A sustainable livelihood cost-benefit model to enhance the understanding of the dynamics between low income housing and location

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Abstract

To keep pace with increasing urbanisation pressures and a substantial inherited backlog, subsidised low-income housing and services have predominantly been provided on the peripheries of South African cities where land is cheaper and more readily available. While this strategy has been widely praised for its rapid delivery of more than a million low-income housing units, it has been severely critiqued for perpetuating the marginalisation of the poor by restricting their access to urban opportunities and leading to extensive commuting, which absorbs a disproportionate share of their time and already limited disposable income, with associated environmental costs in terms of resource use and greenhouse gas emissions. The alternative proposed has been the compact city model, involving curtailing outward expansion, increasing housing densities and promoting public transport. The merits of this model, have however, only been subjected to scant empirical testing in South Africa. This article seeks to make a contribution to the 'location-question' by empirically testing the hypothesis that low income housing in peripheral localities is more costly and less beneficial to society than the same housing provided in more central localities. In order to do this, a sustainable livelihood cost-benefit model was developed and applied in eight subsidised housing locations in two cities. Amongst others, measured variables were transportation costs, travel times, fuel consumption and accessibility to employment and other urban opportunities and amenities. The results indicate that more central localities do not necessarily perform better overall than more peripheral localities on the scores as measured. This is attributed to:

- the polycentric nature of our cities; and
- the relatively lesser importance of access for lower-income households to formal employment nodes than to informal job opportunities within or near the low income settlement itself and in middle to high income residential areas.

In addition to this, the needs of low-income households were found to change over time, which suggests that no single type of location will optimally serve all low income households, while at the same time, being affordable to households and government.

'N VOLHOUBAREBESTAANS-KOSTEVOORDELIGE MODEL VIR DIE UITBREIDING VAN KENNIS RONDOM DIE DINAMIEK TUSSEN LAEKOSTEBEHUISING EN LIGGING

Gesubsidieerde laekostebehuising en dienste is voorsien op die randgebied van Suid-Afrikaanse stede waar grond goedkoper en meer geredelik beskikbaar is, om tred te hou met die toenemende verstedelikingsdruk tesame met 'n substansieële inherente agterstand. Terwyl die strategie erkenning ontvang het vir die spoedige lewering van meer as 'n miljoen laekoste behuisingseenhede, het dit net soveel kritiek ontvang vir die voortgesette marginalisering van die agtergeblewenes deur hul toegang na stedelike geleendhede te beperk. Dit lei tot uitgebreide pendeling, wat op sy beurt lei tot die absorbering van 'n groter proporsie van die persoon se tyd met 'n alreeds beperkte besteebare inkomste, geassosieerde omgewingskoste in terme van die gebruik van hulpbronne en die bydrae tot aardverwarming deur die vrystelling van uitlaatgasse. Die voorgestelde alternatief behels die 'compact city model' wat insluit: beheer oor stedelike uitbreiding, 'n verhoging in behuisingsdigthede en die aanmoediging van publieke vervoer. Die meriete van die model is egter nog net onderhewig gestel aan 'n geringe empiriese toetsing in Suid-Afrika. Hierdie artikel poog spesifiek na 'n bydrae tot die liggingsvraagstuk deur die empiriese toetsing van die hipotese: laekostebehuising geleë op die randgebied is duurder en minder voordelig tot die groter gemeenskap vergelykend met dieselfde behuising wat voorsien word in 'n meer sentrale ligging. Om die doe l na te streef is 'n volhoubarebestaans-kostevoordelige model ontwikkel en toegepas in agt gesubsidieerde behuisingsontwikkelings in twee stede. Onderandere sluit die meetbare veranderlikes die volgende in: vervoerkoste, reistyd, petrolverbruik, toegang na werksgeleendhede en ander stedelike geleendhede en geriewe. Volgens die telling soos gemeet dui die uitslag daarop dat die meer gesentraliseerde ontwikkelings nie noodwendig beter presteer in die geheel as die ontwikkelings op die randgebied nie. Dit word verklaar aan die hand van:

- Die polisentriese aard van ons stede; en
- Die relatiewe minder belangrikheid vir laer-inkomstegroepe in terme van toegang tot formele werksgeleentheid nodusse vergelykend met informele werksgeleendhede in of naby die lae-inkomste nedersetting en in middel- tot hoërinkomste residensieële areas.

Addisioneel, die behoeftes van lae-inkoste huishoudings verander oor tyd, wat voorstel dat geen enkele tipe ligging alle lae-inkomste huishoudings optimaal kan voorsien en bekostigbaar vir die huishouding en die regering is nie.

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TSELA/MOKGWA WA NTSHETSOPELE O BOLOKANG DITJEHO HO NTSHETSA-PELE KUTLWISISO YA PHAPANG/SEKGEO SE TENG PAKENG TSA MATLO A THEKO DI TLASE LE SEBAKA SA KAHO

Ho kgema le sekgahla sa kgatello ya kgolo ya diteropo le phaello e kgolo ya kaho e salletseng morao, dithuso tsa ditjhelete tsa matlo a theko di tlase le ditshebeletso di ne di fanwa ka sekgahla se seholo ka thoko/ntle ho diteropo tsa afrika borwa moo sebaka se leng theko ditlase ebile se fumaneha hanghang. Le ha tsela/mokgwa o na o ile wa babatswa ka hohlehohle ka moo o ileng wa aba ka potlako matlo a theko di tlase a diketekete(million), o ile wa kgeswa haholo ka ho ntshetsapele nyenyefatso ya ba kojwana-di-mahetleng ka ho ba hanela ka menyetla e fumanwang diteropong le tsela e telele ya dipalangwang, e nkang karolo e kgolo ya mekgolo ya bona, ebile e nka seabo tshebedisong e mpe ya menono ya naha le tshilafatsong ya tikoloho(greenhouse gas emissions). Tselana e nngwe e hlahisitsweng ke mofuta o kopaneng wa teropo, o kentseng polokeho ya ditjeho tsa kgolo e tlohang hare ho teropo, le keketso ya matlo sebakeng se le seng le kgothaletso ya tshebediso ya dipalangwang tsa setjhaba. Dintle tsa mokgwa o na, le ha ho le jwalo, ke ho na di sa tswa kenngwa ditekong tsa tshebetso ka sekgahla se monyebe mona afrika borwa. Pampitshana e na e leka ho kenya letsoho diphehisong tsa 'dipotso tsa sebaka sa tulo' ('location-question') ka ho ken ya tekong tlhahiso ya hore matlo a theko di tlase a ahilweng ka ntle ho metse seteropo, a ditjeho di hodimo ebile ha a tswele setjhaba molemo ha a bapiswa le matlo a ahilweng ka hare ho metse seteropo. Hore se na se tle se kenngwe tshebetsong, mokgwa wa ntshetsopele o ditjeho di tlase o ile wa hlahiswa wa ba wa kenngwa tshebetsong dibakeng tse robedi tsa kaho tse tsheheditsweng ka ditjhelete diteropong tse pedi. Ka hara tse ding, tse ileng tsa kenngwa ditekong ke ditjeho tsa dipalangwang, nako e nkuwang leetong, tshebediso ya mafura a makoloi le menyetla ya mesebetsi, le menyetla le ditshebeletso tse ding tsa diteropong. Diphuputso di hlahisitse hore mofuta o kopaneng wa teropo hantlentle ha o fete wa metse seteropo e ka ntle ho teropo ha e bapiswa. Tsena di totobaditswe ke:

