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Spatio-TemporalAnalysis of Housing Issues in Medway and Development of Socio-Demographic Variables for Monitoring Changes

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ABSTRACT: The study analysed the geographical trends, patterns and changes in the housing and demographic variables such as housing tenure, economic activity status of the people, etc by using various approaches which involves applications of spatial analysis methods in GIS for exploratory analysis by combining GIS and Statistical analyses tools, census data and digital boundary map to accomplish spatial analysis. The results of the study revealed the existence of changes in the economic activity status, tenure as well as the usual resident population of Medway. The most affected and prominent one is the changes in the people renting council/social housing, this and other variables were observed and compared using trend analysis by plotting Statistical and geographical correlations between those variables. Some which shows positive, negative, strong, weak or no correlations. Among these is the correlation between the unemployed and those renting council housing which shows a strong positive correlation which logically means that those that are unemployed or out of work will be unable to buy or mortgage a house which they can live in but have no choice other than to live in council house which by British standard and culture are not the best option. The results also highlighted different areas which has experienced various degrees of changes over the period under study. The result of the study may be a very good prospect for understanding of the spatial relationships so as to determine changes and predict future changes to monitor environmental phenomenon.

Keywords: GIS, demographics, Medway, Spatial analysis, Medway, Spa

I. INTRODUCTION

A conference on Human settlements was held in 1996 at Istanbul in Turkey UNHCS [(Habitat) The United Nations Centre for Human Settlement] and part of their recommendations was that participatory countries should monitor and evaluate performances in the implementation of the Habitat Agenda using human settlement and housing variables [1]. Housing variables or characteristics are measures that show trends, also used in determining the quantitative and qualitative information as well as help in prioritising and defining targets [2] or better define as models that simplify complex subjects to numbers and percentages. The quality, quantity and location of housing to a great extent determine how people live and influence their contribution to the wider society. However, housing supply has been on the decrease to its lowest levels for decades, affordability has fallen too thus leading to lack of interest in demand for housing.

The problem of housing in Medway and in UK in general has become very pronounced and relevant due to the changing political and economic environment. As it is always expected according to [32] increase in population growth and real disposable incomes caused a shortage of housing in UK, therefore increasing the demand for housing and consequently increasing the house price.Information on housing and population change is useful in determining the effect of changes in human growth and development and thus can be used to formulate policies to guide future growth []. [] further stated that housing development, human settlement, and population growth are dynamic spatial and temporal processes and that changes in human settlement pattern differ in the sense that they are being seen as either spatially or temporally static. An overview of housing problem in UK is to a great extent due to lack of planning, although planning is just part of the reason, national government are also part of this problem. They have not adequately invested in public service sectors and in as much as possible

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withdrawn from a social housing provision, making local provider to source for the wrong houses in the wrong places [5].

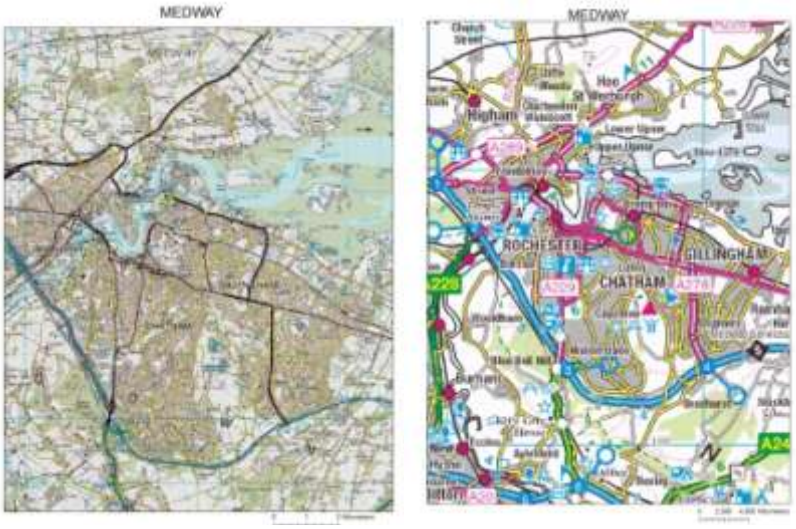
GIS is now indispensable to spatial planners, environmental managers and decision-makers. This has made data readily accessible and flexible. Manipulation and analysis of data can easily be done to meet environmental and physical planning needs. Monitoring and detection of urban change and growth are of significant interest to the urban developers, applying this in spatial planning can to a great extent result in better understanding of the functionality of urban area. The possibility of using GIS as an aid in housing needs studies is now possible given the fact that there is a large untapped and underutilised data such as census material, social housing waiting list and data on homelessness. This data can be mapped using GIS techniques by planners and decision makers with the possibility of producing complex overlays of different variables[3].

Demographic data is one of the major data input in spatial data analysis. Among these analyses are the size of population, composition, characteristics and spatial distribution [6] which are at the same time are disaggregate data needed in preparation and producing of different comprehensive plans such as location –allocation plans, development plans. Most of the demographic variables are aggregated to enumeration blocks for the planning purposes and for plan preparation demographic data used might be presented in form of tables but may not be mapped.However, analysis of demographic structure is based on disaggregated level of demographic variables.

A. Study Area

Medway is a metropolis with a significant social, economic, political and cultural diversity located in county of Kent, the south East area of England. It is also an important hub for cross boundary connections for trades with different industries moving into the area due to its closeness to Thames Gateway in the north-west of Kent resulting in significant investments, creating job opportunities, and can as well be classified as a typical residential area in many aspects and like every other city in South East England is facing functional changes and now more in retail, tourism and finance [11]. The presence of four universities in the area makes it unique in some sense[9].

a. STUDY AREA



II. METHODOLOGY

The methodology was developed so as to allow for aggregate level statistics to be adjusted by creating random points onto other boundary blocks.

sub steps. Figure shows the research steps for modelling demographic statistical spatial analysis which involves statistical spatial analysis methods of demographic analysis. Below gives an overview of the methodology flowchart of how the result was obtained.

