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Information and Communication Technology and Urban Transformation in South African Cities

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A thesis submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in fulfilment of the requirements for the degree of Doctor of Philosophy in Town and Regional Planning.

Johannesburg 2010

Declaration

I, Nancy Odendaal, declare that this thesis is my own unaided work. It is being submitted to the Degree of Doctor of Philosophy to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

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(Signature of Candidate)

…….. day of …….., ……
(day) (month) (year)

Abstract

Policy rhetoric and the media portray Information and Communication Technology (ICT) as a means to social and economic empowerment. The ubiquitous presence of mobile telephony and proliferation of digital networks imply a critical role for these technologies in overcoming the tyrannies and constraints of space. Academic literature draws from a range of disciplines but fails to address the significance of new technologies for African-, and South African cities. Debates on technologies and urban spaces reflect a Northern bias and case literature that dwells on the developmental aspects of ICT do not engage with the broader significance with regards to urban change in African cities. This research addresses these gaps by examining the metropolitan and local transformative qualities of ICT in a South African city, Durban.

Three cases were selected. The first examined the city of Durban as place and policy space. Geographic data was used to analyse distribution of technology access. Perusal of policy documentation and newspaper articles together with open-ended interviews informed the analysis of ICT policy and discourse in relation to access. The second case tracked a process by which web sites were developed for 8 community organisations in marginalised places in Durban. This was an action research project where participant observation, interviews and focus groups were methods used to collect data. The third case was concerned with the ways in which technology is used by informal traders active in the city. Photography, interviews and focus groups comprised the methods used in this instance. Actor-network theory was used in all three cases in the analysis of the field work, uncovering material and human actors, network stabilisation processes and agency in determining the transformative potential of ICT at city and local scales.

The distribution of ICT access in Durban was found to follow a spatial trajectory resembling historical patterns of investment and resource distribution. The inclusion of ICT policy on the municipal agenda has deepened the complexity of the local governance terrain. Digital Durban may be promoted as developmental but its transformative qualities are limited; its goals are aligned with the needs and agendas of a broad range of actors, not necessarily in support of inclusion. Network relations are determined by aligned strategic agendas as actors are enrolled into the actor-network through translation. A failed web development process showed that translation processes are core to stabilising network relations. Work with informal traders indicated that appropriation of technology is informed by livelihood strategies.

Innovation is enabled when translation extends to appropriation. More in-depth research is needed on how technology is moulded and appropriated to suit livelihoods. Throughout the research the spatial dimensions of the relationship between ICT and networks were considered. The network spaces that emerge from actor relations do not correspond with the physical spaces usually considered in policy. Future work on these contradictions is necessary in order to provide insights into how more meaningful public intervention can be enabled; the true spaces of transformation.

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Acronyms

Area Based Management (ABM)
Automatic Teller Machines (ATMs)
Central Business District (CBD)
Chief Executive Officer (CEO)
Community Based Organisation (CBO)
Common Market for Eastern and Southern Africa (COMESA)
Democratic Republic of Congo (DRC)
Durban University of Technology (DUT)
Eastern African Submarine Cable System (EASSy)
Enumerator Area (EA)
Foreign Direct Investment (FDI)
Fédération Internationale de Football Association (FIFA)
Geographic Information Systems (GIS)
Human-Computer-Interface (HCD)
Human Science Research Council (HSRC)
Inanda-Ntuzuma-KwaMashu (INK)
Informal Trade and Small Business Opportunities (ITSBO)
Information and Communication Technology (ICT)
ICT for Development (ICT4D)
Inner Thekwini Regeneration and Urban Management Programme (iTrump)
Integrated Development Plan (IDP)
Internet Service Provider (ISP)
International Telecommunications Union (ITU)
KwaZulu-Natal (KZN)
Local Economic Development (LED)
Multi-point Distribution System (MMDS)
Multi Purpose Community Centre (MPCC)
National Integrated Programme (NIP)
New Partnership for African Development (NEPAD)
Non-governmental Organization (NGO)
Performance Management System (PMS)
Personal Computer (PC)
Science and Technology Studies (STS)
Self Employed Workers Union (SEWU)
Short Message Service (SMS)
Spatial Development Framework (SDF)
Spatial Development Plan (SDP)
South African Cities Network (SACN)
South Durban Environmental Alliance (SEDCE)
Southern African Development Community (SADC)
Southern Basin (SB)
Statistics South Africa (STATSSA)
Structural Adjustment Programmes (SAP)
Tongaat Hullett Group (THG)
United Nations Economic Commission for Africa (UN)
Universal Service Agency (USA)
Voice over Internet Protocol (VOIP) Voice over Internet Protocol (VOIP)
Women in Informal Employment: Globalizing and Organizing (WIEGO)
World Wide Web (www)

1 Introduction

Plato defined the limits of the size of a city as the number of people who could hear the voice of a single orator: today those limits do not define a city but a civilization. (Mumford 1976: 329).

In 1976, when Lewis Mumford's autobiography was published, cross border communication was enabled by a faltering postal service, transnational phone calls were considered a luxury, radio was ubiquitous but television access was patchy; the only virtual universe that existed was in Marshall McLuhan's prose. More than three decades later, an obituary of Mumford, published in the New Yorker in 1990, appears on a computer screen in Cape Town, at the touch of a button. The onscreen pages have a lifelike quality, a slight scratching can be heard as the Burberry advertisement disappears and an irreverent cartoon mocking the East Coast elite emerges.

In South Africa, 1976 was the year that the struggle against Apartheid entered the global imagination when television screens across the globe documented the Soweto uprising. In this same year television was introduced in the country; an ironic coincidence since its availability was delayed by fears that exposure to a global media would unsettle the masses despite the widespread and ubiquitous presence of radio. The power of communication media was realised in the many campaigns that underpinned the late struggle against Apartheid. Many of these battles were fought in and around cities. Media images projecting toy-toying crowds in inner city streets, barricades at the entrance to townships and police battles with angry demonstrators became part of the global imagination.

In May 2008, post-apartheid South Africa experienced a violent scourge of xenophobic violence which left 62 people dead and many more injured. In brief, competition for resources coupled with outright bigotry saw immigrants from other African countries become the scapegoats for some. Focus group interviews, conducted as part of this research the following month with nationals mainly from the Democratic Republic of Congo (DRC), revealed that the use of mobile phones during the xenophobia was critical in averting danger. Text messages sent, received and forwarded by 'networked members' warned of places to avoid, advised on how to dress, recommended how best to behave and advocated how to avoid unwarranted attention from aggressive South African nationals. In short, technology was deployed to render the visible invisible, and a collective infrastructure was used to protect selected personal boundaries.

The world is fundamentally changed because of the relentless pace and nature of Information and Communication Technology (ICT) advances. The digital orator (to use the metaphor of Lewis Mumford) has indeed become the symbol of our 21st Century civilisation. ICT has enabled the transcendence of spatial boundaries and a deepening of trans-national and trans-continental networks. Since the mid-1970s, economies have restructured while computers and mobile phones have become ubiquitous.

Despite these developments, so much that is familiar remains: urban poverty, social inequalities and increasing marginalisation. Transformation remains selective: then and now. It appears that the "… new era will still contain many echoes of the old. In other words,

business will go on, but never as usual – because it never has" (Thrift 1996: 1488).

The overall aim of this research was to gain insights into firstly, the transcending power of information and communication technology (ICT), and secondly into its limitations. The scope of this research was informed by a cross-disciplinary approach, and emerged out of an absence of critical themes in a literature drawn from urban studies, planning, sociology and information science. Following a rigorous consideration of a range of different debates, 'blind-spots' in academic writing to date around the relationship between urbanity and ICT in South African cities, were identified. These in turn informed the questions that framed an exploration of the qualitative domain of technology appropriation that is the crux of the work contained in this thesis.

The Research Problem

ICT and cities are connected and mutually supportive of one another (Graham 2002: 33). New technology enables spatial transcendence but also promotes physical proximity. But do cities look and function differently in this digital age? Structural analyses reveal the roles of cities in global circuits of capital (Castells 2000b; Castells 2004), identifiable with late capitalism (Harvey 1989). The deepening of globalisation with its concomitant economic relations and labour migration has led to the dominance of certain cities in world networks, processes related to the diffusion of ICT (Sassen 1994; Castells 2000a; Castells 2000b; Sassen 2002; Castells 2004). However, these discourses overlook the specifics of the local, the individual connections to the global; the domestic circuits. Following Amin and Thrift (1995) and Robinson (2006), perhaps all cities are ordinary?

Comprehensive work on the internal dynamics between cities and ICT exists but little of it has taken place in Africa. The question, "how do the multifaceted realities of city regions interrelate in practice with new technologies in different ways in different places?" (2004: 4) is posed by Graham in the introduction to the Cybercities Reader. This is an impressive text, as are the others that explore ICT and cities. There is an undeniable rigour to Splintering Urbanism (2002), William Mitchell's reflections on urban space and ICT, Cities of Bits (1996), the relationship between the urban self and cyberspace (2003) and utopian concepts (2000). Yet this impressive body of literature is dominated by the North. Few attempts have been made to engage with the African 'digital' city, and in particular, the South African city and its relationship to technology.

The influences that have contributed to the evolution of South African cities are layered and are manifested in different spatial guises. A common general assumption is that the effects of ICT including the mobility afforded through cell phones are positive. Yet in the South African context, where fragmented urban landscapes and apartheid-generated population distribution patterns persist, the potential for ICT to enable inclusion and integration is largely unexplored. The overall spatial distributional impacts of ICT in South African cities have not been documented; nor have local-level dynamics and their impact on place.

Technology appropriation in the African context is predominantly engaged in development studies and information science (IS). ICT for Development (ICT4D) is a thematic body of literature that emphasises the developmental potential of ICT in the southern context. The modernist parameters of ICT4D are unmistakable whilst the parallels with early modernisation theory can also be discerned (Schech 2002). More recent work is critical of the assumptions embedded in ICT promotion in the south. There is need for

interrogation of the day-to-day livelihood creations of households and individuals. Case research in IS examines instances of technology use and management, but typically fails to engage broader socio-economic factors.

The 'digital divide' is a well known theme in conversations about the transformative quality of technology as a driver of modernism. Studies of digital divides have matured from an early focus on physical and educational barriers to a more nuanced understanding of socio-cultural dynamics and demographic determinants (Crang and Graham 2006). That both agency and power dynamics underpin ICT availability is also known. However, considering these dynamics in the South African context, given income disparities and social inequalities, brings into sharper relief the tensions inherent in the distribution and optimisation of infrastructure. While the empowering potentials of ICT have certainly been explored, with India's software industry often cited as an example, little is published on the nature of these empowerment opportunities or on why they are not distributed evenly.

These gaps in the literature relate to trajectories of infrastructural investment in South African metropolitan spaces and are addressed in this research. More importantly, there is a conceptual frame that is missing – a frame considering the urban technology dynamic and how it stretches beyond material manifestation in space. Underlying the interaction between the inanimate and the urban are institutions, social arrangements and relations that delineate the dimensions of technologically mediated urban experiences. The city is not just the sum of the physical elements that make up its neighbourhoods, public places and streets. Rather, it is a layered representation of the aspirations, interventions and negotiations of individuals and groups.

Understanding the 'different ways and different places' of the urban-technology interface required an engagement with context. The broad intention of this thesis was to construct a relational lens that considered overall changes as well as small transformations that guide survival. This necessitated an understanding of technology appropriation and innovation. The process was spatially loose and followed a number of networks to unexpected places, physical and virtual. As a result, it engaged with power, that which constrains and that which transforms. Stories were captured, all informed by the research questions outlined below.

Research Questions

The City of Durban is located in the province of KwaZulu-Natal on South Africa's east coast and provides an opportunity to interact with and understand a multicultural African metropolis. Some 3.5 million people live in the metropolis (eThekwini)[1], where economic disparities are reflected in a high Gini coefficient (0,60) and settlement typologies range from informal settlements to high-income, gated estates (eThekwini Municipality 2008).

The policies that guide the city's transition, the economic relationships that determine its functioning and the spatial manifestations of investment in infrastructure are documented, but the effects of ICT are unexplored.

In an endeavour to understand the relationship between South African cities and ICT, the

1 The city of Durban is located in the eThekwini metropolitan area, defined by post-Apartheid demarcation. The local government entity that manages it is the eThekwini metropolitan council.

primary research question was: *Does technology enable urban transformation in Durban?*

Durban is Africa's premier port city. It has a strong manufacturing base linked mainly to its port operations, and its economy previously relied heavily on the clothing and footwear industry. It has always been a popular tourist destination particularly to the domestic market. With some 30 to 40 percent of the population without formal jobs (Ibid.), the contraction of this sector and the subsequent overhaul of the regional economy, saw further job losses. The city had to reinvent itself and focused on developing and accommodating its service sector. Much of this growth is evident along Durban's northern corridor where extensive investment by public agencies (local government investments in infrastructure and roads) and by semi-private and private companies (in telecommunications, land release and the development of a new international airport) has taken place.

No primary research on the distribution of infrastructure for telecommunications had been done in Durban. Indications are that ICT availability and access are affected by affordability, spatial proximity to new economic hubs (such as Durban's northern corridor) and by income. Metropolitan local government (eThekwini Municipality) deems ICT access an important developmental mandate. In fact, enhancing Durban's status as a 'smart city' is an integral part of the development strategy, according to the 2008/2009 Integrated Development Plan (IDP). ICT access however, does not just constitute the physical manifestations of fibre optic, mobile phones and computers. It is also informed by actor energies and different agency interests.

It is these dynamics in the City of Durban that this research uncovered by answering the following subsidiary research question: *Who are the actors that play a role in ICT in Durban and what are the relationships between them?*

Interrogation on a smaller scale examined local level barriers to ICT access. An engagement with peripheral areas showed how marginalised groups use technology to access information and resources. In more recent literature on African cities and spaces, the emphasis on associational life points to how the economically marginalised reinforce their livelihoods, build social capital and negotiate their way around the city. Physical access as well as social infrastructure needed to be considered, and the less overt dimensions of technology access and appropriation understood. Networks are indeed crucial vehicles in overcoming the spatial limitations of cities.

A further research question was: *How are digital technologies used to reinforce social infrastructure and networks employed by the marginalised in Durban?*

ICT in this research was defined as computers and mobile phones and by extension, the use of computers to access Internet and e-mail and the use of cell phones to make phone calls and send text messages. Infrastructural elements that enable access to ICT such as cabling and wireless technology, digital hubs, tele-centres, Internet cafes and phone shops were all included in this definition.

Research Design

This research engaged at two levels: the metropolitan and the local with policy making understood in tandem with insights into real experiences at the margins. From a hard infrastructural perspective, the extent to which fragmented urban forms are encouraged through ICT ownership patterns were examined, as were the ways in which physical

constraints are transcended by technology access. Yet this is a limited representation as it presupposes a division of distinctive features that appear to operate in isolation from one another. It is also too modernistic and conceptually too basic. A quantitative overview was therefore supplemented by an investigation into those agency interests that drive ICT implementation and the policy discourses that inform them.

