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The role of Time, Income and Expenditure Patterns in Pedestrian decision-making in the Kumasi Metropolis (Ghana)

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Abstract
This research was undertaken in May 2012 using a sample size of 174 respondents in four proxy communities in the Kumasi Metropolis of Ghana. Using cross-tabulation quantitative methods, the research shows that walking speed is directly related to age. Also, when presented with the choice to walk or not in different scenarios, respondents with higher incomes prefer to trade money for time whiles lower income earners would trade time to save money. In addition, motorised transport costs represent 15% of the average monthly income of respondents and 18% off their expenditure; of which lower income earners cannot afford on a regular basis and therefore walk to 'survive'.
Keywords: Pedestrian, Travel time, Kumasi, Income, Expenditure, Pedestrian behaviour, Ghana

1. Introduction

Pedestrianisation is a neglected aspect of transportation especially in the developing world; which has also translated into the planning and implementation of transportation projects in these countries. It is generally associated with low income communities in many developing countries.

In cities like Delhi (India), even a subsidized public transport system remains beyond the means of the poor segment of the population (Tiwari, 2011). Approximately 28% of households have a monthly household income of less than 2000 Rupees (i.e. $45/ €32)[1] in Delhi, which means that for a minimum of 4 trips per household per day, at a cost of 4 rupees per trip, a household would need to spend 320 rupees per month on transportation (i.e. $7/ €5). For low-income people living on the outskirts of the city, the cost per trip may be between 4 to 6 rupees per day, depending on the number of transfers. On average, a low-income household cannot spend more than 10% of its income on transportation. This implies that a household's income must be at least 3,200 Rupees (i.e. $72/ €50) for it to be able to use the public transport system at minimum rates. For these people cycling and walking are the only logical choices (Tiwari, 2011).
The over – reliance on vehicular transport in the developing world together with its comparatively high infrastructure budget (to the neglect of Pedestrian infrastructure) has resulted in limited protection for Pedestrians. Between the 1970 to 1980 period, 43% of road accidents in Africa constituted pedestrians, thus reiterating the neglect and lack of protection of pedestrians (Downing, 1992; page 3). This high involvement of pedestrians in accidents is in part due to their comparatively large numbers in developing countries and to the high proportion of walking trips made.

2. The concept of Pedestrianisation

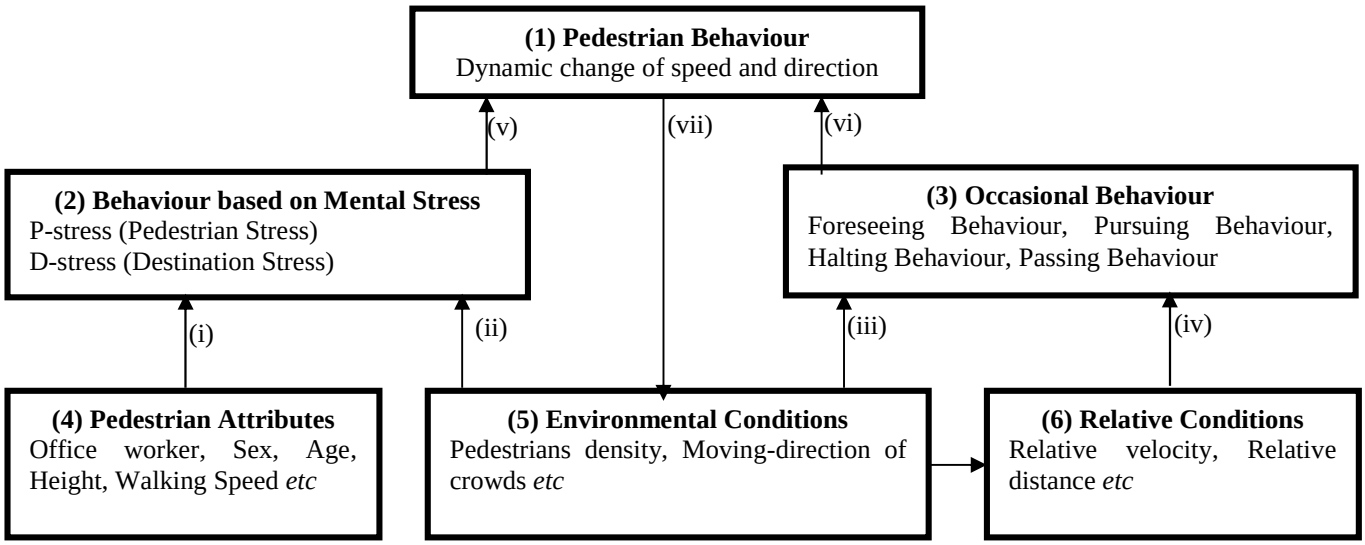
A pedestrian is generally a person travelling on foot, whether walking or running (New York department of transport, 2015). Walking has always been the primary means of human locomotion. It sometimes generates into offshoots such as running and is important for human health and is environmentally friendly. People become pedestrians at some point; whether they are walking to or from their cars, strolling or running. It is important because it reduces the over – reliance on vehicular transport and utilizes every little space available without any major land use disruptions. Frequent exercise such as walking tends to reduce the chance of obesity and related medical problems. In contrast, using a car for short trips tends to contribute both to obesity and via vehicle emissions to climate change (McCann & Ewing, 2003). General availability of public transportation encourages walking, as it will not, in most cases, take one directly to one's destination.

Efforts are under way by pedestrian advocacy groups to restore pedestrian access to new developments, especially to counteract newer developments in some cities. There is a strong advocacy for large auto - free zones where pedestrians only or pedestrians and some non-motorised vehicles are allowed. (Melia *et al*, 2010).
The use of cars for short journeys is being restricted throughout many countries of the (especially) developed world whiles sustainable mobility (walking and cycling) is receiving a lot of positive attention often in conjunction with public transport enhancements (Gehl, 1987; Gehl, 2007; Gehl, 2010).
In Copenhagen, one of the world's longest pedestrian shopping areas, Strøget, has been developed over the

[1] This currency conversion is based on historical rates from http://www.xe.com/ as at June 15, 2011

last 40 years principally based on a concept of urban design known as *Copenhagenization* (The Independent, 2009). The term relates to the implementation of better pedestrian facilities and segregated bicycle facilities for utility cycling in cities; and it focuses city transport on pedestrianisation and cycling rather than the car, and thus reaps the associated benefits. There are various benefits to such strategies. A survey conducted in South Asian cities (Thomson, 1977) found out that "low cost strategy" cities consume less transport energy. High population densities, intensely mixed land use, short trip distances, and high proportions of pedestrians and non-motorized transport characterize these "low cost strategy" cities or urban centres (Newman and Kenworthy, 1989).