- Ditsha tse fapaneng tse mmalwa tsa ditshebeletso tse fumanwang ka hare ho diteropo tsa rona; le
- Tlhokahalo e nyane ya menyetla ya malapa a fumanang mekgolo e tlaase ho isa ho basebetsi ba nako tsohle papisong le basebetsi bao e seng ba nako tsohle ka hare ho, kapa pela dibakana tse theko di tlase le tse theko di mahareng ho isa ho tse theko di phahameng tsa tulo.

Ho tlatseletsa tsena, ditlhoko tsa malapa a fumanang mekgolo e tlaase, ho fumanwe hore di fetofetoha ho ya ka dinako, ho hlahisang hore ha ho tulo/sebaka se ka sebeletsang malapa a mekgolo e tlaase kaofela, se bile se le theko di tlaase ho malapa le mmuso.

1. INTRODUCTION

A common assertion in local and international urban development literature and policy is that modern cities are characterised by sprawl, which results in costly infrastructure, high transportation costs and associated high environmental costs in terms of energy consumption and greenhouse gas emissions. The popular solution advanced under the umbrella of catchy terms such as "New Urbanism", "Smart Growth" and "Transit-Oriented Development", is to manage urban growth by curtailing outward expansion of the city, increasing densities and promoting public transport (Bernick & Cervero, 1996; Dekel, 1997; Gordon & Richardson, 2000; O'Toole, 2001, Speir & Stephenson, 2002).

From this perspective the large scale, low density, single-stand, peripheral, low income housing provision in South African cities over the past twelve years has been criticised for having reached numerical targets at the expense of achieving quality objectives such as accessibility and sustainability (Republic of South Africa. Department of Housing, 2004). In its defence government has pointed to budget constraints, leaving little choice but to develop in peripheral locations, and dictated against costly multiple-storey housing units, with which to offset higher land costs. The perceived results of this form of city building are that poor people:

- remain marginalised in terms of access to jobs, urban amenities and social networks; and
- spend disproportionate amounts of time and income on motorised transportation, with its associated costs to the environment in terms of increased fuel usage and greenhouse gas emissions.

Infrastructure costs to the local authority are also perceived to be higher due to the greater distances which need to be traversed with services.

These popular assumptions and perceptions have, however, hardly been explored in an empirical way in the local literature. The only local empirical research dealing to some extent with the topic has been a limited number of studies focusing on costs but not incorporating benefits. Evidence of transportation cost implications of land use patterns in general and more specifically, of low income housing location, is the most common (Stylianidis & Gunning, 1990; Republic of South Africa. Department of Transport, 1991; South African Roads Board, 1992; Aucamp & Moodley, 2002). In terms of other services, Biermann (1998; 1999; 2002; Biermann & Landré; 2003), has developed an infrastructure potential cost model for determining infrastructure costs across a planning area, integrating these into the process of assessing the suitability of land for low income housing. This leaves the issue largely unexplored in scientific terms, which means that the debate will continue based on little substantiated evidence.

In the light of the absence of empirical research and in order to add some scientific flavour to this important policy discourse, this comparative study seeks to quantify and compare the costs and benefits of centrally-located low income housing with those of more peripherally-located housing. This is done by developing and applying a sustainable livelihood cost-benefit assessment model.

This article describes the formulation of the model and its full application in eight low income settlements in a range of locations in two cities. Presenting only selected results, deemed sufficient to demonstrate the value of the model in elucidating the impact of locality on cost and livelihood benefits, the article proceeds to focus on the

transportation-related cost variation with location and the three most locality-influenced aspects of sustainable livelihoods — physical, social and natural capital.

2. RESEARCH FRAMEWORK

2.1 Sustainable livelihoods framework

Moser (1998) uses the idea of "asset portfolios", which are sets of physical objects, relationships and abilities that are able to provide a household with coping mechanisms to survive harsh realities. Expanding on the idea of Moser, is the concept of 'sustainable livelihood', defined by The UK Department for International Development (DFID), as " ... comprising the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Department for International Development, 2000).

Whereas Moser originally only covered three kinds of capital, i.e:

- investments (in education and health as well as housing and equipment);
- stores (food, money or valuables); and
- claims on others for assistance (networks of kin and friends and institutional relationships), DFID subsequently expanded it to include five main forms of capital represented in the form of an assets pentagon:
  - Human capital, which represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives.
  - Social capital, under which is understood the social resources which people draw on in pursuit of their livelihood objectives, and which are developed through social networks, relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and provide the basis for informal safety nets amongst the poor.
  - Natural capital is the term used for the natural resource stocks from which resource flows and services necessary for livelihoods are derived, and include intangible public goods such as the atmosphere and biodiversity and divisible assets used directly for production (trees, land, *etc.*).
  - Physical capital comprises the basic infrastructure and producer goods (tools and equipment used to function productively) needed to support livelihoods.
  - Financial capital refers to the availability of cash or its equivalent, which enables people to adopt different livelihood strategies, and which comprises available stocks and inflows of money.

The sustainable livelihoods framework has proven useful as the conceptual basis for subsequent studies relating to enhancing and sustaining livelihoods. Napier (2002) develop a conceptual model relating the concept of sustainable livelihoods to informal settlement location and the biophysical environment and through an improved understanding of the interfaces, to propose ways to mitigate environmental impacts of informal settlements, to better integrate informal settlements into urban areas and to respond effectively to environmental hazards and disasters, thus enhancing sustainable livelihoods.

