YOUTH EXPECTATIONS OF SMART CITY LIVING: AN IMPORTANCE-PERFORMANCE ANALYSIS OF YOUNG RESIDENTS' PERSPECTIVES OF CITY GOVERNMENT

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ABSTRACT

Young people are important to cities, bringing skills and energy and contributing to economic activity. New technologies have led to the idea of a smart city as a framework for city management. Smart cities are developed from the top-down through government programmes, but also from the bottom-up by residents as technologies facilitate participation in developing new forms of city services. Young people are uniquely positioned to contribute to bottom-up smart city projects. Few diagnostic tools exist to guide city authorities on how to prioritise city service provision. A starting point is to understand how the youth value city services. This study surveys young people in Braamfontein, Johannesburg, and conducts an importance-performance analysis to identify which city services are well regarded and where the city should focus efforts and resources. The

results show that Smart city initiatives that would most increase the satisfaction of youths in Braamfontein include wireless connectivity, tools to track public transport and information on city events. These results identify city services that are valued by young people, highlighting services that young people could participate in providing. The importance-performance analysis can assist the city to direct effort and scarce resources effectively.

Keywords: smart city, resident participation, city services, importance-performance analysis, youth empowerment, city governance

INTRODUCTION

Young people are important to cities as they bring energy, fresh ideas and skills that are needed for economic prosperity. Cities compete to attract highly skilled people and to effectively meet their needs (Giffinger et al. 2007; Neirotti et al. 2014), as well as to engage young people in city initiatives with the goal of social inclusion (Carigliu et al. 2011). Where cities have large populations of young people, with declining labour markets, there are concerns for harnessing their energy and providing for them (City of Johannesburg 2013; Statistics South Africa 2014).

The idea of a smart city has emerged in response to the challenges of increasing urbanisation as well as the opportunities of new technologies to address those challenges (Ojo et al. 2014). A smart city can be thought of as a city that makes use of new technologies in the pursuit of goals of economic sustainability and improved quality of life for residents (Hollands 2008; Neirotti et al. 2014). Smart cities typically apply the sensing, data collection and analytical power of information and communication technologies (ICTs) and other technologies to the challenges of managing cities (Giffinger et al. 2007; Hollands 2008; Neirotti et al. 2014), and to provide information-based services to residents (Caragliu et al. 2011; Lee and Lee 2014; Leem and Kim 2013; Neirotti at al. 2014). The possible applications of technologies to the challenges of city living are not fully understood and emerge as people become familiar with the potential of specific technologies and think of new ways to harness them.

Smart city initiatives are implemented by city governments in providing services to residents and by private companies for profit, but they are also initiated by residents (Neirotti et al. 2014). Sensors make the collection of large volumes of real-time data easy and the resulting large datasets are increasingly being made public. Such data, together with cheap devices such as smart phones, allow individuals to conceptualise and develop tools to improve city life (Neirotti at al. 2014; Pinero et al. 2013). Young, technology-savvy people are likely to have new perspectives of the potential of such technologies and can contribute to identifying and evaluating relevant smart city initiatives. This may be especially important in contexts where

access to ICTs is uneven and where information-based services may be underused (Topo and Backhouse 2015).

An important measure of the success of smart city initiatives is the extent to which they meet the needs of residents and improve their quality of life (Allwinkle and Cruickshank 2011; Caragliu et al. 2011; Dohler at al. 2011; Giovannella at al. 2013). Consequently, it is important for city administrators to identify and prioritise those smart city initiatives likely to be most relevant for the types of young city residents that the city hopes to attract and retain, and those that will most effectively address social inclusion. This helps to avoid wasted resources and missed opportunities that may result from implementing initiatives that fail to address relevant needs.

There are few diagnostic tools available to inform priorities and help city planners to understand the relative importance of different smart city opportunities. The objective of this study is to address this need by illustrating how importance-performance analysis (Gustafsson and Johnson 2004, Martilla and James 1977) can be used to elicit young residents' experiences of the city, map their priorities, and determine which smart city initiatives are most important to their satisfaction.

CONCEPTUAL BACKGROUND

For cities to be sustainable, they need to attract and retain skilled people who will contribute to developing the economy (Giffinger et al. 2007; Neirotti et al. 2014), including technology-savvy young people. Youths are often criticised for their lack of civic engagement (Furlong and Cartmel 2012), but they can be powerful agents of social change as they seek out new media for political participation (Bakker and De Vreese 2011). Younger city residents are willing and eager to engage in public affairs and to contribute, share, search for and consume online content; technologies such as social media have been used to increase their civic and political engagement (Bolton et al. 2013). They are future beneficiaries of smart city efforts and are likely to be early adopters of smart city initiatives. We thus consider them an especially relevant subgroup of city residents, deserving attention.