Various researchers have come out with theories to describe how pedestrians react in given circumstances. Osaragi (2004) analyses the characteristics of pedestrian flow as an important prerequisite for the effective design of human usable space. The concept and framework of the model proposes that Pedestrian behaviour is composed of the behaviour based on mental stress, and occasional behaviour based on environmental conditions (Figure 1). The mental stress, which pedestrians receive due to their walking journey, is described by their attributes and environmental conditions. The occasional behaviour is described by conditions determined by the state of crowds within the pedestrian space. Furthermore, the individual behaviours together contribute to constitute the state of crowds, which in turn affect individual behaviour.



Examples of (i) – (vii)

- **(i)** Aged people receive smaller stress than other attributes
- **(ii)** Degree of the stress is dependent on Pedestrian density
- **(iii)** Pedestrians pursue other pedestrians in the front in case of high density
- **(iv)** Pedestrians pass other pedestrians being too close in the front
- **(v)** Pedestrians move to the position where the mental stress is minimum
- **(vi)** Pedestrians foresee subsequent states to walk efficiently
- **(vii)** The state of crowds is determined by individual Pedestrian behaviour

Figure 1. Pedestrian Behaviour
Source: Osaragi, 2004

2.1 Pedestrian Stress

Pedestrians receive a kind of mental stress from other pedestrians while walking; this is called a "*P*-stress" (pedestrian stress). Also, if he/she cannot walk along the shortest path to his or her destination, he/she receives another kind of mental stress; called a "*D*-stress" (destination stress). Thus, the mental stress used in this study is composed of *P*-stresses and *D* - stresses, and pedestrians are assumed to move to positions where their stress is minimized (Osaragi, 2004).

2.2 Pedestrians' Occasional Behaviour

There are many variations of Pedestrians' occasional behaviour. These occasional behaviours are:

- Pursuing Behaviour: As pedestrian density rises, pedestrians consciously pursue a pedestrian in front of

them who is walking in the same direction.

- Halting Behaviour: In crowded flows, pedestrians sometimes come to a halt in order to avoid a collision with other pedestrians passing in front of them. Any move of less than 30cm is barely observable within successive time steps (0.3 seconds later), and so this range (30cm by 30cm) is defined as a "halting range". If the next position at where stress is at a minimum is estimated to be within this range, pedestrians are assumed to halt at the present position.
- Foreseeing Behaviour: In order to efficiently arrive at a destination, pedestrians are continuously anticipating subsequent states. This is because avoidance behaviour with respect to the person in front greatly influences the efficiency of the subsequent walk. Foreseeing behaviour can be interpreted as an action undertaken in advance for the purpose of avoiding collisions with surrounding pedestrians.
- Passing Behaviour: Sometimes pedestrians occasionally pass the person in front of them. This behaviour is defined as "passing behaviour". The associated increment of walking speed is expressed by temporarily changing the preferred walking speed. The increment of speed is assumed to be 0.3 m/s based on observed data (Osaragi, 2004).

2.3 Pedestrian Time

Time is a valuable non-renewable resource.. After sleep and work, a major share of people's personal time is devoted to transport. People around the world tend to devote 60-90 minutes per day to personal travel (Litman, 2009; page 6). It is an influence on everyday life of which pedestrian decision – making is part. A survey conducted in Japan (Zhang, 2009) on the influence of time use on pedestrian decision making in Hiroshima indicates that 59.3% of pedestrians visited the city centre for shopping purposes followed by recreational, social and dining activities (29.4%percent). Average time spent in the city centre is 172 minutes, which (according to pedestrians) would be far worse if they were using a car; since they will have to park and pay at designated parking lots, which are a distance away from the city centre. This shows that pedestrianisation is vital in avoiding traffic and time wasting in city centres.

Travel time is one of the largest categories of transport costs, and time savings are often claimed to be the greatest benefit of transport projects such as roadway and public transit improvements. The *Value of Travel Time* (VTT) refers to the cost of time spent on transport, including waiting as well as actual travel. It includes costs to consumers of personal (unpaid) time spent on travel, and costs to businesses of paid employee time spent on travel. The *Value of Travel Time Savings* (VTTS) refers to the benefits from reduced travel time costs. There are several types of travel time. *Clock time* is measured objectively, while *perceived* (also called *cognitive*) *time* is how users experience travel; which tends to increase with discomfort, insecurity and congestion. (Litman, 2009).

Travel time unit costs tend to increase with income, and are lower for children and unemployed people; who might prefer walking (put differently, employed people are often willing to pay more for travel time savings). Some travel time has a low cost or positive value because people enjoy the experience, including recreational travel and errands that involve social activities (Litman, 2009). Travel time is an internal cost. The main equity issue occurs if people who are transportation disadvantaged (for instance pedestrians) bear excessive travel time costs compared with those who are more advantaged (for instance motorists). Travel time costs can be considered inefficient if users impose delay on other travellers. Transportation project evaluation practices that value certain travel time savings (such as reduced motorist congestion delays) but not others (such as delays to pedestrians) can result in inequitable planning decisions (Litman, 2009).

Some transport system changes intended to increase travel speeds and save travel time tend to reduce other forms of accessibility and increase travel time costs for other users. For example, expanding roadways and increasing traffic speeds tends to create barriers to non-motorized travel (including pedestrianisation) and encourages more dispersed land use development, which reduces accessibility and increases travel time costs, particularly for pedestrians (Litman, 2009).

3. Income and Expenditure

Income is the consumption and savings opportunity that is gained by an entity within a specified time frame, which is generally expressed in monetary terms. For households and individuals, income is the sum of all the wages, salaries, profits, interests, payments, rents and other forms of earnings received in a given period of time (Barr, 2004; Case & Fair, 2007).

On the other hand, expenditure refers to the decreases in economic benefits (in this case of a person) during an accounting period in the form of outflows of assets or incurrences of liabilities that results in decreases in equity (IASB, 2001). In other words, it is an outflow of money to another person or group to pay for an item or service; including transportation.

As shown in a research by the European Environment Agency (2005) on the share of expenditure on personal mobility in EU countries, the share of spending on transport appears to increase with income, but the difference

is largely due to greater spending on vehicle purchase. The research also found that variations can be found between social groups; retired people for example spend less on transport and are interested in pedestrian activity for health reasons, whiles the unemployed embrace pedestrianisation for financial reasons (EEA, 2005).