2.2 Sustainable livelihood cost-benefit assessment model

Based on the traditional cost-benefit approach which has been applied to a limited extent in development planning (Hill, 1990; Schofield, 1987; Shefer & Kaess, 1990; Tudela, Akiki & Cisternas, 2005), combining the sustainable livelihoods framework and expanding on the model of Napier (2002), a sustainable livelihoods cost-benefit assessment model was developed to include the relationships between settlement location, land and bulk services costs (capital, operational and maintenance costs), benefits of location in providing and improving sustainable livelihoods and the biophysical environment (Figure 1). Unlike conventional cost-benefit analysis, where all costs and benefits are reduced to monetary value in order to compare alternatives in terms of their net impact on social welfare, this model addresses some of the major criticisms of cost-benefit analysis of not paying homage to trade-offs between:

- equity (political) and efficiency (economic/ monetary);
- quantifiable and non-quantifiable issues; and
- theory and practice (Shefer & Kaess, 1990).

In addition to this, the model seeks to emphasise benefits relating to individuals in accordance with human development indices, instead of focusing on macro-indicators such

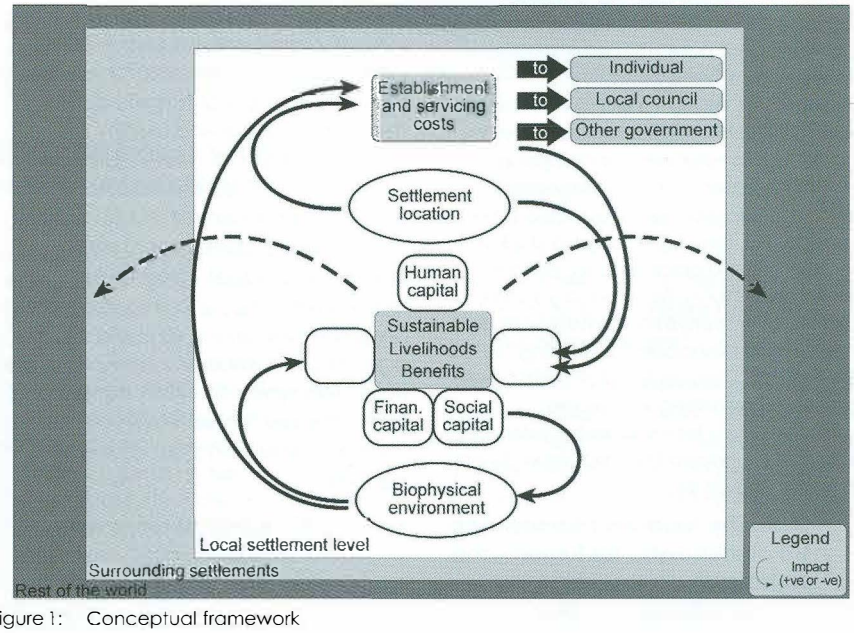

Figure 1: Conceptual framework

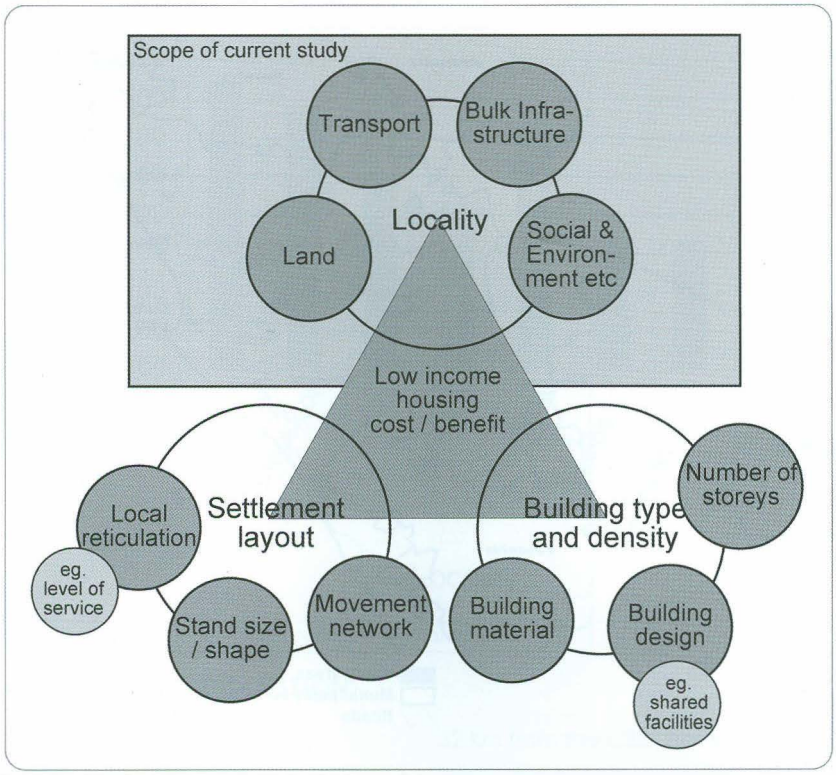

Figure 2: Cost components included in model

as gross domestic product (Clements, 1995). As such it conceptualises benefits in relation to sustainable livelihood capitals, necessary for improving quality of life. In comparison to conventional cost-benefit analysis, whereas costs are still measured in monetary terms, benefits are measured in terms of an index and not as monetary value. Net cost-benefit is thus not calculated but rather the comparative assessment between localities is made on the basis of the most suitable locality being one that with the least cost and highest benefit to achieving a sustainable livelihood.

The question of costs and benefits 'to whom' is explicitly incorporated. Settlement establishment and servicing costs are explicitly assigned to the individual, the local council, a higher sphere of government or to the wider world outside of the specific settlement (especially in the case of biophysical environmental costs). As far as benefits are concerned, only benefits to the individual are considered as theoretically, government is not supposed to make a profit but is rather there to contribute to improving the quality of life of its citizens. The benefits to the government therefore are directly proportional to the individual's quality of life as measured through the sustainable livelihoods framework.

The application of the model to various settlement locations facilitates decision-making regarding the prioritisation of locations where the most benefit is obtained for the least cost. Or, put differently, locations where, for the same amount of investment, more benefits are gained.

Infrastructure and housing costs are affected by both locality related factors (such as the distance from bulk water supplies or main roads), and in-settlement factors (such as the standards to be provided and the dwelling density). The model only considers locality-related factors, in order to control for differences in in-settlement and on-site costs (Figure 2). Off-site costs of land, social/community services, bulk infrastructure, and transport and environmental (including energy) costs, both capital and maintenance costs, to all parties concerned, including households and government are included.

In the case of transport, costs that were included were:

- infrastructure cost (constructing and maintaining roads and bus/taxi/rail infrastructure);
- user costs (energy cost, maintenance cost and capital cost of owning and operating vehicles, as well as the opportunity cost of time spent travelling); and
- indirect costs (accruing to individuals and society in the form of accident cost).