Thus, in Chapter 6 metropolitan Durban was examined as a case, a place. Understanding the transformative qualities of new technologies within the context of a South African city required more than the quantification of access; an element of this research provided the metropolitan context to the City of Durban's ICT policy and associated programmes.

There is a tension between policy and actual distribution of access. The respective roles of the City of Durban's ICT policy and of the actors that drive it were interrogated in this research by examining the City's ICT policy as part of a network of actors. This actor-network is effectively a heterogeneous web of human and material actors enrolled for a particular purpose, in this case, ensuring Durban's status as a smart city. During this research, actor-network theory (ANT) was used to gain insight into the motivations, operations and agendas that are embedded in Durban's ICT policy. It was used to understand the transformative qualities of technology in Durban in terms of the physical manifestations and the less overt networked space, the topological spaces that are contingent upon the agency of actor-networks (Murdoch 2006).

What then happens when technology is introduced into social networks? How are mobile phones and computers currently used in associational webs? Does technology transform? Two additional cases in Durban were investigated to explore these questions. One entailed examining the process of introducing technology into networks, a process whereby websites designed for community-based organisations were tracked and analysed. This took place over two years (2006 and 2007), a line of enquiry which revealed the interfaces between community networking, the Internet and computer technology, documented in Chapter 7. The second case examined one particular network and how technology was embedded in it, and looked specifically at a marginalised grouping of informal street traders. Through focus groups, photography and interviews, the extent to which mobile phones were used for information exchange and networking, as well as the extent to which ICT was used for advocacy, was probed in Chapter 8. Both cases were researched, documented and analysed to determine the functioning of networks and the role of technologies in these networks.

This research involved an approach that revealed the intricacies and complexities of urban life. Quantitative data was used to provide context and background but the enquiry itself relied mainly on a qualitative method. Layered descriptions of phenomena combined with theoretical understanding revealed a textured meaning, enabled through the use of ANT.

Chapter Outline

Following Chapter 1 as the introduction, Chapter 2 of this thesis is an overview of the relationship between technology and society. Its intention is to provide an inter-disciplinary background and point out the milestones in history around this discourse and the trajectory of different debates. Importantly, the underlying themes that apply to this research in an urban setting are uncovered in Chapter 2.

Chapter 3 focuses specifically on the literature that has been written on ICT and cities.

Debates on South African cities are included here to reveal their contextual specifics and to explore the entry points into the relationship between ICT and South African cities. However, these entry points needed a conceptual foundation. Chapter 4 thus discusses ANT, the elements of which provide the conceptual markers for the remainder of this document i.e. the research.

The frame for the field work is explained in Chapter 5 as the research methodology chapter. Chapters 6 to 8 contain the findings of the field work. Chapter 6 focuses on metropolitan Durban, on the distribution of ICT access and on the City's smart city strategy. Chapters 7 and 8 describe the findings of the qualitative research that was conducted at the local level in the web development process and amongst informal traders.

Chapter 9 is an analysis of the findings of Chapters 6 to 8 and includes the key conclusions that are derived from this analysis. The conclusions point firstly, to how technology, urban life and city spaces are intertwined, and secondly, to how webs of relations are established through technologies that are socially co-constructed, through embedded power relations and urban life that is continuously updated. Techno-social relations in space constitute and impact on how people move and live in urban environments. This theme was explored in the face of technologically determinist notions that advocate either the power of ICT in fundamentally changing the way people behave in urban contexts or the enforcement of high technology solutions as the panacea for all society's ills. There are impacts, yes, but this research shows that technology is not value-free. To think of ICT as being separate from urban life is to fall into a modernist daze that ignores the intricacies and complexities of real urban life in the African context.

2 Society and Technology

No one can escape the transforming fire of machines. Technology, which once progressed at the periphery of culture, now engulfs our minds as well as our lives. Is it any wonder that technology triggers such intense fascination, fear and rage? One by one, each of the things that we care about in life is touched by science and then altered. Human expression, thought, communication, and even human life has been infiltrated by high technology... (Kelly, 1998 in Preston 2001)

Philosophical musings on technology date back to the mid 1800s when the term 'Philosophie der Technik' was first coined in 1877 (Strijbos 2003). The relationship between technology and society was seen as puzzling, dynamic and iterative. Technological progress was closely associated with the Enlightenment project. Modernist aspirations towards insightful progress culminated in the early 20th Century, permeating sociological, philosophical, artistic and architectural considerations of technological innovation.

Some were suspicious of its power however. Mumford's Myth of the Machine series of books and articles is circumspect: machine development accompanies a change in thinking about the world, one that is not without contradictions (Mumford 1973). Mechanisation has improved efficiency and increased production. but the social costs require attention: "…the drudgery and routine remain, only a smaller and smaller part of society participates in it" (Mumford 1973: 231).

Mumford's work is analytically sophisticated. Machine and social organisation are treated as part of an overall dynamic. Machines are imbued with meaning. They do not sit outside societal structures or human experience. Positivist influences later separated human experience from the objectified machine in the name of science; the relational understanding implicit in Mumford's work, re-emerged later under the banner of 'sociology of science' in the latter half of the 20th Century.

Sociologists Bloor and Barnes interrogated the complex processes of debate, consensus and alliances between scientists that ultimately influence scientific analyses (Dear 1995). This enabled a deeper understanding of scientific communities, the epistemologies and ontology that inform their work as well as the impact of contextual factors. Science and Technology Studies (STS) developed as an interdisciplinary field exploring the reciprocal relationships between science, technology and society. Actor-network theory, pioneered by Latour and Callon were inspired by philosopher of science Michael Serres in probing the operations of socio-scientific networks in the construction of knowledge (Law 2007)., Constructivist studies of technology evolved in the 1990s from the premise that: "There are no definitive 'things' without concomitant judgments of people to establish those things" (Dear 1995: 161).

The range of approaches to understanding the 'socio-technical landscape' engages with a complex mix of processes involving heterogeneous agents. The dynamic between social change and technology reveals a concern with the human/technology interface and its

impact on political, economic and cultural systems. The aim of this chapter is to present an overview in this regard drawing from sociology, information science, urban studies, human and cultural geography as well as communication studies. It provides a contextual understanding and broad chronological account.. Technological 'markers' in recent history are noted. Characteristics specific to ICT are gleaned as a conclusion to the first part of this chapter. The second part focuses specifically on Africa and South Africa. Separating this from the historical overview is intentional. The dearth of literature on infrastructural development prior to decolonisation and the focus of this research on South African urban areas necessitate an engagement with the developmental dimensions of technology.

The chapter concludes with conceptual themes that emerge from both parts. One of these themes refers to the dominance of the urban which is explored in detail in Chapter 3.

2.1 Transcending Space with Technology: An Overview of Innovation

> *Steam was the first olive branch of science…. followed by this wonderful electrical telegraph, which enables any man to be within reach of a wire to communicate instantaneously with his fellow men all over the world. (Standage cited in Mosco 2004)*

Insight into the geographic dimensions of mass communication commenced with rail (Behringer 2006). Rapid movement through space enabled efficient transportation of goods, services and carriers of information. Some argue that the development of the first postal services in the first decade of the 16th Century heralded the symbolic beginnings of modernism. "The Communications Revolution did more than any other change to replace a world of the miraculous with a world of the measurable." (Behringer 2006: 372)

Telegraphy signified the moment when physical movement was no longer a requirement for information transmission. The telephone facilitated immediacy and brought the communications revolution into people's homes and work places. Media innovation in television and video together with advances in cybernetics research and telecommunications innovation provided the seeds for another revolution; a profound change in economic organisation that was concomitant with advances in how information is transferred and processed. Increased mobility became a dominant feature of these innovations, resulting in reorganised production processes and distribution networks.

Technological advancement and spatial imagination share an intimate historical relationship. In the late 1860s the transatlantic telegraph was hailed as the means whereby distance could be traversed. Commercial telegraphy became active in South Africa in the mid-1960s also (Cogburn 1998). Media awe is expressed in a statement in the New York Evening Post (in the 1920s) that extension of telegraph lines across the seas would "make the great heart of humanity beat with a single pulse" (in Mosco 2004: 120). This milestone was achieved a decade later when telegraphic communications between Europe and North America were enabled. Further innovations included the fitting of a telegraph in an automobile in New York in 1905. The telegraph was seen as a means whereby the alienation of industrial society could be overcome, bringing people from different creeds in different locations together (Mosco 2004).

The progression from telegraph to telephone, to wireless telegraph and digital television indicates a gradual minimisation of the constraints of space and increasing immediacy in communication. Mumford predicted that the outcome would be a widened range of interaction, increases in contacts and a resultant increase in pressures to communicate

and interact (1973). His concern was that reflective thinking best accommodated through writing and reading would be weakened by technologically enabled media. The concern with lifestyle changes, with the disruption of social behaviour and sense of community are themes that resonate. Whilst the telegraph was considered a means to build cross-country solidarity, it was also viewed with suspicion.

Despite dystopian leanings, the public imagination was captured by the symbols of achievement represented by this and other inventions. Electricity (that enabled the telegraph) was celebrated at World Fairs and in the media from the late 1800s onwards. Visual imagery was captured by the magically illuminated cityscapes created, not entirely different from when William Gibson first announced in Neuromancer that: cyberspace looks like Los Angeles seen at night from 5000 feet in the air (2000). Electricity, the light it created, became a metaphor for progress, embedded in a Darwinian notion of technical superiority displayed by 'more advanced' cultures (Mosco 2004).

> *If the telegraph's lightning wires made it the Victorian Internet, then the telephone's pairs of twisted copper made it the Internet of the Gilded Age and the Roaring Twenties. (Mosco 2004: 126).*

The telephone became a technological and social icon of the early 20th Century. The history of the telephone represents an interesting array of social dynamics and perceptions. It was used as a broadcast medium initially; a carrier of point-to-point messages to individuals, but also a medium of multiple address at concerts, political campaigns and other public events (Lasen 2005: 15). It was not intended as a medium for the masses. Women and people of colour were dismissed as technically incompetent. These perceptions and prejudices regarding social groups were represented in the marketing and distribution of the telephone (Ibid.). Pioneering telephone men were seen to be part of the new technologically adept elite. Telephone use was subsequently seen as an element of social distinction. Those in control of the technology were opposed to mass dissemination, revealing a pervasive 'cognitive imperialism' (Lasen 2005: 19).

Different contexts impacted on the way the telephone was appropriated and marketed. Private ownership of telephone services in the United States was encouraged from inception and distributed in accordance with target markets and perceived trends. In France, the telephone became a public commodity at an early stage where public administrative and military uses were prioritised. In the United Kingdom, the phone was viewed as a threat to the telegraph system in which the government had invested.

The telegraph was considered an essential means of enabling communication between Britain and its imperial subjects. The telephone was viewed as useful only in cities, in businesses and industry. (Lasen 2005) The distribution of this technology in colonial Africa is undocumented. Presumably it followed the path of transportation networks: serving Empire through clustering in urban and administrative centres. Telegraphic transmission continued into telex mode as automatic encoding allowed for data transmission between business sites. This method of data transmission was most commonly used in developing countries before the gradual growth of telephony (Belrose 1995).

In studies that examine the social impact of the telephone in the late 1970s, the transcendence of space, enabled through communication networks is raised as a possible alternative to urban conglomeration (Gottmann 1977). This ambivalence with urban growth is displayed in the following:

As telecommunications improve, could the massive and dense concentration in large urban centres, and the nuisances this concentration entails, be done away with and replaced by a scattered habitat held together by networks of wires and waves? (Gottmann 1977: 303)

The physical impact of the telephone was identifiable in what Gottman (1977) terms new concentrations of transactional centres, whilst also enabling sprawl through decentralisation. He refers to the following spatial patterns: higher intensity of communications between spaces focused on transactional activities, greater flow between cities of similar specialisation, separation between office and other stages of business, congregations and specialisations. The telephone was seen to contribute to larger metropolitan systems with more diversified and complex structures. Spatial trends were not necessarily caused by the telephone, but it facilitated and perpetuated dispersed settlement. Nationwide metropolitan impacts became more pronounced as regional economic specialisations and networks between centres were enabled (Abler 1977).

The telephone's early broadcasting role was superseded by radio. The telegraph enabled messages to be transmitted free of temporal and geographic constraints. It depended on insulating wiring that was expensive to install and easy to damage however (Garratt 1994). Early developments in electromagnetic theory culminated in electromagnetic waves harnessed as voice carriers, starting with the spark technology that enabled morse code in the late 1800s (the consensus is that this work was lead by British industrialist Marconi) to development of continuous wave transmission required for voice transmission (by US/Canadian scientist Fessenden) (Ibid.) Electromagnetic theory, the invention of wireless signalling by radio, and the development of antennas needed to transmit and receive the signals culminated in radio broadcasting being available to the masses. The first radio stations emerged in Europe and North America in the early 1920s; many African countries adopted this medium in the late 1920s to 1930s. The adoption of radio in the early 20th Century was profound given the two World Wars that followed. Radio broadcasts enabled immediate information dissemination and debate, seen as a means whereby democracy could be enabled (or propaganda spread).

There was something about radio waves and their impervious mobility across social boundaries that served as an ideal symbol for national togetherness. (Hilmes and Loviglio 2002: xi)

General broadcast television became available in the 1930s in North America and Europe. As a communication medium, it essentially hit the ground running, using the industrial structure, textual forms and audience formations created by radio to establish markets (Hilmes 2002). Whilst advertisers and broadcasters optimised the commercial capacity of this medium, radio persisted as a medium for those on the margins of mainstream advertising revenues. Wang (2002) considers the social stratification employed by market players in determining content and forecasting advertising revenue in response to the 'radio-active housewife' phenomenon (radio persisted as an important information and entertainment medium for housewives despite television access).

As expressed in early industry discourse, sponsors, advertising agencies, and broadcasters used gender and class, among other social axes, to differentiate the two media; radio became the site for commercial female programming targeted at a lower – to middle-class serial listener, and nighttime television became the place for prestige, quality programming aimed at a family audience. (Wang 2002: 349)

Television technology is subject to innovation in hardware and electronic transmission. Sets have become more streamlined, cheaper and portable and transmission becoming wireless. Early terrestrial broadcasting was in high frequency with coverage limited to major cities. Innovations in microwave that enable multi-point distribution (MMDS) have become more ubiquitous in developing contexts in particular. The range is limited but repeater stations are cheap and easy to install.

Recent growth in satellite television is enabling international content to be accessible to the globe. This exposure tends to be one-sided however. Concomitant with market liberalisation, the introduction of news content in particular remains contested as some argue against the colonisation of minds by multinational media conglomerates (Paterson 1998). Reception of international television is expensive and available only to upper income groups in the Africa context. Transmission of news data to international agencies is limited by few options for extending signals to international satellite. Hence news content is often skewed with limited coverage of local events.

The simultaneous appropriation of the telephone, cinema and recorded music is seen as the first multi-media technical revolution (Preston 2001). The distribution and increasing availability of electricity led to simultaneous excitement. A second revolution followed in the 1960s and 70s with cable promising to be a medium for mass communication. The term 'wired nation' was first coined in the book "The Wired Nation – Cable TV: The Electronic Communication Highway" by Smith in 1972 (Mosco 2004). Traditional cable television, expensive due to the need for physical reticulated infrastructure and economic capital has not met uptake expectations as initially predicted (Paterson 1998).

