5%) were agreed

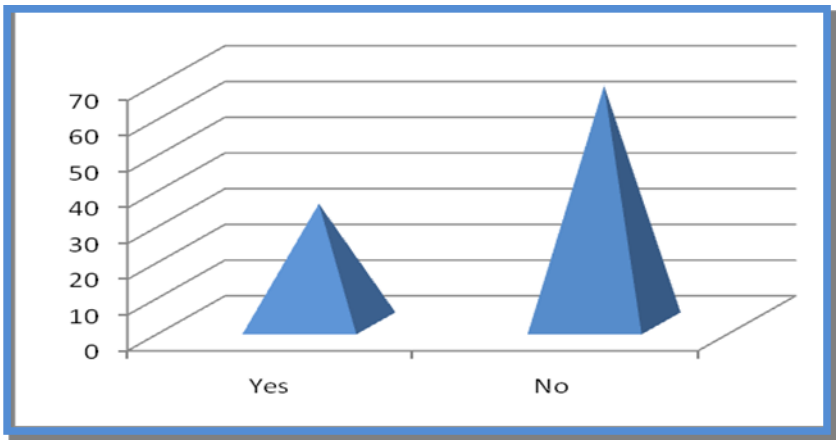


Fig.(7-53) home remodeling

(Source: The Author survey – questionnaire results)

.

2. Have you remodeled this home, resulting in changing sizes or uses of rooms?

From the figure (7-54) it is obvious that the majority of the sample size (50.4%) disagrees with; (**Resulting in changing sizes or uses of rooms**) while (49.6%) were agreed.

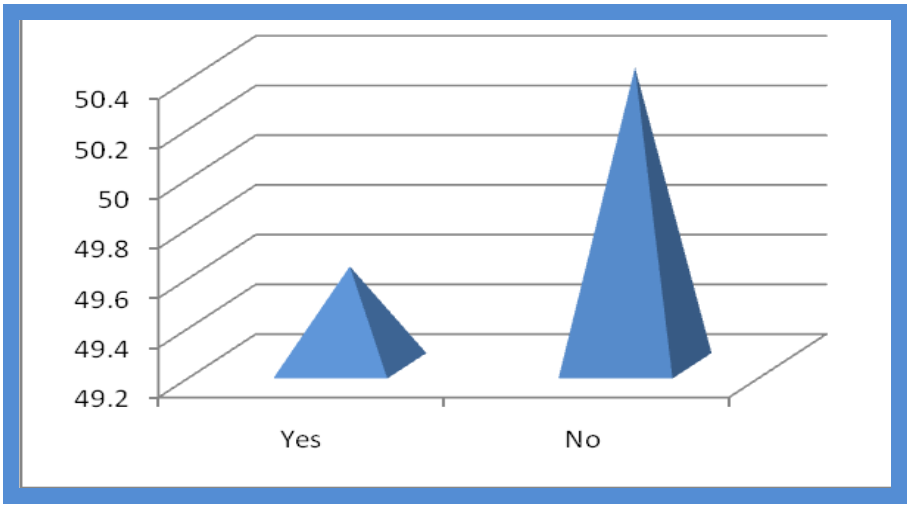


Fig (7-54) Have you remodeled this home, resulting in changing Sizes or uses of rooms? (Source: The Author survey – questionnaire results

3. If yes, please describe these changes and your reasons for making them

From the figure (7-55) it is obvious that the majority of the sample size (47.7%) the **reasons for making them changes** (For increased homework) and (18.9%) (family size growing) and (11.7%) (wanting larger kitchens).

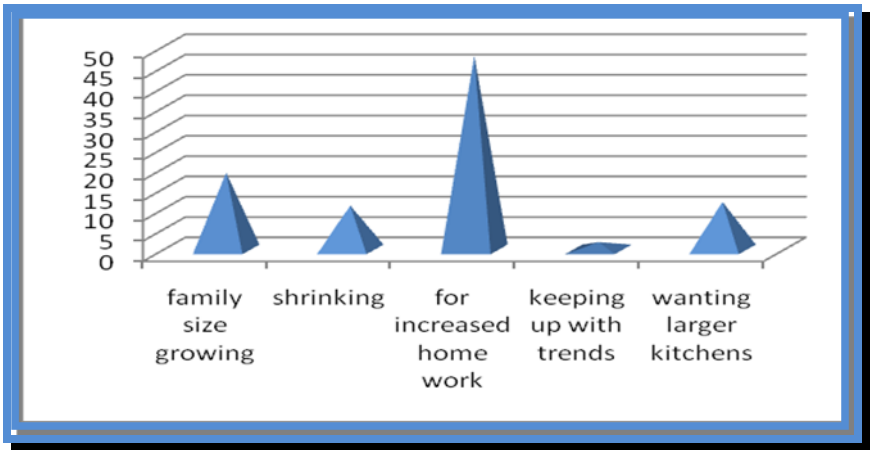


Figure (7-55) If yes, please describe these changes and your reasons for making them

6. **Do you plan to remodel this home in ways that would change sizes or uses of space? Please indicate possible changes and your reasons for them**

From the figure (7-56) it is obvious that the majority of the sample size (65.2%) disagree with: (**plan to remodel this home in ways that would change sizes or uses of space**) while (34.8%) were agreed.

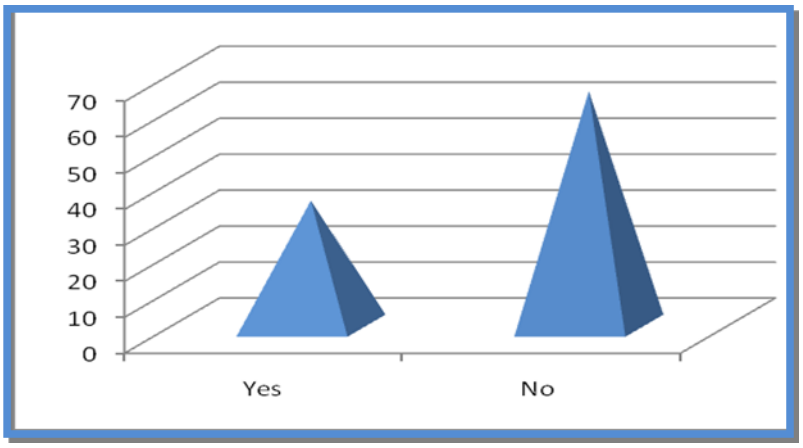
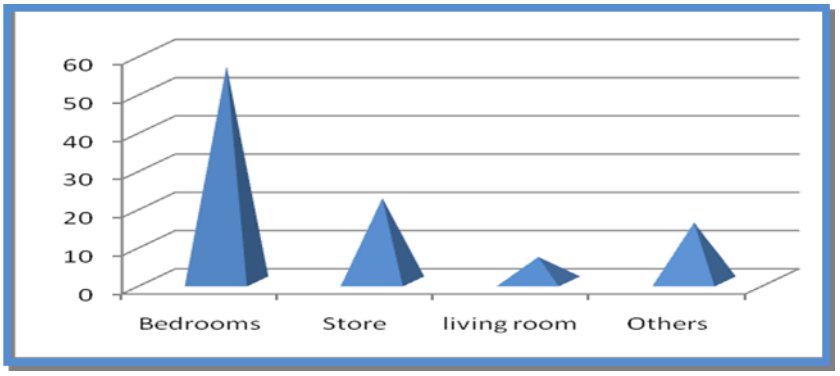


Fig (7-56) Do you plan to remodel this home in ways that would change sizes or uses of space? Please indicate possible changes and your reasons for them (Source: The Author survey – questionnaire results)

5. Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer

From the figure (7-57) it is obvious that the majority of the sample size (47.7 %) the **space in your house does not use or have been badly arranged it has been used efficiently by the designer** (Bedrooms), (21.8%) (Store) and, (6.4%) (living room).



Fig(7-57) Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer

(Source: The Author survey – questionnaire results)

7. The space within your home has been used efficiently by the designer.
From the figure (7-58) it is obvious that the majority of the sample size (63%) disagrees with: (**the space within your home has been used efficiently by the designer**) while (37%) were agreed.

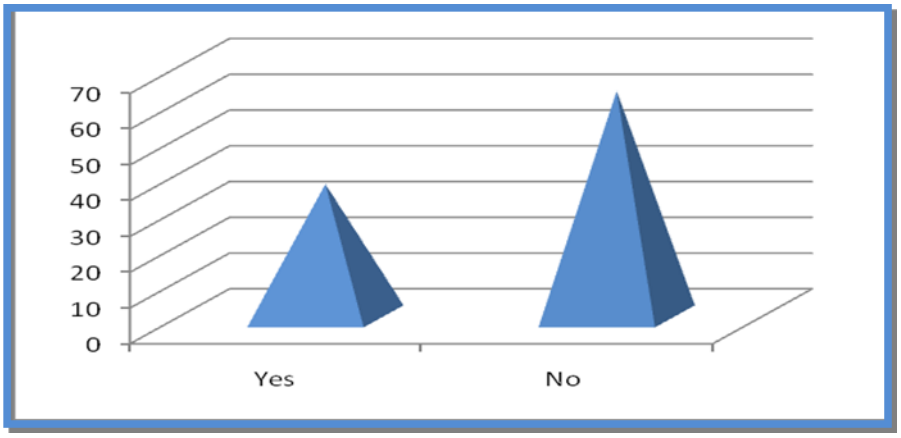
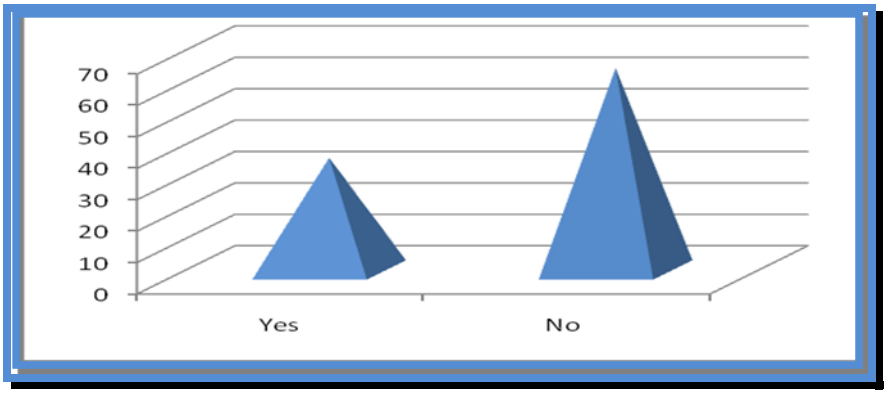


Fig.(7-58) The space within your home has been used efficiently by the designer
(Source: The Author survey – questionnaire results)

7. Do you find that it is better that you and your family members to divide spaces and residential unit? And what would you do?

From the figure (7-59) it is obvious that the majority of the sample size (64.3%) disagrees with: (**your family members to divide spaces and residential unit**) while (35.7%) were agreed.



Fig(7-59) Do you find that it is better that you and your family members to divide spaces and residential unit? And what would you do?
(Source: The Author survey – questionnaire results

(7-5) CONCEPTUAL FRAMEWORK OF THE RESEARCH MODELE:

The research adapts the conceptual model developed by various approaches and concepts have been testing housing satisfaction worldwide, this conceptual most applies to Sudanese context, there is an interrelationship between descriptive and research variables, conceptual model presented in figure (7-60).

Wikianswers (2008) describes a conceptual framework as a basic structure that consists of certain abstract blocks which represent the observational, the experiential and the analytical/ synthetically aspects of a process or system being conceived, thus, the interconnection of these blocks completes the framework for certain expected outcomes. Kombo and Tromp (2006) cited two definitions of a conceptual framework as "a set of broad ideas and principles taken from relevant fields of inquiry and used to structure a subsequent presentation" and as "a research tool intended to assist a researcher to develop awareness and understanding of the situation under scrutiny and to communicate this."

(Mujersana ,2003) claimed that there are many ways to explain a conceptual framework which it can be any or all of the following:

- A set of coherent ideas or concepts organized in a manner that makes them easy to communicate to others.
- An organized way of thinking about how and why a project takes place, and about how we understand its activities.
- The basis for thinking about what we do and about what it means, influenced by the ideas and research of others.
- An overview of ideas and practices that shape the way work is done in a project.

For modeling there are seven features seen as essential towards depicting a comprehensive and well-presented model (Thevendran, 2003).

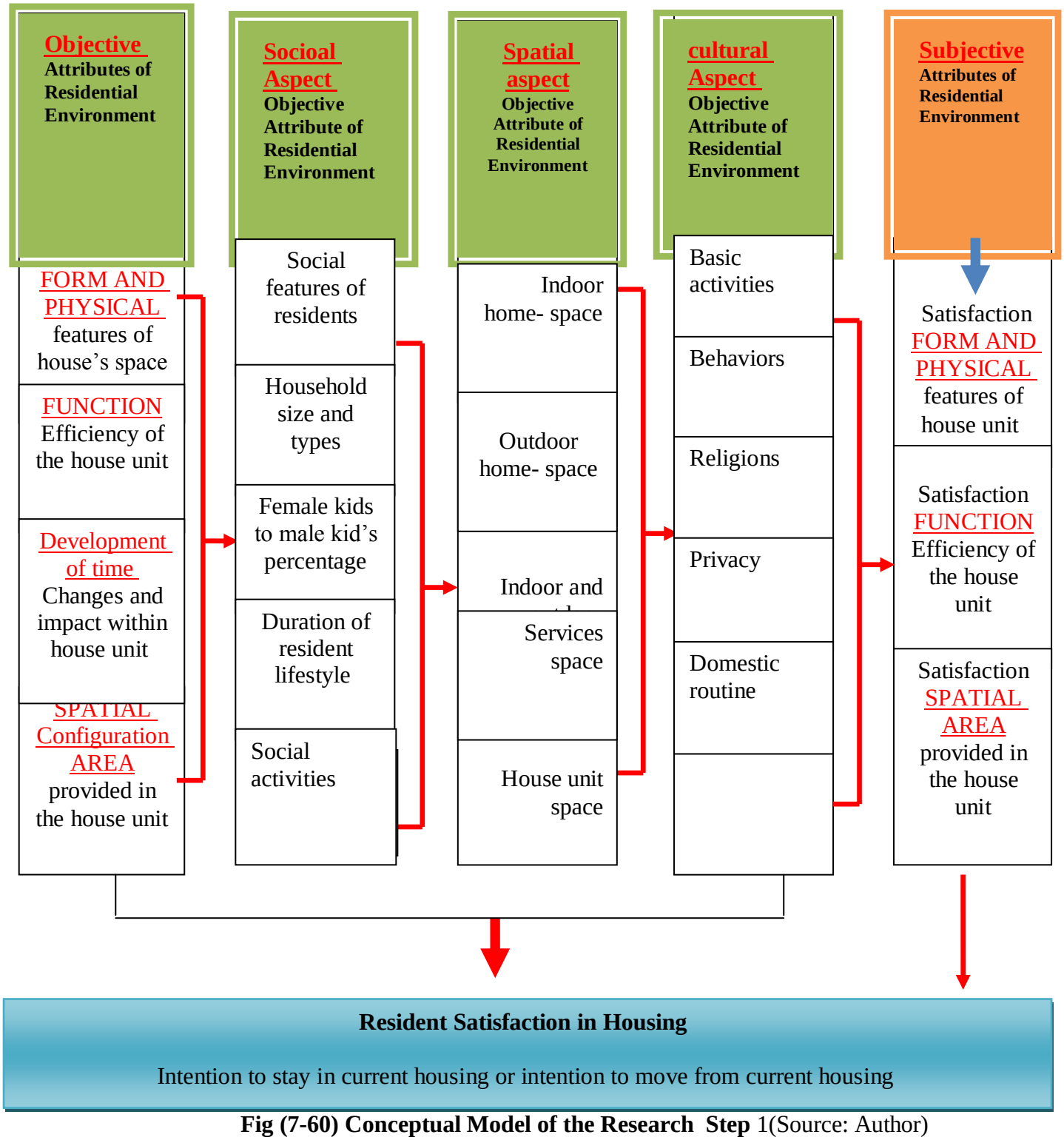


Fig (7-60) Conceptual Model of the Research Step 1(Source: Author)

(7-5-1) Model Features:

1. **Semantics.** **2- Ease of understanding.** **3-Arrow variety.**
4- Node shapes variety. **5- Clarity of boundary.** **6- Colour coding ability.**
7- Symbol usage.

1- Semantics:

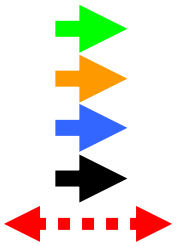
Meanings of the important words used in the model are:

- Concept: An abstract idea or a mental symbol
- Project: A temporary endeavor undertaken to create a unique product, service, or result.

2-Ease of understanding:

The model is a straightforward, simple presentation of accumulate knowledge as the research goes into detail.

3-Arrow variety:



Sequence of managerial levels to main parameters
Sequence from main to detail of parameters
Sequence from project lifecycle
Sequence from one phase to the next

Feedback

4-Node shapes variety:

Intersection of lines carries no significance in this model.

5- Clarity of boundary:

The model is only concerned with the project and subproject managerial levels along with their life cycle parameters.

6-Colour coding ability:

Label boxes and lifecycle phases carry distinguished colours to help the follow up of phases (see figure 7-58).

7-Symbol usage:

A hypothetical matrix will be used as an outline that links all model constituents where vertical columns represents lifecycle phases and horizontal rows depicts the construction project and partnering main parameters.