We conceptualise the smart city as having two necessary dimensions. The first dimension reflects a set of city attributes that provide for *digitally connected living*. These attributes include the degree to which residents enjoy access to the necessary software applications, devices, network infrastructure, and e-skills needed to use information-based services within the city (Nam and Pardo 2011; Shin and Kim 2012). The second dimension focuses on smart city initiatives that provide for *informated living* where information is made available to residents that can support decisions and actions in their daily lives (Giffinger et al. 2007; Lee and Lee 2014; Velosa and Tratz-Ryan 2013). Informated living initiatives can influence how residents experience participative governance, economic inclusion, and services for safety and security, health care, transport and entertainment (Giovannella et al. 2013).

The city attributes that provide for digitally connected living are pre-requisites for residents to enjoy the benefits of informated living because people need first to be connected before they can use or contribute to information services (Topo 2016; Topo and Backhouse 2015). This distinction is thus useful in understanding the needs and preferences expressed by young people, particularly in the context of a developing country, and was used to structure our investigation.

CONTEXT OF THE STUDY

The context for our study is the City of Johannesburg in South Africa. Johannesburg is the most populous municipality in South Africa with 4.4 million residents of which 42% are between the ages of 15 and 35 (Statistics South Africa 2014), the range used to define youth in national planning and reporting. Braamfontein is an inner-city district of Johannesburg characterised by high-density residential accommodation, retail and service businesses. It houses the city's municipal headquarters (mayor's office) and serves as a major transportation hub. The area includes a leading public university and several colleges, including the National School of the Arts. As a result, it attracts many young people who have moved to Johannesburg to study or for work opportunities.

Johannesburg has developed an integrated development plan, which defines the city's aspirations to become a smart city (City of Johannesburg 2013). Initiatives underway include broadband rollout, city Wi-Fi, computers in public libraries, an integrated operations centre for safety and security, projects for smart metering, waste reduction, traffic management and public transport, among others. The city has an opportunity to establish its attractiveness among the young and upwardly mobile residents of Braamfontein who are likely to develop high-level skills. Our study presents a useful opportunity to evaluate preliminary outcomes of such efforts, to understand the relative importance of different attributes of a smart city and to prioritise those most important to the satisfaction of young residents.

METHODS

A survey methodology was used and a structured questionnaire instrument developed to elicit responses from young residents. Digitally connected living was examined through seven questionnaire items reflecting the provision of wired and wireless network infrastructure, the use of sensors and mobile devices in the city (Leem and Kim 2013; Neirotti et al. 2014), as well as opportunities to develop e-skills (Lee and Lee 2014). Six service domains – health, safety, habitat and utilities, economic participation, transport, and entertainment and leisure – were identified from the literature as being common to understandings of smart cities. The smart city dimension of informated living was examined through 11 questionnaire items

reflecting these service domains. Items were adapted from Lee and Lee (2014), Leem and Kim (2013), Neirotti et al. (2014), and Caragliu et al. (2011). These items are shown in Table 1. Respondents provided their perceptions of the city's current level of performance in terms of these smart city attributes, from 1 = 'very poor' to 5 = 'very good'.

Our criterion variable, resident satisfaction, is defined as the extent to which a resident's expectations are perceived to have been met by the City (Welch et al. 2005). We reflect this through three items on a 5-point Likert scale. For example, 'I would rather live in Braamfontein than elsewhere / My expectations in life are being met in Braamfontein' ($\alpha = 0.63$).

Data collection took place over a five-day period at randomly selected locations within the Braamfontein district, and at randomly selected time blocks. An intercept method was employed where every fifth person was approached and invited to participate. One hundred and ninety-four (194) responses were collected. However, only data collected from respondents between the ages of 18 and 35 were retained for analysis. Reponses with large amounts of missing data were also discarded. As a result, 162 responses were analysed.

FINDINGS

Seventy per cent of the respondents were between the ages of 18 to 23 years with the remainder between 24 and 35 years old. The majority of respondents (66%) were male. Given our emphasis on youth, and the concentration of educational institutions in Braamfontein, it was not surprising that a large proportion of respondents was studying (77%).

Data analysis involved several procedures. First, to facilitate easier interpretation, the responses were rescaled to a range of 0 to 100. Results suggest that there was generally a low overall level of aggregate satisfaction among the respondents with the satisfaction index at 49.7 (out of 100), with 45% feeling their expectations are not being met by the city (scoring less than 50). A performance index score was then calculated for each attribute (see Table 1). Performance along all 18 attributes was poor with average scores below 50 (out of 100) on each attribute that we evaluated. The lowest performing attributes included access to computers in a public domain, ability to use mobile devices to track public transport, and information on medical services and facilities.