Radio and television are adept at catering for different demographic cohorts and interest groups. The interface between technology capacity, availability and market segmentation is reflected in what is available to whom and with how much ease. How technology best fits livelihoods and lifestyles is dependent on its malleability as information medium and communication transmitter in particular social and cultural contexts. Cost and flexibility are important considerations.

Since the 1980s, the progression from analog to microprocessor-enabled digital technology revolutionised information storage and transmission. Computers became accessible to the public, automatic teller machines (ATMs) dispensed money and businesses built networks to process information and facilitate communication. The World Wide Web (www) migrated from the military to universities and research institutions, then ultimately to the public in the 1990s. The Internet has increasingly taken on the role as information provider whilst allowing for a more interactive model. The following section broadly traces the history of the Internet.

2.1.1 The Internet

Thomas and Wyatt (1999) outline four stages of Internet development. The first entailed development of wide-area computer networks by computer scientists in the 1970s; the first message sent across a computer network was documented in 1969 (Zittrain 2006). Thomas and Wyatt (1999) describe this as the 'test bed' phase, followed by the formation of an 'Internet community' in the early 1980s: 'Usenet' newsgroups connecting computers scientists and associated experts were formed. Internet access was broadened to the academic community in the late 1980s to early 1990s, with commercial expansion following shortly thereafter in the mid – 1990s (Ibid.). Its rapid development has led some

commentators to speak of Internet years, shorter than actual years containing innovations that would normally develop over longer periods of time. Information services could be provided in multiple formats and transmitted in real time; these qualities led to the notion of the information revolution.

How these new media interfaced with society and culture became the subject of considerable interdisciplinary debate. Preston (2001) argues that Information and Communication Technology (ICT) debates reflect a renewed intensity in social and cultural discourses. They differ from past technological debates in two ways: the extent to which technology matters dominate contemporary public discourses, and the second refers to the profound assumptions that dominate views on the impact of ICT on social change (Preston 2001:3). Numerous terms associated with digital technologies have become part of our techno-socio vocabulary.

The term 'information society' was first used in management science in the United States in 1962 when it posited computer-mediated mathematical techniques to replace mid-level managers (Kline 2006). The concept 'information technology' emerged in academic and policy debates in the early 1980s at the time that personal computers (PCs) became available in the workplace and in private homes. Associated with that was the development of microelectronics and in particular rapid innovation in the development of the microchip (becoming smaller yet more powerful) (Preston, 2001). The notion of information technology evolved with the development of microprocessors, cable television, fax machines, computer networking and satellite communication in the 1970s and 1980s. Its social relevance became an interest of sociologists and philosophers that considered technology an agent of social change (Kline 2006).

From the mid-1980s the term Information and Communication Technology (ICT) became more ubiquitous referring to the cluster of associated digital electronics, telecommunications and computing technologies. The notion of 'information' was semantically defined as the mid-point on the continuum of recognition between 'data' and 'knowledge' (Kline 2006).

> *19th-century revolution was based on the transformation and transmission of energy. …The 20th-century revolution is based on the transformation of information. (Davis in Kline 2006: 518).*

The terminology that identifies ICT with the post-industrial and the new economy has its roots in Wiener's work on cybernetics in the late 1940s (Kline 2006). This idea was developed more fully by science writer Harry Davis in an article in Scientific American in 1949 where he made the prediction quoted above. Cultural historian Marshall McLuhan wrote of the 'age of information' whilst sociologist Daniel Bell wrote of a new post-industrial society in the 1960s (Kline 2006). Notions of the 'knowledge society' and 'knowledge economy' were developed by management scientist Peter Drucker in 1969 (Ibid.). Two decades later it was systematically explored and developed into a network configuration by Manuel Castells (Castells 2000b).

The relationship between networked infrastructure, lifestyle and work is illustrated in the introduction to William Mitchell's book City of Bits. He expresses his curiosity at the construction workers laying cables in his neighbourhood. Upon enquiry he was told they were 'pulling glass' (1996: 3), which he determined was the installation of fibre-optic cabling to enhance telecommunication networks. Whilst witnessing the installation, he

ponders the fact that he no longer needs to go to work… As a result of sophisticated infrastructure and technology, work now comes to him through the very same fibre optics he witnessed being installed around the corner from where he lives. It is an eloquent introduction to a book that illustrates just how pervasive advanced telecommunication technologies had become. It dispels the myth that cyber-technology is somehow outside the body, beyond the human. It is contained in the infrastructure, the cables, the antennas that wire together home and work.

What then makes ICT distinctive? Instead of atoms, Mitchell (2003) argues, our cities are internally connected through 'bits' or 'bytes'. The non-rival character of information products is significant. Text, digital imagery and voice can be exchanged, combined and jointly disseminated at varying scales. This has revolutionised logistics, exchange of information and goods, and more profoundly: "challenges the idea of a fixed workplace" (2003: 84).

Mosco (2004) refers to Mitchell's City of Bits as containing one of the claimed transformations of our time: an age where face-to-face contact and physical movement are rendered unnecessary by information technology. Thrift (1996) is critical of the view that space has been transcended by fluid constructions of bits and bytes. These systems are never abstracted when appropriated, enacted and used; they remain social, he argues. Underlying this conversation is a conceptual chasm between determinist notions and that which sees the human-technology interface as a relational dynamic.

Referring to the 'metaphor war' between drivers of the 'information superhighway' concept (under Al Gore's vice-presidency in the US) and proponents of a more evolutionary notion (evident in contributions to the iconic *Wired* magazine), Thomas and Wyatt (1999) distinguish between the technocratic orientation represented by the former whilst the latter is considered supportive of a more organic, co-evolutionary perspective. Metaphoric constructs are often symbolic of the professional and political interests that drive a particular discourse (Thomas and Wyatt 1999). This metaphoric landscape permeates political and policy discourses.

2.1.2 The Mobile Phone

Brown (in Lasen 2005) refers to the history of the cell phone as one of 'non-development'. Early commercial systems were possible as early as the 1940s. Its delay in capturing a mass market some 40 years later was due to the crude nature of early models and market decisions to favour other technologies (Lasen 2005). Kopamaa (2000) defines three stages of adoption: production for and marketing to a particular class market (1975 – 1990); mass market uptake due to low prices and new technologies (1990 – 1995) and diversified mass markets (1995-) where many lifestyles and hybrid uses are accommodated.

The cellular phone distinguishes itself by its mobility and by being potentially always connected. It is small enough to be an extension of the body and has become a fashion icon as designs respond to lifestyle trends. It has become a more complex artefact as its functionality expands. Some refer to it as an indiscreet technology having the capacity to blur the lines between public and private, personal and social (Lasen 2005). Transitional spaces such as hallways and transport termini become spaces for communication whilst 'dead' times, waiting for buses and standing in shopping lines become productive. Physical space (talking together) combine with virtual space (remote conversation) to create

interactions that are simultaneously remote and co-present (Lasen 2005). Mobile telephony in urban spaces creates new urban practices and new meanings for urban space (p. 41). In a cacophony of sound that envelopes public space, private spaces are created. Urban space is momentarily colonised whilst private spaces become public.

The three distinguishing characteristics of the mobile phone: accessibility, mobility and phone as personalised device have been subject to broader social enquiry. Action is made possible at a distance whilst the mobile phone combines permanence and mobility: "… the call is mobile, while the person who is being called is 'always there'.." (Roos in Lasen 2005: 33). This ongoing presence is ubiquitous. Access to information and to friends, colleagues and others is seen as unproblematic and always desirable (Lasen 2005). As a corporeal extension, mobile telephony offers individualisation whilst enabling networking; a personal expression yet also a tool for collaboration.

The mobile telephone, Internet and digitisation of information transmission have permeated social and economic life in the early 21st Century. Personal banking, job hunting, relationships, social networking have transformed the incorporation of information into day-to-day lives. The following section gleans the distinguishing features of ICT.

2.1.3 Distinguishing Features of ICT

> *I construct, and I am constructed, in a mutually recursive process that continually engages my fluid, permeable boundaries and my endlessly ramifying networks. I am a spatially extended cyborg. (Mitchell 2003: 39)*

Cyber + +[1]

Perhaps the most pervasive language of the Internet is the notion of the cyber[1], at varying scales and degrees of detail. In his text Me ++ Mitchell (2003) explores the notion of the cyborg self. ICT provides an interface with the world that is not clear-cut. As we use our mobile phones we take the private into the public realm, as we surf the Internet we leave traces (bits) of ourselves. Donna Haraway (1991) explores the cyborg self in terms of its relationship to identity. Her feminist perspective departs from a structural reading of technology: it is one which investigates the interface between technology and the self in a fluid interactive way.

Conceptual movement between the personal and the social through to spatial representations at a broader scale is a feature. Cyberspace, cyber community and cyber geography are terms that developed as ICT-enabled exchanges and travel became possible (Preston 2001). Cyber-democracy emerged as a term referring to the ability of grass roots organisations to organise themselves on the web and through cell phones. The use of e-mail by the Zapatista rebels in Mexico during the uprising in 1994 and the use of cellular phones to mobilise against the World Economic Forum in Seattle in 1999 are known as turning points in advocacy.

The prefix 'cyber' contributes to a language infused with fantasy. In a witty but insightful account of the many myths that pervade the ICT/society hyperbole, Mosco (2004) likens

1 The prefix 'cyber' evolved from the field of cybernetics founded by mathematician Norbert Wiener in the late 1940s. Wiener wrote about the second industrial revolution as identifiable with the processing of information through computation in these times:

Kline, R. R. (2006). "Cybernetics, Management Science, and Technology Policy:

The Emergence of 'Information Technology' as a Keyword. 1948 - 1985." Technology and Culture **47**(3): 513 - 535.

the notion of cyberspace to 'noosphere', the 'space where networks of thoughts reside'. This is a notion developed by Jesuit Priest and lay philosopher Pierre Tielhard de Chardin. Proclaimed as a cyber-prophet ahead of his time by Wired magazine, Al Gore and a range of others, Tielhard de Chardin was popularised by Marshall McLuhan in his work on the global village. Tielhard defined the 'noosphere' as the 'thinking layer' (in addition to the material layers that constitute existence) brought about by human speech and the more complex networks of communications. This idea was expanded by McLuhan to include electronically mediated communications (Mosco 2004).

In the 1960s, with the onset of satellite broadcasting, McLuhan prophesied that the entire globe will resemble and function as a single computer and cultural unity: "the dialogue between cultures will become as pervasive as back-fence gossiping" (McLuhan 1962: 35). This was contested by media writer Daniel Bell and cultural historian James Carey as generalised hyperbole. The notion of cyberspace as constituting a parallel universe that enabled free-flowing exchange and unlimited travel while "…back at home, we have a surplus of disorder and disarray" is flawed (Carey, in Mosco 2004). Preston (2001) sees the notion of the cyber as a continuation of the 'third wave' claims by Toffler (1983) signifying profound post-industrial changes in the way in which we organise socially and economically. An increase in the pervasiveness of computing, technological convergence and ubiquitous mobile telephony have contributed to this technological consciousness integral to the 21st Century. It departs from other technologies in a number of ways.

Convergence

Telephones were operational by 1880, television by the 1930s, digitisation as the key to current ICT was developed as early as 1938 whilst the first factoring programme was run by computer scientists in 1948. Thrift (1996) maintains that the convergence of these technologies, through telephony, occurred as each joined the suite of ICT. The International Telecommunications Union (ITU) defines convergence as "technological, market or legal/regulatory capability to integrate across previously separated technologies, markets or politically defined industry structures" (quoted in Gillwald 2003). Digitisation of information facilitates this process, which is what distinguishes it from old analogue models; compression and decompression of digital bits allow for greater efficiency (Ibid.).

Technical convergence allows for a seamless exchange between audio, visual and data platforms. This enables the use of cell phones for e-mail access, the use of the Internet for entertainment and the use of computers for telephony. Voice-over-internet protocol (VOIP) enables computer-to-computer calling whilst a hybrid version allows for computer to land line communication. Industry role players have responded given the impact that VOIP could potentially have on the pricing models of the telecommunications industry. International mobile operators such as E-Plus in Germany and UK-based Vodafone are facilitating internet-based networks to enable value-added services and lower-cost operations (*The Economist* 2005).

Convergence assumes a common digital mode leading to the smooth transition between broadcasting, telecommunications and computing (Preston 2001). It enables a digital pervasiveness that is closely tied to the notion of ubiquitous computing. Mitchell's 'bits' are present in the everyday. The products and services that are used, produced and appropriated in social life, economic systems and cultural practices are imbued with digitally transmitted information.

Ubiquitous Computing

Ubiquitous computing is referred to as the 'third age' of computing. It follows mainframe technologies and the distribution of hardware (Weiser in Dourish and Bell 2007). Mainframe computing enabled distribution of data to a network of hardware, personal computing enables individual access. The fixtures and utilities of contemporary life are, "…augmented with computational capacities…" (Dourish and Bell 2007: 414).

The boundaries between private and public become less certain. As technologies become increasingly mobile and pervasive, opportunities for surveillance increase. As we purchase goods at supermarkets (using credit cards), stop at traffic intersections (through traffic web cams), acquire books and music online and enter buildings (through electronic entry points) we leave 'bits' of ourselves; "These technologies allow spaces to both remember and anticipate our lives" (Crang and Graham 2007: 789).

This has implications for the experience of space and movement between places. Ambient computing anticipates a spatial dimension where the 'cyber' and 'real' co-produce an experiential dimension typified by seamless flows of information and interaction. A hybrid space is possible at the interface between infrastructure and human experience (Dourish and Bell 2007). Whilst traditional networked infrastructures are tangible and fixed, ubiquitous computing is pervasive, mobile and increasingly footloose due to wireless capacity.

The Future is Wireless

The first wireless telegraph towers were initially thought of as 'electromagnetic lighthouses'. This was followed by mobile radio telephone systems used by taxis and police vehicles (Mitchell 2003: 51-52). A number of devices now enable wireless coverage. The communication range covered depends on transmission power. Bluetooth-enabled devices (typically used to connect mobile phones and enable transfer between computers and mobiles) can connect to about ten metres whilst larger wireless base stations accommodate connections of up to 100 metres.

Wireless enables access in public spaces; Manhattan's Bryant Park in New York is an example of one of the first wired public spaces in a major city. The technology is relatively inexpensive, easy to install and therefore potentially available for public use at the grassroots (Mitchell 2003). The cell phone takes over where mobility is required at city-block and urban neighbourhood scales. These private networks make public use expensive. Mitchell (2003) notes the market requirements that have led mobile phone operators to concentrate their infrastructure in urban areas and along major transportation routes, producing islands of wireless connectivity connected by long-distance links.