(7-5-2) Organization of Sudanese housing space standard (SHSS) Model:

The conceptual framework of the model is organized in a matrix structure, where the cells of the horizontal rows and vertical columns are descriptive of hierarchy of information (Altag, Hala, 2014). The vertical columns demonstrate the Objective Attributes of Residential Environment. The horizontal rows depict the elaboration of the parameters the Subjective Attributes of Residential Environment. Figure (7-59) shows the basic concept of the matrix

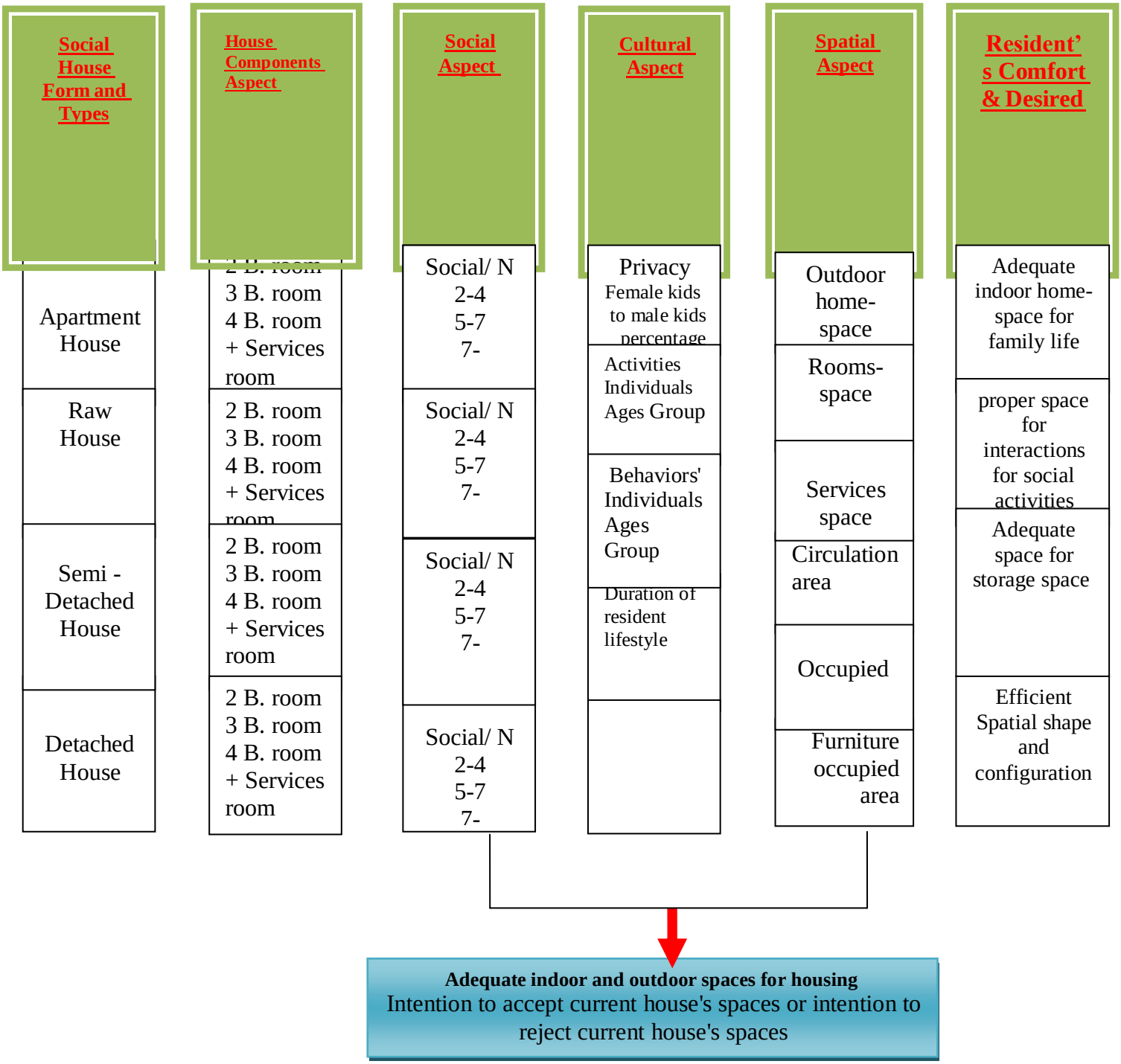


Fig (7-61) Conceptual Model of the Research Step 2 (Source: Author)

(7-5-3)The flow charts of determined the house model:

1- Functioning:

- Spatial situation of basic dwelling activities (gathering, cooking, eating, sleeping, ect.
- Privacy regulations
- Form of tenure and ownership
- Other building activities Use of spatial margins extensions of core structure, within the physical support

Fig (7-62) show the flow chart of determined functional efficiency of the house according to the Degree of acceptance of the desired dwelling and Degree of acceptance of the target group, and Degree of acceptance of the use of the spaces according to the house type

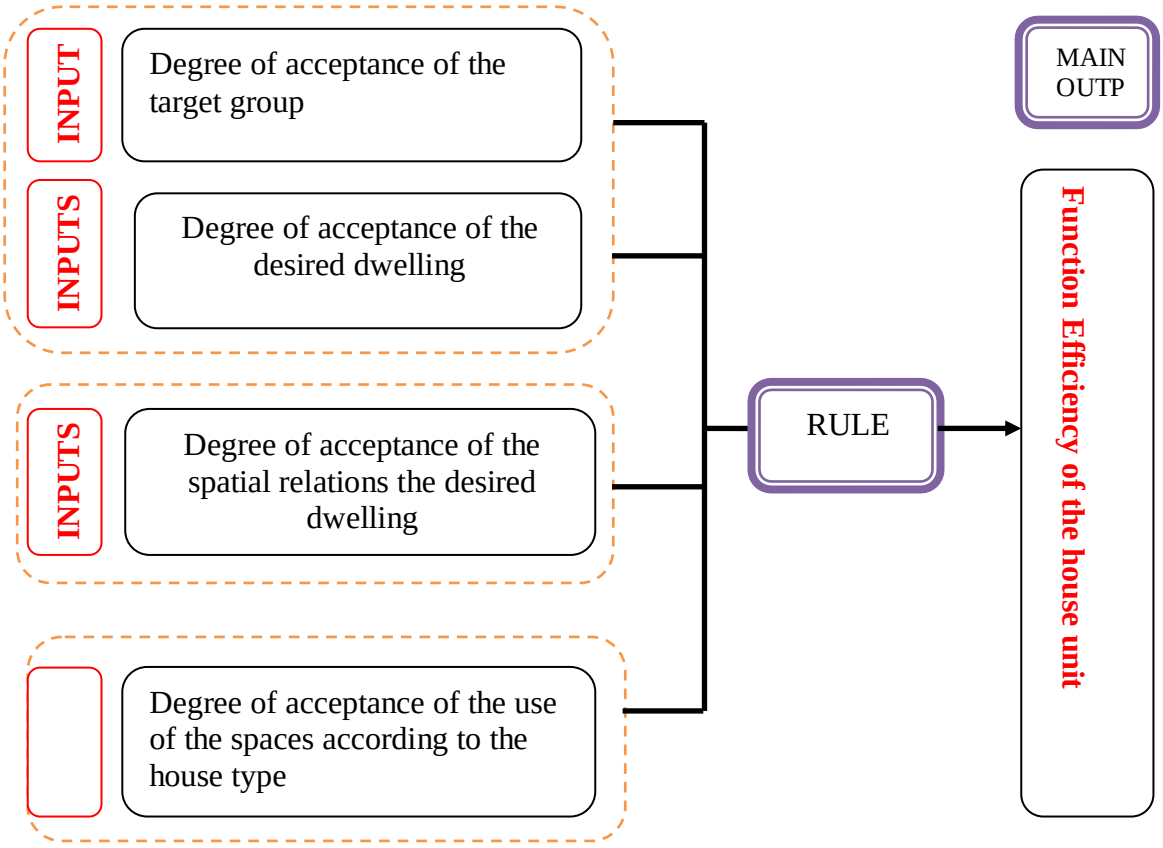


Fig (7-62) the flow chart of determined functional efficiency of the house (Source: Author)

.

2- Form and Physical (Morphology):

- Spatial relationship between dwelling and immediate surroundings (street, garden, neighboring dwelling)
- Detailed distribution and dimensioning of built and open spaces within the dwelling (rooms, kitchen, courtyard, ect.)
- Spatial articulation of privacy (privacy gradient) between most over and most intimate places of the house
- Identification of a core/support/zone structure and its complementary extension.

Fig (7-63) Show the flow chart of determined Form and Physical Efficiency of the house unit (Morphology) in term of degree of acceptance Social features of residents, Degree of acceptance household size and types, Degree of acceptance duration of resident lifestyle ,and Degree of acceptance privacy

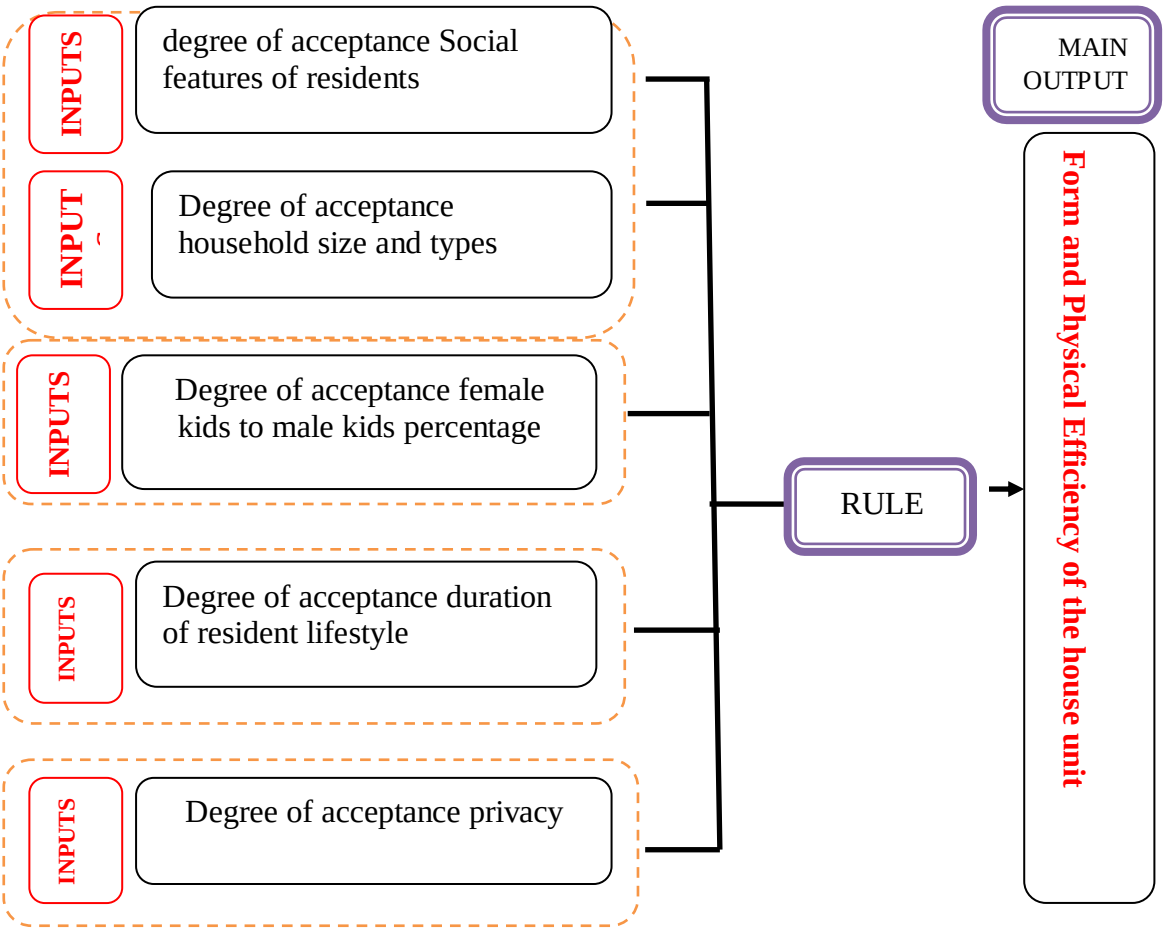


Fig (7-63)The flow chart of determined *Form and Physical (Morphology)*

3- Development over Time

Changes in tenure status and type of occupancy. Examples of consolidation, upgrading, extension, densification or de- densification of particular dwellings. Four basic kinds of items which in practice are interrelated, it is not a functional universal way (e.g. One form –one function). Some of these items focus on the spatial articulation of the settlement (built forms) other deal with the identification of a network of functions (space use) for which built forms act as a physical support. This means that observation started from the present situation, one tries to find how this present state finds its roots in a past state and how a future condition can already be predicted. (A. Loeckx & B, DeMeuldar)

Fig (7-64) show the flow chart of determined Development over Time efficiency in the house

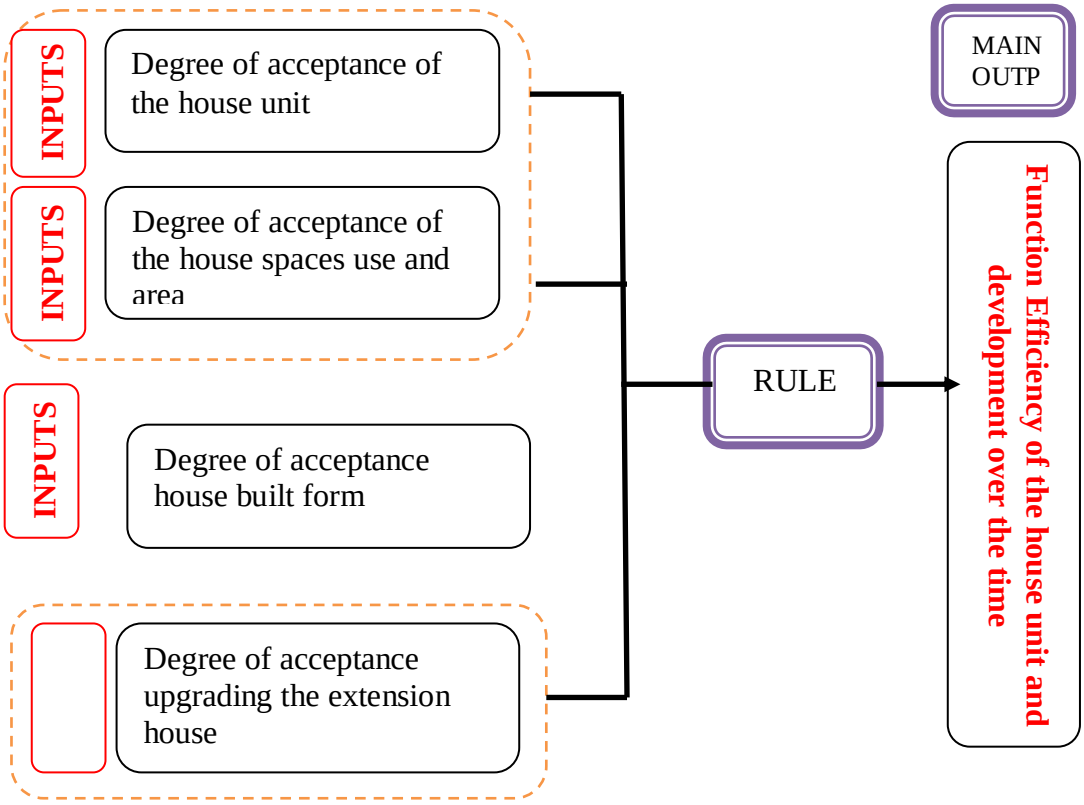


Fig (7-64) Flow chart of determined *Development over Time efficiency in the house*

4- Spatial Configuration and Area:

All social activities are not attributes of individuals, but patterns, or configurations, formed by a group. They depend on an engineering pattern of co- presence, and co-absence. Few of the purposes for which buildings built and environment and space will found at the level of the configuration of space. In the most reasonable spaces, most human activities can carry out. In this sense, any habitable space defined at configuration formed by performing several activities by a group of user in a recognized space. Fig (7-65) show the flow chat to determined Spatial configurations and area efficiency in the house