Also according to this research, travel budgets are much lower for households without a car, a situation more common in the lower income groups; who mostly resort to walking and cycling for short and sometimes long distances (EEA, 2005).

Again the study by Tiwari (2011), shows that sample surveys from colonies in Delhi indicates that people are largely dependent on walking (20%) or cycling (44%) to work. It is estimated that there are over 1,500 unauthorized colonies without civic amenities in Delhi and as much as 60% of the population lives in sub-standard housing. This is true for people employed in the informal sector, with household income of less than 2,000 Rupees (i.e. $45/ €32) per month (Tiwari, 2011).

4. Transport in Developing Countries

In developing countries, transport improvements have tended to be aimed at motorists rather than pedestrians in spite of the evidence of the high involvement rates of pedestrians in accidents. Developing countries' concern about road accidents began much more recently and with this late start in road safety and with comparatively few resources, developing countries have lagged behind developed countries in pedestrian facility and road safety improvements. Delays in taking action have also occurred because reliable information has not been available and because there has been uncertainty about the transferability of developed country solutions to the different conditions found in the developing world (Downing, 1992). Pedestrian fatalities represent up to 70% of the transport fatalities in developing countries (Downing, 1992; page 2).

According to Downing (1992), studies carried out by the Overseas Centre Transport Research Laboratory (Crowthorne UK), indicate that pedestrian accidents in developing countries are a major cause of death and injury; accounting for almost 10% of deaths reported in the 5 - 44 year age group. It is also a considerable waste of scarce resources with accidents typically costing at least one per cent of a country's GNP per annum.

5. Pedestrianisation in Ghana

Pedestrianisation is commonly integrated with other modes of transport in Ghana. In the capital (Accra), as at 2011, walking modal share was 36%; with 6% for cycling, and 52% for cars; including private cars, taxis, informal and formal buses (Quarshie, 2011). In the recent past, non – motorised transport issues were not common. This was because mobility and urban sprawl were not as common as it is now; most people lived and worked in walking distances. The intensification of urbanisation in Ghana, with the growth of cities and communities, relocation of farmlands and the sprawling of residences and job places has resulted in mobility issues (Quarshie, 2011). In the wake of Ghana's development, road engineering was vehicle-oriented instead of being people-oriented (Quarshie, 2011). This situation has rendered pedestrians as the most vulnerable road users in Ghana. Drivers' attitude towards pedestrians (especially at zebra crossings) is quite different from the norm (Ibrahim & Kidwai, 2005).

The National Road Safety Commission of Ghana (NRSC, 2008), has observed that pedestrians have great difficulty in crossing roads as most of the drivers do not care for the waiting pedestrians. Mostly, they would have to wait for a significantly long time before a driver would be willing to stop and allow them to cross; or wait until there were no more vehicles close enough. This phenomenon may probably be due to the misunderstanding on the rule of the right-of-way in such a situation or it could also be due to the attitude of the motorists themselves that they are not willing to stop because they think they would be losing travel time.

These problems coupled with the lack of pedestrian infrastructure have resulted in a significant proportion of pedestrians being involved in road accidents. According to the NRSC (2008), averagely, 42.6% of pedestrians and cyclists have been involved in accidents from 2002 to 2008 in Ghana.

Even in instances where they have been provided with the requisite infrastructure, there is no guarantee that it will be used for this purpose. A case in point is the conflicts or encounters between pedestrians with cyclists, motor vehicles, pedestrian street-sellers, kerbside vendors and people living on the street who illegally occupy sidewalks sometimes (Amponsah *et al*, 1996).

6. Objectives of the study

The research focuses on assessing *the role of Time, Income and Expenditure patterns in pedestrian decision – making in the Kumasi Metropolitan area.* The aim of this research is to answer these research questions:

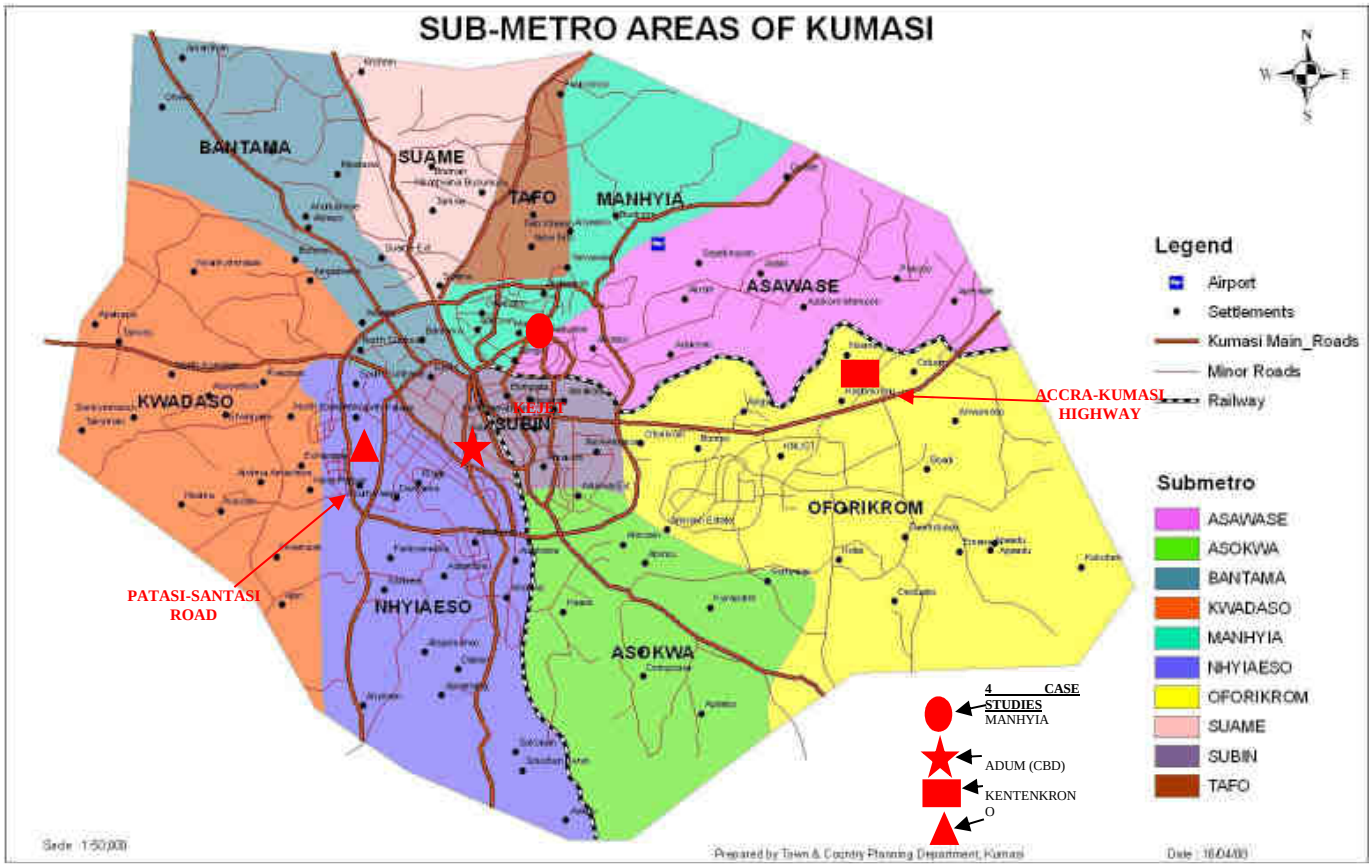
- What are the characteristics of Pedestrians in the Kumasi Metropolis?
- What is the role of time and total travel cost in pedestrian decision – making in the Kumasi Metropolis?
- Does the interplay between distance and time play a role in pedestrian decision making in the Kumasi