Increasing ubiquitous wireless technology has led social commentators to laud their power to transform social and economic relations in poorer contexts. Much is made of the 'leapfrog' phenomenon where mobile telephony has enabled telecommunications where landline telephony is not available. Enthusiasm abounds with regards to the power of wireless technology (relatively inexpensive once basic infrastructure is in place) in transforming communications in rural contexts. The high number of mobile networks in African countries (and others in Latin America, China and South-east Asia) is often cited as an example of technological leapfrogging. The following section gives an overview of technological development in Africa.

2.2 Networked Infrastructure and ICT in Africa

> *The large avenues of the European city, its modern services and infrastructures were to show very clearly in which side progress, wealth and power were situated. Some 'natives' could be granted the gracious concession of living in the European city, thus taking advantage of its 'modernity', but they could never expect to be fully integrated into the colonial urban society.(Balbo 1993: 25-26)*

Literature on early dissemination of telecommunications infrastructure is scarce. The structures put in place by colonial governments to serve imperial interests contributed to an institutional legacy and infrastructural landscape that endured beyond the 1960s when most African countries attained independence. Servicing standards were associated with colonial status: city planning and the provision of infrastructure has always been highly politicised and linked to ideology in Africa (Balbo 1993).

Networked infrastructures were important arteries in the relationship between Empire and colonies. Taaffe, Morrill and Gould (1963) use a methodology informed by Rostow's stages of growth to explore the social, political and economic forces that informed the spatial diffusion of transport infrastructure in Ghana and Nigeria (Graham and Marvin 2001). Their analysis reflects a gradual transition with the initial phase being outward looking with the establishment of ports, followed by the development of rail and feeder routes that support this export network. Three principal motives for penetration into the hinterland are noted: political and military control, mineral exploitation (particularly with regards to rail transport), and potential agricultural production (Taaffe, Morrill et al. 1963: 506). They remain mindful of less technical factors. The establishment of Ghana's Sekondi-Kumasi road link was prioritised due to the influence of the Ashanti, based in Kumasi. Mention is made of inter-colonial conflicts where links were forged between Accra and the Hohoe cocoa area in British Togoland in order to divert cocoa traffic from Lome port in French Togoland (Taaffe, Morrill et al. 1963). In Nigeria, as in Ghana, rail lines formed the basis for the entire transportation network; essential in enabling export of primary goods to European ports. A later phase emerged with the dominance of road over rail (with water transportation in Nigeria a competitor). Internal regional exchanges were emphasised as colonial control lessened (Ibid.).

The history of South Africa's infrastructure is informed by colonial interests and Apartheid. In investigating the first air route to Cape Town in 1932, McCormack (1974) tracks the imperial motivation that led to the first flight from Croydon airport to Cape Town in 1932. He argues that this was a continuation of Rhodes's 'Cape to Cairo' ideal, promoting a rail-road "linking the scattered outposts of empire along the 5, 600 mile backbone of the continent in the 1890s…premised on the notion that communications were the keys to the empire's strength and unity in Africa" (emphasis added) (McCormack 1974: 77). An airline 40 years later was seen as a more effective way of fulfilling Rhodes's dream. "In peace and in war, these swift communications would provide the basis of a strengthened sense of imperial unity and community" (McCormack 1974: 78).

Whilst Cairo was envisaged to be the 'Clapham Junction' of the empire, its political future was not considered to be certain enough to exclude other options such as Cape Town. Not only would the carrier provide a more time effective transporter of diamonds and gold from South Africa, but it would provide British settlers with newspapers a few days after publication and demonstrate the innovations of British technology. Distance was

seen to be the great obstacle to imperial solidarity and technology provided the means to overcome it (largely funded by the African colonies and South Africa, not the British Treasury) (McCormack 1974: 90). The symbolic value of air travel and the associated imperial propaganda eclipsed actual technical performance typified by underperformance and not immune to criticism (Pirie 2010).

Internal transport infrastructure in South Africa was tainted by racial objectives. Development of rail, road and telecommunication aimed to further the interests of colonial elites and the post-1948 Apartheid-era white minority. The Cape Province's first railway lines were constructed in 1862 by the colonial regime (between Cape Town and Eerste Rivier) and between Cape Town and Wynberg by the private Wynberg Railway Company in 1863; external links to Kimberley were prioritised due to colonial diamond interests. In 1875, the southern line to Simons Town was considered essential given the Royal Navy base there (Matzopoulos and Lerer 1998).

The introduction of early rail in South Africa was associated with the mechanisation and industrialisation of British colonies. In South Africa the priority was to connect mining centres with the ports of Durban, Port Elizabeth, East London and Cape Town. Under Apartheid, rail was considered an inexpensive and efficient way to carry the black workforce from their 'locations' to places of employment in white suburbs and industrial areas. In the 1950s the availability of the mass produced motor vehicle removed much of the pressure on trains, which remained important mass commuter networks (Matzopoulos and Lerer 1998).

Pirie's (1992) account of racial segregation on trains and railway stations between 1948 and 1953 recounts a heavy handed approach that was part of the repressive measures under the Group Areas Act and influx control: "When Apartheid on the SAR was finally secured, it paved the way for more pervasive racial segregation in other public amenities…." (Pirie 1992: 690). Formalised segregation on trains was established as early as 1918 but rail Apartheid was intensified after 1949 (Pirie 1992). The economic significance of rail is well illustrated by its function as an inexpensive, quick and efficient transporter of mining labour to the Rand gold mines from the start of the 20th Century. Given the politically charged landscape, and the dismal conditions within which mine workers were transported, the social meaning that accompanied this experience is profound (Pirie 1993). Transport infrastructure facilitated migration, considered a masculine rite of passage captured by Pirie:

> *As creatures of the industrial age, railways have a potency which resonates with, and helps construct the subterranean techno-civilisation into which the peasant miners descended. Boarding the enclosed cattle trucks signified a momentous plunge into an inorganic, noisy, dangerous world. (Pirie 1993: 729)*

The relationship between infrastructure and political intentions, closely aligned with economic imperatives, provides the backdrop for the late anti-Apartheid struggle. A fractured institutional landscape evolved from the desperate measures employed to engrain segregation in the provision and administration of utilities. Black local governments were created in the early 1980s to govern in urban townships with little resources, and were vehemently opposed by civic organisations, seen as Apartheid puppets with support from conservative members of township communities (Shubane 1991). Non-payment for utilities formed a core part of oppositional politics, and the concomitant opposition to Black

local authorities was a commentary on the legitimacy of local government institutions (Cashdan 2002).

Pipes, cables, stations and motors enable movement and reticulation. They are also imbued with political discourse. In the post-Apartheid era official ambitions are layered with neo-liberal measures such as privatisation and an emphasis on cost-recovery. Different standards of the provision of network infrastructure are not necessarily restricted to oppressive regimes. Bond (1999) argues that servicing standards that differentiate between rich and poor areas in post-Apartheid South Africa are deeply discriminatory, contributing to class divisions. Whilst showing initial promise of pro-poor governance, a neoliberal policy trajectory has influenced service provision to the extent that affordability remains a concern (Bond, Dor et al. 1999). Privatisation of networked infrastructure extends to the telecommunications industry, set in motion by the introduction of the Telecommunications Bill in 1996 (Cogburn 1998). There is a significant shift here. Increasingly, in South Africa and elsewhere, the location of infrastructural networks has been influenced by a broadened spectrum or role players. The private sector has become a much louder voice in this regard.

Networked infrastructure lends itself to objectification; treating infrastructure elements as technical entities ignored the political and economic systems that established them. The relationship between technology and development is underpinned by institutional relationships that extend beyond state boundaries and are closely aligned to policy rhetoric. The underlying discourses and actors that emerge when examining the interface between technology and society becomes more pronounced with examination of the ICT sector.

2.2.1 ICT in Africa and South Africa

In Africa, telecommunication technology diffusion was limited in the 20–25 years following independence movements due mainly to monopoly governance structures in the telecommunication sector. From the 1980s onwards telecommunication was on the agenda of many countries (Henten, Falch et al. 2004). The South African situation differs in that is well developed and considered innovative. The South African Department of Post and Telecommunications changed its system from analogue to digital earlier than a number of developed countries, considered bold at the time (Cogburn 1998). High levels of tele-density served mainly the white population however. By 1997 telephone access was available to 10.1% of the population living in predominantly white areas, compared to 0.1% in the previously independent homelands (Cogburn 1998).

Investment in ICT infrastructure as an extension of telecommunications in Africa has intensified since 1995. Access to information technology across the African continent is variable but generally low. In many cases intra-continental communications are more problematic than between sub-Saharan countries and their former European colonial metropolises. This expansion has largely had uneven results. Of the between 5 and 8 million Internet users in Africa in 2001, between 1.5 to 2 million were from outside Southern and North Africa. Less than 0.6% of the population in Sub-Saharan Africa used in Internet in 2001, but there was a 638.4% growth in Internet users between 2000 and 2007 (Obijiofor 2008). Internal regulation, socio-economic development indicators and human resource development inform access variation between countries (Oyelaran-Oyeyinka and Nyaki Adeya 2004). A study in West Africa notes the dominance of Cote d'Ivoire in ICT performance facilitated in part by investment in tertiary education in the sector and the ability to retain appropriate skills (Bollou 2006). Internal factors such as geography and

socio-economic dynamics impact. Bollou (2006) notes the underperformance of Mali due to its low urban population, problematic topography and low GDP per capita.

Internet Service Provider (ISP) tariffs vary across Africa between US$10 and $80 depending on local market competition, domestic tariff policies and access to international bandwidth (Oyelaran-Oyeyinka and Nyaki Adeya 2004). The high price of local ISP e-mail facilities leads to a high number of Africans relying on US-based web-based services such as Google, Yahoo and Hotmail (Jensen 2000). Generally ICT services in Africa are more expensive than elsewhere. Access compared to the North is low. Statistics (ITU 2007) indicate that for every 100 people in Africa, 1.25 have access to the Internet compared to 21.12 in the United States. South Africa has 9.02 Internet subscribers per 100 population, and 0.78 per 100 people have broadband access (compared to 0.21 in Africa and 23.94 in the United States) (ITU 2007).

South Africa is often cited as being exceptional in terms of telecommunication infrastructure on the continent given tele densities higher than elsewhere in Africa (Coeur De Roy 1997). Recent statistics indicate that 80% of telephone lines in Africa are located north of the Sahara and in South Africa (Henten, Falch et al. 2004). Recent statistics on mobile phone access show exceptional figures for South Africa. For every 100 people, 87.08 are mobile phone subscribers, compared to 28.44 in Africa and 83.51 in the US (ITU 2007). Cell phones account for 89.6% of telephones in Africa, compared to 61% in the US (Ibid.).

Cross country disparities, patchy demand for ICT services and the need for improved economies of scale have necessitated regional alliances to optimise infrastructure investment and integrate regulatory mechanisms (Adam 2004). An example is the New Partnership for African Development (NEPAD) East-Africa Commission intended to promote horizontal cooperation with regards to infrastructure development. One of the initiatives of this body was the development of an East African Submarine Cable (EASSY) linking South Africa to Djibouti (completed in late 2009).

ICT policy discourses reflect neo-liberal aims intended to assist transition into knowledge economies. The Southern African Development Community (SADC) aims to turn the region into an information-based economy while the Common Market for Eastern and Southern Africa (COMESA) has established initiatives to integrate ICT into local programmes to attract Foreign Direct Investment (FDI) (Adam 2004). Some of these regional initiatives display a predictably urban bias, the Eastern African Community is working on a network connecting Dar es Salaam, Kampala and Nairobi for example (Ibid.). In the South African context, the spatial distribution of ICT access nationally also reflects an urban bias, with Gauteng and Western Cape dominating provincial access (Tlabela, Roodt et al. 2007).

Economic liberalisation was a feature of the process of Internet diffusion in South Africa between 1990 and 2003 (Lewis, 2005). Van Audenhove (2003) identifies a number of phases in the evolution of political discourse in this regard: the initial commitment to ICT for social development (as embedded in the Reconstruction and Development Programme) followed by a transformation stage that sought to establish a regulatory authority (the South African Telecommunications Regulatory Authority) and a new legislative framework. Recognition that a telecommunication policy has implications for social and economic development was identified in early aspirations towards the creation of an

information society, as well as in the inclusion of a number of government portfolios in pursuing this aim. The result was an implementation phase that relied on co-operation between divergent government and private sector actors in pursuing the common goal of ICT access. Implementation was constrained by limited infrastructure roll-out by Telkom, underperformance of tele centres provided by the Universal Service Agency (USA), problems in negotiating the deregulation of Telkom and the third mobile service license as well as legitimacy issues with regards to the state regulator (Van Audenhove, 2003).

The most recent phase entails the evaluation of implementation and new measures to ensure universal access. Van Audenhove (2003) notes the shift from 'universal service', (individual access to basic telecommunications) to 'universal access' (access to ICTs in general - including the Internet - at the community level). These intentions are, however, constrained by a legislative framework that effectively supports Telkom's monopoly and maintains high ICT costs, whilst the neo-liberal economic environment encourages high quality infrastructure investment in wealthier areas. The recent package of policies is contradictory and not necessarily supportive of achieving universal access (Ibid.).

Privatisation and deregulation in Africa has had weak results compared to Latin America (Stovring 2004). Performance in the mobile phone sector, on the other hand, has been excellent. A regulatory environment that allows for competition combined with technical ease (cellular infrastructure is relatively quick to establish) and market accommodation of the needs of customers through prepaid services contribute to broader access. The substantial cell phone growth in Africa is perhaps more associated with the profit motive of telecommunication multinationals than it is with equity. The expansion of South African cellular companies in Africa is testimony to this. Technological innovation combines well with the profit motive as reflected in the following extract from biography of the CEO of South African cellular company Vodacom:

> *A cellphone went with the user, wherever he or she chose to do whereas the fixed-line phone was only as portable as the length of its wire. In theory, there was nowhere that cellphone technology could not go. The entire African continent was one gigantic cellular market. (Knott-Craig and Afonso 2009: 144).*

The lack of infrastructure is a constraint; the Vodacom expansion story tells of non-existent roads that had to be traversed or built from scratch in Tanzania, reliance on diesel-powered generators for base stations in Lesotho, deploying security firms to safeguard equipment and employees in the war-torn Democratic Republic of Congo (DRC) and installing a base station on Mount Kilimanjaro (Ibid.). Unlike other forms of FDI, revenues from mobile networks are often invested in infrastructural expansion – expanding network coverage (Kwaku Kyem and Kweku LeMaire 2006).

A number of geographic advantages further cell phone use. Usual spatial hurdles such as varying topography and natural barriers are less significant (but clearly still a factor as reflected in the Vodacom experience), and infrastructure is less vulnerable to theft and damage (Kwaku Kyem and Kweku LeMaire 2006). The flexibility in payment options enables lower income groups to benefit. The total cell phone subscribers in Africa increased from 6 per 100 inhabitants in 1999, to 30 per 100 in 2003 (Ibid.). By contrast, a decline in land line connections resulted from the increase in telephone tariffs (an average increase of 24% per annum) from 1997 to 2004 (Ibid.). Cell phones have, to a large extent, substituted land line use in Africa (Kwaku Kyem and Kweku LeMaire 2006).