Next, an importance-performance analysis (IPA) (Martilla and James 1977) was carried out. The importance-performance analysis identifies which attributes are highest priorities for intervention based on (a) their relative importance to resident satisfaction, and (b) residents' evaluations of their current performance. This required the use of partial least squares (PLS) structural modelling. The PLS path coefficient linking the latent construct reflecting the 18 smart city attributes to overall satisfaction was significant ($\beta = 0.398$, t = 13.18, $p < 0.001$) with $R^2 = 0.16$.

Attribute importance scores were derived by multiplying the PLS weight for each attribute by the beta coefficient (0.398). The stronger the contribution of an attribute to the latent construct predicting satisfaction, the higher its importance.

Table 1:   Smart city attributes; importance and performance

Attribute	PLS weight	Importance	Performance
Easily accessible information on medical services and facilities within the district	0.0742	0.029606	29.16667
Easily accessible information for engaging emergency medical services	0.0742	0.029606	37.50000
Easily accessible information on district employment opportunities	0.0595	0.023741	40.12346
Easily accessible information about sight-seeing opportunities	0.0852	0.033995	36.26543
Easily accessible information about events that will be hosted in the district	0.1239	0.049436	32.71605
Easily accessible information about the district disaster procedures	0.0571	0.022783	40.27778
Easily accessible information to engage security services within the district	0.0639	0.025496	36.41975
Easily accessible information about how to make the district more eco-friendly	0.0776	0.030962	34.5679
Easily accessible information about how to control pollution in the district	0.0991	0.039541	36.11111
Easily accessible information about forms of public transport available	0.1084	0.043252	38.58025
Easily accessible information on routes and times of public transport services	0.0678	0.027052	36.41975
Tracking inhabitants, movement around the district through mobile devices	0.0719	0.028688	34.10494
Allow smart phones and/or tablets to be used to track district buses	0.089	0.035511	28.85802
Access to high speed internet (e.g. broadband)	0.1108	0.044209	36.26543
Access to WIFI hotspots around the district	0.1034	0.041257	33.95062
Access to computers or tablets in a public space, such as a library	0.0786	0.031361	28.08642
Access to the facilities to train and learn new eSkills	0.0589	0.023501	44.59877
Use of smart cards that facilitate access to a number of district services	0.0616	0.024578	43.67284

The importance and performance data for the attributes were then plotted by mapping the attributes into one of four groups depending on their performance (high/low) and importance (high/low) to respondents (Martilla and James 1977). A mean split was used to distinguish between the high/low categories on each dimension. The results are depicted in Figure 1 below.
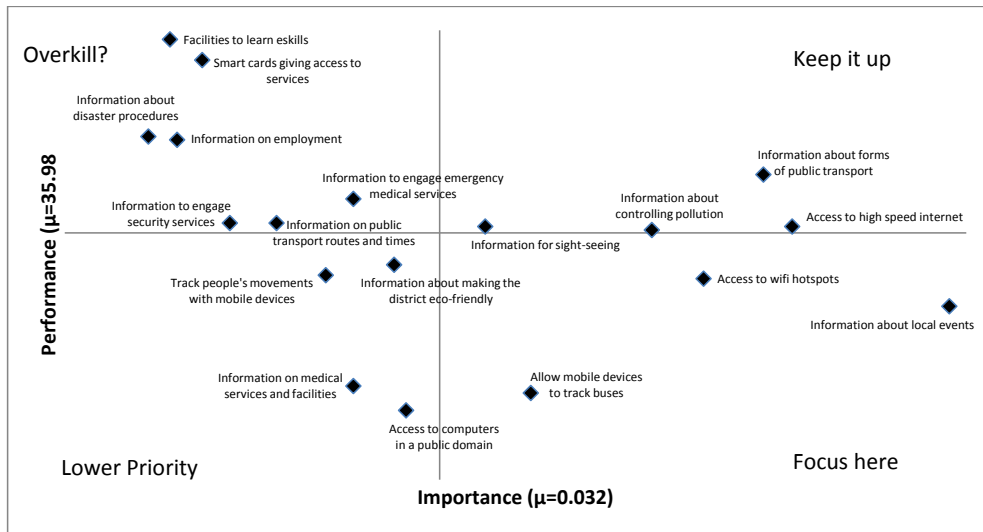

Figure 1:   Importance-performance analysis of smart city attributes

Three attributes were ranked high on the importance scale, but low on the performance scale. These should be high priorities for the city to address as effort expended here is likely to have the greatest impact on the satisfaction of young people. One of these, wireless network hotspots, related to being digitally connected, while two of these, the tracking of public transport and information about events, related to informated living.