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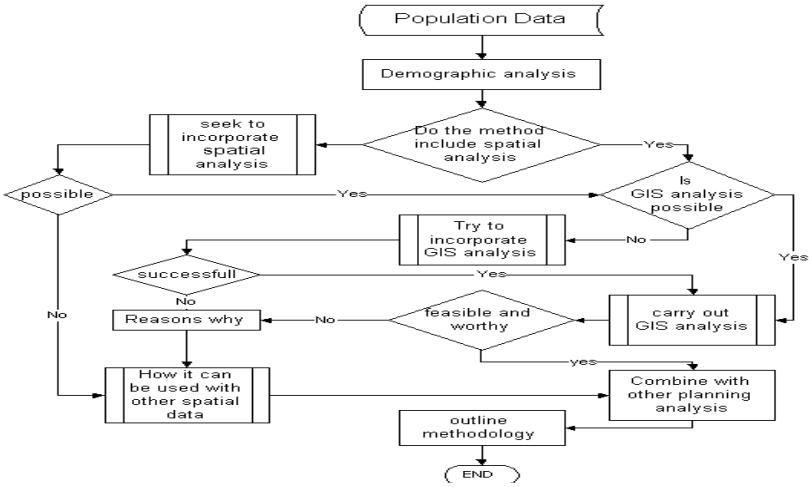
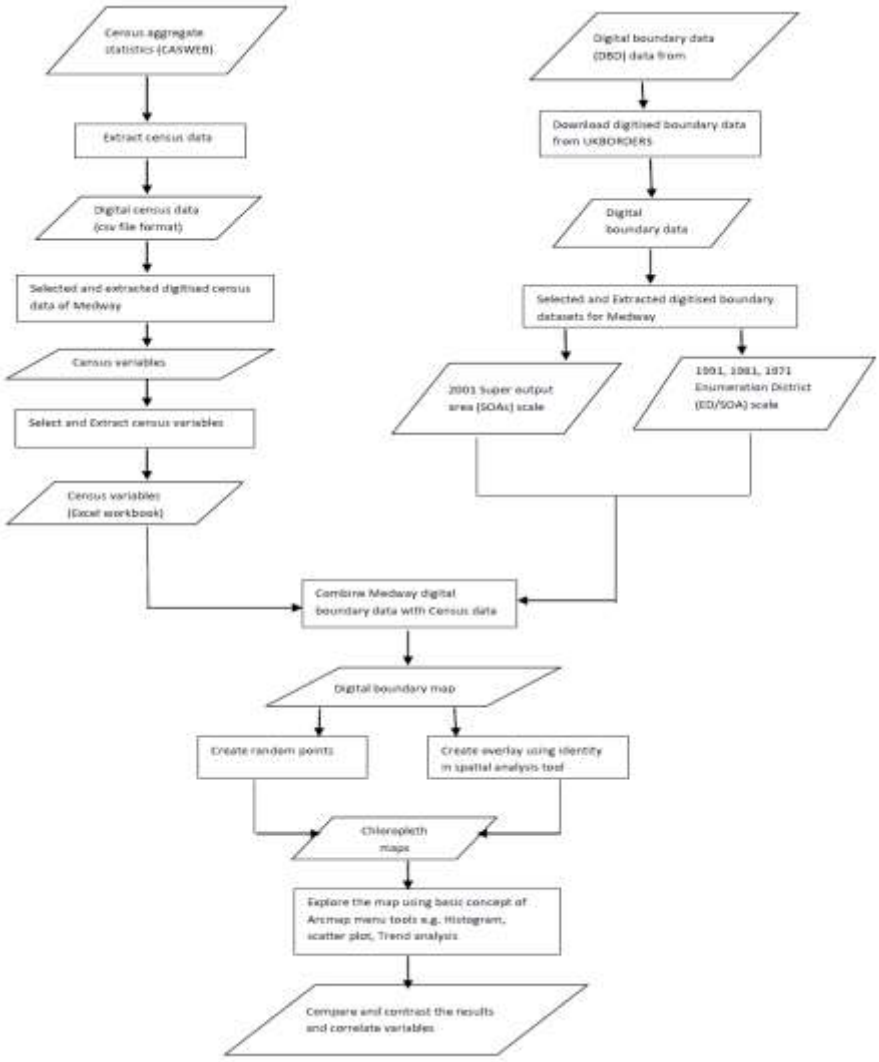


A flowchart model of stages in GIS Demographic Spatial Analysis
Source: Spatial Analysis by [8]



Methodology Flowchart

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A. Data collection

After which the census variables were downloaded from CASWEB digimap, the data obtained was saved into Excel spread sheet 97 – 2003 workbook. The columns contain different Zone ID while the rows contain different variables which are more of non – spatial and/ or statistical and numerical (quantitative) values which were downloaded in the largest scale possible of enumeration district ED/SOA for 1981 and 1991 census data and 2001 in B. The next step involved downloading digital boundaries of Medway in different decades from [11] by choosing the largest scale of enumeration district/SOA for 1981 and 1991 digital boundaries and Super Output Area (SOA) for 2001 digital boundary

The digital boundaries were combined with the digital census data using relate and join tool in ArcMap. The map was prepared with all the labels, symbols, legends, and other necessary needed text involved in laying-out and printing. The purpose of the lay-out is to assemble all the desired components to appear on the map.

B. Data processing using Arcmap analyst tool

Combination of Medway boundary data extracted from [11]digimap with the Census data obtained from CASWEBdigimap was used to create random points. An overlay operation wasperformed between the map data comparing between maps and analysis of the variables using trend analysis. Due to the problem of Modified Areal Unit Problems (MAUP) and to minimise the influence of ecological fallacy that is always associated with spatial data, random points were created. The randompoints use the known values to predict for any unknown values surrounding the prediction location. In essence the known value closest to the prediction location have more influence on the predicted value than those farther away. The assumption was that each known point or value has a local influence that diminishes with distance hence can be used to minimised the influence of Modified Areal Unit Problems (MAUP) and ecological fallacy.The last exercise was all about exploring the data, Identify the trends in the data using trend analysis plotted using scatterplot.