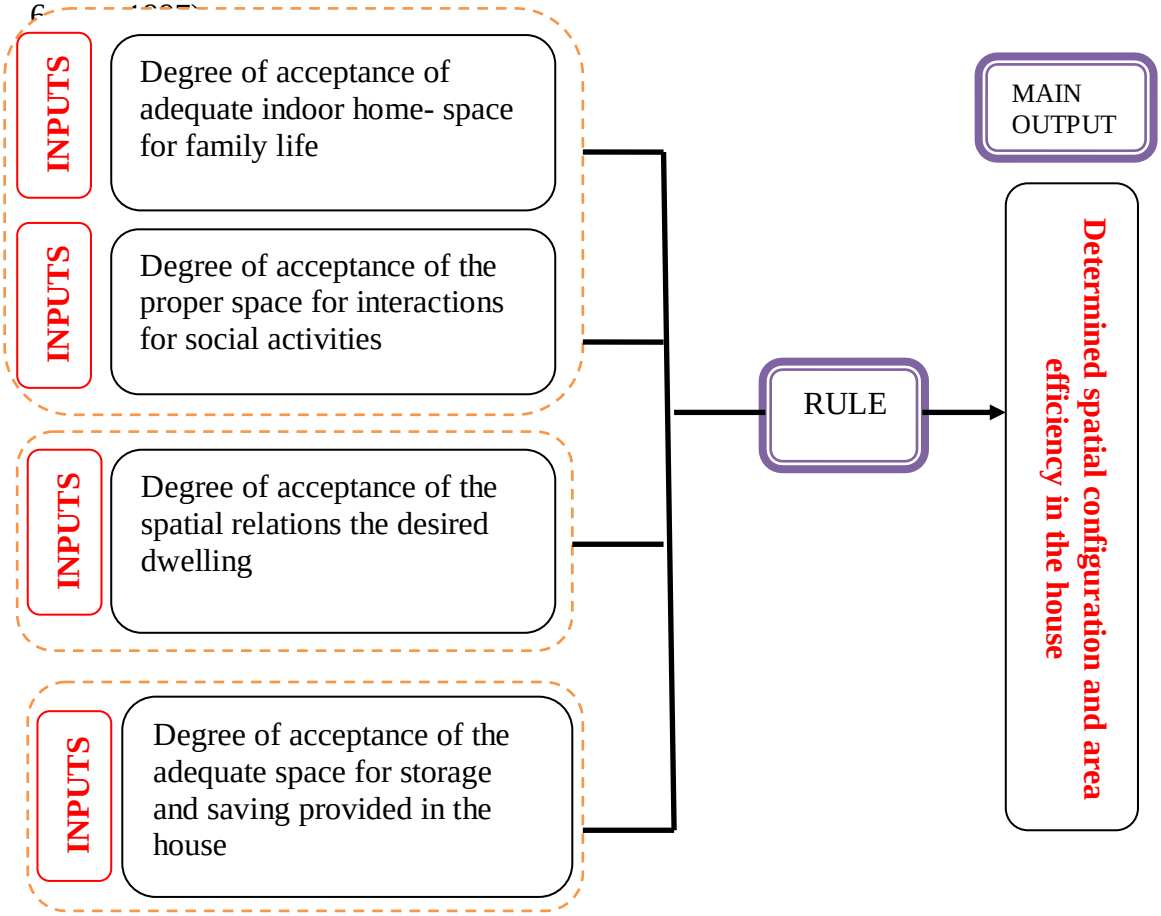


Fig (7-65) Flow chat to determined Spatial Configurations and Area efficiency in the house

(7-6) DESIGN CONCEPTION MODEL OF (SHSS):

The ways of thinking **Design Conception for low income group model** (SHSS Model, **Questionnaire Formation and Design**(fig7-66)**,** take four Considerations :

1- Space standards:

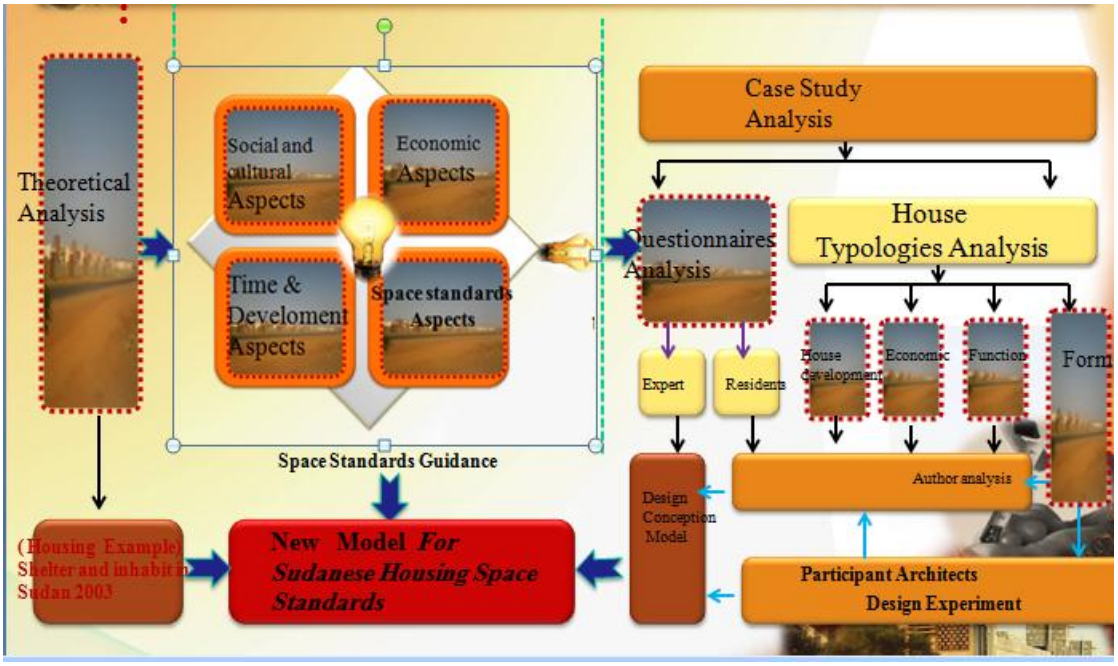
A- Form: Generally related to the site, the physical environment, psychological factors and the quality of space and construction

B- **Function:** it is what answers the question:"what". It defines activities, spatial interrelations and people; their number, lifestyle and socio-culture

2- **Economy:** All the issues that have to do with the initial budget and quality of construction, in addition to consideration of running and life cycle costs

3- Time and developments: The study of influences of history (the past) inevitability of changes and impact of events from the present, and projections into, and aspirations for the future

4- Socio-cultural factors



Fig(7-66) **Design Conception for low income group model** (SHSS

(Source: Author, 2016)

(7-7) MODEL MATRIX STRUCTURE AND ORGNIZATION:

- The conceptual framework of the model is organized in **a matrix structure(fig 7-67)**, where the cells of the horizontal rows and vertical columns are descriptive of hierarchy of information.

- The horizontal rows represented objectives attributes of residential environment in term of the 4 considerations which it mentions above.

- The vertical columns are represented the flow chart of the 4 considerations.

- The matrix structure consist of many cells each cell represented one of housing building in term of residents' economic situation(low-income housing and medium income housing , investments housing , economical housing).

- The input of objectives attributes of residential environment represented the output of subjective attributes of residential environment

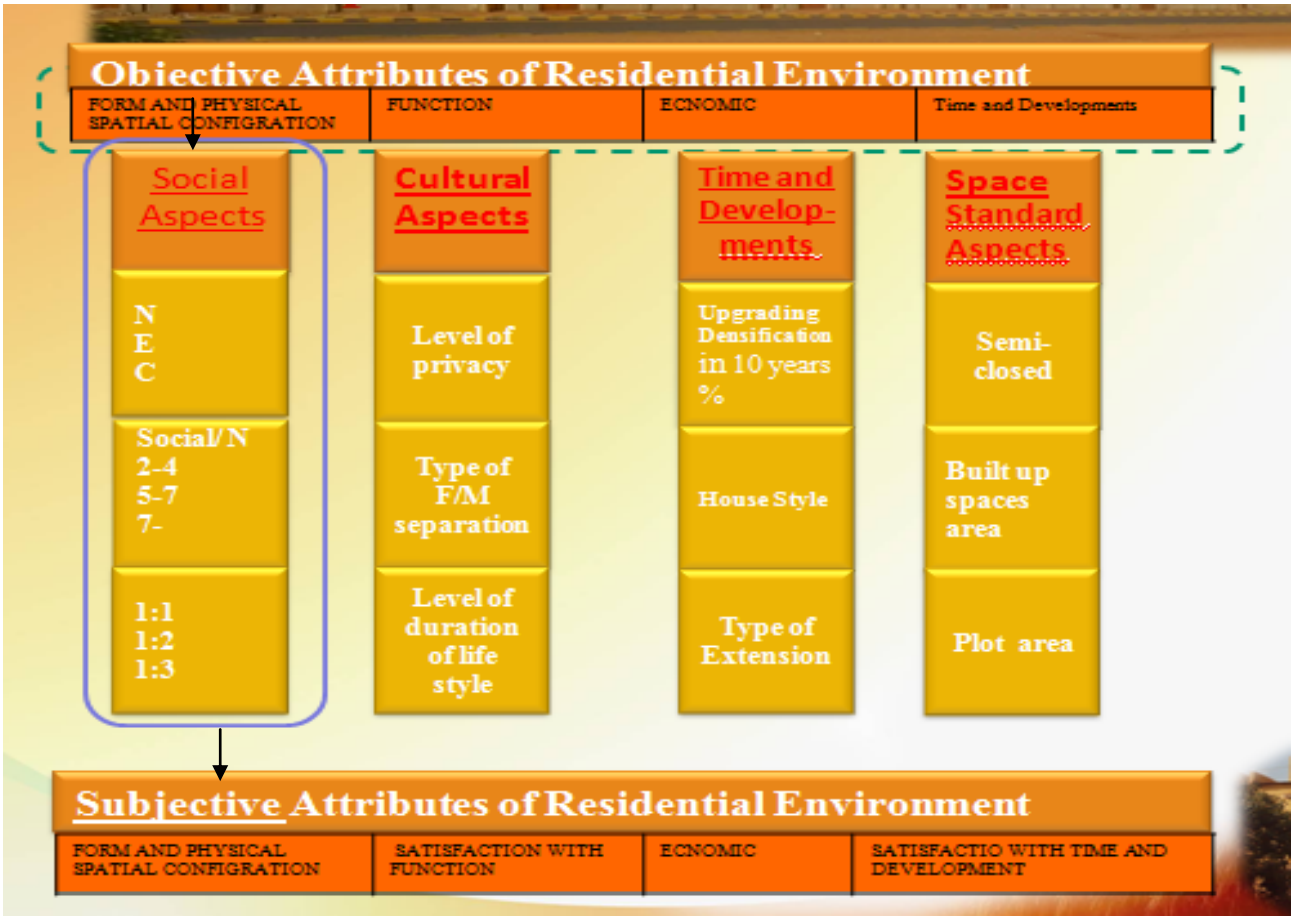


Fig (7-67) Model matrix structure, (SHSS)
(Source: Author, 2016)

(7-8) Descriptive the use of Sudanese Housing Space Standards Code (SHSS) model:

The conceptual framework of the Sudanese housing spaces Space standards code (SHSS) model was organized in a matrix structure using PhP. programming language based on 4 considerations that conclude from theoretical and practical analysis of the research problem

Housing Space standard model is a software program get it in internet, it is easy to use by the planners and designers in new residential projects, also it can use by citizen to view the shape and design of spaces and future expansion of the house horizontally or horizontally that suit the family taking into account the economic factor.

The program also provides different options and alternatives for housing types of spaces, area, proportions and distances required, and it can contribute to the public participation house type preference according to socio- cultural composition.

Planners, designers, and residents get the program in internet by follow the followings steps:

1- Open internet explorer page

2- Search in google.com about this address**(local host/uni)**

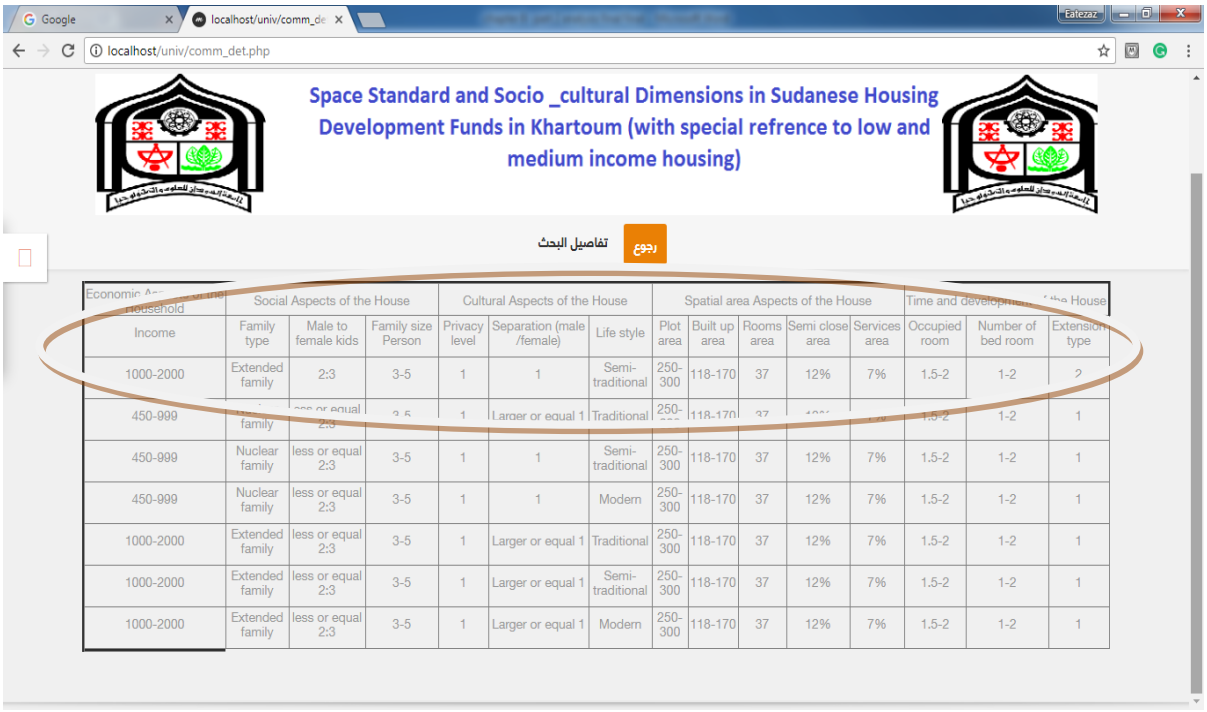
The title of the page which it should be open **(Space standards and socio-cultural dimensions in Sudanese Housing Development Funds in Khartoum (with especial reference to low and medium income housing(fig 7-68)**

Fig (7-68) Sudanese Housing Space Standards(SHSS) model programmed page
(Source: Author)

3- Select the area that you would like to analyze it
4- Select the households numbers
5- Click on search (fig7-69)

Fig (7-69) Housing Space standards Model, (SHSS
(Source: Author, 2016)

6- Analysis details of area and spaces option
7- Spaces configuration (house 2 D and 3 D) (fig 7-70)and (fig 7-71)



Economic A... household	Social Aspects of the House			Cultural Aspects of the House			Spatial area Aspects of the House					Time and develop... the House		
Income	Family type	Male to female kids	Family size Person	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
1000-2000	Extended family	2:3	3-5	1	1	Semi-traditional	250-300	118-170	37	12%	7%	1.5-2	1-2	2
450-999	... family	... or equal 2:3	3-5	1	Larger or equal 1	Traditional	250-...	118-170	37	...	...	1.5-2	1-2	1
450-999	Nuclear family	less or equal 2:3	3-5	1	1	Semi-traditional	250-300	118-170	37	12%	7%	1.5-2	1-2	1
450-999	Nuclear family	less or equal 2:3	3-5	1	1	Modern	250-300	118-170	37	12%	7%	1.5-2	1-2	1
1000-2000	Extended family	less or equal 2:3	3-5	1	Larger or equal 1	Traditional	250-300	118-170	37	12%	7%	1.5-2	1-2	1
1000-2000	Extended family	less or equal 2:3	3-5	1	Larger or equal 1	Semi-traditional	250-300	118-170	37	12%	7%	1.5-2	1-2	1
1000-2000	Extended family	less or equal 2:3	3-5	1	Larger or equal 1	Modern	250-300	118-170	37	12%	7%	1.5-2	1-2	1

Fig(7-70) Analysis details of area and spaces source(Author)

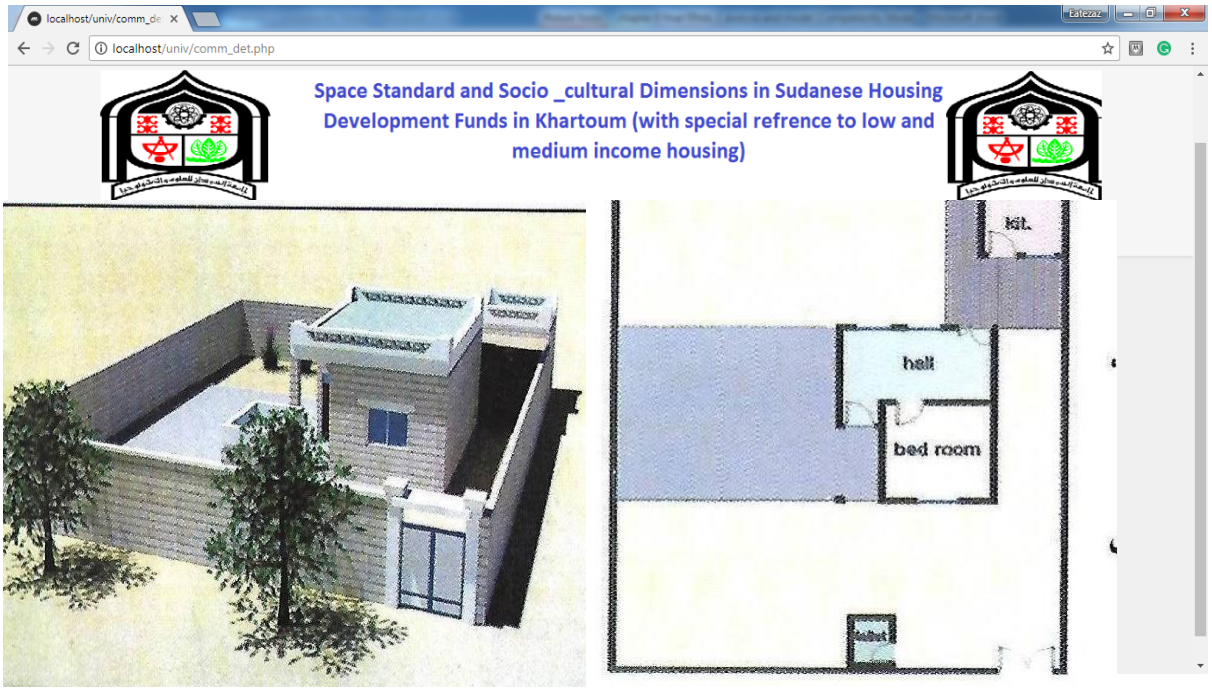


Fig (7-71) Housing Space standards of house in 2Dand 3D

(Source: Author, 2016)