All relevant modes of transport (including private cars, bus, rail, minibus-taxi, and travel by foot and bicycle) were included, with the focus falling on the three major trip types, namely work, education, and shopping trips (Venter, Biermann & Van Ryneveld, 2004).

Benefit indicators and measures were determined in accordance with the five kinds of capital and combined with costs within the sustainable livelihoods framework in order to enable the 'measurement' of the relative costs and benefits of different low income housing locations.

2.3 Study area

Once the model had been constructed data was gathered in accordance with the set indicators in a number of low-income housing areas in two cities: two in Johannesburg and six in the Durban/eThekwini metropolitan area (Figure 3). In the case of Johannesburg, Diepsloot, 35 km from the Johannesburg CBD, was selected as an example of a peripheral location and Alexandra, while still 11 km from the Johannesburg CBD, was selected as a prime location located virtually on the doorstep of the rapidly expanding Sandton node.

In eThekwini, the selected settlements represent a range of localities. Cato Manor is located in close proximity to the Durban CBD (8 km along existing transport routes), Quarry Heights and Westridge are 15 km from the CBD, Madiba Valley is 32 km away from the CBD, but approximately 10km from the Pinetown CBD. Lovu and Waterloo are 35 to 25 km from the Durban CBD, to the south and north respectively, while Fredville is about 45 km west of the city.

2.4 Data, surveys and analysis

The primary source of information for determining the costs and benefits accruing to households was surveys.

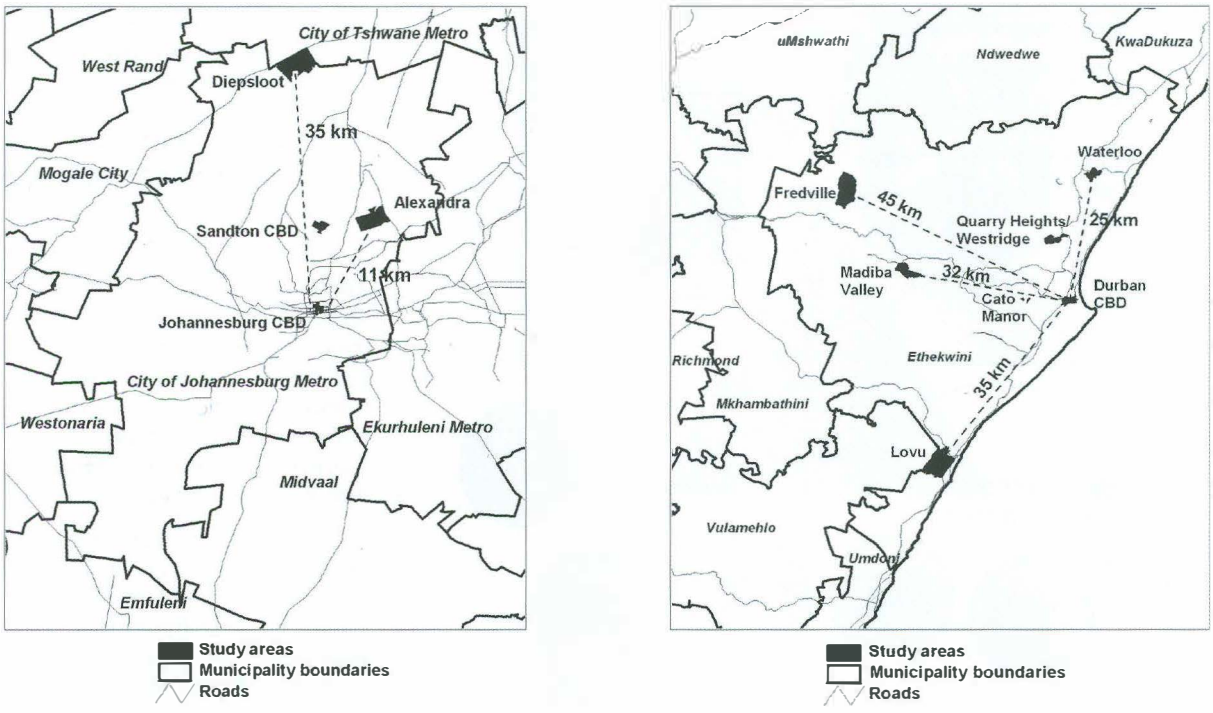

Figure 3: Low income housing settlements in Johannesburg and eThekwini included in study

Sample sizes varied between 250 (in the case of Johannesburg) and 100 (in eThekwini) households per settlement. The total sample consisted of 1100 households, which allowed for useful statistical analyses to be made. Due to the fact that the Johannesburg part of the study was conducted first, additional complementary questions were incorporated in the subsequent surveys undertaken in eThekwini in response to learning which emerged from the analysis of the Johannesburg samples. For this reason, part of the analysis includes results only for eThekwini. As for costs accruing to government, data was sourced mainly from public transport operators.

Multi-criteria evaluation, a technique developed specifically to enable the comparison between disparate data sets and which entails weighting, was used to combine benefit measures to facilitate the comparative assessment of locations (Voogd, 1983). An advantage of this technique is that it is relatively simple and can be applied to whatever data is available, regardless of whether it can be translated into monetary value. Although weighting introduces an element of subjectivity into the process, the technique remains simple and easy to use.

Table 1: Average transport costs per person (R/month)

	>25km from CBD					<15km from CBD		
	Lovu	Fred-ville	Madi-ba	Diep-sloot	Water-loo	Q.Hts/ W'ridge	Cato Manor	Alex
Infrastructure Costs	8.58	7.28	6.97	10.42	9.86	6.15	5.98	9.82
Direct operating costs								
Operating costs: private cars	23.21	28.06	9.15	18.36	57.39	14.58	18.83	26.30
Operating subsidies: buses	0.00	0.00	7.64	11.41	0.00	4.72	2.26	1.81
Operating subsidies: rail	0.76	0.18	0.01	0.00	1.10	0.45	0.20	0.00
Public transport fares	64.81	50.26	44.74	75.67	46.64	41.03	39.42	66.49
Journey time costs	32.49	24.29	29.82	31.35	34.49	26.54	24.21	4.28
Indirect operating costs								
Accident costs	1.29	0.92	1.03	1.67	1.30	0.60	0.63	1.60
TOTAL COSTS	131.1	110.9	98.87	148.8	150.7	94.1	91.5	140.3
Average	127.8		108.6					
Government cost	10.63	8.36	15.15	23.50	12.26	11.92	9.08	13.23
Individual cost	120.5	102.6	83.7	125.3	138.5	82.1	82.4	127.1