III. RESULT AND ANALYSIS

A. Usual resident population

The Office for National Statistics (ONS) takes the responsibility of producing annual population estimates in 30 June for the year in between censuses. More so, various factors are always being considered such as allowances for natural change occurrences either through births, net migration etc.

TABLE 1 USUAL POPULATION ESTIMATES FOR THE TWO DECADES UNDER STUDY

Medway	1981		1991		2001	
	Total population	Percentage	Total population	Percentage	Total population	Percentage
Males	113352	49.12	112740	49.12	122896	49.26
Females	117085	50.88	116768	50.88	126592	50.74
Total household	230437		229508		249488	

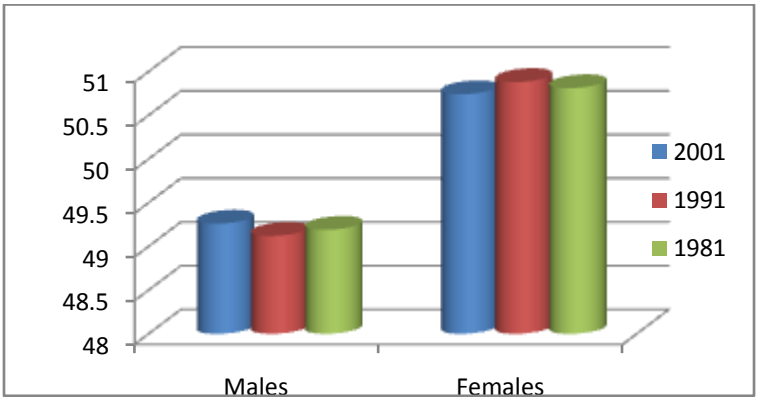

CHART 1: HISTOGRAM SHOWING THE USUAL RESIDENT PERCENTAGE INCREASE OR DECREASE POPULATION IN MALES AND FEMALES BETWEEN THE YEARS UNDER STUDY

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113,352 males and 117,085 females, a percentage of 49.19% and 50.81% respectively were usually resident in Medway in 1981. Also in 1991, 112,740 males and 116,768 females with a percentage of 49.26% and 50.88% respectively were usual resident in Medway showing a significant increase in the number of female residents and in 2001, 122,896 males and 126, 592 females, a percentage of 49.26% and 50.74% respectively were usually resident in Medway with obvious increase in the number of males and a little decrease in the number of female residents.

B. Employment

TABLE 3.1 ECONOMIC ACTIVITY STATUS

Medway	1981		1991		2001	
	Total Aged 16-74	percentage	Total Aged 16-74	percentage	Total Aged 16-74	Percentage
Employed	86927	78.02	97777	52.41	102103	56.95
Unemployed	9921	8.904	13036	6.99	6261	3.49
Self-employed	7748	6.95	11129	5.96	13633	7.60
Total household Aged 16-74	111418		186555		179290	

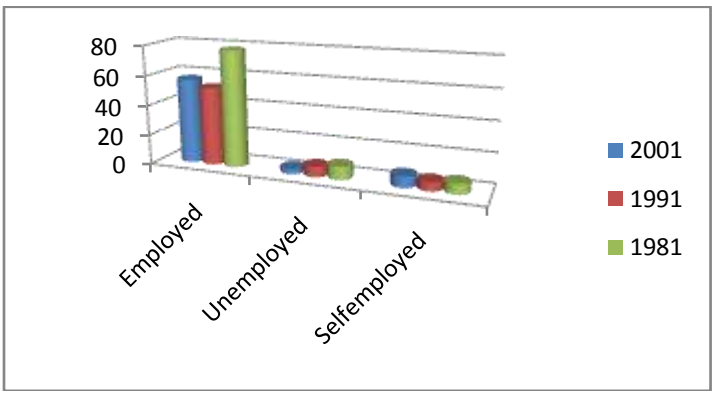

CHART 2: HISTOGRAM OF ECONOMIC ACTIVITY STATUS OF PEOPLE IN WORKING AGE OF 16 – 74 YEARS BETWEEN THE YEARS UNDER STUDY

The histograms showed that a higher proportion were unemployed with 8.9% of the working age not in any employment in 1981. However, there were steady decline in the percentages of unemployed between 1981, 1991 and 2001 and a significant decline in percentage of employed people and self-employedin 1991.

C. Housing

TABLE 3.2. HOUSEHOLD TENURE

Medway	1981		1991		2001	
	Total	percentage	Total	Percentage	Total	Percentage
Owned outright	55827	34.13	20473	22.59	26788	26.92
Owned mortgage	48605	29.72	50292	55.48	47538	47.78
Rented from council	17652	10.79	7650	8.44	4267	10.79
Total household	163568		90648		99503	

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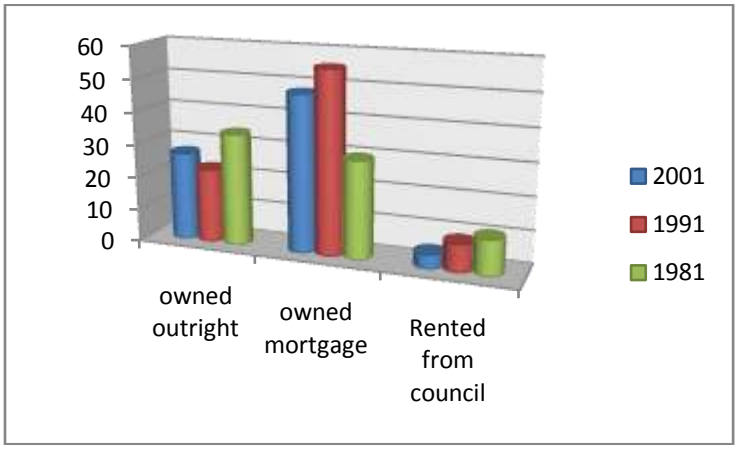

CHART 3: HISTOGRAM SHOWING THE HOUSING TENURE STATUS IN THE YEAR UNDER STUDY

The histogram above showed that in 1991 largest proportion of those that owned their house through mortgages are more than those that are outright owner of their houses. More significantly there were steady decline in those renting from the council from 2001 back to 1991 from 10.79% in 1981 to the lowest proportion of 4.29% in 2001.