Research Process Model:

Research Process Model developed through 8 chapters; it justified in chapter 1 and in chapter 5the Selection Concept of Investigate, it developed in chapter 6, the acceptance of the model illustrated in the end of the research (fig 7-72)

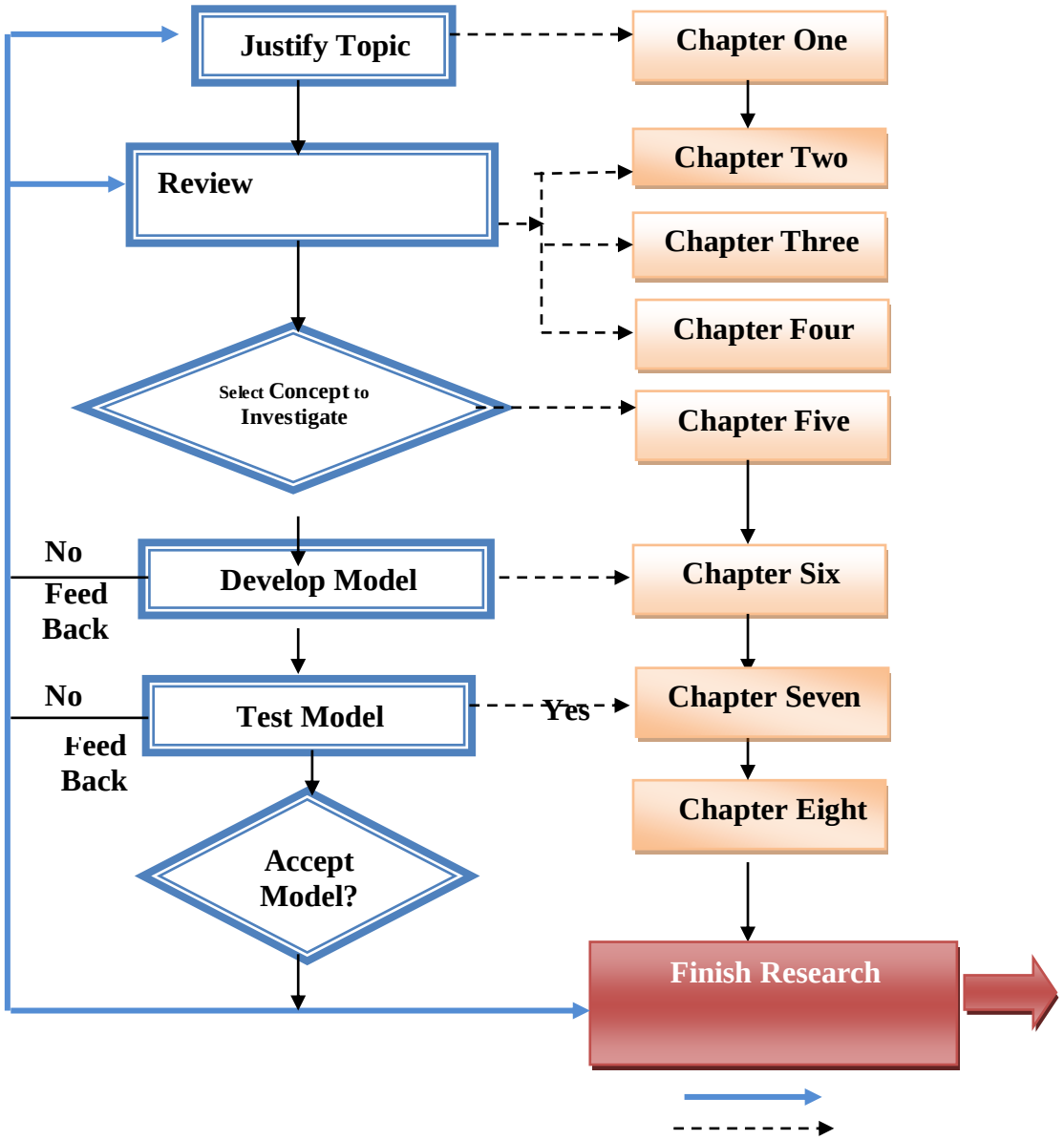


Figure (7-72) Research Process Model
(Source: Author)

(7-9) CONCLUSION:

The conceptual framework of the model is organized in a matrix structure, where the cells of the horizontal rows and vertical columns are descriptive of hierarchy of information
The ways of thinking Design Conception for low income group model (SHSSC Model, Questionnaire Formation and Design, take four Considerations Space standards, Form, Function, Economy and Time and developments
The study of influences of history (the past) inevitability of changes and impact of events from the present, and projections into, and aspirations for the future
The sample was selected intentionally and is one of non – probability sample chosen by the researcher to obtain the information from the specific vocabulary of the population under study. It was distributed (230) questionnaire cover all the population under study.

To analyze the results and to test the hypotheses of the study, the researcher used the Reliability Test for the questions of the questionnaire and, descriptive Statistics Methods

Questionnaire result shows that the majority of the sample in the case study were built and organize by (H D F) and the percentage of people who acquire the house by Government sector represented 33.9 % while 39% and 7 % were bought it and 7% granted it .
The majority of the sample shows that urban experience of inhabitance in the capital Khartoum (16-20) years represented 57% of sample study.

PHP is one of the simplest server-side languages out there, and it was designed primarily for web development, it also used as a general-purpose programming language so that, it used and designs o establishments the space standards model for the purpose of planning and designing residential area in the public and private sector it easy to use also by residents when they decide to buy and own house unit

(8-1) INTRODUCTION:

This chapter summarizes and concludes the research, so that it provides a brief summary of the whole study with particular reference to the research problem, research methodology, results, the main contributions of the research and suggestions for further work. It thus presents a synopsis of the main findings of the study, conclusions and recommendations.

The research problem addresses space standards code was ignore by Building Law and Regulation in the housing. Beside residents haven't enough spaces and not satisfaction in the house size, which allow to adaptation, conversion and extension in the Sudanese Housing Development Funds' houses in Greater Khartoum, Furthermore planner ignore the spatial relation by reducing the room spaces in the low cost housing.

The aim of this research is to set out the standard of design expected from residential development and establish housing guidance code for planners and designers in Sudanese housing Also to -Promote sustainable urban housing by ensuring the high quality of space standards, and conclude by establishing housing guidance code to provide a clear set of standards for designers and planners for a wide range of housing projects in Government and private sector.

The experience in the majority of developing countries shows that governments have failed to respond to quantitative and qualitative needs of poor people when they act as sole providers without the people's participation and other actors being involved in the housing process, so that Public housing is no longer for providing the best solution to improve housing if planners and designer ensure housing qualitative needs

On the other hand, the housing needs of the poor have been better met when there is participation between the government, the people and other actors. The enabling approach, therefore, has recognized the role and potentialities of all actors in the housing process and stresses the importance of the participation of the intended group and other actors with the facilitating role of the government in scaling up housing supply. World Bank affordability, cost recovery and reliability and Habitat enabling approaches, all these main shelter approaches have stressed partnership between governments and people in order to improve the housing conditions of the poor. The only role for government, according to these shelter approaches, is to improve access to land, funds, secure tenure, affordable standards and procedure and infrastructure.

The people for their part will employ these housing inputs to house themselves according to their needs and priorities.

(8-2)ACHIEVEMENT OF OBJECTIVES:

In search for the most effective means of solving the research problem, the following objectives were fulfilled:

- To study the possibility of a better domestic creation by establishing Housing Space Standards code for designer and planner. Therefore, to provide a set of standards for a wide range of private and Governmental housing.
- To test and analyze the concept of housing which built with Sudanese Housing Development Funds in Greater Khartoum, and to examine the physical adaptation as housing modification.
- To ensure a high quality standard of housing for new residential developments in the public and private sector in Khartoum. Beside to ensure that internal, external space provision for house unit layout requirements for the housing.

(8-3) RESEARCH LIMIT:

- A single research approach is used while the study is in need of a team approach.
- Establishing housing codes and provide a clear set of standards for designers and planners for a wide range of housing projects need a team approach
- The research focus on the Houses space standards in Greater Khartoum. Which organized and built by the Governmental(Housing Development Fund) in the both levels of house and cluster.

(8-4) CONTRIBUTION TO KNOWLEDGE:

- Bearing in mind the above mentioned limitations of this research, nonetheless, it introduced the SHSS a comprehensive and holistic point of view. No research in the Sudan compiled and reviewed Space standards concepts and techniques.

(8-5) CONCULUSION OF THE RESEARCH :

The research put out the fact that significant change in the lifestyle of low income families in Khartoum have come to influence their needs and desires in designing their housing.

Low income families in Khartoum need more areas in the storage and livening spaces according to their needs and this mean more economical.

Characteristics of low income families the socio-cultural and economic characteristic of low income dwellers can be summarized as follows:

- In current time, the majority of low income families belong to the middle class which appears to be moving toward the lower class.
- The monthly income of household head in Sudanese pounds 56% of them (1000-2000) per month.

.***Lifestyle of low income dwellers***:

- The research investigates and described how dwellers live in their dwelling and how they meet their needs and focus on low income housing group therefore, the general aspects of dwellers can be described in the following points :
- The majority of low cost housing families usually host guests and they need to have separate guest room as they received their guests in the living room or in the yard at evening
- The living space showed to be a multi-use space where family members perform various activities in different times of the day such as eating, watching television, studying, playing and hosting guests.
- Defects of existing low-income dwellers in the fact that most of low income dwellers attempt to meet their spatial and functional needs on their own and this related social and behavioral aspects of dwellers which it neglected by planners and designer and for this reasons most of low income families attempt to increase the area of inhabitable spaces such as living room and other spaces to achieved separation between boys and girls in the sleeping areas.
- Sometimes low income dwellers used the street to be a solution used by the male in the families when they need additional space this solution is common when the family include sons and daughters.

- On the other hand, there is real demand for space strategies' to achieve the optimal use of the available space and save the area of the small dwelling and to provide other needed spaces and solving the storage area problem
- The requirements of low cost income families 'desires needs is a flexible in the house space that could be used to perform various activities and accept the idea of multi-use space.
- Low income families have the desire to change and remodeling their spaces according to their needs.
- In general Sudanese families, especially in low income housing area usage of outdoor spaces in the house used for one specific activity, or without limitation to a single activity, it can be used for more than one activity for example the veranda can be used for female guests reception in the morning or in the afternoon and it is also used as a living room or used for sleeping at night and that is the opposite of what happens in families with a higher standards in cultural and social aspects.

- The majority of the sample in the case study were built and organize by (H D F) and the percentage of people who acquire the house by Government sector represented 33.9 % while 39% and 7 % were bought it and 7% granted it .
- The majority of the sample shows that urban experience of inhabitance in the capital Khartoum (16-20) years represented 57% of sample study.
- Low income housing families who live in Khartoum consist of members on average 6 persons.

(8-6)RESEARCH RECOMMENDATIONS:

- As a result, from the social study; most of low income families have owned various new electrical appliances such as TV sets computer and automatic washing machine and the design should take this into account when they design spatial needs for those.
- Establishing small apartments' and tiny house using the concept of low cost housing to restrict the horizontal expansion of the city and small apartment housing types for low and medium income groups
- Devise an expert system in judging housing competition and evaluating projects for low income families, and refer the benefits from other experience in the Arab and African countries to solve the problem of spaces in low cost housing .

- In order to use the concept of the devised expert system, further studies are needed for developing or creating a more flexible system that take account other housing types and other dwellers groups
- Studding the new space saving strategies and the social acceptance of these new concepts and to studying what suitable to the dwellers socio-cultural characteristics' and manufacturing conditions.
- To generate space standards that classifies the levels of housing to undertake the duration of use in a lot of dwelling with various conditions and different levels.
- research recommended at the both level of planning and house design in the public and private sectors the need for population's acceptance cultural awareness acceptance of living in high density housing, to extent the horizontal expansion of Grater Khartoum, the importance of establishing laws governing ownerships share in a one building and encourage citizens to own small areas to and secure their rights. It also recommended the establishment of Sudanese housing space standard code (SHSS) through an integrated program to provide a clear set of standards, guidance in the form of minimum areas and dimensions for acceptable residential space standard and layout alternatives and options in different housing type and style.

Population density:

- Striving to achieve the ideal population density by means of urban planning to restrict the horizontal expansion of cities and residential areas by increasing density.
- Classification of new residential areas, not on the basis of income only, but on other variables such as home characteristics, and the family structure, ect.
- Reduction the dimensions of residential plots frontages in order to reduce the cost of services and their connections (water, electricity, telephones) and defining the suitable housing area for each socio-cultural group according to types and family size and the special editions of reception of guests.

The housing models:

- Paying attention to the families' financial ability to defer mine the standard of homes and finding different options and alternatives for housing models to suit the population and expatriates.
- Use of advanced houses starting from the traditional type to the independence house; it is also possible to use raw houses because it is environmentally and socially suitable for Sudanese families.

- The importance of setting up and using the booklet for housing options in terms of (design , space standards, …..ect) for all levels of the country's population

The need of spaces:

- More than one court-yard can be used to meet the families according to the family size, the family determines courtyard size in accordance with cultural and environmental standards of residential area.
- The need for storage space, bathroom and area for receiving guests

Building laws:

- Amendment of building laws connected with the area left on the two sides. Arrangement building law for housing, which were built with Sudanese housing development funds in Khartoum to save the urban fabric of district in developed views.

Planning levels:

- To find alternatives and search about plot divisions and densities in housing, which is built by the Sudanese Housing Developments Fund.
- Promoting public participation in urban planning in efforts to move towards decentralized society, various participants of municipal government, civil groups, and other local organizations in Khartoum city is redefining their respective roles
- Reduce plot frontages dimensions to reduce the infrastructures

(8-7) RECOMMENDATIONS FOR FURTHER RESEARCH:

Studying a new space saving strategies

- Activate the local researchers to study ergonomic in performing home activities according to local aspects and socio-culture characteristic of the inhabitants and try to develop the existents typologies instead of suggest new methods

- Try to applicant and benefit of the previous experiences in the low cost housing spaces and areas

-Studying the new space saving strategies and the social acceptance of these new concepts and studying what is suitable to the dwellers socio-cultural characteristics manufacturing condition.

Public Participation:

Participatory processes are spaces for reflection where architects and inhabitants try to reach a consensus. The architects contribute their knowledge on built environment, and the inhabitants contribute their personal experiences from living in different places.

A participatory process is therefore an educational process, not only in terms of giving and receiving but also of sharing knowledge.

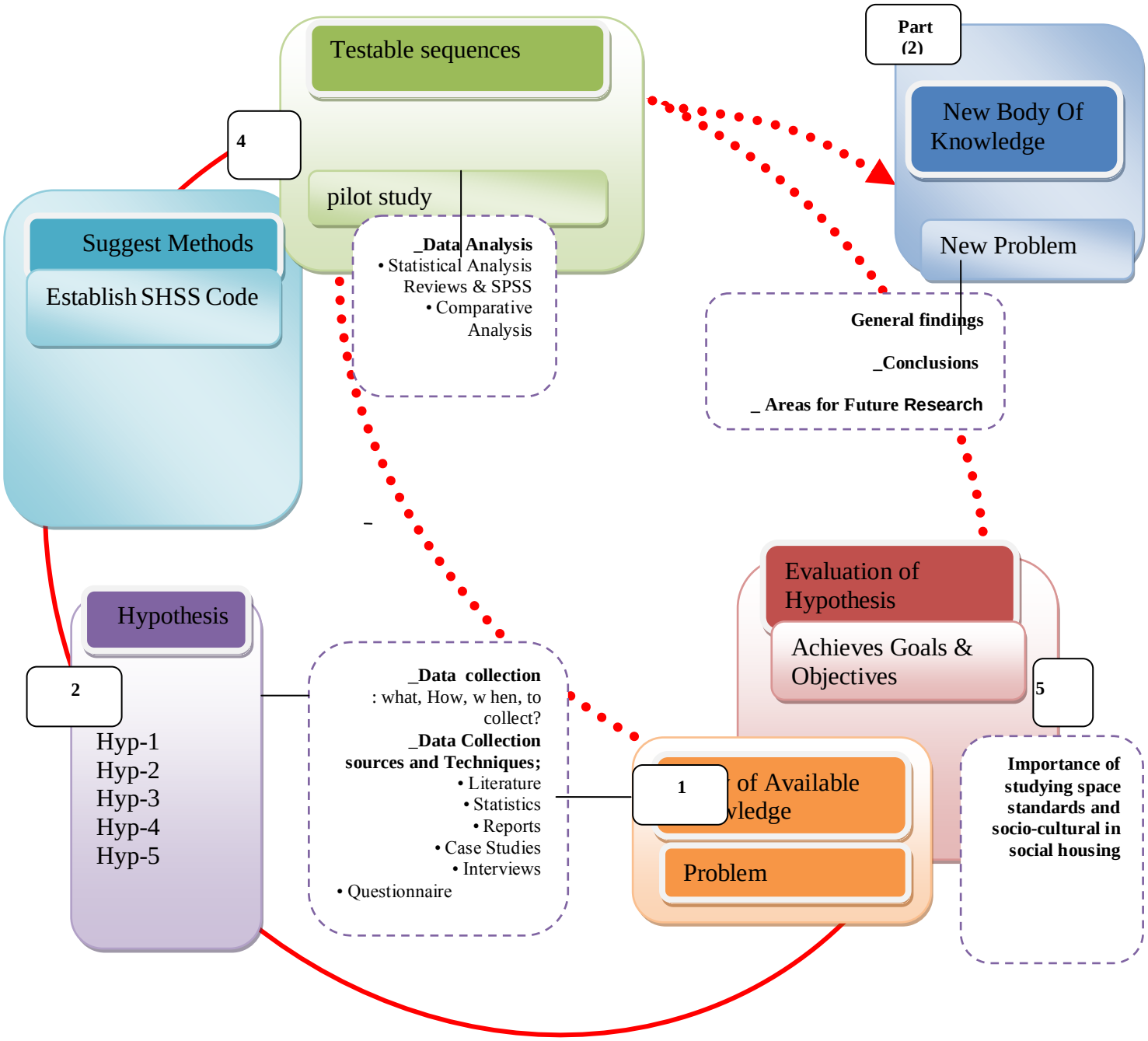


Fig (8-1) research cycle (Source: Author)

The inhabitants become an integral part of the design team. Participatory processes can be based on dialogue (exchange of information and negotiation), observation (of the behavioral patterns of people in living spaces) or both, and use graphical means of representation to facilitate communication among architects, inhabitants and other technicians.