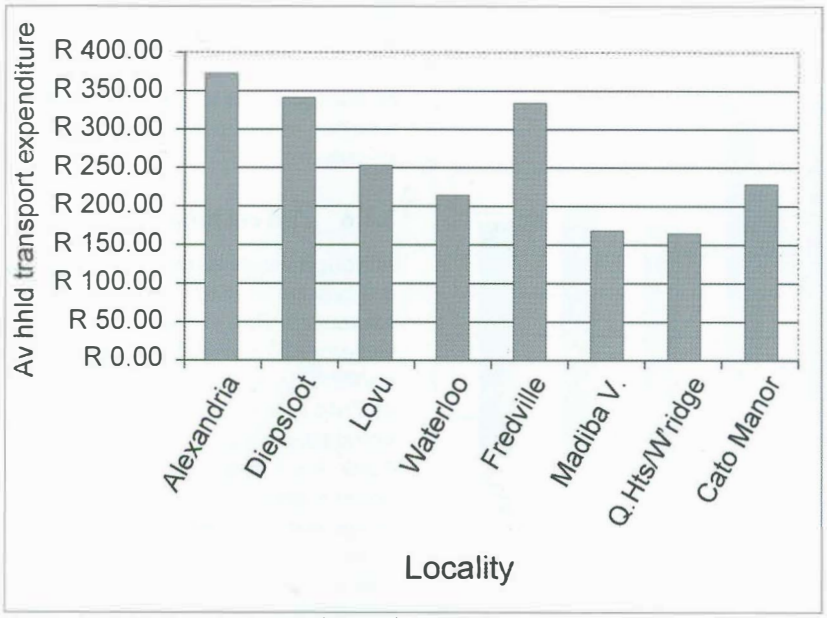

Figure 4: Average household expenditure on transport

3. RESULTS AND DISCUSSION

3.1 Transport costs

3.1.1 Total costs

The average total transport cost for the more central locations (< 15 km from CBD) is lower than the average for the more peripheral locations (>25 km) (Table 1). In Johannesburg, however, the difference between total costs in Alexandra and Diepsloot is only a marginal 6%, despite the difference in distance to the CBD of 24 km.

A consideration of the transport costs of each settlement reveals considerable diversity in costs even within each broad grouping. Waterloo has the highest total transport cost although it is located somewhere between a more central and peripheral location (25 km). Alexandra, although a more central location, has costs which correlate better with those of the more peripheral sites (Diepsloot, Lovu). It in fact exhibits the third highest total transport cost, largely due to higher private car usage. Madiba, although 32 km from the CBD, has costs comparable to those in the more centrally located settlements. With the exception of Waterloo, the two Johannesburg settlements (Diepsloot and Alexandra) exhibit much higher total costs than the eThekwini settlements.

3.1.2 Who pays?

The findings indicate that by far, greater costs accrue to the individual than to government. Only between 8 and 15% of total costs are borne by government. Diepsloot and Madiba Valley have the highest proportion of cost to government as a result of bus subsidies (Table 1). Residents of more peripheral localities in eThekwini — those with generally higher travel distances — consume almost no subsidised transport, as they have no access to subsidised bus services, and make very little use of rail. The highest costs to individuals accrue to households in Waterloo, which is by no means the most peripheral location — it is located at a fairly modest 25 km from the CBD. Individual costs are also higher for households in the more central Alexandra, than for households in the more peripheral Diepsloot.

The question of who pays is also a function of the kind of trip made. In the case of Diepsloot, it is the bus-subsidised education trip that contributes most to the higher government cost (bus subsidy). Improving education facilities in Diepsloot would thus significantly reduce the transport cost rather than some transport solution.

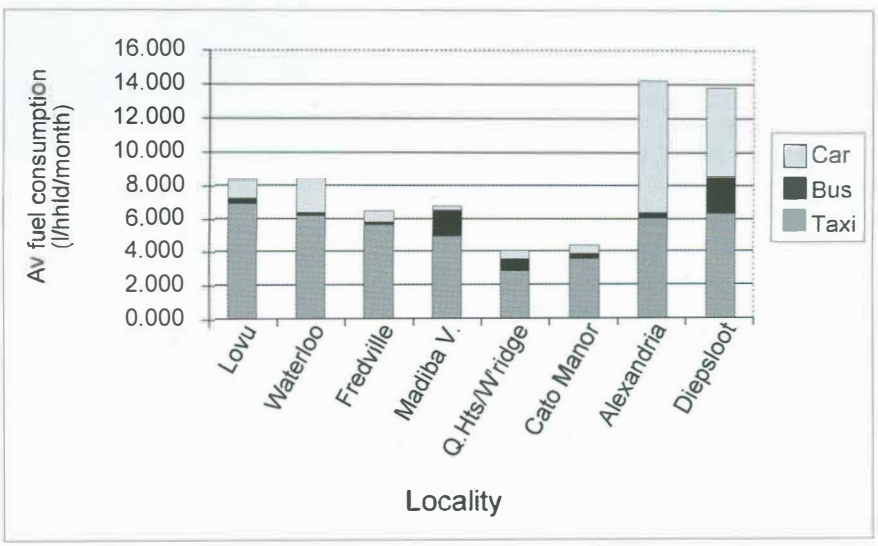

Figure 5: Average fuel consumption per household per month

Price discrimination appears to affects transport costs. For instance, Alexandra passengers pay on average R 157 per month for taxi service, but travel shorter distances than Diepsloot passengers who pay only R137 per month. This, it has been

Table 2: Average travel distances per mode (km)

	JHB		ETHEKWINI					
	Peripheral	Central	Rural	Peri-urban		Urban periphery		Urban core
	Dieps	Alex	Fredv	W'loo	Lovu	MVal	QH/W	CM
By car (all trips)	18.6	16.9	18.4	15.2	5.4	10.9	17.0	8.5
By bus/taxi/rail (to work)	19.9	17.1	21.9	18.6	18.3	21.9	13.2	9.7