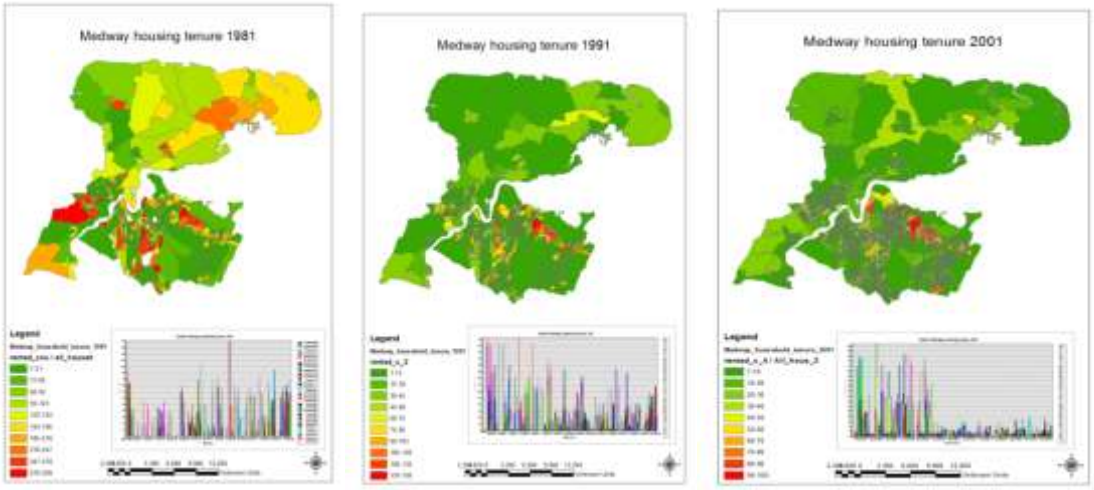

FIG**:3.2.1** A HOUSING TENURE STATUS: RENTED FROM COUNCIL OR LOCAL AUTHORITY

This variable can be used to further analyse the changes that have taken place. Obseving the map visually shows significant changes between the maps. Looking at the 1981 in comparison with the 1991 and 2001 maps. It can be decipher that rented council house has been on steady decline. The proportion of those living or renting council house are higher in 1981, followed by 1991 and then 2001. This absolutely reflects the economic situation within those period.

The graph above showed the changing trend in council housing, indicating lower response to the decline in council housing over the years. Ploting the number of people renting council house in 1981 against those on the rented council house in 1991 and 2001 respectively indicates steady decrease in people living or renting council housing.

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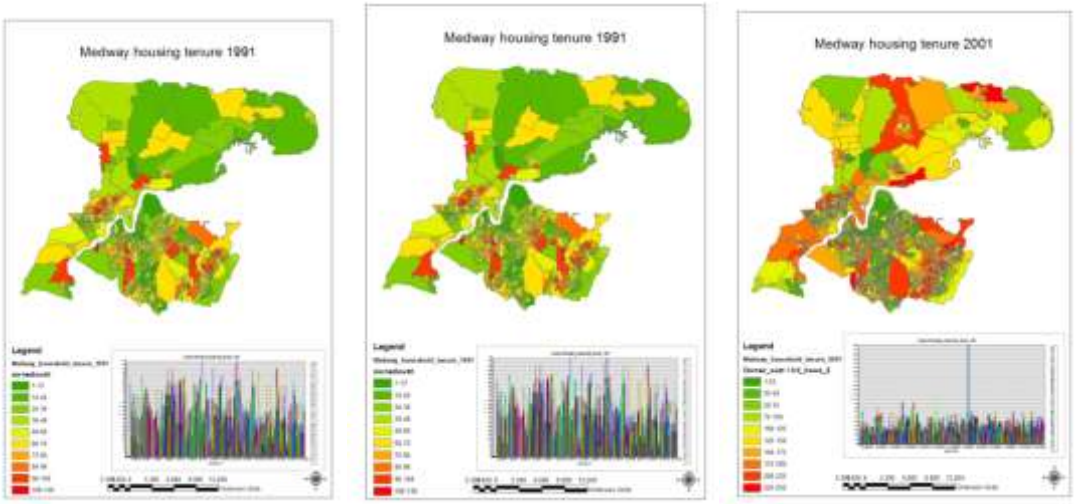
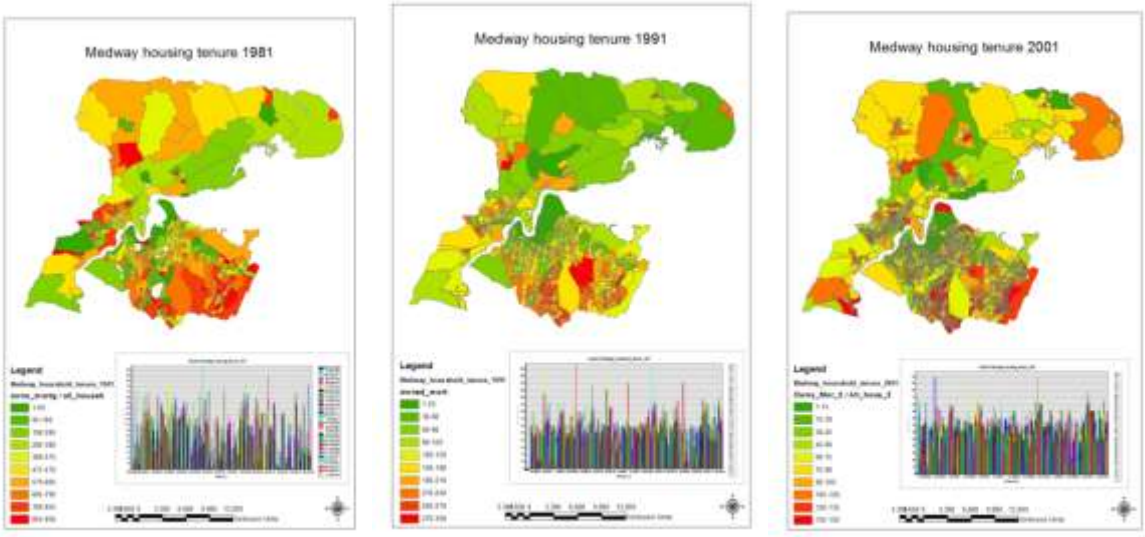