(8-8) DISSCUSION FOR FURTHER STUDY:

Wider dissemination of the culture of housing in apartments, and this leads to a vertical housing must not Of horizontal expansion, easing population pressure on land distribution and the provision of land from the economic side.

Demographic and social changes:

Government officials should be aware of the impact of these demographic and social changes in urban planning and housing demand. Planning should be oriented towards strengthening social cohesion and achieving social inclusion and avoiding social exclusion of the various social groups in the housing supply and the allocation process. The housing allocation system should ensure different groups have equal chances and access to government housing plots.

Training and research development:

Training and research development should be extended to adopt and adapt best international practices and experiences in the field of housing.

Housing polices:

Housing policy and practice in Khartoum has shown that housing officials are not fully aware of these practices, and these practices also show that housing officials have limited professional capabilities to cope with the increased demand for housing, bonded with many other regulatory constraints and resource limitations.

The objective should be maximizing the number of beneficiaries of the housing programs, best utilization of the housing land resources within the city development plans, increasing the housing production and increasing the housing supply

Plot subdivision:

With a view to those standards, we find there is a real need to optimize these standards and establish them in a more rational method and to avoid the ad hoc application of standards.

Plot subdivision means better utilization of the plot space, through plot subdivision more compact settlements could be achieved Compact settlement is an alternative term for

consolidating. Plot subdivision as a method for achieving compact settlements also provides more sustainable settlements (Hillman, 1996; Jenks et al., 1996a; 1996b, Williams,

et al., 1996). On the other hand, smaller plots do not constrain building more space for the household, or even constrain the development of home-based enterprises (Tipple, 1993; Gilbert, 1988; Strassmann, 1987). Increased space can effectively be achieved by housing extensions and transformation (Tipple, 1996; 2000). Tipple (2000) maintain that plots should be large in the expectation that a single household could just manage thereon. The housing policy should provide enough plot area for the house to allow for housing extensions and transformation.

Plot subdivisions are constrained by regulatory systems and the official and conventional planning and design standards; and to some extent by the construction technology and building materials. The regulations state that, in case of subdividing a plot, the frontages should not be less than ten meters and the remainder plot size should be minimum 200 sq. m. Such regulations should be changed to enable plot subdivision and allow for smaller plots. Appropriate plot subdivision could not be achieved because planners, architects and the professionals in Khartoum failed to develop alternative small size dwellings.

The housing officials lack belief that land subdivisions could be achieved by smaller plots. The housing policy should modify the regulatory systems which constrain plot subdivision. Particular consideration should be given to improving plot apportionment system and alienation and setbacks. Such setbacks reduce the efficiency of the plot use, hence reduces the built-up area.

Consolidation by optimizing the housing standards:

The analysis has shown that many of the official housing standards and those which came up from the analysis of the current conditions can affect housing supply, such as room occupancy, plot ratio and the plot size. The practice in Khartoum has shown a lack of appropriate land subdivision guidelines, criteria, and zoning regulations that would lead to appropriate estimates of densities, plot sizes, housing areas, and therefore the whole housing land coverage.

Room occupancy is an important indicator for housing qualities and standards. Increasing room occupancy thresholds can absorb part of the housing need and reducing room occupancy requires more housing land. For example, Tipple (1994a), in Kumasi, Ghana, showed that reducing the overcrowding to a maximum of three persons per room would have required nearly 50 percent more housing than existed. At the local context, the analysis of room occupancy and the plot area per person clearly shows an existence of stalemate in housing standards in Khartoum.

The median room occupancy in all districts is 2 persons per room and the plot area per person is 61.5 meters. This means that while each person enjoys a mean of 61.5 square meters of the plot, he shares a room with another person within this area. The room occupancy index at policy level could be used to forecast the housing supply, but in the low income group is more than 5 persons.

Besides admitting the role of `family houses' in housing supply for households on low-income, the government should encourage development of high density housing, apartments and multi-storey buildings, to partially meet the housing requirements of the middle and high-income households. This helps in providing for the low-income households through the filtering process, and launches aspiration towards modernization in the housing qualities and innovation diffusion.

- To contribute to social inclusion, housing should be integrated with other policies, notably those governing employment, urban planning and transport.
- Housing should be developed with a long-term perspective, taking into account demographic trends. In this connection the rapidly growing numbers of the elderly should be given due attention.
- Housing should be integrated with other forms of housing to prevent segregation in housing areas. For this reason the architectural quality of l housing should also be emphasized.
- Public authorities should establish experimental housing programs within their overall social housing policies. Public subsidies for new social housing projects should be connected to conditions regarding technical innovation, new social approaches, and new economically oriented solutions. Pilot projects and building exhibitions should be 5organized to profit from experiments and from international know-how transfer.
- The research recommended at both the level of planning and house design in the public and private sectors the need for population's acceptance, cultural awareness, acceptance of living in high density housing, to extent the horizontal expansion of Grater Khartoum, the importance of establishing laws governing ownerships share in one building and encourage citizens to own small areas to and secure their rights, and to benefit from other countries experiences in solving the problem of low-income housing, and housing density problem focusing on low and medium income housing. The research also recommended the establishment of Sudanese housing space standard code (SHSS) through an integrated program to provide a clear set of standards, guidance in the form of minimum areas and dimensions for acceptable residential space standard and layout alternatives and options in different housing type and style. Also it encouraged developing different types of housing starting from the traditional type.

REFRENCES:

1. Abou Saleem, M . (1991) History of Khartoum Berirout. Dar El-jeel (Arabic)
2. Abou Sin, M.E.H.R.S Davies (eds) the future of Sudan capital region , Khartoum university press (K.U.S)
3. Ahmad, A, M et al,. (1991) Low cost housing projects in Khartoum with special focus on housing patterns , Habitat International 2
4. AHD, 1994. American Heritage Dictionary, Soft key International Digital Dictionary
5. Alhassan, Z, M et al. (2012) Low cost housing projects in Khartoum with especial focus on housing patterns Habitat International
6. Alahassan, Z, A.(2013)Urban planning towards low energy residential house building integrated photovoltaic systems in Alazhari city – Sudan ,PhD thesis , University Kebangsaan Malaysia, Bangi
7. **A**l tayieb, Z. (2000) Spatial and Socio – cultural dimensions Khartoum urban house with references of flat, PhD thesis , University of Khartoum .
8. Al-Ahmadi, A. R., (2006). Petua Membina rumah Melayu: Dari Sudut Etnis Antropologi. Kuala Lumpur: Perpustakaan Negara Malaysia.
9. Alexander, C. (1977). A Pattern Language: Towns, Buildings, Construction. New York: Oxford University Press.
10. Altman, I., & Chemers, M. M. (1980). Culture and Environment (basic concepts in environment and behavior series). New York: Cambridge University Press.
11. Altman, I., Vinsel, A., & Brown, B. (1981). Dialectic Conceptions in Social Psychology: An Application and Privacy Regulation Advances in Experimental Social Psychology.
12. Anderow D., (2006) Housing Space Standards, A report by HATC Limited for the, Greater London Authority,
13. A., zener, O. .., .zden, T. and Edg., E.(2001) An Evaluation of Social Interactive Spaces in a University Building, in J. Peponis, J. Wineman and S. Bafna (eds.),
14. Anne G,(2010 Filed under Architecture, Book reviews, Cities & urbanism

15. Andrew H,Smith, (2006) Digitally Distributed Urban Environments: The Prospects for Online Planning. PhD University of London Available at: http://www.casa.ucl.ac.uk/digtialplanning/
16. Awadel Karieem , M, (2008) Scientific Conference on urban Housing in Sudan, April28-30, Khartoum, Sudan
17. Bahmammam, A. (1998) Factors which influence the size of the contemporary dwelling: Riyadh, Saudi Arabia, Habitat International Conference 22(4)
18. **B**runskill,R. (1981) Traditional building of Britain :an introduction to vernacular architecture, Victor Gallons ,London.
19. Bilal , H, E (2014) Adoption of Performance Improving Management Concepts and Techniques in the Sudanese Construction Industry, PhD thesis , University of Khartoum.
20. Burhan E, B Elghazali, (2006)Urban Intensification in Metropolitan Khartoum: Influential Factors, Benefits and Applicability. Doctoral Thesis in Regional Planning KTH, Royal Institute of Technology.
21. Cambridge City Council Affordable Housing Supplementary Planning Document, January 2013.
22. Central Bureau of Statistical (CBS), (2009) Sudan census 2008 Available at WWW.CBS.gov.sd.
23. Chad W. Gibbs، (2011) designing "Home" into the House City limits: urbanization and vulnerability in Sudan report.
24. Conference on Built Form and Culture Research 18-20, October 1984, KU Press, Lawrence, Exxon Education Foundation.
25. Country profile: Sudan (2008) http://www.fco.gov.uk/en/about-the-fco/country-profiles/sub-saharan-africa/sudan?profile=geography&pg=5.
26. Creswell, J. W. (2012). Educational Research, Planning, Conducting and Evaluating Quantitative and Qualitative Research; Fourth Edition. Pearson Education, Inc.
27. D, Walters, (2005) Design First: Design-based planning for communities, Architectural Press.
28. Difalla. M.H. (1989), Utilization and differentiation of space – a study of social factors influencing unpublished M.Sc thesis, University of Stockholm.

29. Doxiadis and Mustafa, a, M, (1991) 'Preparation of an urban development plan and action program for the National Capital Khartoum' reports no 1 and two.

30. **D**erck T, (2002) Architecture and the urban environment, oxford Amsterdam Boston Lon 2002.

31. Department of statistic (Census office, fourth population census of Sudan 2013).

32. El Agraa , O.M. and Ahamad, A.M (1985) Popular settlements in Greater Khartoum, Khartoum university press.

33. El Agraa, O, M, and Shadad.M.Y, (**198**8) Housing rental in Sudanese capital Khartoum. Group on assessment of human settlements,.

34. Elle A. D,(2008)" Validity and Reliability in Social Research", Education Research, and Perspectives, Vol. 38, No. 1.

35. Elias, B. O., (1977) "Social Aspects of Housing Standards". In the social indicators and poplar participation, United Nations, New York.

36. Elkhalifa A. A., (2011) The construction and building materials industries for sustainable development in developing countries: Appropriate and innovative local building materials and technologies for housing in the Sudan, School Of Advanced Studies SAS, Universita' di Camerino.

37. Elkhidir, A, M, Khair, (2009) Apparaisal of the impact of the information and communication technology (ICT) on the urban environment in Sudan: The Prospects for Interactive e-Planning , Sudan university for science and technology

38. Elkheir, O (1988)." Naffer Housing project, at Khartoum Sudan", Stockholm.

39. Elkheir, O (1997). "Nubian (Egypt, s; Sudan, N) in: Ecyclopedia of vernacular Architecture of the world, volume – culture and Habitats, first publish, Cambridge University Press,

40. Eltahir , M, M , (2008) Targeted investment projects in infrastructure in Khartoum research paper1.phd .

41. Eltayeb, B, B, E, (2006) Urban Intensification in Metropolitan Khartoum: Influential Factors, Benefits and Applicability. Doctoral Thesis in Regional Planning KTH, Royal Institute of Technology

42. Environmental Health Professional Practice, VOL II, Chapter III

43. Environment and planning, The urban II operation programmed 2007-2013

44. Effects of residents' participation in margining work on Satisfaction in Multi-storey Housing http://www.bartleby.com/61/54/T0065400.html.

45. Elhoweris, M. N., & Hassan, S. S. (2003). Urbanization and Distribution and Classification of Urban Settlements in the Sudan: Factors and Influences and the Role of Intermediate Settler in the Urban System. In F. M. Ahmed (Ed.), Proceedings of the Fifth Scientific Conference, 17-19th, April 2001 (Vol. 1, pp. 102-118). Khartoum:National Center for Research (NCR

46. AFawzi, S, (1954), "Social Aspects of Low-cost Housing in the Northern. Sudan" Ministry of Social Affairs, Sudan Government of Khartoum

47. Frah, I, (2000), House form and social norms, spatial analysis of domestic architecture in wad-Nubbawi, Chalmers University of Technology, Department of Urban Design, Sweden.

48. Forrest, R and J. Lee, (2003) Housing and Social Change: East-West Perspective, London, Routledge (Taylor and Francis Group), London, Cromwell Press, Trowbridge, and Wiltshire.

49. Gillham, B. (2000) Case Study Research Methods, London, Continuum Press.

50. Getz, D, C, & Morrison, A. (2005) in Jones, E. Tourism SMEs, Service Quality, and Destination Competitiveness. Cambridge, USA: CABI Publishing.

51. Gilman, (1903) In Saunders, P. & Williams, P. (1986) The Constitution of the home: Towards a Research Agenda. Housing Studies, Vol. 3, No. 2.

52. Giorgi, S., Padiglione, V and Pontecorvo, C. (2007) Appropriation: Dynamics of Domestic Space Negotiations in Italian Middle Class Working Families, Culture and Psychology, vol 1.

53. Graham, T, (2005) An Introduction to Urban Housing Design, at home in the city.

54. Guidance and Standards for Housing Development and House Conversions, London Borough of Lambeth Unitary Development Plan, July 2008

55. Hafazalla, A, A, (2008) The urban development planning of Greater Khartoum: Coping with urban dynamics, Architect' Third Scientific Conference on Urban Housing in Sudan, April28-30, 2008, Khartoum, Sudan.

56. Hashim, A., Rahim, Z., Rashid, S., & Yahya, N. (2006) Visual privacy and family intimacy: A case study of Malay inhabitants living in a two-storey low-cost terrace housing. Journal of environment and planning.

57. Hashim, A. H., & Abdul Rahim, Z. (2008) the influence of privacy regulation on urban Malay families living in terrace housing. [Journal article]. Archnet-IJAR: International Journal of Architectural Research).

58. Hall, J.S.,(1944) From Cannibalism to Christ: A tory of the Transforming Power of the Gospelin Darkest Africa, Evangelical Publishers, Toronto.

59. Hanson, J., (**1999**)Decoding Homes and Houses .Cambridge University Press, Cambridge.

60. Hillier, B., & Hanson, J. (1984) The Social Logic of Space. Cambridge, MA: Cambridge University Press.

61. Hillier, B., Hanson, J., Peponis, J., House, W., Street, G., London, W., et al. (1987). Syntactic analysis of settlements. Architecture & comportment/ Architecture & Behavior, 3(3)..

62. Hole, W and Attenburrow, J. (1966) Houses and people. University of Technology HMSO London.

63. Housing Design Handbook ,1993,) and the National Housing Federation's Guide to Standards & Quality (1998).

64. Housing Design Standards Evidence Summary, 2010

65. Housing Corporation Design and Quality Standards (2007) and Housing Quality Indicators version 4 (2008)

66. Housing Standards -Towards Inclusive Design ,PRP's Specialist Housing Conference,17 November 2009

67. **H**uet , B (1983) : "The modernity in a tradition – the Arab Muslim culture of North Africa , Mimar , No, 10, October December."

68. Imrie, R. and Hall, P., (2001), "Inclusive design: designing and developing accessible environments", SPON Press, London.

69. Jackson , B. H. (1995). Global Needs and Development in Urban Sanitation, Engineering, Division, Overseas Development Association, United Kingdom

70. Johan Post,1995 The politics of urban planning in the Sudan, Published by Elsevier Science Ltd,

71. Jacobson M, Silverstein M, Winslow B. (2002) Patterns of Home: The Ten Essentials of Enduring Design. The Taunton Press, Newtown.

72. Khartoum State Housing and Development Fund, Housing and Development Fund: Past, Present and Future Challenges (In Arabic). Khartoum: Ministry of Urban Planning and Public Utilities.