Metropolis?

- Does pedestrian income and spending pattern influence trip decisions in the Kumasi Metropolis?

7. Scope

The Geographic scope for this research is the Kumasi Metropolitan area in Ghana with Kumasi as its capital. It has a land area of 254 square Kilometres with a population of 1,170,270 as at the year 2000 (Ghana Statistical Service, 2005; page 126). It is located in the southern part of Ghana and is the second largest metropolis apart from the capital (Accra) in Ghana. Map 1 shows the Administrative Map of Kumasi Metropolitan area. Four neighbourhoods in the Kumasi Metropolis (shown in Map 1) were sampled out based on their economic characteristics for the research.



Map 1: Kumasi Metropolitan Area
Source: Kumasi Metropolitan Assembly, 2009

8. Methodology

8.1 Research Design

Mostly quantitative data was employed in this research; complemented by some qualitative elements. The Data collected related to pedestrians sampled from four neighbourhoods in the Kumasi Metropolis. This therefore entailed primary as well as secondary data.

Data Type	Data Collection	Dependent Variable	Independent Variables	Sources
Primary	Questionnaire	Pedestrian decision making	Pedestrian time	Households
			Pedestrian income	
			Pedestrian expenditure	
Secondary	Relevant literature	Pedestrian decision making	Pedestrian facilities	1. Ministry of Road & Transportation 2. Kumasi Metropolitan Assembly
			Pedestrianisation policies	

Table 1: Study Variables, Data Type & Sources
Source: Author, March 2012

8.2 Sampling and Data Collection Techniques

Stratified sampling method was used to sample out three proxy communities based on their high, middle and low income residential status in the Kumasi metropolis. The Central Business District was also included as one of the proxy communities. Thus, the four communities are Adum (the Central business district) as well as Manhyia, Kentenkrono and Patasi which are low, middle and high income residential areas respectively. *These four communities are represented in Map 1 by a star (Adum), Circle (Manhyia), Square (Kentenkrono) and Rectangle (Patasi).* In all, 174 respondents were interviewed in the Kumasi Metropolis; 44 each from Manhyia, Patasi and Adum and 42 from Kentenkrono. This was a based on a 2012 projection of the year 2000 population statistics for the four communities (sampling details in Appendix).

9. Analysis of Data

9.1 Overview of Respondents

Of the 174 respondents interviewed for the research, 95 of them (54.6%) were female whiles 79 were male (45.4%) with the minimum age at 14. A total of 133 respondents (76.4%) were between the ages of 25 to 57 whiles those from 14-24 and over 57 were 23.6%. This would help to provide enough information about the income and expenditure influences on pedestrians' decision – making; and the data proves this because all 133 respondents were employed as at the time of responding to the questionnaires.

9.2 Pedestrian Route Choice

This aspect of the research delves into pedestrians' preference for either sidewalks (mostly associated with the main roads) or alleys and footpaths in the inner neighbourhoods. Upon the survey, it was found out that 44.3% of respondents prefer to use the sidewalks whiles 55.7% prefer the alleys and footpaths in their neighbourhoods.

		COMFORT					
		YES	%	NO	%	*TOTAL*	%
Preference	**Sidewalk (Near Roads)**	42	54.5	35	***45.5***	***77***	100
	Alleys & Footpaths	8	8.2	89	***91.8***	***97***	100
TOTAL		***50***	***28.7***	***124***	***71.3***	***174***	***100***

Table 2: Cross – Tabulation of Pedestrian Route Choice and Comfort
Source: Field survey, March 2012

From Table 2, it is inferred that 54.5% of the respondents are comfortable with walking on sidewalks; this is because 73.1% of the 50 respondents who responded "yes" to being comfortable on sidewalks (table 3), attributed the comfort to the existence of available pedestrian walkways in their vicinity. Conversely, 28.2% of the 124 respondents who responded "no" attributed their discomfort to the lack of pedestrian walkways and sidewalks in their community (table 4). Thus 91.8% of the 124 respondents (who responded "no") have no option than to use the internal alleys and footpaths in their community since they cannot access proper pedestrian facilities.

9.3 Pedestrian Comfort

This aspect of the research analyses the reasons why pedestrians feel comfortable or uncomfortable as they walk.

REASON	PERCENTAGE
Available walkways	73.1
Less congestion	23.1
Others	3.8
Total	***100***

Table 3: Reason for Pedestrian Comfort (percentages)
Source: Field survey, March 2012

Table 3 shows that 73.1% of respondents associated their walking comfort to available walkways. This is because not only do the respondents have access to the walkways on the main roads, but also, about 60% of the roads in their neighbourhood are characterised by pedestrian walkways. A case in point is the Central Business District of the Kumasi Metropolis (Adum) which is characterised by pedestrian walkways and sidewalks in about 85%[2] of its roads. This is to help enhance brisk business and reduce human – vehicular congestion.

The community of Manhyia in terms of pedestrian comfort, possesses pedestrian walkways because it is experiencing the trickledown effect of the "Kejetia – Adum commercial zone" (which is the main business and transport corridor of the Kumasi metropolis) and is therefore typified by pedestrian facilities in response to the trickle down of commercial activities from Kejetia[3] and Adum. The distance from Manhyia to Kejetia is less than 1km.