3.2.1b Housing Tenure Status: Outright Owners

The figure above showed the changing pattern in those that acquire outright ownership of housing in Medway. It can be identified from the map above a significant proportion of the outright owner in Rainham area in 1981 and a significant lower proportion in area aroud Gillingham and Chatham. The Graphs above showed that in 1981 more people own outright compare to 1991 but again in 2001 thegraph peaked again showing an increase in the number of people acquiring housing outrightly.



3.2.1C: HOUSING TENURE STATUS: OWNED BY MORTGAGE

The figure above indicated higher proportion of those purchasing houses in Medway by mortgaging in 1981 and 2001 respectively and lower proportion in 1991. With the highest proportion around Rainham, Twydall and Hampstead.The added map in the map showed different increase or decrease as the case may be . The number of people were plotted against Zone ID or Zone code wich represented each enumeration districts.

These two graphs again explain the changes between those who purchase by mortgage in different occassion of the years. It can be seen that when compare this same variable at different period in time, there was decline in the number of people buy housing by mortgage in 1981 but rose again in 1991 and 2001.

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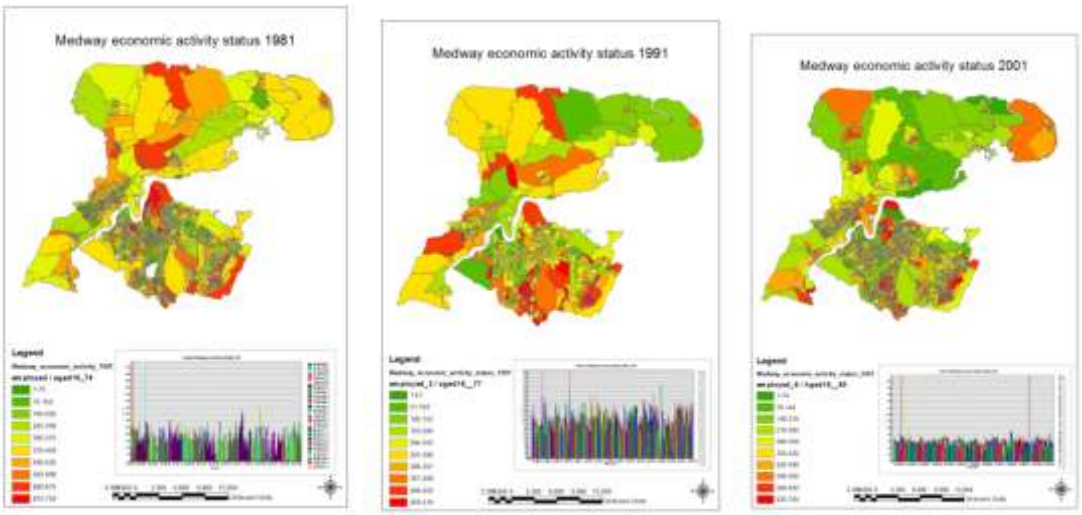
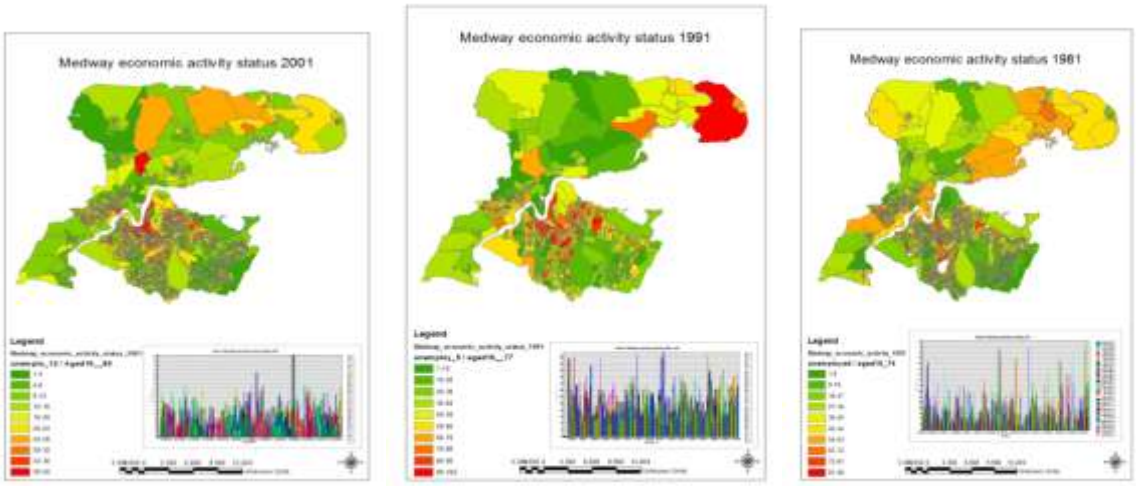
3.2.2 Comparison of economic activity status of Medway using maps prepared from 1981, 1991 and 2001 census data respectively



3.2.2A ECONOMIC ACTIVITY STATUS: EMPLOYED PEOPLE OF WORKING AGE OF 16-74 YEARS

The maps above presented a clear indication of economic situation in Medway showing that there are higher proportion of employment in 1981 and 2001 than in 1991. However some areas like Upnor and Hoo have the highest proportion of number of employed people in 1991 as well as Wigmore and Park Wood in Chatham and Rainham areas.