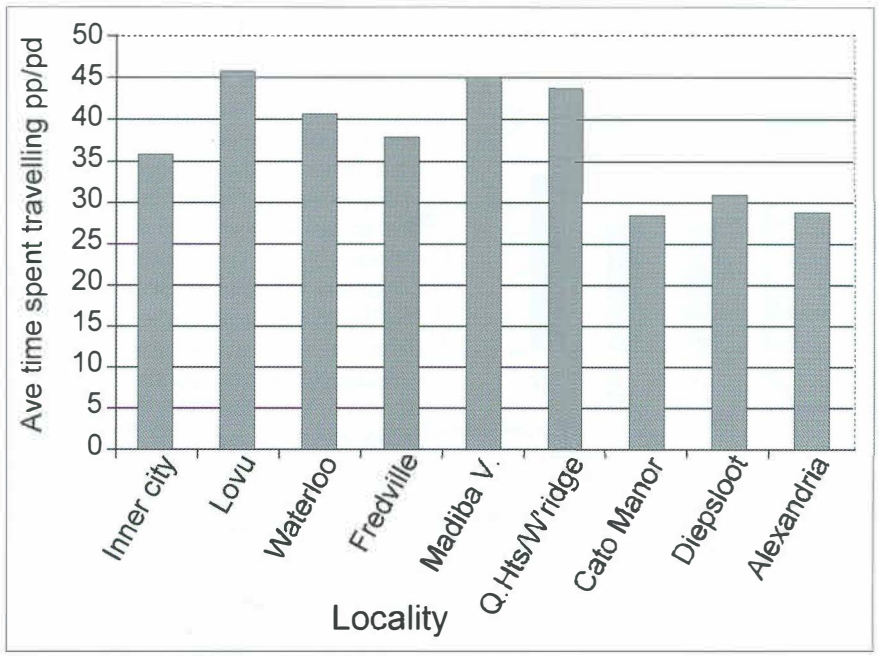

Figure 6: Average time spent travelling per person per day

suggested, is due to the fact that taxi operators can charge more in Alexandra because passengers have higher incomes and are hence able to pay more.

3.1.3 Cost in relation to household expenditure

Households in the Johannesburg settlement of Alexandra and Diepsloot spend around R350 per month on transportation (Figure 4). Except for Fredville, where monthly household expenditure on transport is close to R350, households in eThekwini spend between R 150 and R250 per month, which is much less than in Johannesburg.

Although Johannesburg households spend more on transport than those in eThekwini, expenditure as a percentage of household income is similar, due to higher income differentials in Johannesburg. As a percentage of total expenditure, households almost without exception spend about between 15 and 16% of income on transport, no matter which city or which locality within the city (Figure 4). There is thus no significant relationship between distance from the CBD and expenditure as a percentage of household income. The nationally recommended proportion of household expenditure on transport is 10% of total income. In all localities, transport costs exceed the national recommendation by 5 or 6%.

3.1.4 Travel distances

No clear indication emerged that a more peripheral location means greater travelling distances. Although average travel distances generally increase with distance from the CBD, this relationship is only evident for public transport users (Table 2). In the case of car travel the relationship is not that clear, with long car travelling distances found in Quarry Heights/Westridge (a peripheral location) and shorter distances in the more peripheral settlement of Lovu.

3.1.5 Fuel consumption

The results in this regard emphasise the significance of mode of transport. Private car usage is higher in the two Johannesburg areas, resulting in an almost doubling of average fuel consumption rates (Figure 5). In the three more central e Thekwini areas (Madiba Valley, Quarry Heights and Cato Manor) bus usage is higher, resulting in lower fuel consumption levels. In eThekwini, average consumption rates are the lowest for the two most central areas, while the more peripheral settlement of Diepsloot in the Johannesburg area has a lower average fuel consumption rate, mainly due to higher rates of public transport usage, predominantly for the school trip. Once again, it cannot be concluded that the more central areas are more efficient locations for low income housing from a fuel consumption point of view. In fact, there seems to be a greater derived correlation between fuel consumption and mode of transport, the latter being a function of income level, rather than locality.

3.1.6 Travel time

Although travel costs (and distances) are greater in Diepsloot and Alexandra than in the eThekwini settlements, travel times are significantly lower, except in the case of Cato Manor, which has the lowest travel time for eThekwini (Figure 6). Again this is probably due mostly to travel mode, where greater car usage reduces travel time but more walking increases travel time. There is thus a much more significant relationship between travel mode and time than between distance from the CBD and travel time.

3.1.7 Travel patterns

The most likely reason for the lack of a significant correlation between distance from the CBD and travel cost, time and distance, other than travel mode, is that households travel to destinations other than the CBD. The multi-nodal structure of both cities means that most trips are not to this core, but to other closer locations (Figure 7). 72% of Fredville-commuters travel to nearby Hammarsdale and Pinetown; most Lovu-commuters travel to Amanzimtoti and Kingsburgh; almost 40% of Diepsloot work trips are to Sandton and Randburg and only 11% to the Johannesburg CBD.

Delving deeper into the diversity of travel destinations, it emerges that the multi-nodal form of current-day cities plays a key role in travel patterns and that the picture is far more complex than a simple settlement-CBD travel pattern. This was especially the case with regards to the work-related trip. The data suggests that access to formal employment nodes is less important for low income households than:

- access to informal opportunities, which are predominantly found in the informal service industry within or near the low income settlement itself, and
- access to middle to high income residential areas where unskilled, semi-skilled and domestic occupations are in high

Figure 7: Number of work trips made to employment areas

demand. Instead of trying to locate all low-income households near the city centre or near manufacturing locations, a location close to middle and high income neighbourhoods would be far more useful.

The importance of access to informal job opportunities *vis-à-vis* informal ones is closely related to the reality that there are simply not enough formal jobs to employ all economically active people. This was clearly borne out by the data, which revealed that in the eight settlements, on average, more than 50% of the population of employable age were unemployed (Figure 8). Of the 50% employed, about 20% were employed informally or were self-employed and mostly walk to work at a local destination. The other about 30% of the 50% employed, are formally employed but predominantly as unskilled, semi-skilled or domestic workers (Figure 9). In addition, only around 70% of the economically active population travel to work on a daily base. Furthermore, a significant proportion of those formally employed are in occupations not fixed to a single work place.

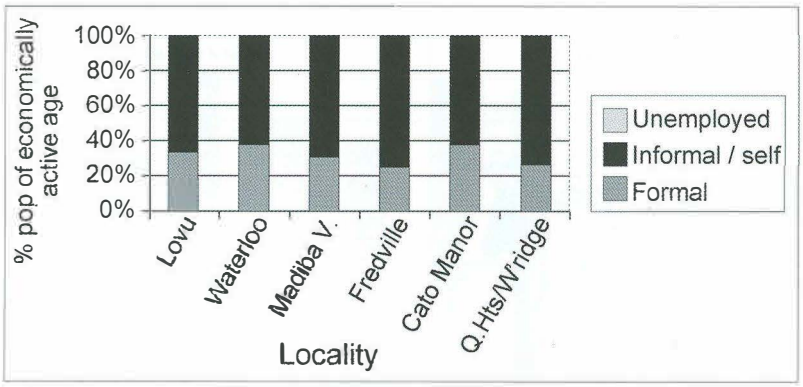

Figure 8: Employment status

3.2 Sustainable livelihood benefit indicators

3.2.1 Overall picture

Taking into account all five forms of capital, all settlements scored relatively the same with an index of between 4.0 and 4.5. The only exception was Madiba, which scored below 4.0, mainly due to low human and financial capital scores (Figure 10). Cato Manor performed the best, scoring well in terms of physical capital and natural capital. Waterloo came a close second due to high levels of financial and human capital, followed by Alexandra. As for the effect of distance on the index, only 19% of the variation in the dependent variable (Sustainable Livelihood Benefits Index) was explained in a regression-analysis by the independent variable (distance to the CBD).