Also (from table 3), 3.8% of the respondents attributed their walking comfort to the presence of (working) streetlights in their neighbourhood especially in the Kentenkrono community. It therefore affords them the security to walk especially in the night. In addition, 23.1% also attributed it to minimised congestion (both human and vehicular).

REASON	PERCENTAGE
Human Congestion	33.9
Vehicular Congestion	2.9
Muddy/Dusty roads	8.7
No walkways	28.2
Distance to Destination	26.3
Total	***100***

Table 4 - Reason for Pedestrian Discomfort
Source: Field survey, March 2012

It is interesting to note (from table 4) that 26.3% of the respondents attributed their discomfort to the distance from their origin to their destination, **also known as Destination Stress or *D – Stress*** (Osaragi, 2004). As stated in the literature, this is a kind **of mental stress (Osaragi, 2004). This stress situation can be attributed in part to human and vehicular congestion, muddy/dusty roads, as well as the lack of pedestrian walkways.** In effect, t**his** could **increase Pedestrians'** ***perceived*** **or** ***cognitive time*** **(how users experience travel; which tends to increase with discomfort, insecurity and congestion)**.

10. Pedestrians' Time – use

10.1 Pedestrians' walking Speed

Walking speed is the speed at which humans choose to walk. In the absence of significant external factors, humans tend to walk at approximately 1.4 metres per second or 5.0 kilometres per hour (Browning et al, 2006; 390 – 398). This section of the research will therefore look at the average walking speed of the respondents and its implications for their pedestrianisation decision– making (table 5).

[2] This is an estimation based on a personal observation of the case study area
[3] Kejetia is one of the two biggest open air markets in Ghana

AGE GROUP	WALKING TIME (in minutes)				TOTAL no. of respondents	
	1-30	31-60	61-90	91-120	Freq.	%
14 – 24	25	2	0	0	*27*	*15.5*
25 – 35	36	15	0	0	*51*	*29.3*
36 – 46	19	25	0	0	*44*	*25.3*
47 – 57	0	36	2	0	*38*	*21.8*
58 and above	0	10	2	2	*14*	*8.1*
Total no. of respondents	*80*	*88*	*4*	*2*	*174*	*100*

Table 5: Walking Speed (minutes per kilometre)
Source: Field survey, March 2012

It can be inferred from table 5 that the walking speed is inversely proportional to increasing age; that is, it reduces with age. This is because all the 80 respondents whose walking speed ranges between 1 – 30 minutes per kilometre are within the ages of 14 to 46. Interestingly, all 6 respondents who spend over 60 minutes to walk a kilometre – distance are above 46 years. It can therefore be concluded from this table that young people walk faster than old people. In addition, the average walking speed for all 174 Pedestrians is 37 minutes; thus, averagely, pedestrians spend 37 minutes on a 1 kilometre walk (37 minutes per kilometre or 1.6km/h)[4]. This in part can be attributed to the lack of pedestrian facilities and the human vehicular congestion that respondents attested to (Table 2 and Figure 4) which restricts and sometimes slows down the pace of their movement.

10.2 Daily Walking (Clock) Time

TIME (in minutes)	FREQUENCY	PERCENTAGE
1-30	16	9
31-60	25	14
61-90	35	20
91-120	64	37
121-150	8	5
151-180	14	8
Over 180	12	7
Total	*174*	*100*

Table 6: Daily Walking Time
Source: Field survey, March 2012

From table 6, it is observed that 70% of the respondents (133 respondents) spend more than 60 minutes of their day on walking. From the analysis, respondents on average spend 97 minutes daily on walking. The vehicular transport cost equivalent of the 97 – minute walk is Gh¢2.50 (i.e. $1.35 or €1)[5]. This means that by walking pedestrians save Gh¢2.50 averagely on transport in the Kumasi Metropolis.

10.3 Pedestrians' Access to Time

This aspect of the research looks at whether pedestrians walk because of time availability or they are constrained by income. Two scenarios are used here. First, whether pedestrians prefer walking or using a vehicle for a 1 - kilometre trip if they have enough time at their disposal and secondly, whether pedestrians prefer walking or using a vehicle for a 300 metre trip if they are time – constrained. Table 7 looks at the two scenarios

[4] One factor that influenced this rather slow walking speed is the range of the walking time provided (1-30, 31-60..)
[5] The exchange rates applied here for the US dollar and the Euro was a historical exchange rate for May 15, 2012 according to http://www.xe.com/. This date and exchange rate source will be applied to subsequent monetary exchange rate calculations in this research.

	SCENARIO 1		SCENARIO 2		
	1KM TRIP (TIME – AVAILABLE)		300M TRIP (TIME– CONSTRAINED)		*TOTAL*
	FREQUENCY	*PERCENT*	*FREQUENCY*	*PERCENT*	
Walk	106	60.9	43	24.7	***149***
Vehicle	68	39.1	131	75.3	***199***
Total	***174***	***100***	***174***	***100***	

Table 7: Pedestrians' Access to Time
NB: All 174 Respondents answered the 2 Scenarios
Source: Field survey, March 2012

From table 7, 60.9% of the respondents who take a 1 kilometre trip without time - constraints prefer to walk; this is mainly due to health reasons. Also, 24.7% of the respondents who take a 300 metre trip prefer to walk even though they are time - constrained; in order to reduce their transport costs and their perceived or cognitive time in areas of huge traffic. It can therefore be said that these two groups of people (149 in total) have two things in common for their actions; health issues and financial constraints. A cross- tabulation of the two scenarios shows that 6.3% (11 out of the 174 respondents) would prefer both decisions in both scenarios; i.e. they would prefer to walk a 1 kilometre journey in order to keep fit and they would also prefer to walk a 300 metre trip to save transport costs. All these 11 respondents are over 57 years and receive a maximum monthly salary of Gh¢400 ($210 or €165). With regard to the scenario of the 300 metre trip, 59% of the 44 respondents in the Central Business District (Adum) prefer to walk this distance because they would want to reduce their perceived travel time (by avoiding human and vehicular traffic). Thus in Adum, walking short trips is preferable to taking a vehicle (especially if the destination is within Adum) because of the potential increase in perceived travel – time and the high value of travel time costs (cost of time spent on transport, including waiting as well as actual travel).