3.2.2B ECONOMIC ACTIVITY STATUS : UNEMPLOYED PEOPLE OF WORKING AGE OF 16 – 74 YEARS

There was steady decrease in the proportion of number employed people from 1981, 1991 and 2001. Somewhere like the Isle of grain in 1991 exhibited a higher proportion of unemployed people and also Gillingham and Chatham areas.

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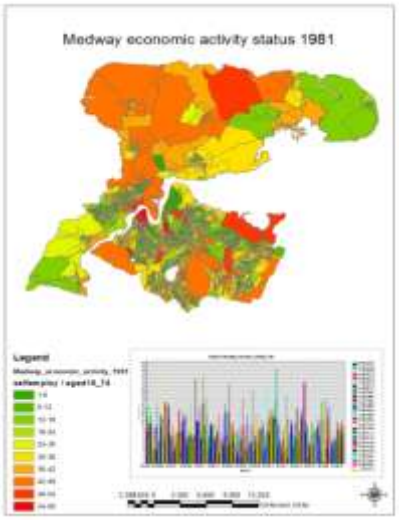

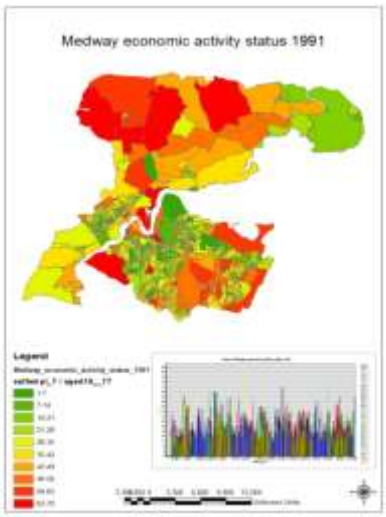

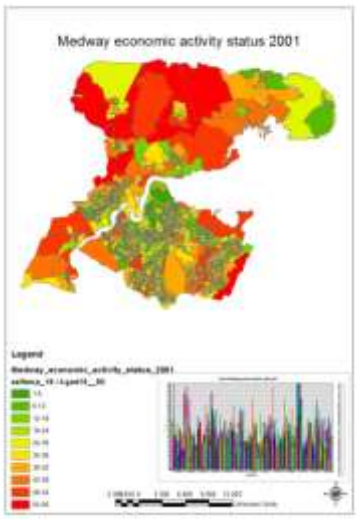

ECONOMIC ACTIVITY STATUS: SELFEMPLOYED PEOPLE OF WORKING AGE OF 16-74 YEARS

No much changes have taken place over the proportion of selfemployed people over this years. Although there are some patches where was a little change such as Halling and Cuxton around strood and Rochester in 2001. The proportion of Male usual resident population estimates for the three decades have not changed significantly but there are patches of changes in the number of male persons resident in all the towns of Medway. The proportion of female residents population estimates in Medway like the Male counterpart has not change significantly but have some patches of change in some area and in comparison with male counterpart there seems to be significant different in the proportion male in some areas probably due the presence of barracks and industries.

IV. RESULT AND ANALYSIS

The trend analysis and correlation investigation between variables highlighting key results and emphasizing their relation to the overall aim. Amongst other things, the analyses showed correlation between variables which will offer insight and a unique opportunity for the determination of a range of factors for understanding of the economic, social and psychological element and the relationship that exist between those variables to better inform policy on this regards.

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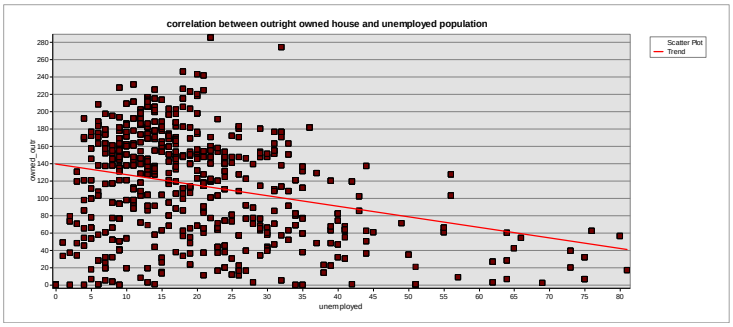

CHART 4.1: THE CORRELATION BETWEEN THOSE WHO ARE OUTRIGHT OWNER OF HOUSING AND UNEMPLOYED PEOPLE.

The figure above showed a negative correlation between those two variables suggesting that the more unemployed people that exist in a particular area, the lesser the people who own outright housing. In other words,it can be said that unemployed people may not be able to purchase houses of their own but will always resort to other available means like the council housing or what is refer to as social housing in some quarters or at most purchase through mortgage. However this may not have much impact on housing issues in Medway as there has been a decline in unemployment of recent. The unemployment status of Medway as shown in the in table above has been on decline from 8.9% in 1981 to 3.5% in 2001, suggesting that while unemployment might be the reason why there were decrease on those who purchase their houses outrightly, the facts that this might be true cannot be proved since from the table above the percentage of those who purchase their house through mortgage which stands at 47.78% in 2001 is higher than those that owns outright housing with a perctange decrease of 26.92% in 2001.