73. Lawrence, R. J. (1987). What makes a house a home? Environment and Behavior, 19(2), 154-168

74. Lawrence, R. J (1987), "Housing, Dwellings and Homes design Werner, Altman, Oxley, 1985,

75. Low, and Chambers(1989) Cultural aspects of design: An introduction to the field. Journal of Arch. & Comport./Arch. Behav, 4(3)..

76. Laslett, P. (1974)'Household and family i9n the past time' Cambridge University Press. ,1974.

77. Lawrence, R. J., (1985)Translating Anthropological Concepts into Architectural Practice, in S. M. Low and E. Chambers (eds.), Housing, Culture and Design-A Comparative Perspective, Philadelphia, University of Pennsylvania Press

78. Lawrence, R., (1997) Introduction In Unugur et. al. (eds.),Culture and Space in the Home Environment. Istanbul,Turkey: Istanbul Technical University.

79. Ministry of Physical Planning, Seminar on: Physical planning and its impacts on urban development in Khartoum State, Alsharigha hall 2005.

80. MPPPU,(2008) Ministry of Physical Planning and Public Utilities, Sudan, annual reports.

81. Madibo, A ,(1989)"The impact of socio – cultural Aspects on the Built Environment with special References to the Sudan", Edinburgh, U.k.

82. Mabogunje, A, (1962)The growth of residential districts in Ibadan. Geographical Review52

83. Mallet, S. ,(2004) Understanding Home: A Critical Review of the Literature. The Sociological Review. Vol. 52, No. 1

84. **M**azumdar, S. and Mazumdar, S (1997), Religious traditional and domestic architecture: A comparative analysis of Zoroastrian and Islamic house in Iran, journal of Architectural Planning Research

85. Mefit 1975- 1990, regional plan and master plan of the Three town –Beautification program me of Khartoum- the physical survey Rome Mefit Consultants.

86. Mohammad, A, A, (2007) Functional structuring of shape as an economical approach to forming the elements of low income housing, a thesis submitted in partial fulfillment of the requirements of the Ph.D degree in architecture, Ain Shams University).

87. Mohammed, K, S,(2000) An intvestigation of design morphology of residential areas and house units in Sudan , M.Sc thesis university of Khartoum.

88. Mohammedani ,E ,A , (2006) spatial and socio cultural dimensions of un urban single family houses, with special reference to Hai Alomda, unpublished M.Sc thesis, University of Khartoum.

89. Mortada, H, (2003). Traditional Islamic Principles of Built Environment. New York: Routledge Curzon.

90. Nageeb, M , (2008) Scientific Conference on urban Housing in Sudan, April28-30, 2008. Khartoum, Sudan

91. Nasir, A.H., & Wan-The,W.H**. (2011).** The Traditional Malay House. Kuala Lumpur: Institut Terjemahan dan Buku Malaysia.

92. Navarro, L, (**2001**) Exploring the environmental and political dimensions of poverty: the cases of the cities of Mar del Plata and Necochea – Quequen . Environment and Urbanization. 13: 185. Ncube Chiko

93. Noel, E, E,(2011) Domestic Architecture in Penin City , A study of Continuity and Change.

94. Omer, S., (2012) Housing Lessons from the Life of Prophet Muhammad (pbuh): The Subject of Privacy. Retrieved April 23, 2012, from medina.net: http://www.medinanet.org/home/10-housing/178-housing-lessons-from-the-life-of-prophet-muhammad-pbuh-the-subject-of-p.

95. Omer, S., (2010) Islam and Housing. Gombak, Kuala Lumpur: A. S. Noordeen.

96. Osman, A. (2003) Space, Place and Meaning in Northern Riverain Sudan: Focus on the Determinants of House Form and Layout, Department of Architecture, University of Pretoria, XXXI IAHS, vol. 0002, Montreal, Canada, Sage

97. Osman, K. M. & Suliman, M. M. (2005) Continuity & Changes in the Morphology of Urban Sudanese Homes, XXXIII IAHS, Pretoria, South Africa

98. Osman ,Amira.(2000)The Spatial and Physical feature of the settlements and buildings along the Nile Valley in Northern Sudan

99. Osman, K. S, M (1996), "Spatial and cultural Dimensions of Houses of Omdurman, Sudan" in human relations volume 49, no, 4 April 1996, Prenvm Press, London.

100. SAHA (1994). Shelter & Habitat in Sudan, A report produced by the Settlements and Physical Development Department, Institute, For Technological Research, National Research Center, Sudan.

101. Osman, S. M. (2001). Housing and development in Sudan, Fifth Scientific Conference, National Center for Research (NCR), Sudan.

102. Oliver, P. (2000). Ethics and Vernacular Architecture, in Warwick Fox (ed.), Ethics and the Built environment, London & New York: Routledge. van

103. P.Hall ,(1995)Urban and regional planning 3rd ed. Routledge,London

104. P.Hall ,(2002) Urban and regional planning 4th ed. Routledge, London

105. Peter C. Dawson Etudes/Inuit/Studies Article, vol. 30, n° 2, 2006, p. 113

106. Parker M, (1961) Report, Homes for today and tomorrow, Ministry of Housing and Local Government and the Central Housing Advisory Committee,. Residential density guide For Landcom project teams, May 2011(Source

107. Residential density guide For Landcom project teams, May 2011 (A report by HATC Limited for the Greater London Authority,2006)

108. Rapoport, Amos (1990), "Socio-cultural Aspects of Man – Environment Studies. In the meaning of the Built Environment, a Nonrebale Communication Approach. The University of Arizona Press.

109. Rapoport, A. (1990) Vernacular architecture, in, Turan, M. (Ed), Current Challenges in the Environmental, Social Sciences, vol. 24, Aldershot, England, Avebury.

110. Rapoport, A. and Hardies, G. (2005) Cultural Change Analysis; Core Concept of Housing for the Tswana, Housing the Poor in the Developing World, vol. 33, London University Press
111. Rapoport A (1969). House, form and culture. Englewood Cliffs, NJ: Prentice-Hall.
112. Rapoport, A. (2007). Some further thoughts on culture and environment. ArchNet-IJAR: International Journal of Architectural Research, 2(1), 16-39.
113. Rapoport, A., 1982, 1983, The Meaning of the Built Environment: A Non-verbal Communication Approach, London, Sage Publications
114. Rahim, A. A. (2008). Housing from the Islamic Perspective. Selangor: IIUM Press,.
115. Radzi, A. N. (1998) andTalib, Anuar The Concept of Privacy and the Malay Dwelling Interior Space Planning , Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia, papper published in Procedia - Social and Behavioral Sciences 101 (2013) 404 – 414
116. Stephen Read, Camilo Pinilla Visualizing the invisible: towards an urban space, Techne Press, 2006.
117. Supplementary Planning Guidance – housing standard ,the Royal borough of Kensington and Chelsea ,2002.
118. Sudan- background, http://www.uneca.org/aisi/nici/country_profiles /Sudan/sudab.htm
119. Sudan e-Government Vision Report, Council of ministers, Sudan, 2006
120. Sudan Net, 2006, country profile Available at: (http://www.uneca.org/aisi/nici/country_profiles/Sudan/sudinter.htm).
121. Scientific Conference on urban Housing in Sudan, April28-30, 2008. Khartoum, Sudan
122. Salah ,K, M,(2000) House Morphology in Khartoum case study
123. Saeed , A. M &Badr. A.Y (2009) Sudan‘s Internal Population Displacement and Migration , Magnitude and policy Issues in the New Millennium, Policy Analysis Report. African –European research and curriculum development project IMMIs
124. salim, A., (1998) Owner-occupiers transformation of public low cost housing in Peninsular Malaysia. Unpublished Ph.D. Thesis. University of Newcastle.

125. Scott,E, (1990) Roman Britsh villas and social construction of space, in Samson, R. (ed), The social archeology of houses, Edinburgh University Press, UK

126. Shaddad .H.A (2005) Housing Scheme for limited and intermediate income Groups.

127. Shelter and inhabit in Sudan (SAHA)Part One(2003)/part 2

128. Tarek, A, and ,Rihan , G, M,(2012) The impact of sustainability trends on housing design identity of Arab cities

129. Tahar, B, (2003) Spatial interface between inhabitants and visitors in M'zabite domestic spaces, department of architecture, Setif university, Algeria

130. Tipple, A. G(1996) Housing extensions as sustainable development Cities 20(3)

131. Taylor Brower, S. (1985)'Home and near home territories 'in Altman, I, and Werner (Ads) Home environment. Plenum Press, New York.

132. Tipple,A.G.,1991.SelfHelpTransformationsofLowCostHousing: An IntroductoryStudy.CARDOinassociationwiththeInterna- tional UrbanPress,NewcastleuponTyne.

133. Tipple, A.G., Salim, A.,(1999)User-initiatedextensionsashousing supply: a study of government built low cost housing in Malaysia. Third WorldPlanningReview21.

134. Tipple, A.G., (2000) ExtendingThemselves: User-Initiated Transform- motions of Government Built Housing in Developing Countries. Liverpool University Press, Liverpool.

135. Thevendran, Vicknayson (2003), Risk Management in Construction: A Systemic Approach towards Managing Human Factors, Ph.D. thesis, School of Civil Engineering, University of Nottingham.

136. UN-Habitat. (1996) The Habitat Agenda Goals and Principles, Commitments and the Global Plan of Action.

137. Wikipedia (2008-b), Conceptual framework, Wikimedia Foundation, Inc, USA. http://en.wikipedia.org/wiki/Conceptual_framework

138. Wikipedia (2008-c), Model, Wikimedia Foundation, Inc, USA.http://en.wikipedia.org/wiki/Model

139. Zami & Lee (2011) and Omer (2011) Widespread adoption of contemporary earth construction in Africa to address urban housing crisis

المراجع باللغة العربية :

1- إدريس، ب. أ. السكن الحضري بولاية الخرطوم بالتركيز على السكن الجاهز وإسكان ذوي الدخل المحدود (السكن الشعبي) ندوة الحالة الراهنة للسكن الحضري في السودان. ندوة الحالة الراهنة للسكن الحضري في العالم الخرطوم (15-18) مارس 1996.

2- الطيب، عوض ،زحل دراسة العوامل الاجتماعية والثقافية التي تشكل تركيبة الاسرة ،مؤتمر الاسكان الحضري الثالث،الخرطوم ، السودان ابريل 2008

3- ابراهيم ادريس ، نوال العمران الراسي غير المخطط واثره علي البيئة الحضرية مؤتمر الاسكان الحضري الثالث،الخرطوم ، السودان ابريل 2008

4- سبيل عبد الرسول التخطيط العمراني في ظل الحكم الاتحادي Architects' Third Scientific Conference on urban Housing in Sudan, April28-30, 2008. Khartoum, Sudan

5- سعيد، جمعة 2006 التخطيط العمراني ودوره في التنمية العمرانية المستدامة في المدن السودانية بحث اجازة درجة زمالة كلية الدفاع الوطني مكتبة كلية الدفاع الوطني

6- سليمان، الرشود ،عبد الرحمن،٢٠٠٤ م الأنماط السلوآية على تصميم جناح المعيشة فى الوحدات السكنية المتكررة فى مشروعات الإسكان بمدينة الرياض، تقييم ما بعد الإشغال.

7- نمر ، سامية. (1999) التمدد الافقى وأثره على التطور العمراني في ولاية الخرطوم الكبرى رسالة ماجستير

8- قناوي، طارق ،رسالة ماجستير ، الاسكان الشعبى بالسودان -دراسة حالة الخرطوم of university Science a technology.،2015.

9- محمود، صلاح الدين منهجية البحث العلمي في مجال العمارة والتخطيط الزمن المناسب للتغير البنيوي، ورقة عمل مقدمة للمؤتمر الدولي الاول لشراكة التنمية في التعليم العالي حول ادارة التشييد في الدول النامية: التعليم، التدريب،البحث والتطبيق، الخرطوم 10 مارس 2013

10- وزارة الشئون الهندسية – الخطة الإسكانية للإنقاذ – المضمون – الملامح والإنجاز الخرطوم – يونيو 1994

11- مؤتمر المعماريين العلمي الثالث ،الاسكان الحضري في السودان ،سجل الاوراق العلمية ،الخرطوم ،السودان ،ابريل

12- المرشد القومي للتخطيط العمراني المجلس القومي للتنميهة العمرانية 2004

13- العامل السكانى ووضع الاسكان بولاية الخرطوم فى الفترة1984 – - 2010 بحث مقدم إلى جامعة الخرطوم لنيل درجة دكتوراه الفلسفة في ا لجغرافيا' آمال عبد الرحمن النعيم أحمد

14- دور الكود المصرى لتصميم المسكن و المجموعه السكنيه فى تحسين كفاءه البيئه العمرانيه فى مصر

QUESTIONNAIRE FORMS

A1. QUESTIONNAIRE FORMS OF Citizens

SUDAN UNIVERSITY OF SCIENCES AND TECHNOLOGY
ARCHITECTURE COLLAGE

Questionnaire form for Citizen in Social housing designed by

MR/MRS

you are kindly informed that I am carrying out a study on" The space standards and socio-cultural dimensions in Sudanese social housing "
your assistant is very import ants to help me in my study, allowed you to fill the questionnaire form please ,and i ,assure you that all of your information and answers will remain secret and it will be used only for the purposed of the study

Thank you

Researcher: **EatezazA/Rahman Mustafa Mohammedani**

Questionnaire instructions:

1. read the questions carefully
2. answer all questions
3. Please Tick (√) Where Appropriate

Household Questioner
Section (1) Classification Data

Interview No ( )
Interviewer: ——————— **Block No:** ———————
House Type: ——————— **Blot No:** ———————
House Property ——————— **Quarter:** ———————
Area:

Please Tick (√) Where Appropriate

Section (2) Household Composition

(1) Household Age (Year)

(1)	(2)	(3)	(4)	(5)
20-30	31-40	41-50	51-60	Above 60

(2) Gender

(1)	(2)
Male	Female

(3) Status

(1)	(2)	(3)	(4)
Single	Widowed	Divorced	Married

(4) Education level

(1)	(2)	(3)	(4)	(5)
University	High institute	High second	Gen second	Elementary

(5) Occupation of household

(1)	(2)	(3)	(4)
Public sector	Private sector	Self-employed	Other

(6) Monthly income of household head in Sudanese pound

(1)	(2)	(3)	(4)
More than 2000	100-1999	450-999	Less than 450

(7) Occupation of the wife of the household head

(1)	(2)	(3)	(4)
Public sector	Private sector	Self-employed	Housewife

(8) How did you acquire this plot or house?

(1)	(2)	(3)	(4)
Distributed by Govern	Bought	Grant	Inherited

(9) Urban experience of the household in capital

(1)	(2)	(3)	
20-16	15-11	10-5	<5

(10) Length in living in the dwelling

(1)	(2)	(3)
>15	5-15	<5

Section (3) Socio- cultural and economic of Household :

A- Household social factors:

(11) Family type

(1)	(2)	(3)
Nuclear	Composite	Extend

(12) Number of family's members living in the house

(1)	(2)	(3)	(4)
2-4	5-7	8-10	Above 10.

(13) Is it others people living in the house

(1)	(2)
Yes	No

(14)

B/ Household Cultural factors :

(15)

(16) Determine the ability of having a multiuse space in the house

(1)	(2)	(3)	(4)
Bed room	Living room	Store	Other

(17) When you receive guest, do this affect

(1)	(2)	(3)
Eating	Sleeping arrangement	Any other activities

Section (4) Characteristic of the Dwelling

A/Form and Physical Features:

(18) Type of house

(1)	(2)	(3)	(4)
Detached	Semi-detached	Row	Residential complex

(19)If you habit in complex building what is the number of building floors

(1)	(2)	(3)
5- Floors	3-5 Floors	1-3 Floor

(20) If you habit in complex building what is the number of house unit in the floor

(1)	(2)	(3)
1-2	3-4	4-

(21) The total numbers f house's space components

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bed Room	Kitchen	Saloon	Veranda	Yard	Balcony	Hall	Store

(22) Does your property have

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Store	Balcony	Store	Balcony	Garden	Veranda	Trace

B/Spatial Organization and configuration:

(23) Is the entrance injured or reveals the spaces in your house?

(1)	(2)
No	Yes

(24)The size and layout of your home doesn't allow you enough privacy.

(1)	(2)	(3)	
Agree		Don't agree	

(25) Dose the house have private space to entertain guests from other members of the household

(1)	(2)
Yes	No

(26) In which space you receive male guest guests in the house ?

(1)	(2)	(3)
Hosh	Male guests room/salon	Veranda/shade

(27) Separation between male &female section

(1)	(2)	(3)
No Separate	Partly Separate	Physical Separate

(28) Your children have a room with enough space in which they can play on their own.

(1)	(2)
Yes	No

(29) Where dose the family eat the daily meals?

(1)	(2)	(3)	(4)
Other(determined)	the yard	Living room	The kitchen

(30) Are you find that eating room is important in the dwelling?

(1)	(2)
No	Yes

D/ House and spaces area:

(31) Doweling Total Area

(1)	(2)	(3)	(4)	(5)
>400	400-300	200-300	100-200	<100

(32) The built up Area

(1)	(2)	(3)
>200	100-200	<100

(33)When you chose to live in the property , did you know the size of the property in square meters

(1)	(2)	(3)	(4)
Not all important	Fairly important	Not very important	Very important

(34) Types of house expansion

(1)	(2)	(3)
Vertical	Horizontal	NO

(35) The kitchen doesn't has sufficient worktop space to prepare meals conveniently (allowing for prepare meals conveniently, allowing for appliances such as microwave, toaster ect.