Expansion of the cellular phone industry into Internet function is the current frontier, making cellular the Personal Computers (PCs) of Africa (Knott-Craig and Afonso 2009: 148). A bullish confidence is reflected by the Chief Executive Officer (CEO) of South African mobile phone service provider Vodacom:

> *Africa is the last continent of big opportunity. Vodacom has over 34 million customers in five countries that have a total population of more than 200 million people. The opportunity for growth is huge. Wherever we go on the continent we encounter an enormous appetite for technology. We have hardly tapped into the internet market and have scarcely touched mobile TV. Cellular technology can democratise the internet in Africa in the same way it is democratising telephones. (Uys, quoted in Van Der Walt 2008)*

The functionality of cell phones has expanded with convergence. Continued technological innovation has resulted in applications such as banking and fund remittance. Engagement with local conditions and sponsored research into user needs and innovations have contributed to a more accurate representation of appropriation (Donner 2005; Lasen 2005). Diffusion studies argue that a favourable regulatory environment that allows for liberalisation of the telecommunication sector needs to be supplemented with technical interventions that address market failure. Many impact studies show, however, that higher levels of mobile penetration correlate with increases in GDP growth whilst others find correlations between mobile penetration levels and foreign direct investment. Technology diffusion cannot be seen in isolation.

Donner (2007) argues that 'ensemble' studies that are cognisant of the relationship between humans and technology in a developing context provide a more rounded perspective. Technology is heavily contextualised and part of an ongoing process of appropriation and invention. In some instances, the cell phone emerges as a"symbol of modernity and capitalism" (Donner 2007). Moyi (2003) investigates ICT use amongst informal traders in Kenya and notes that the need for financial and market information as well as credit related information amongst informal traders presupposes a high IT priority. High costs, bureaucracy and poor infrastructure constrain use. Internet technology is not considered useful due to poor access to telephones, electricity as well as computers.

Whilst ICT facilitates small business development, informal and face-to-face interactions remain important factors in economic exchanges (Molony, 2006, in Donner, 2007). In a study on mobile use amongst small entrepreneurs in Rwanda, Donner (2004) finds that the convenience of maintaining business and personal networks in real time is valued as important. He notes the blurring of boundaries between personal and business use of mobile phones; "users may be using the mobile technology to bring home to work." (p.16). This applies in particular to entrepreneurs at the lower end of the income scale.

Differentiation between technologies indicates that the use of mobiles for economic functions, accessing information and educational purposes becomes important in the absence of PCs and Internet connectivity (Donner 2007). Some see the popularity of mobile phone technology as technological leapfrogging where developing countries are seen to be potential laboratories for advanced mobile use and the Internet (Donner 2007). There is variation, however, on how mobile phones are used and to what ends (Moyi 2003; Donner 2004). The relationship between ICT and development is clearly highly contextual.

2.3 ICT and Development

> *Science and technology were regarded as the reason for the superiority of the North and the guarantee of the promise of development. (Ullrich 1997: 275)*

Technology adoption is a dominant feature of development discourses, integral to the 'age of development'. Early emphasis was on broadcasting; the educational potential of radio was recognised given the affordability and flexibility of the medium: "…once radio had been made affordable and independent of the electric grid, its potential use in the development process was dramatically enhanced" (Schech 2002: 15). Technical advantages enabled radio to reach the illiterate in great numbers and ensure mass coverage; "habituating even the farthest tribe to the approaching tide before it reaches them" (Flinn 1968: 55).

The proliferation of radios on the African content provides an example of differentiation in technology appropriation across geographic boundaries and social strata. Mytton (2000: 2) estimates that the million radio sets in Africa in the mid 20th Century increased to approximately 100 million by 2000. Cheap, portable and battery operated transistor radios became available during this period making individual access possible in remote locations. Community and amateur stations, with access to inexpensive short – to medium term bandwidths, broadened listenership while also allowing for growth in specific sectors such as university campuses and churches. Radio is a highly superior mass medium, given the lower cost of production and transmission (Paterson 1998).

The spatial imagination that accompanies technological export is associated with the assumption that technologies are likely to spread everywhere with the same impact regardless of context, argues Thrift (1996). This 'techno-orientalism' is linked to 19th Century fantasies of Empire. Rarely seen as a repertoire of practices that continue or augment, translation of technologies into the African context is imbued with Western-centric assumptions.

The diffusion of Western knowledge through new communication technologies is seen as desirable whilst also in keeping with efforts to enable greater decentralisation of government (a literature exists on e-government in developing countries). New communication technologies facilitate the non-hierarchical, flatter organisational structures of market-led, decentralised development…in keeping with the trajectories of the World Bank and other development agencies (Schech 2002). ICT developmental efforts are informed by such overt ideological determinants. Neo-liberal expectations of technological diffusion influence access and policy implementation: "…the social and economic model inscribed into the technology which often implicitly sets the rules of the game which affect both the online and the offline world" (Kleine 2009: 181). ICT enables information transfer and communication critical to economic production and distribution. The Information and Communication Technology for Development (ICT4D) paradigm deems this indicative of an opportunity for 'leapfrogging'; poor nations are able to access the knowledge economy without the usual industrialisation prerequisite for economic maturation such as that experienced in the North. Technology adoption enables developing countries to become part of the 'Global Village' as their firms compete internationally (Davison in Kleine 2009).

Social and political imperatives underpin infrastructure development in Africa. Technology represents progress and modernisation with the latter modelled upon the experiences

of colonial powers. Modernisation theory is premised upon a linear path of development with technology enabling the transition from 'primitive' to 'modern'. A more critical examination of the ICT4D idea reveals its modernisation roots. The linear path assumed for development, the global agenda driven from the North and the hegemonic image of the Western developmental model as the most desirable, typify the modernisation paradigm (Schech 2002).

Northern content is dominant (Obijiofor 2008). ICT is considered an export of Western culture (Schech 2002). Much like radio was used by the Portuguese to capture the minds of Mozambicans (Schech cites Power, 2000 in this regard), the Internet distributes a particular brand of knowledge mediated by language preference and content. The reverse holds however. Much like Frelimo invaded the offices of the radio station in Mozambique in 1975 to broadcast indigenous history and culture, the Internet has been appropriated for advocacy of local issues to a global audience. This represents a new power dynamic where, in the hands of subaltern groups, technology can "foster new practices of being, knowing and doing" (Schech 2002: 21).

The relationship between ICT and development, therefore, is contested. Whilst its beneficial impact in terms of connectivity and information access is generally accepted, there is unease with regards to the discourses that inform policy and implementation. ICT4D is informed by the ideological and policy objectives of development agencies and governments. Despite developmental efforts, global unevenness with regards to bandwidth access and hardware costs remain. The role of multinational corporations in ICT provision cannot be denied. Some would argue that the geographic distribution of high technology across the globe in terms of high technology exports, computer power, and Internet hosts follows the hierarchical pattern of the core-periphery system explored by dependency theorists (Guellen and Suarez 2005). Information technology leads to new forms of dependency argues Everett (in Guellen and Suarez 2005). ICT can entrench internal core-periphery relationships, following and perpetuating other indicators of inequality (Wahl in Kleine 2009). Increases in social divides can be perpetuated by unequal access to ICT. Within a community those with greater resources (money, education, and training) are more likely to use and access technology (Donner 2007).

2.3.1 The Digital Divide

> *'I'm illiterate,' says one fisherman. 'I don't know how to use a computer, and I have to fish all day.' (The Economist 2005)*

The developmental potential of ICT is frustrated by the mundane: physical and socio-economic barriers such as lack of training, literacy, hardware access and infrastructural limitations. Prioritisation of resources, time scarcity and literacy are all factors that impact on the divide between those that are digitally enabled and those on the wrong side of the ICT revolution. Early studies of digital divides have tended to focus on physical and educational barriers that separate the information 'haves' from the 'have-nots'. Later work departs from the determinist notion that technology is enough and capable of addressing complex social issues (Servon 2002). Demographic and socio-economic factors influence the choice and use of ICTs as well as how they are used in conjunction with other resources (Crang 2006 et al; Selwyn and Facer 2007). Differential access is influenced by perceptions of the usefulness, fears and suspicions of ICT (Bridges.org. 2002). Availability of technology does not guarantee use. Several African studies quoted in Obijiofor (2008)

show a predominance of Internet use for e-mail while web surfing remains low. Social attitudes to computers are associated with social hierarchy and status. These perceptions are closely tied to other socio-economic indicators such as education, income and age (Crang 2006).

Demographic and socio-economic factors influence the choice and use of ICTs as well as how they are used in conjunction with other resources (Crang 2006 et al; Selwyn and Facer 2007). Race, age, income, gender and education are important informants; the majority of Internet users in South Africa are younger than 50, have a tertiary education and are white and male (Langa, Conradie et al. 2006). A study of schools in South Africa shows that pupils in middle-high income schools are more open to using the Internet and e-mail whilst those surveyed in 'township' schools see ICT as an opportunity to enter guaranteed careers that pay well (Bovee, Voogt et al. 2007). Clearly perceptions will impact on use, as will the nature of access.

Servon (2002) examines a number of myths concerning this phenomenon, mainly from an American perspective but certainly worth noting in this context. The first is that providing computers, hardware and access to the internet will eliminate the digital divide. Clearly, access needs to be accompanied by training, whilst content needs to be relevant in order for people of diverse backgrounds to relate to the internet and therefore use it. The second myth, according to Servon (2002) is the determinist notion that throwing technology at social problems will help solve them. "Technology, then, is one tool, not 'the' answer." (Servon 2002: 225) ICT does not necessarily overcome spatial inequalities; the opposite is in fact true. Drawing on Graham and Marvin's 'Splintering Urbanism' thesis (2001), Servon argues that "IT is deeply rooted in geography" (p. 226). The lack of investment in ICT infrastructure in poor areas represents market failure as provision is then inequitable.

The location of Internet cafés and mobile phones in Africa reflects access differentiation (Obijiofor 2008). Where individual contact is constrained by income and bandwidth, public and private Internet cafés become important access points. Tele centres are in many cases the result of private entrepreneurial activity in urban centres that offer connectivity and a suite of services that include photocopying, faxing as well as computer and Internet access. In some cases they provide telephony (that relies on cellular technology) and have compensated for low land line availability, providing services for small businesses in many cases (Falch 2004).

A recent study in Uganda finds that Internet café users represent a cyber-elite: typically urban, male, young and educated (Mwesige 2004). "Acquiring technology is still a dream for the majority of Africans who do not live in the capital cities and are not part of the elite" (Jensen 2000: 218). Connectivity is best in major cities, and is expensive (Mbarika, Okoli et al. 2005). Sometimes tele centres are used in addition to other services. For example, many academics in Nigeria and Kenya are compelled to use telecentres due to difficulties in Internet access in universities (internal politics often constrains general access) and the high cost of household connections (Oyelaran-Oyeyinka and Nyaki Adeya 2004).

The distribution of ICT access is therefore impacted upon by physical barriers as well as less overt factors such as lifestyle, culture and perception. Whilst geography matters, the appropriation of technology is closely tied to lifestyles and livelihoods. A contextual

understanding reveals more nuanced insights into use. Constraints to digital access are indicative of broader socio-economic factors but can also create opportunity for innovation.

2.3.2 ICT: Spaces for Innovation?

> *We're a nation of talkers," said Kayode Sukoya, a Lagos taxi driver known by the nickname 'Guvnor'. He links the cellphone's popularity to the ancient storytelling customs of Yoruba culture. (quoted in Tobar 2004).*

In the 1970s Lewis Mumford (1973) explored the notion of 'expression through the machine'; the development of new aesthetics, language, feeling and quality of materials that evolve from the interchange between engineer and machine. The aesthetic imagination of the machine is captured in modernist architecture and minimalist design and is discernible throughout art and architecture history. Appropriation of technology can be highly personal and creative. Social acquaintance with technology is ongoing and imbued with values and norms. We still need to understand how different technologies take on different social meanings in particular cultural contexts, argues Thrift (1996). The choice of the cell phone as an extension of personal style is a contemporary example.

Technological innovation in the African context is informed by creativity, culture and access constraints. Work on mobile phones shows appropriation is linked to social networks, cultural beliefs and socio-economic contexts. New spatial modalities of ICT use in developing countries mitigate cost restrictions: container telecentres and informal phone shops on side walks ('umbrella ladies') are examples (Donner 2007). The ways through which innovations are mediated by culture and social norms is illustrated by the notion of 'beeping' (making missed calls) as documented in Donner's ongoing work on mobile phone use in developing countries (2005; 2008). Not only are missed calls intentional but they represent an implicit communication code. Donner (2008) records the 'beep repertoire' as consisting of call-back beeps, pre-negotiated instrumental beeps and relational beeps (likened to waving). A number of rules are uncovered by Donner in Rwanda: rule 1: send call-back beeps to people with more money; rule 2: send to friends and family when you have run out of call time; rule 3: if you are asking for favourable treatment, do not send a call-back beep; and finally rule 4: do not beep too much! Understanding of context is required to interpret a beep. Rules vary across cultural milieus. They are indicative of particular social network arrangements. Beeping "joins a repertoire of voiceless conversations, text messages, image-exchanging, emailing, and even purely visual 'display' " (Donner 2008: 17).

The accessibility and convenience of the mobile phone has made cell phone banking an emerging trend. Whilst Internet banking has grown (of the 4 million South Africans that have access to the Internet, 2.4 million bank online (Naidu 2008), the cell phone surpasses online demand due to its flexibility (Goldstuck in Naidu 2008). A much lauded East African example is M-Pesa, a mobile money transfer service pioneered by Kenyan operator Safaricom, initially intended for the unbanked population. Its low transfer charges and broad availability (especially to the rural population) has made it the most popular and convenient money transfer service with 9 million subscribers in Kenya. (Wangara 2010). M-Pesa services have, since inception in 2007, extended to online payment for flights, payment of utilities and cash withdrawals at kiosks (Jack and Suri 2009).

In South Africa, MXit, a medium for social networking using instant messenger (IM) cellular phone functionality is more popular than the social networking site Facebook. The number of IM users in South Africa doubled in 12 months between July 2007 and 2008 with most of these in the 16 to 24 age category and the majority believed to be on the MXit platform (Digital Lifestyles Predictor quoted in Naidu 2008). Besides ease of use, this is a cheap application (2 South African cents to send a message) compared to between R1.40 and R2.50 for a phone call or 80 cents for an SMS (Vodacom 2009).

Extending such innovation to Internet use in Africa has been slower. The ubiquity of the mobile phone raises the expectation of mobile Internet use. Research indicates that this functionality is still in its infancy. Appropriation of cell phones for Internet use amongst marginalised communities is low due to limited access to Internet-enabled cell phones and little understanding of what the mobile internet is and what it is capable of (Chigona, Beukes et al. 2009). Users able to use this resource in a study in Cape Town did so to reduce time spent waiting in service queues and travelling expenses. The new generation Internet, Web 2.0[2], enables the seamless exchange of information between news agencies, web sites, social networking sites and blogs. The resources available enable "…engagement with resources and other users so that it is easy to form and interact with social and technological networks (Hardey 2007: 869). Applications such as blogs, Mashups, wikis and podcasts enable users to add content with the web providing a platform for such. Much of this functionality extends to mobile phone use. Social networking sites (such as Facebook) are becoming increasingly popular in South Africa. Yet, local application MXit enjoys double the usage of Facebook (Naidu 2008).