A closer inspection of the score of each settlement reveals that their respective capital type is made up of very different individual capital index scores. So for instance a moderate human capital index does not mean that all the component measures of human capital perform moderately. Some may perform well and others poorly to give an average moderate score.

In some cases settlements scored high on one index relative to other settlements, but low on others. For example, whereas Cato Manor ranks highest overall, it only ranks the highest in physical capital — not in all forms of capital and Waterloo, which ranks the lowest overall actually performs the best in terms of financial capital. Cato Manor scores well above the average in terms of physical capital, close to the average for social and natural capitals, below the average for human capital and above the average for financial. Waterloo scores below the average only for social capital but then comes in at just below Cato Manor in the final score.

These observations imply that people employ different livelihood strategies in different localities, depending on their own circumstances and the locality in which they find themselves, or chose, but that the overall outcome is a similar level of livelihood reached. This overall similarity is however achieved under statistical conditions of the assumption of equal weighting of each of the different capitals .

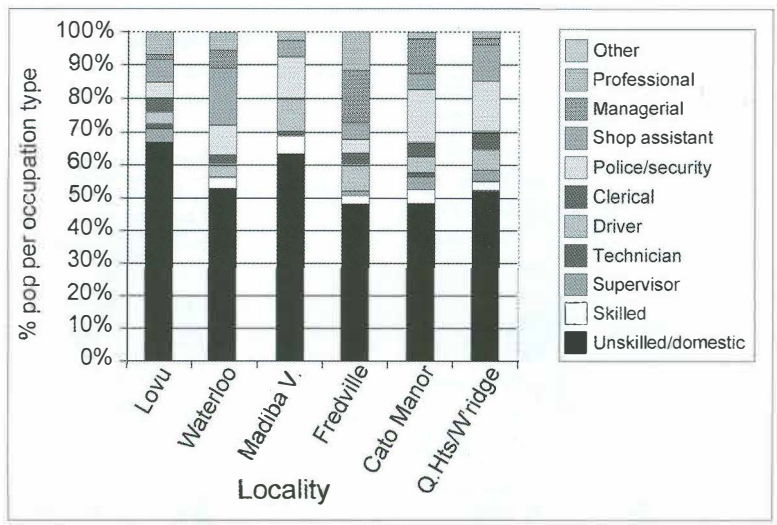

Figure 9: Occupation levels

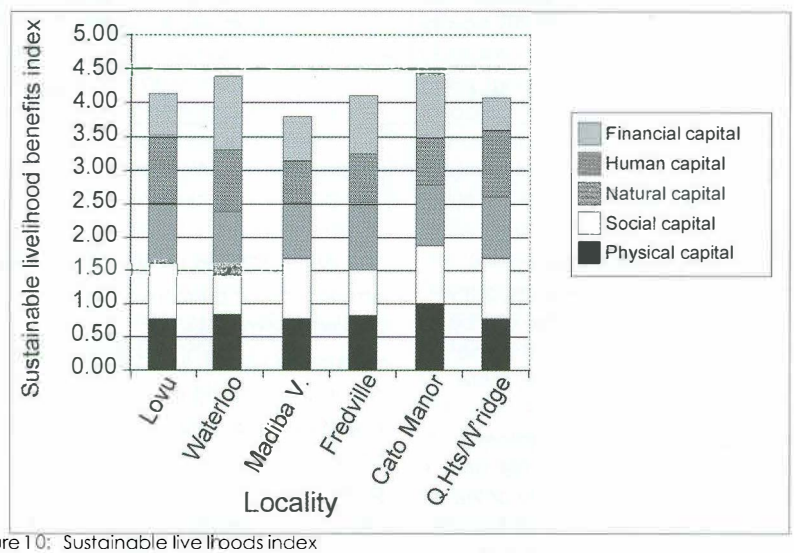

Figure 10: Sustainable livelihoods index

3.2.2 Physical, social and natural capital scores

Figure 11 shows the sustainable livelihoods scores of each locality for physical, social and natural capital, which are arguably the three assets most relevant to the question of locality. In eThekwini, the index is very similar, around 2.5, except for Cato Manor, which scores higher than 2.5 and Waterloo which scores below 2.5. Of note is Diepsloot in this regard,

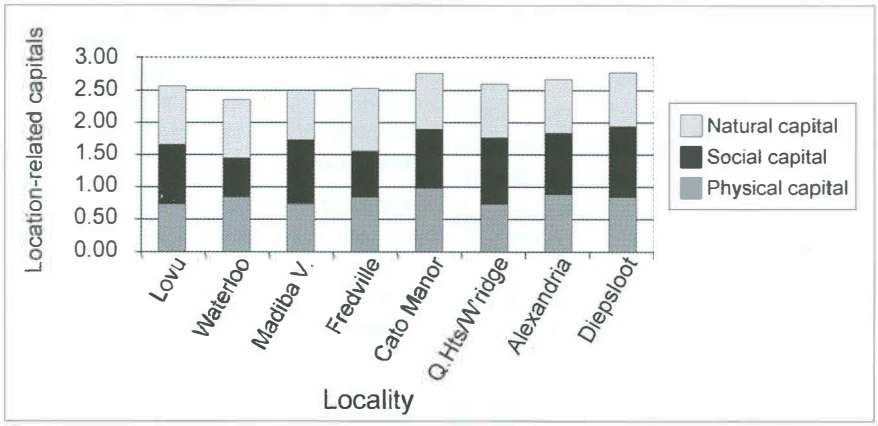

Figure 11: Locality-related capitals

which scores as high as Cato Manor, yet is a peripheral location. In Johannesburg, Diepsloot outscores Alexandra in social and natural capital, but not in physical assets. Alexandra has better infrastructure, but Diepsloot residents are certainly as satisfied with their area and are actually better connected to social networks than Alexandra residents. To someone arriving in Johannesburg with nothing, Diepsloot would offer more in terms of "opportunities to survive" and improved quality of life than Alexandra.