Table 7 also shows that 39.1% of the respondents prefer to use a vehicle for a 1km trip, even if time is available. 75.3% of the respondents also prefer to use a vehicle for a 300 metre journey and their reason is simple, that time is far more important at that instance than paid travel cost. A cross tabulation of these two groups of people in the two scenarios in table 7 indicates that 10.3% (18 of the 174 respondents) would prefer to use a vehicle in both scenarios (1 kilometre or 300 metre trip). All 18 respondents receive an income of more than Gh¢600 a month ($316 or €247) and therefore prefer to spend money to save time rather than spend time to save money.

10.4 Pedestrians' Occasional Behaviour

Pedestrians' occasional behaviour looks at the situation where pedestrians are faced with a rise in human traffic on a pedestrian walkway or sidewalk. The aim of this aspect of the research is to find out pedestrians' reaction in such situations. Four behaviours were used as a range for this analysis as explained earlier; this includes Pursuing Behaviour, Halting Behaviour, Foreseeing Behaviour and Passing Behaviour (Osaragi, 2004). Table 8 analyses the occasional behaviour of the 174 respondents in the four selected communities.

PEDESTRIANS' OCCASSIONAL BEHAVIOUR	PERCENTAGE
Pursuing Behaviour	14.4
Halting Behaviour	31
Foreseeing Behaviour	13.8
Passing Behaviour	40.8
Total	***100***

Table 8: Pedestrians' occasional Behaviour (percentages)
Source: Field survey, March 2012

Table 8 indicates that 62% of the respondents (44 out of the 71 in number) who exhibit passing behaviour spend 30 minutes or less (walking time) on a 1 kilometre trip and thus have a walking speed of 2 kilometres per hour (0.5 metres per second) which is higher than the overall research average of 1.6 kilometres per hour. Thus, these 44 respondents are able to use their walking speed to pass by other pedestrians in high pedestrian density situations.

11. Pedestrian Income and Expenditure

This part of the research looks at pedestrians' income and expenditure and how it influences their pedestrian decision making. It also looks at pedestrians' monthly expenditure on paid (vehicular transport) and how transport costs also renders people as 'survival-pedestrians'.

The research shows that, 92.5% of respondents (161 respondents) are employed whiles 7.5% (13 respondents) are unemployed. Thus for the unemployed, information was gained on their monthly expenses and monthly transport costs but not their monthly income. The income analysis will therefore be based on the 161 employed respondents but for the income – expenditure dichotomy, all 174 respondents will be used. From the analysis of the income and expenditure data gathered, it is found that respondents receive an average monthly income of Gh¢449 ($236/ €185) and spend Gh¢369 ($194/€152) averagely per month. Table 9 looks at the income and expenditure analysis.

It is observed (from table 9) that 29 respondents earn and spend less than Gh¢200 a month (i.e. $105/€82). In detail, 86% (25 out of 29) of the respondents who earn and spend less than Gh¢200 monthly, walk to work. A further analysis shows that 16 out of these 25 respondents walk to work every day whiles the remaining 9 walk twice or more in a week to work.

		MONTHLY INCOME (in GH¢)						TOTAL
		LESS THAN 200	200 - 400	401 – 600	601 – 800	801 - 1000	ABOVE 1000	
Monthly Expenditure (Gh¢)	Less than 200	29	18	0	0	0	0	***47***
	200 – 400	0	48	2	0	2	2	***54***
	401 – 600	0	2	19	6	0	0	***27***
	601 – 800	0	0	0	15	6	0	***21***
	801 – 1000	0	0	0	0	5	0	***5***
	Above 1000	0	0	0	0	0	7	***7***
Total		***29***	***68***	***21***	***21***	***13***	***9***	***161***

Table 9: Income and Expenditure Analysis
Source: Field survey, March 2012

Furthermore, (from table 9) 58 out of the 161 employed respondents (36%) receive and spend more than Gh¢400 ($210/€165) a month whiles 93% (54 out of the 58 respondents who receive and spend more than Gh¢400 monthly) use vehicles; i.e. either private cars, public transport or a combination of both to work.

In relation to transport, the average monthly expenditure on transport per month is Gh¢67.4 ($36/€28). This figure includes costs for both public transport as well as private transport cost (fuel and maintenance). It also means that the average transport cost per month constitutes 15% of pedestrians' average monthly income and 18% of their expenditure. By drawing inference from the income – expenditure situation and the average monthly expenditure on transport, it is found that 45 (94%) of the 58 respondents who earn and spend more than Gh¢400 monthly spend more than Gh¢40 ($21/€17) a month on transport; thus for 20 working days in a month, they spend Gh¢2 ($1/€0.80) daily on transport.

For the 103 respondents who earn and spend less than Gh¢400 ($210/€165) monthly, 66% spend less than Gh¢40 on transport per month. It is also important to find out the reasons why 76 respondents prefer to walk to work (as shown in Table 10).

REASON	FREQUENCY	PERCENT
Cost Effectiveness	47	61.8
Convenience	20	26
Health	7	9.2
Others	2	2.6
Total	***76***	***100***

Table 10: Reason for Walking to Work
Source: Field survey, March 2012

Table 10 indicates that 61.8% (47 out of the 76 respondents) who walk to work do so in order to minimise transport cost (cost effectiveness). 40% of these 47 respondents who walk to work in order to minimise transport costs actually earn and spend less than Gh¢200 monthly (i.e. $105/€82) and thus prefer to walk to work in order to channel their meagre earnings to other activities. This is proved by 26 of the 47 respondents (55%) who responded that they walk to work in order to avoid paying transport costs sometimes.
In addition, table 10 also shows that, 26% of the respondents admitted that they walk to work because it is convenient (proximous). These respondents live in and around Adum (including Manhyia) and thus find it convenient to walk (to their workplaces in the central business district of Adum) rather than increase their travel time cost by taking a vehicle.

In addition, 9.2% of the respondents who prefer walking on health grounds (table 10) are aged above 46 and thus value the health benefits of walking. Also, 2.6% of the respondents also acknowledged the fact that it is difficult to get public transport from their place of residence (in Ashtown, the immediate north-western neighbour of Adum). Therefore they either have to hire a taxi or walk, and they prefer the latter. Hiring a taxi in Ghana (by yourself) is more expensive due to the culture of shared taxis being operated in designated transport points.

12. Pedestrian Problems

12.1 Pedestrian – Vehicular Conflict

Under this category, pedestrians were asked about the reception they receive from car drivers when crossing a road (Table 11).