The appropriation of a particular function of a technology in a particular context is not new. The history of the telephone and mobile phone shows how the appropriation of technologies can often be contrary to their intended uses. The mass market of conversational women in the former case was not anticipated (and largely discouraged) whilst the popularity of the text (SMS) function of the cell phone was unforeseen (Lasen 2005). The history of networked and information technologies reflect an uncanny tendency for thematic repetition. Whilst ICT has particular characteristics there are nevertheless a number of themes common to the interface between technology and society at different times and in varying contexts.

2.4 On the Relationship between Society and Technology

Debates on ICT and society were particularly intense in the 1990s when it became clear that this as a phenomenon would grow in importance. The emphasis on impact is discernible. Early utopian visions saw increased democratisation and the lessening of the dominance of physical and spatial constraints as benefits. Broader social systems and structural dynamics remain important, however. The 'transformation theorists' often entail a 'born-again' rhetoric absent of social and cultural dynamics (Preston 2001: 17). This focus on the transformative power of technology is not new. History of communication technologies reflects an ongoing grappling with its societal dimensions. A spectrum that ranges from populist hyperbole to scientific enquiry is discernible throughout the history of technology and society.

2 Web 2.0, a phrase coined in 2004, is known as the 'social internet'. Users are able to add content and essentially have more agency in interacting with the Internet.

Evident also are parallels between the pervasiveness of ICT and the many 'posts' explored in the late 20th Century: the post-modern, the post-industrial and the post-colonial. A reading of particular social, cultural and economic characteristics off technological artefacts gives a simple representation of ICT by isolating it conceptually and temporally (Preston 2001: 7). The suite of technologies that has evolved over the last 150 years is the continuation of history in all its social, cultural and economic guises (Thrift 1996). A number of themes emerge from the historical overview of the relationship between communication technologies and society. They are explored as a conclusion to this chapter.

2.4.1 The Ghost in the Machine

> *To fly, to talk at a distance, to overcome natural forces – these things we have achieved, thanks to exact science and the associated arts. But the myth making functions, which produced Prometheus, not fire, and Icarus, not flight, are still left untouched by the machine… (Mumford 1973: 239).*

The history of technology is imbued with myth, predicting the end of life as we know it, the pre's, the post's and new eras. Philosophers such as Langdon, Winner and Roszak questioned the exclusionary aspects of the information society brought about by 'myth-information' and the 'mumbo jumbo of a widespread public cult' of the information society (Kline 2006). Thrift (1996) detects 'a new virus of thinking' – technological determinism. Two forms are evident, according to Fischer (in Thrift 1996). One sees technology as the driver of social change. The second sees technology as altering history: moving from epoch to epoch driven by technological innovation with the transfer of cultural and psychological properties that this presupposes.

One of the most enduring determinist notions concerns the relationship between technology and space. Telegraph technology separated information transfer from physical travel, whilst the telephone was the first immediate means of communication. The idea that space could be traversed through technological innovation is common. A resurgence in interest accompanied ICT innovation with the 'death of distance' hypothesis. The term was coined by The Economist's senior editor, Cairncross, in her book entitled The Death of Distance, which predicted the end of geography as technology triumphs over space and place (Mosco 2004). Some politicians found this compelling. Bill Gates is quoted in Mosco (2004) as saying: "….one of the most remarkable aspects of this new communications technology is that it will eliminate distance….this highly mediated network will be unconstrained by miles and kilometres" (1995).

The mythical imagination is evident in William Mitchell's work. The MIT-based urban designer and media theorist explores the implications of digital technologies for space and place, from the urban to the immediate neighbourhood to the actual body. At times tantalising, Mitchell draws parallels between software development and the spirit of genius loci in ancient Rome, between 'computational nodes and radiating bits' that resemble Hausmann-like diagrams (1996). He moves beyond hyperbole in E-topia (2000) where he acknowledges the need for material public space (in his ideas on recombinant design) and the possible divides between information haves and have-nots (drawing on the work of Castells). The distinction between digital space and physical place remains a feature of both Castells ('spaces of flows' versus 'spaces of places') and Mitchell's work.

Accounts of the relationship between space and technology provide insights into distance and place. Cartographic conventions marking roads, rivers, ports, national borders and

cadastral boundaries are now supplemented by the footprints of signal coverage, geographic reach of new media and availability of technology (Ibid.). The ubiquity of wireless technology is best captured by Mitchell (1996: 8) "The Net is ambient – nowhere in particular and everywhere at once."

The developmental potential of technology falls prone to its own myth generation. Introduction of tools of progress will generate development towards to ideal of the connected, visible and the modern. This mindset is not just reflective of bilateral interventions in developing countries. It is elegantly captured in the following quote from Vodacom International's Managing Director:

> *Landing in another African country can be like landing on the moon, a totally different and alien environment…technology is helping to spur on the African Renaissance. Vodacom is determined for its construction of cellular networks across the continent to play a leading role in African's rebirth. (Knott-Craig and Afonso 2009: 142)*

2.4.2 'We have never been modern'[3]

Equating technological innovation with cultural epochs provides a comfortable framework for marrying social, technical and economic dimensions into a conceptual whole. Reflections on the relationship between technological advancement as an indicator of modernist progress and its impacts on society and the city was documented in several of Lewis Mumford's works. Technological innovation is seen as an extension and enabler of industrialisation. The telephone, for example, is often identified with modernity: the extension of individual agency, of impersonal relations and the growth of urban areas at the expense of the rural (Lasen 2005).

Some see the adoption of ICT as a continuation of the Enlightenment project using new technologies to continue innovation and progress. In the developmental context, Schech (2002) shows how the ICT4D approach equates technological innovation with Western notions of progress and knowledge creation. Mosco (2004) identifies the myth of digital technologies as identifiable with a continuation of the argument that modernism continues and is expanded through technologies:

> *…Computer technology makes space more malleable, more subject to human control and therefore better able to serve the Enlightenment vision of steadily building a better world by applying human reason. (p. 91).*

Others identify ICT innovation with the post-modern. Splintering urbanism (Graham and Marvin 2001) is concomitant with the fragmented nature of post-modern space. Global imagery transmitted through the Internet permits the interplay between multicultural global and the contextual local. Mobile telephony enables a translation of space that challenges notions of place. Others are critical of the tendency to equate new technologies with an advanced form of modernity, or post-modernism. The end of one era to be replaced by the next is simply not the way that history works, argues Thrift (1996). Gestation periods overlap and one technology feeds into another. Furthermore, social appropriation and invention contribute to these evolutions. For example, research by Thrift in London's networks of international finance shows how this 'avatar of post-modernity' is associated with more face to face interaction – more not less association between communities of practice and new forms of social involvement (1996).

3 Taken from the title of Bruno Latour's book: (1993) ."We Have Never Been Modern".Hemel Hempstead: Harvester Wheatsheaf.

ANT writers have been extremely critical of the periodical boundaries defined in studies on technology and society. Much of it is premised on an analytical separation between human and machine. Latour argues for an analytical symmetry between the social, technical and natural worlds; speaking of the "determination of the existence of those things in the first place" (Dear 1995: 153). Economic organisation, societal systems, cultural beliefs all evolve in conjunction with technological appropriation (Latour 1994). In an interview with Lovink (2004), Latour expands on the notion of hybrids with regards to the relationship between society and technology. This dynamic is mediated by computer cables, training, and interpretation of use. There is no such thing as instantaneous access and connection with all.

> *The computer is not a reservoir of abstraction, scientificity, and technicity. Science and technology for me does not mean abstract. It means highly socialized, extremely embodied, and localized….. Even since Pascal's first calculating machine, the socializing bas been going on. (Latour in Lovink 2004: 155)*

ANT and its concept of hybridism inform work by John Urry (and others) on mobility in the social sciences (Urry 2002; Urry and Sheller 2006). The notion of 'liquid modernity' (Berman 1983) represents a shift in viewing modernity as material and solid to one which recognises the fleeting movement of information and reinventions of space and place (Urry and Sheller 2006). The notion of the hybrid emerges in movement technologies (walking, transport, surfing the Internet), in cultural identities (contextually and historically grounded yet globally informed) and communications (telephone, face to face, e-mail) within epochs (elements of the post modern and the modern co-exist).

2.4.3 Uneven Access and the Dynamics of Inclusion and Exclusion

An account of the early history of the telephone shows a reluctance to mass distribute the technology and the close association between perceived technical competence and social status (Lasen 2005). This was reflected not only on the marketing strategies of distributors but also the quality of service provided to minority groups. The history of the telephone is

> *…Less the technical evolution of the telephone system than a series of arenas for negotiating issues crucial to the conduct of social life: who is outside and inside, who may speak and who may not, who has the authority and may be believed. (2005: 12).*

The gender dynamic is intrinsically linked to the home/work divide and the perceived role of the 'wife' in this context. The industry view was that women as managers of the household would use the phone to order goods and services. The conversational aspect was simply not anticipated nor encouraged; only in the 1930s did marketing campaigns promote the telephone as a social medium (Lasen 2005). Women worked as operators before automation. The history of the telephone displays an interesting dynamic of inside/outside.

Gender and ascribed social status are supplemented by global dynamics in technological histories. Development of transport infrastructure in South Africa and other African countries was closely tied to the objectives of Empire. In the South African context, the added layer of Apartheid underpinned infrastructure reticulation whilst also having more insidious impacts on the day-to-day functioning of rail, for example. Race was the

organising principle for the operational, spatial and economic aspects of transport and communication technologies.

The digital divide in ICT debates started as a simplistic differentiation between the information-rich North and the poor South. Work in North America and Europe indicates internal divides closely related to socio-economic factors. Thus, divides within countries as well as between them exist. More recent work places emphasis on the cultural and social barriers to technology use – the internal divides. A sophisticated understanding of technology access has evolved. An urban bias is discernible throughout.

2.4.4 Urbanity and ICT

> *This book opens with a city that was, symbolically, a world: it closes with a world that has become, in many practical aspects, a city. (Mumford 1961: Preface to The City in History)*

The role that technology plays in urban conglomeration is explored by Mumford throughout his work on cities. In The City in History, he sees rail as the initial force that contributed to conurbation, augmented by electrical power, automobiles and the roads that accommodate them (Mumford 1961). The way in which space is represented in ICT studies has had many incarnations: from Castells's 'space of flows', to 'data spaces' and 'cyberspace'. These conceptions of space are represented as urban.

Mumford's analyses of the impact of industrialisation on society defined the city as a central institution of study. Early conceptual linkages between the urban condition and technological innovation are evident in sociological studies about technical inventions at the University of Chicago in the 1930s (Lasen 2005). The School's influential study and modelling of the city (under Burgess) considered economic specialisation as part of industrialisation. The study of the city in sociology was developed as a distinctive field where society was considered central to enquiry into technological development (Cortese 1995).

How the city is envisaged varies from how technology is seen and perceived as a part of the urban condition. Mitchell's 'city of bits' (1996) is one where pixels and emotions co-exist, new vocabularies evolve as technologies are appropriated, expanded and utilised. A new tactile and auditory experience permeates urban experience. This is similar, Thrift (1996) argues, to the 18th Century city which was a site of aural, oral and visual experiences informed by change in public life and cultural evolution. Recent work explores how ubiquitous computing and mobile telephony has created a 'sentient city': an animate urban experience that redefines the distinction between public and private (Crang and Graham 2007).

Experiences of technologies are often, therefore, circumscribed as urban. In the introduction to the Cybercities Reader, Graham (2001) explores more functional dimensions between ICT and the urban. ICT has, in many cases, facilitated urban agglomeration and has led to new forms of urbanity. Globalisation theory and its emphasis on world cities explores the impact of ICT on the function of certain cities at the exclusion of others. Many social studies of technology use are located in the urban context.

The city in the early 21st Century is an amalgamation of energies and technologies with the two intertwined in an ongoing socially-mediated environment. Cities today, as they

did 100 years ago, display a multiple array of experiences that intersect with technological innovation at varying levels and scales. A number of bodies of literature inform the interface between digital technologies and urban life. Early contemplations of the relationship between society and technology reflect a suspicion of the objectification of technology. Studies on electricity and the telegraph show that technology adoption is imbued with social norms, political objectives and cultural boundaries.

Yet the relationship between scientific innovation and human progress in the Modernist mindset continues where technological determinism pervades. This is evident in the many 'myths' related to ICT, the assumptions that underpin ICTD initiatives in the South and the hopes for virtual capital and ICT-enabled community networking. The empowering prospects of ICT cannot be denied, but the overview contained in the first part of this chapter shows an evolving scepticism. In Africa the new epoch has yet to emerge. The grand innovation, the restructured lifestyles and spaces have not happened. What matters are the small scale innovations that typify the day-to-day interaction with the material.

3 ICT and Cities... 'urban life Jim, but not as we know it'[4]

There are many dimensions to considering cities within the context of ICT diffusion. The deepening of globalisation with its concomitant economic relations and labour migration has led to the dominance of certain cities in world networks. Quite how this may be altered by the 2008-2009 Global Financial Crisis remains to be seen. These processes are nevertheless related to the diffusion of ICT; (Sassen 1994; Castells 2000a; Castells 2000b; Sassen 2002; Castells 2004). Networks of world cities are augmented through urban conglomeration and investment, facilitated through ICT. The functioning of cities in the global marketplace is tied to digital networks (Castells 2000b; 2004). This implies that some cities are winners and others losers in the global competition for capital and investment.

In his trilogy on the information society, Manuel Castells examines the global inequalities perpetuated by new information technologies; 'spaces of flows', do not necessarily correspond with the 'space of places' (2000a; 2000b). By 'spaces of flows', he refers to networks of interaction as well as nodes and hubs, the connections and core activities in localities that dominate specific industries and exchanges in the New Economy (2000a; 2000b). It incorporates the actions of key actors that intervene in these networks as well as electronic spaces: web sites and interactive electronic sites such as notice boards and blogs. Access to the means to engage in these activities is limited, thus resulting in the exclusionary nature of the distribution of these flows. Space in the Information Age, Castells argues, presents opportunities for democratic endeavour. The 'space of places' is the terrain of city governance and informal networks and hence the platform for mobilization and grass roots action (2000a). Cities are not only nodes in these networks of flows; they are also the loci of oppositional politics.

A rich literature exists on the play of ICT in the realm of the urban. It draws from a number of disciplines. Graham (2004) delineates three perspectives in this regard. The impact of ICT on the city is the focus of debates that are technologically determinist. Much is made of the potential of technology to transcend physical space; the 'death of distance' hypothesis is dominant. At the micro level urban life is anticipated to be reconstituted in the cyber-realm, leading some to question the alienating and anti-social tendencies of information technology.

Structural constraints to the adoption of technology are explored by Castells (2000a; 2000b; 2004) and Harvey (1989), amongst others. Graham (2004) refers to this as the co-evolution perspective – the 'co' referring to the way through which technology innovation runs in parallel with socio-economic change. Economic modes of production and distribution have evolved as technologies have developed. Hence ICT is associated with a particular political economy.