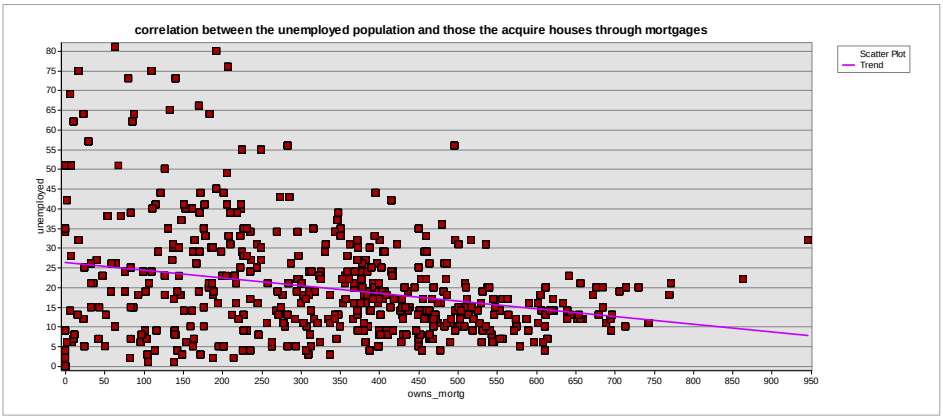

CHART 4.2: THE CORRELATION BETWEEN UNEMPLOYED PEOPLE AND THOSE BUYING THROUGH MORTGAGE

The correlation between those that are unemployed and those who were living or purchased their house through mortgage shows a relatively negative correlation given the fact that it could be possible that unemployment can hinder people buying through mortgages with the obvious reason that those who never worked and have no source of livelihood may not be able to purchase house but as stated in previous discussion, it really might not make much impact on housing issues in Medway as it was noted that their has been decline in unemployment over the decades under study.

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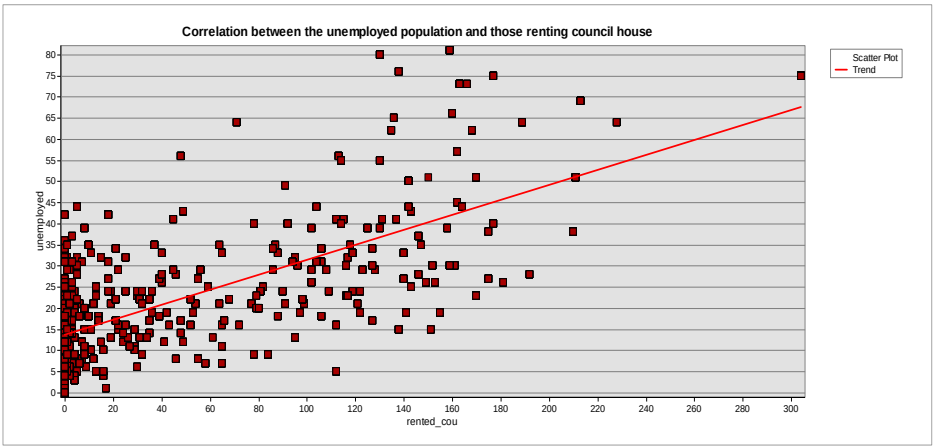

CHART 4.3 THE CORRELATION BETWEEN UNEMPLOYED PEOPLE AND THOSE RENTING COUNCIL HOUSE

The correlation between unemployed people and those living or renting council house shows a strong positive correlation. This shows that unemployed people tends to rely so much on council house as lack of finance remained the biggest obstacle for most of unemployed people. In comparison with the figure above which showed a steady decline in provision of council house in those years under study. It follows that decline in council house will not have serious impact on the people of Medway given the fact that while there were decline in council housing, there were also decline in unemployment but it should also be noted that as renting of council house declined it became used increasely only for those in the highest degree of need especially in Chatham, Rainham and the outskirt of Medway where the proportion of renting is already lower.

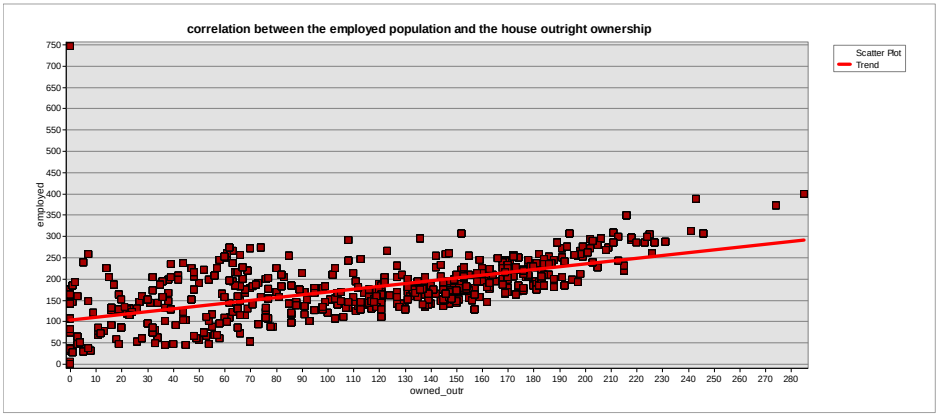

CHART 4.4 THE CORRELATION BETWEEN EMPLOYED PEOPLE AND THOSE WHO OWNS OUTRIGHT HOUSING

Contrary to the correlationship between the unemployed and those who own their houses outrightly, which showed negative correlation, the correlation between the employed and those who own their houses outrightly showed a positive correlation indicating that the more people are in employment the more likely they will want to purchase houses such that as people become wealthier or have enough resources there are the tendencies that they will aspire to better living condition and more desirable housing. This will have positive impact on Medway as an increase in the percentage of employed people increased in the previous decades as indicated in the table above more houses were bought.