3.2.3 Residents' perceptions

In order to gain an understanding of user perceptions regarding the relative importance of sustainable livelihood capitals, respondents in eThekwini were asked to distribute 20 points amongst ten predetermined assets on the basis of perceived importance. The list of assets was not compiled to ensure an equal spread of questions between capitals, but rather to obtain a broad indication of relative importance. The findings reveal that the greatest proportion of points (16%) was allocated to good quality housing and services (Figure 12). Nearness to friends and relatives rated a close second at 14%. Good health, proximity to schools, clinics and shops and good community leaders, each scored around 10% of the total, while proximity to good jobs surprisingly scored less than 7%, along with access to credit and pensions and land for urban agriculture. The study did not probe the reasons for this scoring, which does provide an interesting area for further research.

Attempts to relate scores obtained in the respective settlements to locality did not paint a conclusive picture, as, despite small internal variations, respondents in all localities exhibit similar trends in rating good housing and services as the most important asset and access to jobs, land for agriculture and credit/pensions as the least important. It was more meaningful to relate characteristics of household, like length of stay, to importance-rating. It is clear that the shorter the period of stay at the same address, the more important community leaders, good health and good education and skills become, although after 2 years, the relative importance of these two latter assets seemed to stabilise and remain fairly constant (Figure 13). Housing and services seems to dramatically increase in importance between years 2 and 5. Access to credit and pensions and to land for urban agriculture seemed to gradually increase in importance with increasing length of stay. Proximity to friends and relatives, schools and clinics and good jobs remained more or less constant with length of stay. The number of responses, of those being at the same address for less than a year, was small and too much emphasis should not be placed on those results. Attempts at relating income level and importance-rating provided only marginal differences, with very little from which to make any solid deductions.

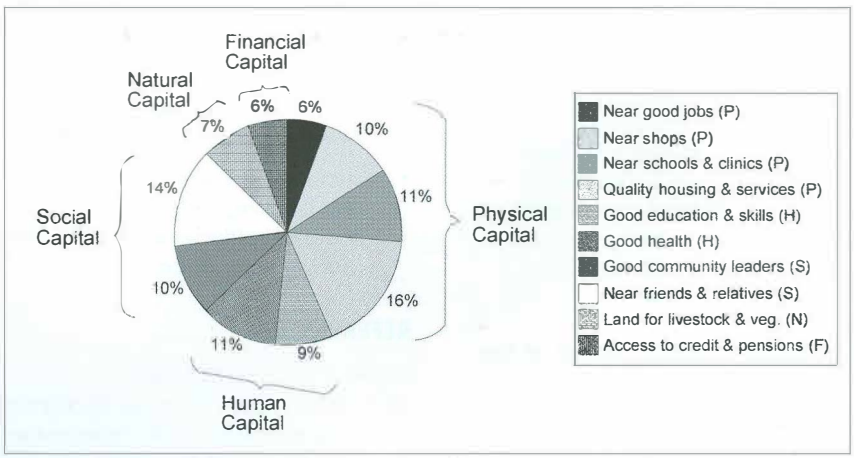

Figure 12: Perceived importance levels

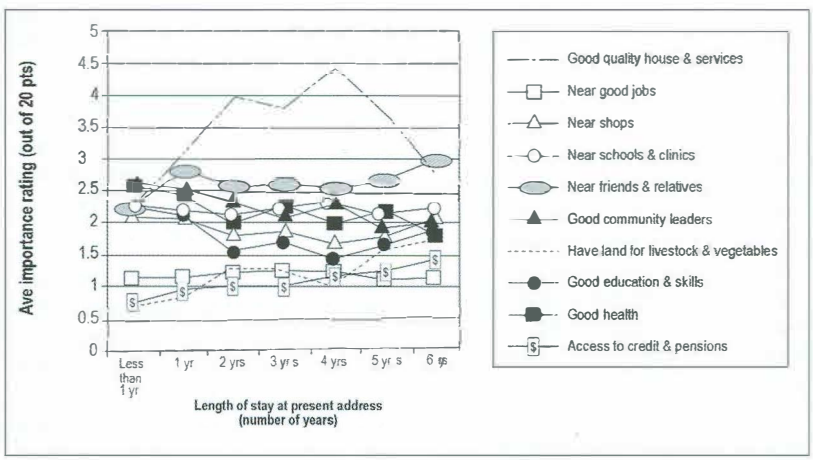

Figure 13: Length of stay and perceived importance levels

4. CONCLUSION

4.1 Central or peripheral?

This study has empirically shown that there are as many cost and benefits for locating low income housing in peripheral localities as for the same housing provided in more central localities. It has been found that conventional notions of what 'central' and 'peripheral' mean, in relation to a single, dominant, formal central business area, is flawed in the context of growing polycentrism, unemployment, domestic employment, informal employment and temporary employment. As such it does, however, ask serious questions about the popular view that central locations are better for low-income households than peripheral ones. It is certainly not clear that more central localities alone will be significantly better for poor households than more peripheral development. What is also clear is that the relationships between cost, benefit and location are far more complex than commonly assumed. One area in which this is glaringly apparent is in "access to work", with the significant share of intra-settlement travel and commuting to middle and high-income neighbourhoods clearly indicating that this is more complex than simply mapping access to the CBD and other major formal employment centres.

4.2 Further development of the model

Even though the sample of 1100 respondents was relatively small in relation to the total population of residents of low-income settlements these findings have significant implications for the local and international agenda on urban form, and as such deserve further investigation. In order to further inform the urban form debate — in particular that relating to the suitable location of low income housing, it is necessary to further improve the techniques of determining and refining the more qualitative macro-indicator of 'benefit', as used in the sustainable livelihood cost-benefit model. Addressing the latter, the model could be refined to include a wider range of indicators of 'benefit' as there clearly is no single type of locality suitable for all types of low income households — there is no 'one size that fits all'. Low income households clearly demonstrate far higher levels of diversity than those peering in from the outside unfortunately often assume.

In the case of further research into the development of the model, a wider range of input-data should be used, especially settlement establishment cost, to ensure incorporation of differentials in land, housing type and density. This will enable far more accurate comparisons to be made regarding development on different parcels of land. This should also assist policy makers in making trade-offs between lower density development on cheaper peripheral land, versus higher density development on more expensive, more centrally located land. In addition to this, environmental economic costs of land-uptake should be more explicitly incorporated. Finally, 'time' should be factored into the model, to enable inter generational cost-calculation, not just in environmental terms, but also in the far more concrete form of maintenance costs. Such research should enable policy makers to better:

- consider and incorporate the question of affordability; and
- include and define the role of the banking sector in low-income settlement establishment and maintenance.

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