4 Quotation taken from: Mitchell, W. (2000). E-topia: "Urban Life, Jim – But not as we know it". Cambridge, MIT Press.

A relational understanding of the interface between ICT and cities informs the third perspective delineated by Graham (2004). The emphasis here is on the heterogeneity of networks that contain human and non-human elements. Social change is never strictly social; technological innovation is not just about science. Actor-network theorists have influenced thinking on the interactive relationship between humans and machines as part of the body of work under Science and Technology Studies (STS).

The themes concluded on the historical overview provided in Chapter 2 contain resonances of these three perspectives. Technological determinism is discernible in the myths surrounding technological influence and the tendency to equate technical innovation with social change. However, early contemplations of the relationship between society and technology reflected a suspicion of the objectification of technology. Studies on the telephone show that technology adoption is imbued with social norms, political objectives and cultural boundaries. The co-evolution perspective is evident in the literature examining the structural factors that impact on technology adoption. The scepticism regarding ICT4D in more recent work on Africa, in particular, reveals unease with the cultural contexts that inform ICT appropriation; recent more exploratory and contextually informed work signifies a relational approach.

Work on ICT and African cities is limited, largely concerned with developmental objectives and technology diffusion with some recent work tending towards an ethnographic approach (for example Donner 2007). The urban bias of ICT is noted (Adam 2004; Mwesige 2004; Tlabela, Roodt et al. 2007); but little literature exists on the particular dynamics of South African cities and digital technologies. The aim of this research is to address this.

In this chapter, literature on ICT and cities is reviewed concurrently with work on South African cities. An initial discussion of some of the current dynamics of South African cities within the African context highlights the salient features pertinent to this research. Attention is paid to informality and associational networks as some of the ways through which polarisation is addressed and individual agency activated. This part of the review also reveals some of the pertinent role players that contribute to contemporary dynamics.

The remainder of this chapter considers literature on ICT and cities thematically. Gaps within the literature are revealed and unanswered questions highlighted. Conclusions are derived on the conceptual approach best suited to this task.

3.1 The South Africa City in its African Context

Cities in Africa owe allegiance to their colonial legacies, but generalising across such a vast continent underplays the diversity of cultures and imperial histories that influence physical. Cross border migration has intensified the diverse content of these spaces whilst bearing testimony to the porous nature of state boundaries and the attraction that cities have for immigrants and migrants. A trajectory in the literature on African cities reflects an increasing concern with the social infrastructure that allows for livelihoods to persist despite debilitating circumstances (for example Tostensten, Tvedten et al. 2001; Swilling, Simone et al. 2002), an ongoing concern with fragmentation and inequality (Saff 1994; Todes 1998; Harrison, Huchzermeyer et al. 2003; Pieterse 2004; UNHabitat and ECA 2008) with postcolonial perspectives questioning the vantage point from which African cities are assessed and the framing that informs analysis (Simone 2001; Mbembe and Nuttall 2004; Harrison 2006).

The colonial heritage of cities cannot be denied. Imperial histories can be discerned in the spatial imprint facilitated by town planning endeavours of the past as well as legacies of segregation discernible in the urban fabric. Rakodi (2006) contends that, notwithstanding ancient African urban settlements in some regions, "contemporary African cities were new creations in the colonial period"… Colonial interests sought a city form that promoted order and predictability aspiring to "the best of European cities of the time" (p. 312).

City centres were the spatial, economic and administrative domains of colonial power; segregated neighbourhoods flanked the economic cores, safe havens of colonial administrators and local elites. The South African context provides a more pronounced manifestation of these power relations reflecting the desires of the conservative white community following the National Party election victory in 1948. Modernist planning laid the foundation for exclusion and marginalization now evident (Scott 2003). Townships were designed along New Town guidelines, residential developments and growing economic hubs as a result of industrialization in the 1930s, displayed the many excesses of modernism.

Communication and transport infrastructure are implicit and complicit in this regard. The establishment of rail in the late 1800s not only facilitated movement across the continent but also displayed a regional spatial dynamic that was closely aligned with colonial relationships and capital interests (Taaffe, Morrill et al. 1963). Modernization through technological innovation and selective infrastructural development was closely aligned with the needs and goals of Empire, as explored in the previous chapter. A combination of land tenure systems and colonial financial priorities focused networked infrastructures in city centres and colonial enclaves (Balbo 1993). This legacy is apparent in fragmented urban forms where each fragment appears to live and function autonomously, closely tied to survival strategies.

The metaphoric representations of infrastructure in space resonate in the South African context. Townships represented order and respectability, designed to contain and control (Minkley 1998). Networked infrastructures facilitated the "…planned grids of urban life that were regular, clean, visible and open to surveillance" (p. 209). Infrastructural standards and norms contributed to a socio-technical landscape intended to support the Apartheid project: "The degree to which this technocratic modernism guided the planning of townships and housing is startling" (Minkley 1998: 210).

Post-colonial city administrations were concerned with development and autonomy (Rakodi 2006) as displayed in the African socialist experiments of the 1960s and 1970s. Core to implementation was the centrality of the state responsible for economic development and urban planning. Technocratic modernism was imposed, albeit in a different political dispensation. State control is a key tenet of modernist planning and, whilst post-colonial ideals sought to depart from segregation, urban planning was, nevertheless, premised upon colonial models and methods. Labour influx, increased pressures on the urban fabric and greater demand on a small pool of resources was ineffectively combated by the colonial administrative tools of the past. The master plans and urban schemes of colonial administrators were simply inadequate to deal with the challenges of increasing urbanization and peri-urban development and failed to accommodate infrastructural investment (UNHabitat and ECA 2008). This was (and still is) compounded by weak governance due to the limited autonomy of local government in some regions (UNHabitat and ECA 2008). In the 1980s Structural Adjustment Programmes (SAP) curtailed public spending, further burdening the poor.

African urbanization is not accompanied by the industrial growth experienced in the North (UNHabitat and ECA 2008). Large scale urbanization is dominated by uncontrolled informal developments, resulting in a large number of urban dwellers without access to adequate housing or basic services such as water, sanitation, electricity and roads. (UNHabitat and ECA 2008) Patchy urban distribution across the continent is reflected in the range of urbanisation rates, 22.7 percent in East Africa to 57.3 percent in the Southern African region. African cities generate about 55 percent of the continent's total GDP, but 43 percent of its urban population lives below the poverty line. (Ibid.). Regional urbanization has emerged as a trend. City regions such as Gauteng in South Africa, inter-city corridors such as Suez-Cairo-Alexandria, Kenitra-Casablanca and Ibadan-Lagos-Accra are examples.

In South Africa, the contradictions of the late Apartheid policies became discernible as urbanization intensified in the late 1980s, leaving city governments ill equipped to maintain racial legislation and policies. Apartheid had rendered many urban places isolated, whist social and spatial fragmentation continue to plague cities despite ambitious attempts to restructure the Apartheid city (Todes 1998; Harrison, Huchzermeyer et al. 2003; Tomlinson, Beauregard et al. 2003). The common themes that recur are concerns with exclusion, urban poverty, fragmentation and division. The income gap is evident in a high Gini-coefficient in South Africa rising from 0.596 to 0.635 between 1995 and 2001 with urban Gini-coefficients as high as 0.7 in some cities (UNHabitat and ECA 2008).

There are apparent changes in post-Apartheid cities, but not to the extent anticipated. The changes experienced in South African cities in the last two decades are due to the democratization of space as well as global pressures. Cities such as Cape Town, Johannesburg and Durban are multi-cultural, diverse, vibrant areas that have been undergoing political, economic and social transformation. South African cities have experienced a large influx of foreign migrants (particularly in Cape Town and Johannesburg). Despite this, no policy attempts have been made to integrate international migrants. They are considered temporary sojourners in the city (UNHabitat and ECA 2008).

Across the continent, the oil crises of the 1970s and the resulting debt crisis, as well as the end of the Cold War, opened the door to additional actors that would contribute to a complex power dynamic. Liberalization of the global economy meant that international capital entered the fray with increasing local power and influence whilst bilateral agencies and structural adjustment agendas further influenced economic relations in cities. Thus, the relationship between urban place making and administration is not restricted to a simple dynamic between state and civil society, but includes a myriad of actors ranging from international donors, capital to local bureaucratic elites (Rakodi 2006). The spatial form of African and South African cities represents the outcome of complex contested and vested interests. As a result, their forms have changed, which needs to be interpreted as not only the enforced restructuring necessary to adapt to a post-Apartheid and post-colonial era, but also the outcome of complex social, political and economic processes that relate to globalization and economic restructuring. Attempts by local government, in particular in the South African context, to lead urban restructuring efforts are constrained by market trends and conflicting urban policy agendas (Todes 1998) Despite ambitious plans and policies that address housing backlogs and service failure, many South Africans live in abject poverty. South African cities have become increasingly polarized, characterised by social divides between enclaves of wealth and prosperity and abandoned areas (Saff 1994; Tomlinson, Beauregard et al. 2003; Khan 2004).

The demarcation of space is related to relationships between actors, their agencies and the structural legacies of institutional bureaucratization. The spatial manifestation reflects complex power relations between international elites housed in gated residential estates on urban edges, local elites resident in traditionally high income neighbourhoods flanked by informal settlements housing the urban poor that rely on informal public transport to gain access to disparate economic and industrial centres. The modern ideal of the planned, ordered city that responds to state policy and urban planning has, therefore, been superseded by a broader range of actor inputs. The gated communities, poly-nuclear forms and stark contrasts displayed in many urban centres represent a contested terrain of agency interests that are associated with global circuits of capital and political power (Murray 2004).

3.1.1 Alternative Perspectives

The role of South African cities in the global economy is peripheral if one is to impose a 'world city' analysis. Their 'apparent structural irrelevance' (Robinson 2006: 99) deem them less connected to the world economic hierarchy of global finance and economic transfers. Efforts to attract Foreign Direct Investment (FDI) through place marketing and event attraction (the hosting of the FIFA World Cup in 2010 for example) are integral to policy objectives that seek global visibility. Of the South African cities, Johannesburg (and the Gauteng City Region), is touted as one of two potential world cities (the other is Cairo) on the African continent (Rakodi in Robinson 2006). An analysis more attuned to domestic circuits and regional connections reveals the crucial role of cities such as Durban and Johannesburg and the importance of the connection between them. The former is an important African port connected with the latter, a regional financial capital that plays a crucial role as a transport hub (amongst other functions). Robinson (2006) makes the case for an analysis that considers all cities to be 'ordinary' – "assemblages of wider processes…diverse, complex and internally differentiated" (p. 109). Departing from a hierarchical world city classification enables an analysis that recognises that global economic connections are diverse and complex, where "…the city is increasingly a key articulator in a new, regional geography of centrality, dispersal, mobility and connectivity that expands not only to the rest of the continent but around the globe." (Mbembe and Nuttall 2004: 360).

The simplified definition of cities as 'centres of dysfunctional doom' or success stories of the urban renaissance ignore the diverse relational experiences within them. Amin and Graham (1997) argue that an emphasis on the contingent and diverse social practices that determine life in the 'ordinary city' departs from the generalized notions of the city. They quote Thrift: "There is, in other words, no big picture of the modern City to be had but only a set of constantly evolving sketches" (Thrift 1996: 1485). The tendency to define city functioning from the outside in, from the perspective of what is perceived to be the well-functioning city, is based on models outside the African context (Robinson 2006). The inventiveness, the livelihood strategies and the transactions deployed to access resources may indeed speak of an "….embeddedness in multiple elsewheres of which the continent actually speaks." (Mbembe and Nuttall 2004: 348). The notion that African urban spaces are fraught with chaotic interchanges that render the physical unmanageable, speaks of an imagination that sees the African city as an incomplete or even inadequate rendition of an urban (often Western or Northern) ideal; some may argue an incomplete modernity. On the other hand, there is a tendency to 'other' the African urban experience: to conceptually define it as a problematic entity that sits outside how a city is intended to function. In this context, the concept of the 'marginal' may be problematic.

Post-colonial discourses such as these pose a challenge to conventional analyses of urban polarisation. The very poor, the informally housed, informally economically active, those physically challenged and spatially isolated employ strategies and networks to communicate and access resources. The presence of the marginal remains an issue despite the problems that definition may entail (Amin and Thrift 1995).

There are groups within the city that harness resources and technologies that sit outside the realm of policy definitions. The implication is that intervention may fail at the level at which it ultimately matters – at the point where people's energies are harnessed, where their inventiveness is celebrated. 'Within' these strategies, systems and networks, however, are inequalities and contradictions….."….Africa, like everywhere else, has its heres, its elsewheres, and its interstices." (Mbembe and Nuttall 2004: 351).

Networks facilitate the exchange of resources, the norms and rules of behaviour, traditions and relationships that underpin movement and exchanges. In the African context of extremely poor urban conditions, there are high degrees of economic marginalization and high degrees of impermanence associated with cross-border migration due to war and famine and these exchanges, often elusive, dynamic and unpredictable, are manifested in informal and temporary economic and social arrangements. Harrison (2006) borrows from Mignolo (2000) in defining these strategies as 'subaltern', below the surface, not immediately discernible. Amin and Graham (1997) refer to 'interstitial' spaces in which the dominant ideologies and cultural paradigms are less influential, leaving space for oppositional practices, or that which happens outside the usual realm of regulation and control. The 'informal' is seen as such a space.

3.1.2 Operating from the social and economic margins: informal traders

Operating economically from the margins often entails eschewing the usual articulators in economic exchange. Accessing employment, shelter and recreation sometimes necessitates functioning outside formal economic relations, designated spaces and outside the constraints of institutional rules and procedures. Informal trade could be seen as a means whereby those on the margins seek to participate in the urban economy. However, whilst some may see the informal sector as an entrepreneurial triumph over state regulation, the informal perspective sees it as an attempt by the private sector, with the complicity of the state, to reduce labour costs and increase flexibility through making use of unprotected workers (Meagher 1995). The emergence of the informal economy relies on a number of factors. De-concentration of capital in the public sector (brought on by SAP in many cases) as well as socio-economic factors such as the presence of robust social networks and marginalized sources of labour (such as immigrant communities and women) contribute to the emergence of informal trading (Ibid.)

De-industrialization and loss of manufacturing jobs with limited growth in semi – or unskilled jobs in other sectors has led to an increase in the informal economy. There is perhaps a tendency to contrast the formal and informal yet the relationship is more that of a continuum where formal and informal trade relate in a finer grain; "…some workers classified in the informal economy display characteristics of work which are considered to be formal, and large numbers of workers classified in the formal economy display characteristics of work commonly associated with informal work" (Devey, Skinner et al. 2003: 45).