A number of other attributes are performing relatively better but efforts are needed to continue to maintain these smart city initiatives. These include the digitally connected attribute of access to high-speed internet, and the informated living attributes of information about controlling pollution and about forms of public transport. Of lower importance are access to computers (digitally connected living), and information on medical services and facilities, information about making city districts more 'green', and tracking inhabitants' movements (informated living).

Given their relatively low contribution to respondents' satisfaction levels, diverting resources to some smart city initiatives may be considered overkill. These include the use of smart cards to access services, and facilities to learn e-skills, both of which would contribute to digitally connected living. Also considered unimportant

are information services around disaster management, employment, security services and information to engage emergency medical services, all examples of informated living services.

DISCUSSION

Evaluations of the performance of a city can influence residents' satisfaction and determine the success of smart city efforts. In an effort to direct city planners' attentions towards interventions aimed at maximising residents' satisfaction from smart city initiatives, we carried out an importance-performance analysis of youth perceptions of their city. We focused on attributes that provide for a digitally connected city as well as on the provision of informated services. By mapping priorities we were able to identify where city planners should focus more attention.

To provide for digitally connected living, planners should focus more efforts on wireless connectivity but they should maintain current efforts focused on their broadband rollout. The city has been rolling out fibre-optic networks as part of the Johannesburg Broadband Network Project launched in 2009. However, further efforts devoted towards smart card projects (such as the Rea Vaya public bus service pay pass) may do little to improve overall satisfaction. To provide for more informated living, planners should continue to provide information about public transport options but static information on routes and on times is less helpful, and planners need to now turn their attention towards software applications that would allow residents to track public transport in real-time on their mobile devices. The provision of information on city events emerged as a high priority for young people. Mobile services with real-time and geo-located information on cultural events, sporting events, educational and entertainment related events, among others, could be important services to improve the quality of life of young residents.

Access to information on employment opportunities appears in the overkill quadrant and is currently less important to young residents' satisfaction in the city. This result seems surprising given the high unemployment rates among young people, but it could be a reflection of the high proportion of respondents who are currently studying and thus perhaps not actively seeking employment. It might also reflect an increasing entrepreneurial orientation where respondents may be more interested to engage in their own businesses or seek out opportunities other than traditional employment.

The youth are interested in a greener environment, and information on pollution control is identified as an important need to address. We were surprised that the item corresponding to making the city more eco-friendly was classified as lower priority. However, this may reflect a desire of youth to move away from awareness of basic services, such as the locations of recycling bins, towards having more dynamic information on air quality and pollution levels within the city made available to

them. Health and safety oriented smart city efforts appear in the overkill quadrant. This may reflect the extent to which engaging emergency and security services are less of an immediate need among youth or that such initiatives may be smart city hygiene factors that are necessary, but not sufficient for promoting satisfaction.

Residents of cities are themselves sensors, collecting important data in the course of their daily activities (Roche and Rajabifard 2012). This means that young residents of cities can themselves contribute to meeting their information needs. Residents contribute data both passively and actively (Roche and Rajabifard 2012). An example of the former is when cell phone location is automatically recorded and can be linked to social network activity. An example of the latter is when individuals rate services or report on their experiences. This means that it may be possible to address the priority needs identified above, for the real-time tracking of public transport and information about events, at least in part, by involving young people as sensors. They could themselves contribute information about events, transport to events and how they rate events. They could also contribute tracking information about public transport either directly by reporting when and where they are waiting for a bus or taxi, or indirectly by allowing this information to be recorded.

Just more than half of the residents of the City of Johannesburg do not have access to the internet (Statistics South Africa 2014). If young people were digitally connected, they could have an empowering role in providing for their own informated living.

CONCLUSION

This article recognised the importance of young people in cities and the potential role they can play in identifying and developing information-based city services. In order to better understand how to involve youth in smart city initiatives, this study examined their priorities and levels of satisfaction with current city services. We illustrated the use of importance-performance analysis as a technique for identifying and mapping priorities. Data were collected from young people in the Braamfontein area of Johannesburg which show that interventions focused on wireless connectivity, anywhere and anytime tracking of public transport, and information on city events were unfulfilled needs important to improving young people's satisfaction with the city.

In a developing world context, where access to information and communication technologies cannot be assumed, we conceptualise a smart city as needing to provide both access to facilitate digitally connected living, and information-based services to facilitate informated living. The results show young people in Braamfontein do not have the easy access to information technologies they need for digitally connected living. The study identified information-based services that young people need for informated living. The priorities identified can help city planners to direct effort and

scarce resources more effectively. In addition, we argue that young people who have access could contribute to the provision of information-based services, making the provision of access the highest priority for cities.

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