RECEPTION FROM DRIVERS	PERCENTAGE
Impatient Car Drivers	70.7
Patient Car Drivers	29.3
Total	***100***

Table 11: Reception from Drivers
Source: Field survey, March 2012

The research shows that pedestrian – vehicular harmony is virtually non - existent or minimal at best; at least from the perspective of the pedestrians (table 11). A deeper analysis shows that 85% of the 130 respondents who live in the residential areas of Kentenkrono, Patasi and Manhyia responded that drivers are impatient to allow them to cross the roads. For residents of Kentenkrono, they blamed the lack of speed bumps on the main Kumasi – Accra highway for this situation. This they claim has endangered their lives and according to them at least 1 person gets knocked over by speeding vehicles every 3 months[6]. For Patasi residents, they asserted that drivers have no regard for the speed limit allowed in built – up areas (up to 30km/h) and therefore they over-speed and do not have the courtesy to allow pedestrians to cross even at intersection points. Residents of Manhyia on the other hand emphasized that since Manhyia is one of the few proximous congestion – free zones around the Adum – Kejetia commercial corridor[7], informal transport (*trotro*[8] and *taxi*) drivers are in a hurry to use the Manhyia - roads to quickly reach their destinations to pick up passengers in order to come back to pick up more again. Thus, they have no regard for who is crossing the road. In addition, they (Manhyia residents) are also faced with the problem of over speeding scooters and motorbikes, which also poses a threat to pedestrian life. In part this conflict can be attributed to the ineffective enforcement of traffic laws in these areas.

The 29.3% (Table 11) who acknowledged that drivers are patient and allow people to cross also asserted that drivers usually allow people to cross when they are faced with a jam-packed traffic situation. 64.7% of the 51 respondents who admitted to better treatment from drivers were interviewed in Adum where they asserted that because of the (human and vehicular) traffic, drivers cannot drive at their preferred speed and are forced to move at a slow pace to allow pedestrian movement.

13. Major Findings

The findings of the research have been re-aligned to the research questions that that guided this research. Thus these four categories of the findings answer the research questions.

[6] It should be noted that such word-of-mouth forms of information could be exaggerated.
[7] The Kejetia–Adum commercial corridor experiences the most traffic in the Kumasi metropolis (especially during rush hours)
[8] local name for jitneys in Ghana

13.1 Characteristics of Pedestrians in the Kumasi Metropolis.
The gender distribution of the research is a reflection of the Kumasi metropolis with females slightly outnumbering males. It was realised that people within the ages of 25 – 35 were the majority whiles those 58 and above were the minority. The travel characteristics also shows that 6 out of every 10 pedestrians prefer to utilise the internal alleys and footpaths within their neighbourhoods rather than using the sidewalks mainly due to human and vehicular traffic whiles 4 out of 10 prefer the sidewalk because they have access to them.
13.2 The role of time and total travel cost in pedestrian route choices in the Kumasi Metropolis.
This aspect of the research looks at pedestrians' walking speed and daily walking time. From the analysis undertaken, it is found that 51% of respondents spend 30 – 60 minutes to walk a 1 kilometre journey, 46% spend 30 minutes or less, 2.3% spend 61-90 minutes whiles 0.7% spend 91 – 120 minutes. Also, walking speed decreases with age; because 100% of the respondents who spend less than 30 minutes on a 1km walk are between the ages of 14 – 46 whiles those who spend 60 minutes or more are above 46 years. In addition, the average walking speed is 1.6 kilometres per hour. This is significantly slower than the 5.0 kilometres per hour stated by Browning *et al* (2006). A major reason for this is the various human and vehicular obstacles as well as unavailable sidewalks in certain areas.[9]

Also from the analysis, the average daily walking time of respondents was 97 minutes, which is higher than the 60-90 minutes daily walking time stated by Litman (2009). This 97 minutes equals a daily public - transport cost of Gh¢2.50 (i.e. $1.35 or €1). Thus, respondents who prefer walking are able to save Gh¢2.50 on transport due to walking.

13.3 Time – distance influence in pedestrian decision – making in the Kumasi Metropolis.
Under this aspect of the research, the trade-offs between time and distance were analysed whiles pedestrians' occasional behaviour was also analysed. By looking at the trade-offs, the analysis indicates that 60.9% of pedestrians prefer to walk a 1km journey if they have enough time whiles 39.1% prefer to use a vehicle in the same scenario. Some of the reasons given by respondents who prefer walking are health reasons (these respondents are 58 years and above). Others respondents' reason was cost-effectiveness and these respondents earned less than Gh¢400 a month (i.e. $210 or €165). Under the second scenario of the trade-offs, 75.3% of the respondents prefer to use a vehicle for a 300 metre trip whiles 24.7% prefer to walk in such situations. Whiles the respondents who prefer a vehicle in a time - constrained 300 metre situation perceive it to be the logical thing to do, the 24.7% who prefer walking based their responses on the fact that in places of high human and vehicular density, walking is faster than taking a vehicle. A case in point is Adum and Kejetia where walking is preferable for short distances to avoid traffic (due to the possibility of high perceived travel time).

The second part of this research objective looks at pedestrian behaviour in high human traffic situations. It indicates that 40.8% of respondents exhibit passing behaviour; in detail 62% of the respondents who exhibit passing behaviour have a walking speed of 0.5 metres per second (2 kilometres per hour) and are not older than 46 years. Other preferences include halting, (31%), pursuing (14.4%) and foreseeing behaviour (13.8%).

13.4 The role of income and expenditure patterns on pedestrian decision – making in the Kumasi Metropolis.
From the data collected, 161 out of the 174 respondents were employed. The income and expenditure situation of people influences their pedestrianisation decisions. The average monthly income of respondents was found to be Gh¢449 ($236/ €185) whiles the average expenditure was Gh¢369 ($194/€152). Average monthly transport expenditure on vehicular transport, including fuel and maintenance cost, is Gh¢67.4 ($36/€28). This represents 15% of pedestrian income and 18% of pedestrian expenditure. The Gh¢67.4 monthly transport expenditure, if spread over 30 days in a month means that a daily transport cost of Gh¢2.30 ($1.20/€0.9) is incurred by pedestrians. As already stated, pedestrians spend 97 minutes averagely on walking a day which is equivalent to Gh¢2.50 (i.e. $1.35 or €1) daily savings on transport cost. Thus, in the absence of the daily walking activity, pedestrians would spend Gh¢2.50 and Gh¢2.30 on transport totalling Gh¢4.80 ($2.5/ €1.9) ; this includes actual daily travel cost and travel cost savings due to their walking activity.
Also from the analysis, a general phenomenon discovered was that the high income earners spend more on transport and are willing to trade money for time. This can be attested to by the fact that 93% of employed respondents who receive more than Gh¢400 ($210/€165) a month use vehicles to work; either private cars,

[9] Again, the range of the walking time used in the research design might also contribute to this result (e.g. 1-30, 31-60, 61)

public transport or both. On the other hand, respondents who earn less than Gh¢400 a month spend Gh¢40 ($21/€17) or less on transport per month. Furthermore, 94% of respondents who earn below Gh¢400 monthly walk more than once a week to work. This also complements the two scenario analysis undertaken in the research on the 1km and 300metre trips. According to Litman (2009), "*employed people are often willing to pay more for travel time savings*" but this research goes further to show that income level provides a deeper influence on travel time savings.