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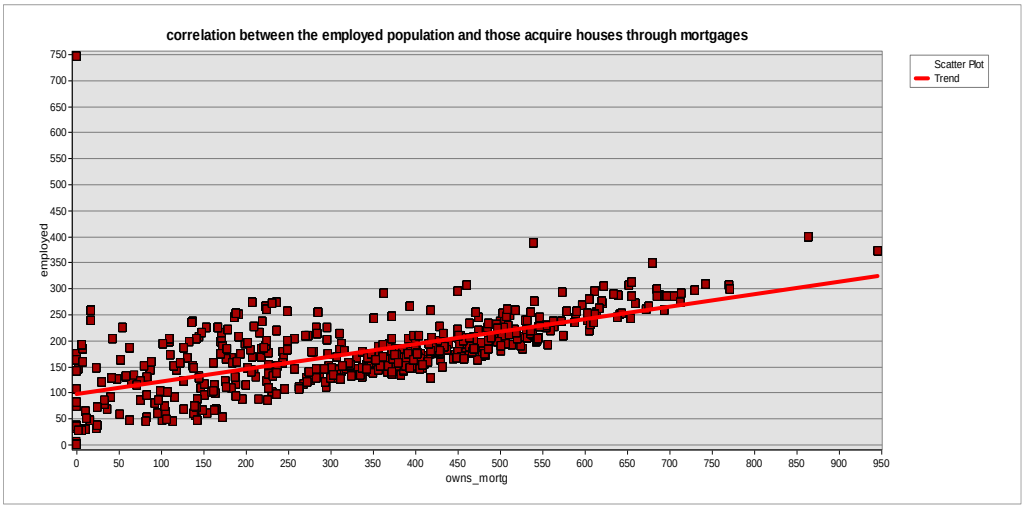

CHART 4.5 THE CORRELATION BETWEEN EMPLOYED PEOPLE AND THOSE THAT BUY HOUSES THROUGH MORTGAGE

As in the correlation between the employed and the outright owners, those in employment and those who purchase through mortgage are positively correlated given an indication that the more people are in employment the more they would like to buy houses through mortgages. The only different is that a lot of renters shows nervousness of house ownership fearing whether they will be able to pay their mortgage and also been responsible for any wrong thing that may happen to the property, although lack of finance remain the biggest barrier for many.

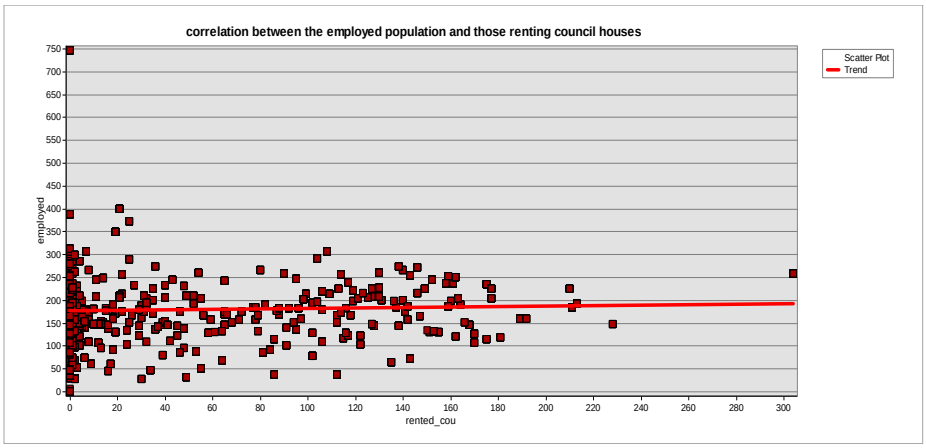

CHART 4.6 CORRELATION BETWEEN EMPLOYED AND THOSE RENTING COUNCIL HOUSE

The correlation between the employed and those renting council house showed relatively weak correlation or no correlation at all as the parallel line indicated. This is just a basic logic that those that have the finance to buy house or own house outrightly will gladly do so instead of renting from the council and borrowing from the word of [10] which he infered that there is something in British culture that prefers ownership rather than renting housing hence the indication of no correlation between the employed and renting from council house.

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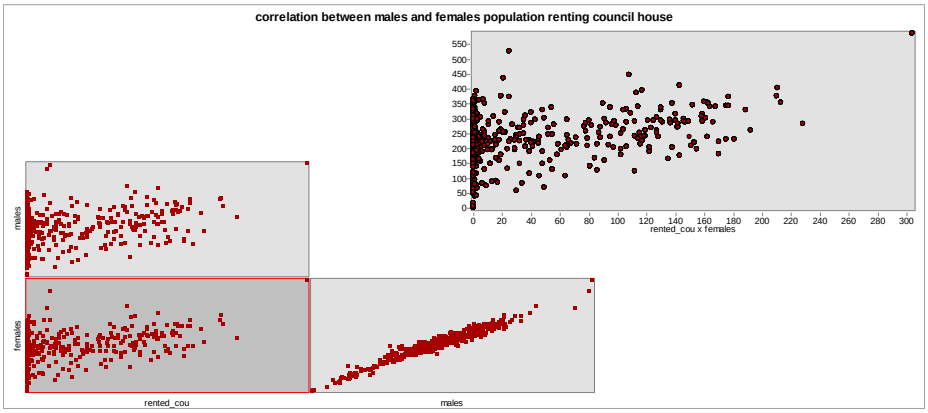

4.7 THE CORRELATION BETWEEN MALES AND FEMALES POPULATION AND THOSERENTING COUNCIL HOUSE

The males and females made up the total population of Medway with females having the highest population. The positive correlation between the males and females population and those renting council housing showed a positive correlation indicating that the more people in an area the more they will require a council house and vice versa. However changing demographies will have a major impacts on the ways in which the existing council house will be used as well as on future demand for housing. Conclusively, one key aspect of changing household structure is the trend towards the general population of the area or the locality. What this signifies is that within a given household population size, there is increasing number of households. Over the decades under study there has been increase in the population except the in 1991 censuses where there was a sudden decline in population but rose again in 2001 census beyond what it used to be in1981 census as can be found in the table above. Undoubtably, this sudden decline and increase in population might in some ways affect the distribution of council housing in Medway.

V. CONCLUSION

The ability to map demographic variables, query the map outputs and undertake numerous multivariate spatial analyses both demostrates GIS's capability as a vital analyses tool and its comparative advantage over traditional statistical tools. Although the study examined geographic variation in the boundaries and demographic variables of the study area.

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