(1)	(2)
Yes	No

(36) The kitchen doesn't has sufficient space for small children to play safety in the kitchen when you are using it

(1)	(2)
Yes	No

(37)does your house have enough Storage space?

(1)	(2)
Yes	No

(38) Where do you store your possessions (closets, garage, attic, storage lockers, etc.)? Name all that apply.

(1)	(2)		
Others	living room	Store	Bed rooms

(39)-1 Is it important to have constant space for storage in your house?

(1)	(2)
No	Yes

(39)-2 is it your bathrooms have enough area?

(1)	(2)
Yes	No

(40) How many meters square are there in the bathroom?

(4)	(3)	(2)	(1)
Less than one meter	2-1.5	3-2.5	More than 3

(41) The corridors and stairs within your home provide sufficient space to move around the home with area.

(4)	(3)	(2)	(1)
agree	agree	Disagree	Disagree

(42) The corridors and stairs in your home are obstructed by furniture, stored items or decorative objectives.

(4)	(3)	(2)	(1)
agree	agree	Disagree	Disagree

(43) The amount of spaces in the corridors and stairs within your home make it difficult to move furniture around.

(4)	(3)	(2)	(1)
agree	agree	Disagree	Disagree

(44) There is not enough space in all of the rooms to be able to move easily around the furniture?

(4)	(3)	(2)	(1)
agree	agree	Disagree	Disagree

(45)Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer. ?

(1)	(2)
No	Yes

(46) Is it the removable and furniture provide a lot of space area?

(1)	(2)
No	Yes

(47) Which type of dining furniture do you prefer the fixed or movable?

(1)	(2)
movable	Fixed

(48) What are the activities that can be performed through movable furniture?

(1)	(2)	(3)	
sleeping	Eating	Reading	Others (determined)

Section (5) Option about user attitude:

(49)Have you remodeled this home, resulting in changing sizes or uses of rooms?

(1)	(2)
Yes	No

(50)Have you remodeled this home, resulting in changing sizes or uses of rooms?

(1)	(2)
Yes	No

A. If yes, please describe these changes and your reasons for making them

(1)	(2)	(3)	(4)	(5)
family size growing	Shrinking	for increased home work	keeping up with trends	wanting larger kitchens

B. Do you plan to remodel this home in ways that would change sizes or uses of space? Please indicate possible changes and your reasons for them.

(1)	(2)
Yes	No

D. In which space do you plan

(1)	(2)	D	(4)
bedrooms	store	living room	others

(51)The space within your home has been used efficiently by the designer.

(1)	(2)
No	Yes

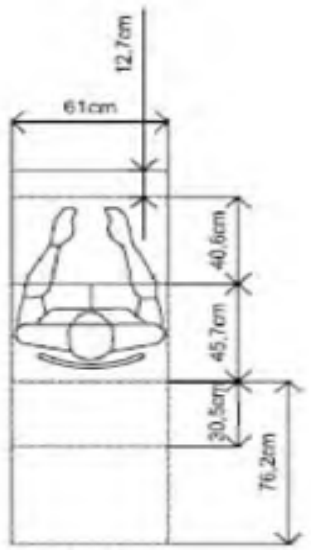
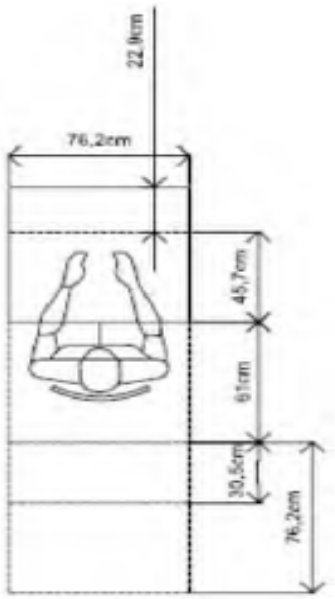
(52)Do you find that it is better that you and your family members to divide spaces and residential unit ? and what would you do?

(1)	(2)
No	Yes

Thank you for completing this questionnaire

APPENDEX(2)

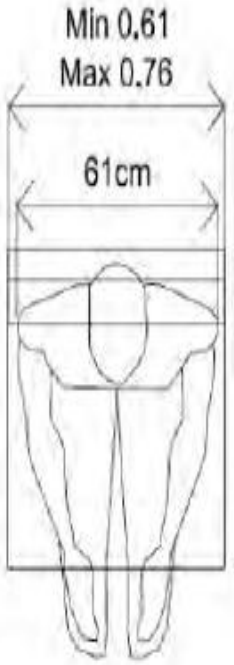
Minimum dimensions for house's spaces

Minimum dimension for eating space (one person) using dining table	
Minimum dimension = 76.2 Maximum dimension = 91.4	
Maximum dimension for eating space (one person) using dining table	
Minimum dimension = 121.9 Maximum dimension = 152.4	

Seating Width (in general)

Minimum dimension = 61

Maximum dimension = 76

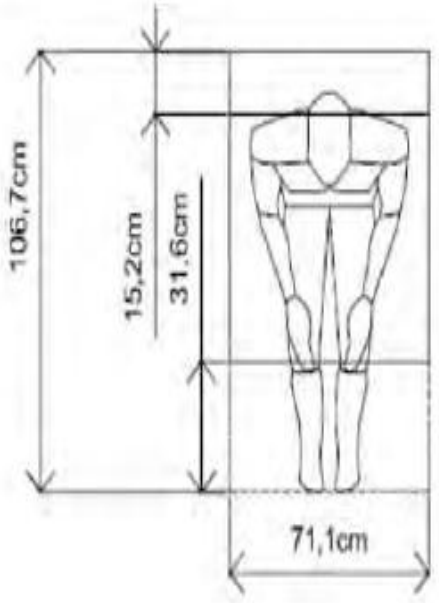


Sofa Seating (Minimum dimension)

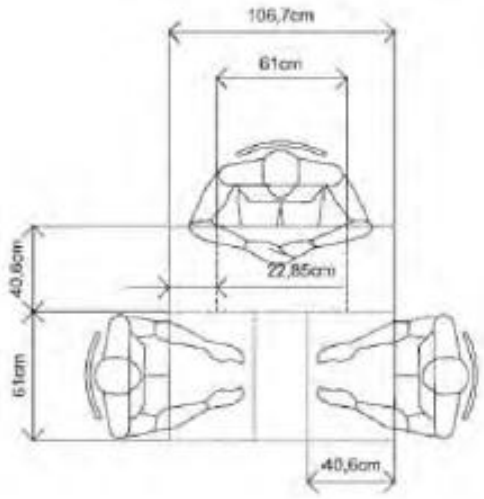
Minimum width = 121.9 cm

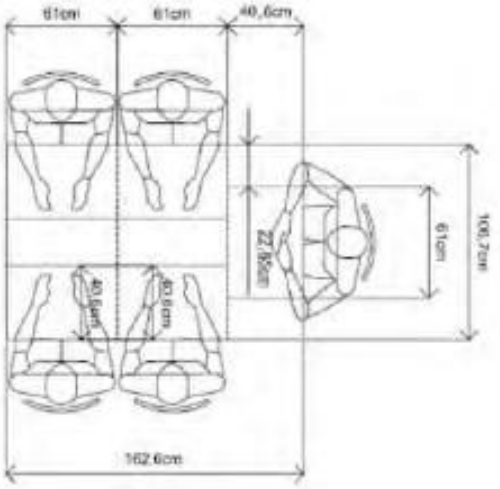
Minimum depth (sofa + clearance) = 106.7

Minimum clearance = 31.6 cm

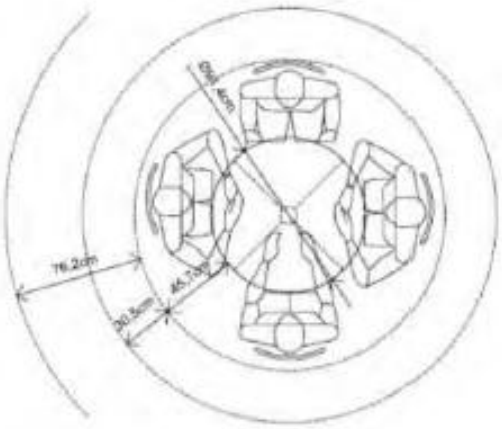


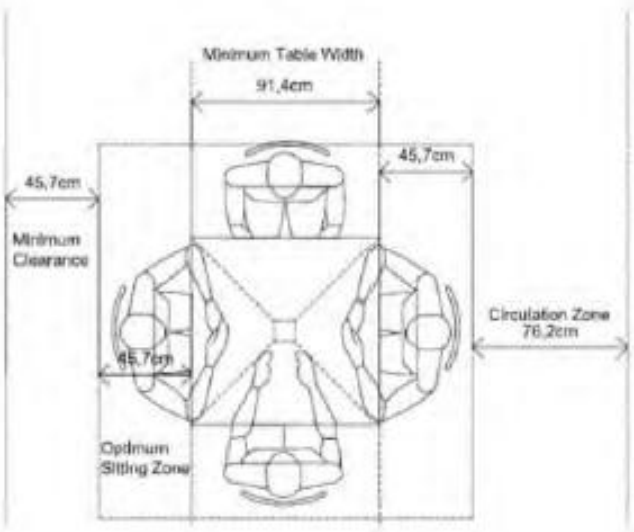
Dining tables

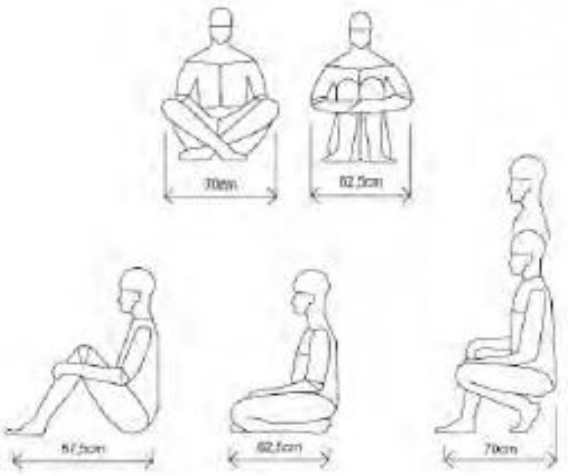
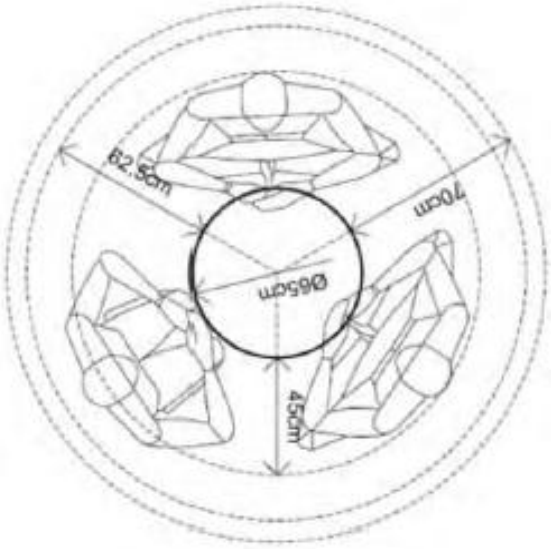


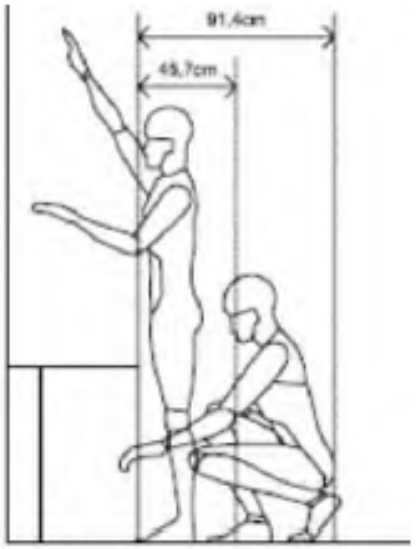
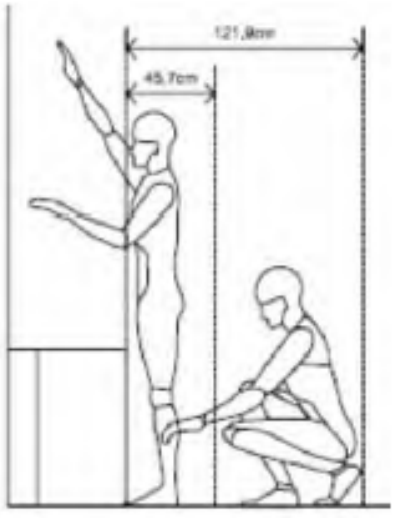


Variuos types of dining tables





Seating on the floor	
width dimension = 62.5:70 depth dimension = 62.5:87.5	
Using (Tablia) in eating on the floor	
	

Furniture accessability (wall unit) - minimum space for a cabinet with door	
Working zone = 45.7 cm Clearance zone for opening cabinet doors = 121.9 cm	
Furniture accessability (wall unit) - minimum space for a cabinet with drawers	
Working zone = 45.7 cm Clearance zone for opening cabinet drawers = 121.9 cm	

Sleeping spaces

Two persons bed:

Minimum dimension =198.1*121.9 cm

Optimum dimension = 213.4*137.2 cm

Maximum dimension = 213.4*152.4 cm

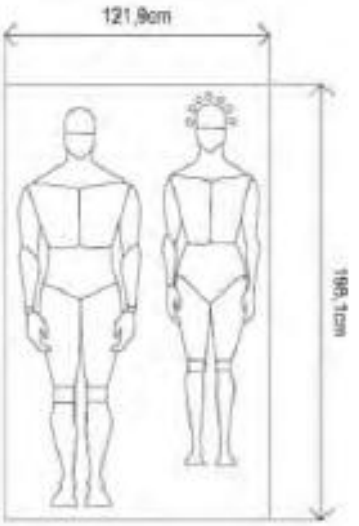
One persons bed:

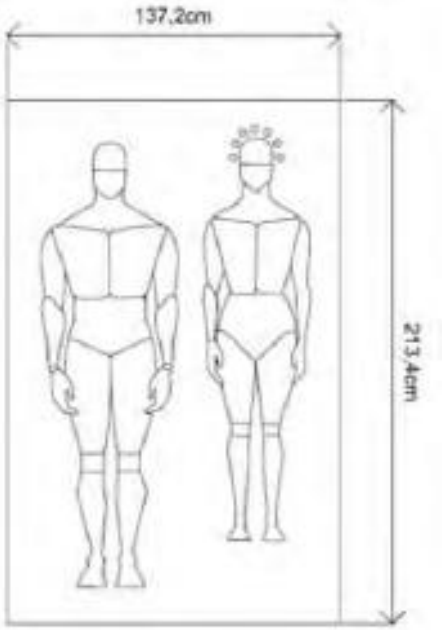
Minimum dimension =198.1* 91.4 cm

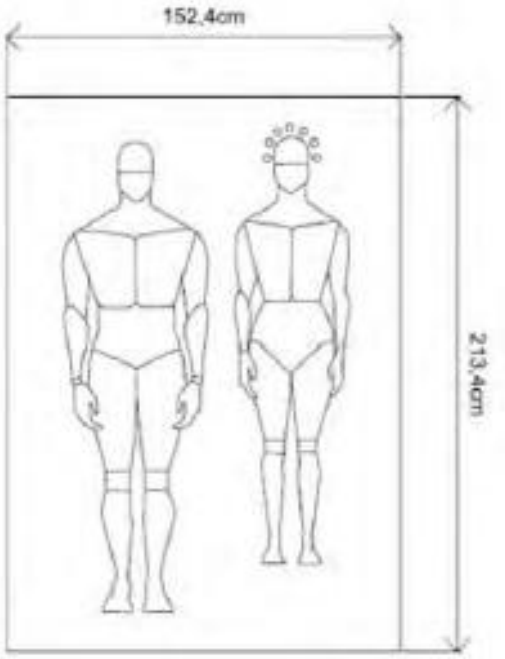
Optimum dimension = 213.4* 99.1 cm

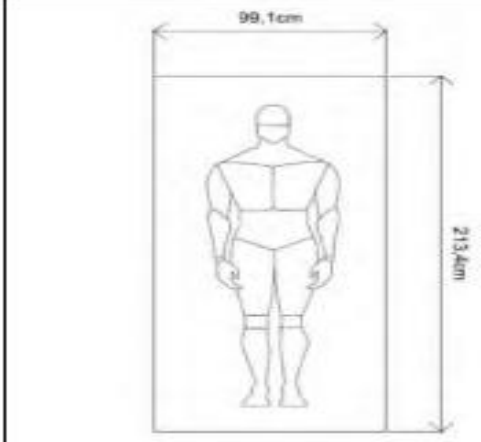
Clearance between two beds = 91.4 cm

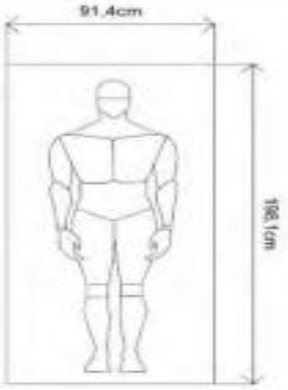
Working zone beside the bed = 116.8 cm

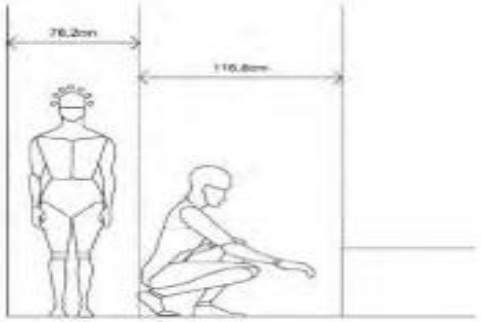


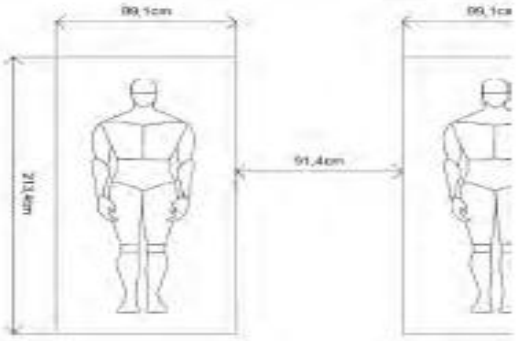








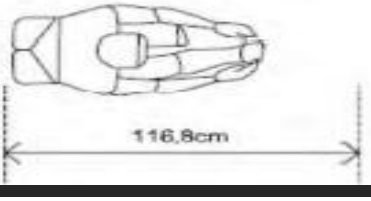


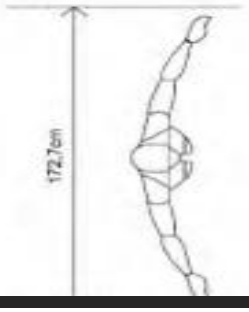


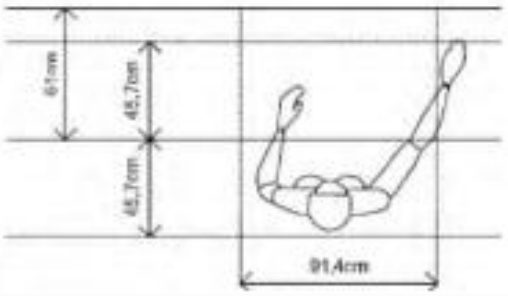
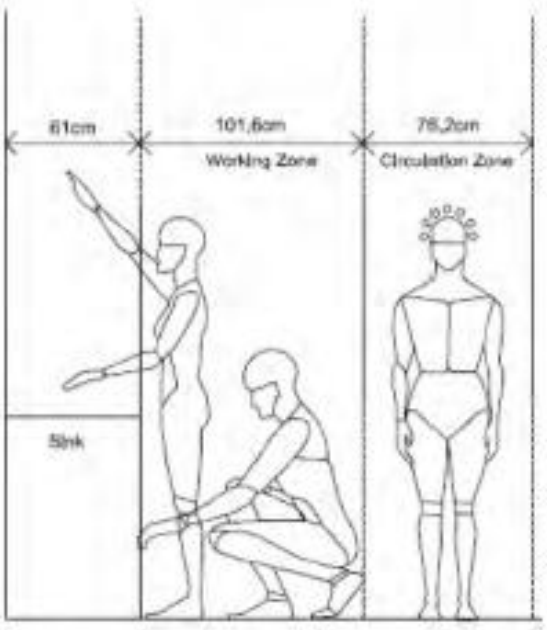
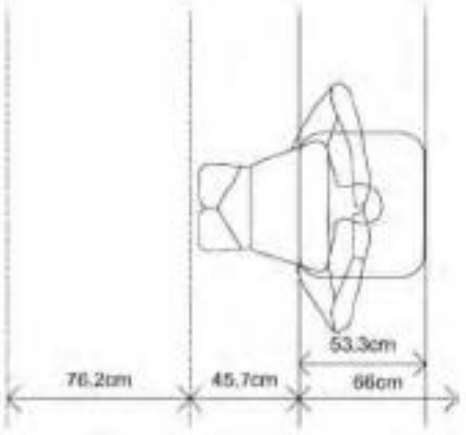
Dressing minimum space

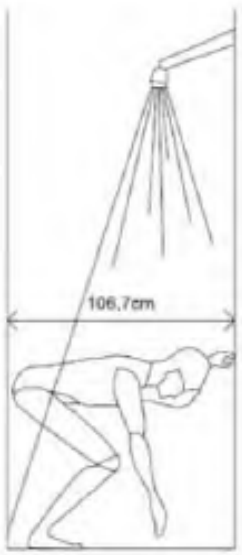
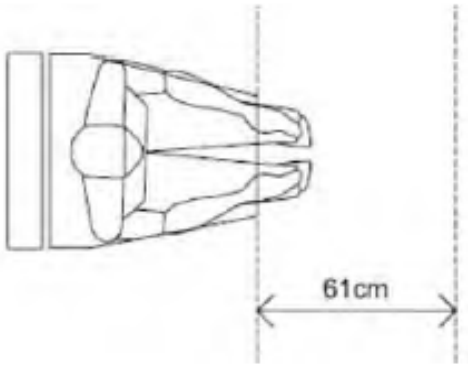
Minimum width = 172.7 cm

Minimum depth = 116.8 cm





Kitchen preparation center	
furniture dimension = 61 cm Accessible area = 45.7 cm Working zone = 45.7 cm Minimum width = 91.4 cm	
Sink center	
Sink dimension = 61 cm Working zone = 101.6 cm Circulation clearance = 76.2 cm	
Bathtub (hand pasin) minimum space	
Bathtub dimension = 53:66 cm Working zone = 45.7 cm Circulation clearance = 76.2 cm	

Showering space	
Minimum working zone dimension = 106.7 cm	
Closet minimum clearance	
Minimum clearance in the front of a closet = 106.7 cm Closet dimensions = various	

APPENDEX (3)

Household's Questionnaire Descriptive Statistics

Section (1) Household Composition

The Phrase	Standard Deviation	median	Interpretation
1/household Age (Year)	1.01	2	51-60
2/ Gender	0.39	2	Male
3/Status	0.98	4	Married
4/Education level	1.43	1	University
5/Occupation of household	1.05	1	Public sector
6/Monthly income of household head in Sudanese pound	1.03	2	1999-1000
7/Occupation of the wife of the household head	1.15	4	Housewife
8/How did you acquire this plot or house	1.42	2	Bought
9/Urban experience of the household in capital	1.15	1	16-20 year
10/ Length in living in the dwelling	0.73	3	1-5 year

Table (1) Descriptive Statistics for the phrases of (Household Composition)

Source: prepared by the researcher, 2016

Section (2) Socio- cultural and economic of Household

A- household social factors

The Phrase	Standard Deviation	median	nterpretation
1/ Family type	0.81	1	Nuclear
2/ Number of family members living in the house	0.88	3	5-7
3/Is it Others people living in the house	0.51	2	No

4/determine the ability of having a multiuse space in the house	1.24	4	others
5/ When you receive guests, do this affect	0.99	2	Sleeping arrangement

Table (2) Descriptive Statistics for the phrases of (household social factors)

Section (3) Characteristic of the Dwelling

A- Form and Physical Features:

	tandar d	medi an	nterpretation
/Type of house	1.19	1	Detached
/If you habit in complex building what is the umber of building floors	0.62	2	3-5 floor
3/If you habit in complex building what is the number of housing unit on the floor	0.87	1	1-2 floor

Table (3) Descriptive Statistics for the phrases of (Form and Physical Features:

B Spatial Organization and configuration:

	Standard Deviation	median	Interpretation
Is the entrance injured or reveal the spaces your house	0.46	1	No
The size and layout of your home doesn't allo you enough privacy	0.85	2	Agree
Does the house have private space to entertai guests from other members of the household	0.45	1	YES
When you receive guests in the house which these spaces are affected by	0.76	2	Sleeping
Separation between male &female section	0.80	3	Physically Separate

Your children have a room with enough spa in which they can play with theirs	0.55	2	N0
Where does the family eat the daily meals	1.10	2	The yard
Are you finding that eating room is importan in the dwelling	0.50	2	YES

Table (4) Descriptive Statistics for the phrases of (Spatial Organization and configuration

C. House and spaces area:

	Standard Deviation	median	nterpretation
Doweling Total Area	0.86	2	300-400
The built up Area	0.64	2	100-200
When you chose to live in the property, did yo know the size of the property in square mete	1.06	3	Not very important
Types of house expansion	0.74	2	Horizontal
The kitchen doesn't have sufficient workshop space to prepare meals conveniently	0.53	2	No
The kitchen doesn't have sufficient space for small children to play safety in the kitchen when you are using it.	0.49	2	No
Does your house have enough Storage space	0.68	2	No
Where do you store your possessions (closets, garage, attic, storage lockers, etc.)? Name all that apply	1.08	4	Bedrooms
1 Is it important to have constant space for storage in your house	0.42	2	Yes
Is it your bathrooms have enough area	0.55	1	Yes

How many meters square are there in the bathroom?	0.85	2	1.5-2
The corridors and stairs within your home provide sufficient space to move around the home with area	0.78	3	Agree
The corridors and stairs in your home are obstructed by furniture, stored items or decorative objectives.	0.79	2	Agree
The amount of spaces in the corridors and stairs within your home makes it difficult to move furniture around	0.76	2	Agree
There is not enough space in all of the rooms to be able to move easily around the furnitur	0.86	2	Agree
Is it any space in your house does not use or have been badly arranged it has been used efficiently by the designer	0.51	1	No
Is it the removable and furniture provide a l of space area	0.43	2	Yes
Which type of dining furniture do you prefer the fixed or movable	0.64	1	Movable
What are the activities that can be performed through movable furniture	1.01	2	Eating

Table (4) Descriptive Statistics for the phrases of (House and spaces area)

Section (4) Option about user attitude

	Standard Deviation	median	Interpretatio
Have you remodeled this home, resulting in changing sizes or uses of rooms	0.63	2	No
Have you remodeled this home, resulting in changing sizes or uses of rooms?	0.77	2	No
Please describe these changes and your reasons for making them	1.44	3	For increase homework

Do you plan to remodel this home in ways that would change sizes or uses of space? Please indicat possible changes and your reasons for them	**0.69**	**2**	**No**
In which space do you plan	**1.37**	**1**	**Bedrooms**
The space within your home has been used efficiently by the designer	**0.48**	**2**	**No**
Do you find that it is better that you and your family members to divide spaces and residential un	**0.49**	**2**	**No**

Table (5) Descriptive Statistics for the phrases of (Option about user attitude

APPENDEX (4)

Data based table of Sudanese Housing Space Standards Model:

1- Nuclear Family:

(1)Economic Aspects of the Household	(2)Social Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
≤450	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
450-999	Nuclear family	≤2:3	1-2	≤1	≤1	Traditional	200	98-167	20	10%	5%	1-2	1	1
1000-2000	Extended family	2:3	3-5	1	1	Semi-traditional	250-300	118-170	37	12%	7%	1.5-3	1-2	1-2
≥2000	Complex family	≥2:3	6-8	≥1	≥1	Modern	300-350	141-193	54	15%	10%	2-3	2-3	2-3
More than 2000	-	-	9-10	-	-	-	350-	191-233	74	20%	12%	2.25-3.3	3-4	-
-	-	-	11-	-	-	-	-	169-233	85	25%	15%	2.75-	4-5	-

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Nuclear family	≤2:3	1-2	≤1	≤1	Traditional	200	98-167	20	10%	5%	1-2	1	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Lifestyle	Plot area	Built up area	Room area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Nuclear family	≤2:3	1-2	≤1	≤1	Semi Traditional	200	98-167	20	10%	5%	1-2	1	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Lifestyle	Plot area	Built up area	Room area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Nuclear family	≤2:3	1-2	≤1	≤1	Modern	200	98-167	20	10%	5%	1-2	1	1

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Nuclear family	2:3≤	6-8	1	≥1	traditional	300-350	141-193	54	15%	10%	2-3	2-3	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Lifestyle	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Nuclear family	≤2:3	6-8	1	1	Semi-traditional	250-300	118-170	37	12%	7%	2-3	1-2	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Lifestyle	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Nuclear family	≤2:3	6-8	1	1	Modern	250-300	118-170	37	12%	7%	2-3	1-2	1-2

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Nuclear family	2:3≤	6-8	1	≥1	traditional	300-350	141-193	54	15%	10%	2-3	2-3	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Lifestyle	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Nuclear family	≤2:3	6-8	1	1	Semi-traditional	250-300	118-170	37	12%	7%	2-3	1-2	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Lifestyle	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Nuclear family	≤2:3	6-8	1	1	Modern	250-300	118-170	37	12%	7%	2-3	1-2	1-2

(1)Economic Aspects of the Household	(2)Social Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
	Nuclear family	2:3≤	11-	≥1	≥1	Traditional	400-500	169-233	85	25%	15%	2.75-	4-5	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
	Nuclear family	≤2:3	11-	≥1	≥1	-Semi Traditional	400-500	169-233	85	25%	15%	2.75-	4-5	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
	Nuclear family	≤2:3	11-	≥1	≥1	Modern -	400-500	169-233	85	25%	15%	2.75-	4-5	2 -3

2- Extended Family:

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determind according to the average of income level	Extended family	≤2:3	3-5	1	≥1	Traditional	250-300	118-170	37	12%	7%	1.5-3	1-2	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determind according to the average of income level	Extended family	≤2:3	3-5	1	1	Semi-traditional	250-300	118-170	37	12%	7%	1.5-3	1-2	1
						-								
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determind according to the average of income level	Extended family	≤2:3	3-5	1	1	Modern	250-300	118-170	37	12%	7%	1.5-3	1-2	1

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Extended family	2:3≤	6-8	≥1	≥1	traditional	300-350	141-193	54	15%	10%	2-3	2-3	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Lifestyle	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Extended family	≤2:3	6-8	≥1	1	Semi-traditional	250-300	118-170	37	12%	7%	2-3	1-2	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Lifestyle	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Extended family	≤2:3	6-8	≥1	1	Modern	250-300	118-170	37	12%	7%	2-3	1-2	1-2

(1)Economic Aspects of the Household	(2)Social Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Extended family	-	9-10	≥1	≥1	- Traditional	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Extended family	-	9-10	≥1	≥1	Semi Traditional	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2
						-								
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Extended family	-	9-10	≥1	≥1	Modern	350-400	191-233	74	20%	12%	2.25-3.3	3-4	2-3

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Lifestyle	Plot area	Built up area	Room area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Extended family	2:3≤	11-	≥1	≥1	Traditional	400-500	169-233	85	25%	15%	2.75-	4-5	1-3
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Extended family	≤2:3	11-	≥1	≥1	-Semi Traditional	400-500	169-233	85	25%	15%	2.75-	4-5	1-3
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Extended family	≤2:3	11-	≥1	≥1	Modern -	400-500	169-233	85	25%	15%	2.75-	4-5	2-3

3- Complex Family:

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	1-2	≥1	1	Traditional	250-300	118-170	37	12%	7%	1-2	1-2	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	1-2	1	1	Semi-traditional	250-300	118-170	37	12%	7%	1-2	1-2	1
						-								
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	2:3≤	1-2	1	1	Modern	250-300	118-170	37	12%	7%	1-2	1-2	1

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	2:3≤	3-5	≥1	1	traditional	300-350	141-193	54	15%	10%	1.5-3	2-3	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	3-5	1	1	Semi-traditional	250-300	118-170	37	12%	7%	1.5-3	1-2	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	3-5	1	1	Modern	250-300	118-170	37	12%	7%	1.5-3	1-2	1

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	5-6	≥1	1	Traditional	250-300	118-170	37	12%	7%	2-3	1-2	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	5-6	1	1	Semi-traditional	250-300	118-170	37	12%	7%	2-3	1-2	1
						-								
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	5-6	1	1	Modern	250-300	118-170	37	12%	7%	2-3	1-2	1

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	2:3≤	6-8	≥1	1	traditional	300-350	141-193	54	15%	10%	3.1	2-3	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	6-8	1	1	Semi-traditional	250-300	118-170	37	12%	7%	2.1-3	1-2	1
	Family type	Male to female kids	Family size Person)	Privacy level	Separati on (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extensio n type
Determined according to the average of income level	Complex family	≤2:3	6-8	1	1	Modern	250-300	118-170	37	12%	7%	2.1-3	1-2	1

(1)Economic Aspects of the Household	(2)Social Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	-	9-10	≥1	≥1	- Traditional	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	-	9-10	≥1	≥1	Semi Traditional	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2
						-								
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	-	9-10	≥1	≥1	Modern	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2

(1)Economic Aspects of the Household	(2)Soc ial Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	2:3≤	11-	≥1	≥1	Traditional	400-500	169-233	85	25%	15%	2.75-	4-5	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	≤2:3	11-	≥1	≥1	-Semi Traditional	400-500	169-233	85	25%	15%	2.75-	4-5	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	≤2:3	11-	≥1	≥1	Modern -	400-500	169-233	85	25%	15%	2.75-	4-5	1-2

(1)Economic Aspects of the Household	(2)Social Aspects of the House			(3)Cultural Aspects of the House			(4) Spatial area Aspects of the House					(5) Time and development of the House		
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	-	9-10	≥1	≥1	- Traditional	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	-	9-10	≥1	≥1	Semi Traditional	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2
						-								
	Family type	Male to female kids	Family size Person)	Privacy level	Separation (male /female)	Life style	Plot area	Built up area	Rooms area	Semi close area	Services area	Occupied room	Number of bed room	Extension type
Determined according to the average of income level	Complex family	-	9-10	≥1	≥1	Modern	350-400	191-233	74	20%	12%	2.25-3.3	3-4	1-2