14. Conclusion

Pedestrianisation is an important aspect of human life in Ghana and indeed in the world at large. It is one of the major ways of a reducing vehicular congestion and its ugly consequences. Whiles in the developed world, it is seen as a major form of leisurely and even functional transport, it is seen as a form of survival in the developing world (of which Ghana is no exception).This research has shown that income plays a major role in determining peoples' preference and non-preference for walking. Even though health issues play a role in pedestrian behaviour, income was found to be the general overriding reason for pedestrianisation.

Travel time is also an important determinant of peoples' preference or non – preference for walking. For someone who is determined to walk to avoid paying vehicular transport charges, he or she is ready to start early in order to reach the intended destination on time. A case in point is workers who prefer to walk to work in order to avoid paying transport fares.Pedestrianisation seems to be an underestimated aspect of urban transport in our society. In areas where pedestrian facilities have been provided, the areas have been encroached by vehicles, street-hawkers and vendors. To add to this, most of the residential areas lack pedestrian facilities. Drivers are also happy to 'colonize' the streets at the expense of pedestrian safety. Undertaking this research has been able to unearth all these issues outlined as well as the problems that are persistent with respect to general pedestrian life. In terms of further research, it would be interesting to delve into the modelling of pedestrian behaviour in city centres in a developing world context like Kumasi. In terms of policy, what is needed is a strong focus on pedestrian facility construction and maintenance as well as enforcement of right-of-way regulations on the usage of public spaces. This would ensure that more people walk (not just for survival but also to enjoy the act of walking) or have the courage to ride a bicycle without resorting to it as a last resort due to income constraints.

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Appendix

Calculation of Sample Size (Four Communities; Manhyia, Patasi, Kentenkrono and Adum)[10]

MANHYIA
Population (as at 2000) = 24458
Average Household Size (as at 2000) = 5.5
Total number of Households (as at 2000) = 4468
Intercensal Growth rate (Ashanti Region by 2010) = 2.6%

Population Projection ---- Pn = P_O $(1 + r)^t$
Where P_n = Future Population, P_O= Current Population (24458), r = rate of growth (2.6%percent)
t = time (2012 – 2000) = 12 years

Therefore P_n = $24458(1 + 0.026)^{12}$
P_n = 24458 (1.360718625)
P_n = 31959.7
Therefore Projected Population of Manhyia for 2012 = **31960**

[10] Data from Ghana Statistical service, 2005

Assumption: Average Household Size in Manhyia (2012) will be the same as 2000 = 5.5
If Population in 2012 is *31960*, and Average Household Size in 2012 is 5.5, then;
Total Number of Households in Manhyia (in the year 2012) is 31960/5.5 = 5810.9
Total Number of Households (2012) = **5811**

Sample Size = $N/(1+Ne^2)$
Where N = total population, e = margin of error (assumed to be = 0.15)

Sample size for number of Households = $5811/(1+(5811)(0.15)^2)$
= 5811/131.7475 = **44**

PATASI
Population (as at 2000) = 9364
Average Household Size (as at 2000) = 5.9
Total number of Households (as at 2000) = 1581
Intercensal Growth rate (Ashanti Region by 2010) = 2.6%

Population Projection ---- $Pn = P_O\ (1 + r)^t$
Where P_O= 9364, r = 2.6%, t = 12 years

Therefore P_n = $9364(1 + 0.026)^{12}$
P_n = 9364 (1.360718625)
P_n = 12741.7
Therefore Projected Population of Patasi in 2012 = **12742**
Assumption: Average Household Size in Patasi (2012) will be the same as 2000 = 5.9
If Population in 2012 is *12742*, and Average Household Size in 2012 is 5.9, then;
Total Number of Households in Patasi (in the year 2012) is 12742/5.9 = 2159.6
Total Number of Households (2012) = **2160**

Sample Size = $N/(1+Ne^2)$

Sample size for number of Households = $2160/(1+(2160)(0.15)^2)$
= 2160/49.6 = **44**

KENTENKRONO
Population (as at 2000) = 3222
Average Household Size (as at 2000) = 5.5 Total number of Households (as at 2000) = 587
Intercensal Growth rate (Ashanti Region by 2010) = 2.6%

Population Projection ---- Pn = $P_O\ (1 + r)^t$
Where P_O= Current Population (3222), r =2.6% t = 12 years

Therefore P_n = $3222(1 + 0.026)^{12}$
P_n = 3222 (1.360718625)
P_n = 4384.2
Therefore Projected Population of Kentenkrono in 2012 = **4384**
Assumption: Average Household Size in Kentenkrono (2012) will be the same as 2000 = 5.5
If Population in 2012 is *4384*, and Average Household Size in 2012 is 5.5, then;
Total Number of Households in Kentenkrono (in the year 2012) is 4384/5.5 = 797.09
Total Number of Households (2012) = **797**

Sample Size = $N/(1+Ne^2)$

Sample size for number of Households = $797/(1+(797)(0.15)^2)$
= 797/18.9325 = **42**

ADUM
Population (as at 2000) = 8016
Average Household Size (as at 2000) = 5.1
Total number of Households (as at 2000) = 1583
Intercensal Growth rate (Ashanti Region by 2010) = 2.6%

Population Projection ---- Pn = $P_O\ (1 + r)^t$

Where P_O= 8016, r = 2.6%, t = 12 years

Therefore P_n = 8016(1 + 0.026)^{12}

P_n = 8016 (1.360718625)

P_n = 10907.5

Therefore Projected Population of Adum in 2012 = **10908**

Assumption: Average Household Size in Adum (2012) will be the same as 2000 = 5.1

If Population in 2012 is *10908*, and Average Household Size in 2012 is 5.1, then;

Total Number of Households in Adum (in the year 2012) is 10908/5.1 = 2138.8

Total Number of Households (2012) = **2139**

Sample Size = N/(1+Ne^2)

Sample size for number of Households = 2139/(1+(2139)(0.15)^2)

= 2139/49.1275 = **44**

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