From an urban planning perspective, the management of street trade activity requires an engagement with the physical and the institutional. Public health, pedestrian traffic management, maintenance of public transport infrastructure and public open space upkeep are important physical considerations. Management of public space is critical. Urban public space is essential physical capital where location is of utmost importance. Hence access and location are subject to bargaining and deal making between traders, between traders and gatekeepers as well as traders and officials (Brown 2006). Negotiations between formal and informal interests, local and foreign claims as well as between formal institutions and organs of civil society are often required. On a local scale, the interplay between formal and informal, between official and unofficial, results in fluid relationships between all actors involved. A complex web of contested claims to space emerges. Tenure arrangements are complex where spaces are sublet and sometimes time-shared. Official licenses are not necessarily consistently rewarded, permits vary and initial access to space is often negotiated through kinship networks and deliberations with officials (that may involve bribery) (Ibid.). All of this is often done within a physical context of inadequate infrastructure where the maintenance of public surfaces does not necessarily keep up with demand for trading surfaces.

The informal sector includes the sale of ICT services in 'informal spaces' such as sidewalks and phone shops. Typologies range from semi-formal Internet cafés and phone shops in bespoke containers to fold-up tables on sidewalks available for phone calls (Odendaal 2008). Again, services range from the formal to the informal; sale of telephony requires negotiations with representatives of multinational mobile phone companies and their agents. Connectivity is enabled through corporate infrastructure. Opportunities exist for using ICT to enhance the communication and data transfer functions inherent in business transactions.

Moyi (2003) investigates ICT use amongst informal traders in Kenya and notes that the need for financial and market information as well as credit related information amongst informal traders presupposes a high priority for ICT. Yet, his research finds that it is not as critical as factors like high costs, bureaucracy and poor infrastructure. Internet technology is not considered useful because it is not accessible due to poor access to telephones, electricity as well as computers.

Whilst the presence of ICT services is evident, how technologies are used to establish and deepen economic relations is less obvious. In a study on mobile use amongst small entrepreneurs in Rwanda, Donner (2004) finds that the convenience of maintaining business and personal networks in real time is valued as important. Of interest would be to understand whether new networks and new ways of building associational relations are facilitated through mobile phone use. He notes the blurring of boundaries between personal and business use of mobile phones; "users may be using the mobile technology to bring home to work."(p. 16) which seems especially true for entrepreneurs at the lower end of the income scale. A further blurring occurs between mobility and connectivity effects of the mobile phone, especially in developing countries where landline use may be low (Ibid.). In the context of street trading, connectivity is perhaps more important in terms of social networks whilst mobility is essential given the transience of many street trader conditions. Social networks in the informal sector are important. In the absence of physical resources, those engaged in informal trade rely heavily on social networks and norms for assistance such as loans, training and negotiating access to space (Brown 2006). Traders associations are effective when enabling policy input into municipal policy

formation. They undertake a number of roles ranging from welfare functions to practical inputs such as storage and infrastructure management to advocacy (Ibid.). Less formal networks such as relations between kin and ethnic groups proliferate in the absence of formal structures.

3.1.3 Associational Life and Networks

Associational life provides the lifeblood for many urban Africans taking many forms, including familial networks, church groups, community based organizations (CBOs) and social groupings, which share a number of characteristics. Groups are not necessarily formally constituted; they include adherents or followers, not formal members. Activity relies on participation, not formal enrolment. Leaders are often self-proclaimed, not appointed or elected. Principles of accountability and transparency are not always present. Associational forms deviate from the usual Weberian principles that inform institutions. (Tostensten, Tvedten et al. 2001)

Romantic notions of social networks overlook the divisive elements contained in them. Multiple rationalities are often informed by a dire need for survival as well as adherence to norms that may be contrary to the values that inform notions of all-encompassing cities (Watson 2006). Social networking provides the lifeblood for many Africans, but gender relations and kinship networks are not necessarily inclusive. Watson's example of Crossroads in Cape Town (2003) illustrates how these relations sometimes venture into the criminal realm. An interpretation of cities as spaces that embody multiple values and cultures is best tempered with caution, informed by agreed-upon values that define city building.

Whilst cities aspire to become part of global circuits of capital, internal divisions persist. As some argue (Mbembe and Nuttall 2004; Robinson 2006), all cities are in some way or another connected to global circuits. Local space is the locus from where trans-national and global frameworks are tapped into for enhancing opportunity in the local. The reference point may be local space but the associational processes that enable sense-making of the local requires broader mobilization. Swilling, Simone and Khan (2002) suggest that within the context of globalization and market liberalization, cities have become nodal points in international market networks and trade intentions that may be more adept at excluding, rather than including. Relationships between poor urban citizens in African spaces need to be constantly reconfigured and renegotiated within a context of ongoing precariousness and general 'living on the edge'. African urbanity is not the outcome of modernization processes that underpinned the North, but an organic renewal of "behaviours, dynamics, activities and processes whose own logics are explicable in terms of the specificities of African cities." (p. 313). Activities in cities may relate to survival in specific spaces, but enabling the engagement with the specifics of the local often entails the negotiation of social spaces across boundaries, markets and immediate spaces. African urban areas can, therefore, be linked simultaneously in different ways to "national, regional, and global markets as well as different modes of production and spatial organization." (Simone 2004: 239). The "highly mobile social formations" (p. 2) are fluid manifestations of a rich, yet often insecure, associational life that underpins survival networks.

Simone (2005) reminds us of the city as a site of change, as a place where social transactions abound, where people use their networks, relations with friends, lovers, family and associations to make sense of the daily grind of African urban life. The terrain of urban governance and planning can no longer be defined in space or indeed, frozen in time,

since the urban terrain comprises a divergent range of intentions, communications and movements exchanged between a multiplicity of actors making sense of their life worlds; negotiating, scheming and bargaining between urban spaces.

> *Such bargaining provides new opportunities for the marginalised in society to play a more significant role in local development, as well as subsume such development into the agendas of those with more substantial resources and power. (Simone, 2005: 5).*

At a continental level there are movements and flows manifested in urban spaces that are often connected elsewhere through networks and relations. How poor residents participate in urban life is, to a large extent, determined by the networks they use to enable access to resources; "….the continent has been and still is a space of flows, of flux, of translocation, with multiple nexus of entry and exit points." (Mbembe and Nuttall 2004: 358)

Understanding how information is exchanged and what forms these networks take, could perhaps provide a meaningful entry point for inclusive decision-making. It is simply not that straightforward, argue Simone and Gotz (2003). There is little coherence in these processes, little that can be pinned down long enough in order for meaningful city policy making to occur. While, "the traditional tools have been directed at tying identified actors to preferable behaviours in approved territories" (emphasis added) ….. "displacement is accelerating and progressively eroding the conditions for clarity and certainty" (p. 123). Not only are these transactional spaces unlikely to correspond with physical spaces, but Simone and Gotz are of the opinion that "African identities also display a remarkable capacity *not to need fixed places*" (emphasis in the original) (2003: 125).

The reference point may be local space but the associational processes that enable sense-making of the local requires broader mobilization. These "localized constellations of interests and urban practices" (Simone 2001: 46) produce a "complex topography of intersecting social networks, which simultaneously 'dissolve' into each other but also often maintain rigid operational hierarchies, norms and criteria for participation", supplemented by "strong personal, street, and face-to-face networks, which are important in residential areas of great density." (pp. 52-53).

Thus a number of issues with regard to the functioning of social networks in African cities emerge. Their fluidity and horizontal forms enable a number of entry points for the marginalized. The relationship between local and global becomes less of a binary when considering how networks transcend space. How technology enables these processes and what the implications are for cities is explored in the following section.

3.2 ICT and Cities

ICT and cities are connected and mutually supportive of one another (Graham 2002: 33). New technology enables spatial transcendence, but it also encourages physical proximity. Recent work in sociology examines the increased mobility discernable in recent decades (Urry 2002; Urry and Sheller 2006). Mobility is discernable in the diversity of the inhabitants of urban spaces. The digital may enable virtual travel, but with it comes increased travel reflecting a greater need for physical proximity (Urry 2002).

This paradox is best understood in terms of the broader processes that inform urban economies. ICT allows urban centres to consolidate their influence beyond their physical

boundaries thereby perpetuating their influence and enabling growth. In the unstable and volatile global economic environment, traditional agglomeration patterns are essential in maintaining competitiveness (Graham 2001). Physical proximity remains important. The demand for ICT services and goods is to a large extent driven by demand in metropolitan areas. These markets are growing. (Ibid.) New landscapes of innovation emerge from the interaction between the 'spaces of flows' and 'the spaces of places' (Castells 2004) such as techno-parks, ICT hubs and innovation clusters (Phillips 2003).

The dimensions of this relationship are largely unexamined in the African context. The unevenness of ICT access has led to new patterns of exclusion and created new vestiges of privilege; this is the gist of Graham and Marvin's 'splintering urbanism' hypothesis (Graham 2001; Graham and Marvin 2001; Graham 2001b; Graham 2002). Does this translate into premium networked spaces in the South African context?

The 'new spaces' created by ICT are intrinsically linked to physical place but increasing interest is paid to the relationships between society, infrastructure and space. New 'spatialities' are emerging (Crang and Graham 2007; Dourish and Bell 2007; Hardey 2007); do they provide the means for greater inclusion and perhaps empowerment? ICT-mediated networks transcend the usual limitations of space (Wellman 2001; Hampton and Wellman 2003); one would assume potential for increased social capital in resource poor African urban spaces. The centrality of ICT to city economies, the increase in infrastructural needs have compelled many city governments to employ 'smart city' strategies. What would the emphases of these strategies be in the South African context and how does that relate to larger goals of urban restructuring?

Responses to these many unanswered questions are systematically examined below through review of literature on South African cities concurrently with examination of debates on ICT and cities.

3.2.1 Digital Technologies and Urban Polarisation

The contemporary city reveals the stark unevenness of the diffusion of ICT. Dimensions of the complex relationship between ICT and urban regions are connected to other processes: neo-liberal economic restructuring, the highs and lows of global economic processes and the changing role of the state (Graham 2002). Graham and Marvin (2001) argue that planners have been largely in denial about telecommunication and other networked infrastructures that how they order the spaces they plan. Patterns of ownership and control relate to the spatial structure of cities. The gradual privatization of urban services, in particular ICT infrastructure, leads to a situation where there is high order investment in wealthier areas and little spending in impoverished areas. This has resulted in

> *…An entirely new infrastructural landscape that radically challenges established assumptions that have underpinned the relations between integrated networks and cities. (Graham and Marvin 2001: 139).*

The ownership of ICT utilities and the nature of the technologies themselves conspire towards the creation of an urban form that is not even in its distribution of infrastructural benefits. Kooy and Bakker (2008) argue, however, that developing nations such as Indonesia have been subject to a high degree of differentiation of utility access, and subsequent fragmentation of networks. The splintering of water supply networks in Jakarta did not result from the introduction of private sector management. The legacy of social

differentiation through particularities of water supply infrastructure which are closely aligned with colonial histories have caused Jakarta to be splintered, not splintering (Kooy and Bakker 2008). The modern infrastructure ideal of even access, referred to by Graham and Marvin (2001), simply never applied to many cities in the South.

In the South African context the modern infrastructure ideal was used to segregate, not integrate. Public policy in post-Apartheid South Africa seeks to address market imbalance through pro-poor infrastructure provision strategies that use tariffs and service levels to address income disparities (Jaglin 2008). Pragmatic government intervention can respond to service inequality. Jaglin (2008) cites others in arguing that the heterogeneity accommodated through introduction of private sector actors into the service domain (for example the inclusion of small-scale informal providers) allows for a shift to more demand-oriented approaches, thus responding more effectively to market diversity. The broadening of supply to a broader range of actors could inadvertently have progressive benefits.

It is nevertheless important to consider the roles played by these actors: the capacity and willingness of government to accommodate even access, related policies such as housing and control over urban development, and access to land (Coutard 2008). There appears to be an unexplored middle ground here; the policy interface between public directives and private investment. How best (and what is necessary) to achieve the necessary framework for progressive private intervention within a comprehensive public framework? In the South African context, pro-poor policy discourses advocate the very modernist ideal that Graham and Marvin (2001) contend has been replaced by neoliberal differentiation. Nevertheless, the spatial manifestation of this splintering is discernable. Disconnected islands of prosperity emerge with minimal interaction with the 'real' city. The privatization of space and proliferation of gated communities that reflect high disparities between rich and poor is a common feature in South African cities (Tomlinson, Beauregard et al. 2003; Shatkin 2007). Infrastructure may be differentiated but there are clusters of connectedness and prosperity that contribute to a continued fragmented spatial reality (Todes 1998; Harrison, Huchzermeyer et al. 2003).

The provision of ICT infrastructure is not a straightforward endeavour but one that involves many role players, many socio-economic factors and a market situation that is not necessarily even in its distribution. The result? According to Graham and Marvin (ibid.): "urban 'spaces of seduction' and safety are 'bundled' together with advanced and highly capable premium networked infrastructure" (p. 220) juxtaposed with marginalized spaces having limited access to the essentials. The authors provide a number of examples of how this 'splintering urbanism' is manifested spatially through gated communities (Johannesburg is used as an example), office park developments, indoor malls and skywalks contrasted with underserved inner city areas and low-income suburbs. The packaging of space through local government involvement in availing infrastructure, land preparation, subsidies and security to investing firms is a feature evident in South African urban land markets. Developments to the north of Durban and Sandton, Johannesburg's financial centre, are examples. ICT cherry pick investment spots in down town business districts, high income residential areas, media clusters and high-tech spaces (Graham 2002). The result is juxtaposition of islands of prosperity and invisible poor neighbourhoods. The dual city pattern is a typical feature of cities in developing countries where disparities encourage a lager response (Sudjic 2008). Urban dualism is perpetuated at multiple scales (Graham 2002).

What distinguishes ICT? Graham and Marvin (ibid.) use the term "unbundling" to refer to privatization of service infrastructure in the telecommunication sector in particular. What results is market dominance by one service provider (formerly state-owned but now either partially or fully privatized) with a gradual increase in competition in other segments of the market. The dominant service provider "does not intervene at all in segments where there are other providers." (Curien, in Graham and Marvin, 2001: 139). This is facilitated by ICT innovations. Here the term convergence is relevant. Digital technology has enabled the potential for combining computer databases, digital television, mobile telephones, and hand held devices as well as Geographic Information Systems (GIS) systems into a comprehensive, connected system of information exchange. There is, therefore, an integrative function that can emerge if these technologies are well managed. Each of these, however, is subject to different ownership and institutional arrangements. Computers are privately or institutionally owned, internet connections are privatized, yet the telephone lines facilitating communication is provided by global service providers whilst the infrastructure that facilitates that is dependent on capacity. Market segmentation undermines the integrative function of ICTs. The result is a patchy network infrastructure landscape, some privately owned, some publicly provided with very little understanding of where the gaps are.

Digital technologies are distinctive. Rapid rates of innovation are closely associated with the very strong, but fragmented market interests that control their distribution. These differentiated market interest do, however, allow for access to ICT services. Fernandez-Maldonado (2008) contends that liberalisation of the telecommunications sector has broadened access to Internet services in Lima, Peru. Who uses the technology? A survey of the digital divide in Cape Town indicates that local elites become cyber elites as technological favours the more educated, mobile and technologically sophisticated (Bridges.org. 2002). Access is enabled, but also restricted, at various entry points on the spectrum of scales.

In a review of Graham and Marvin's book, Jacobson (2002) finds the juxtaposition of modernist modes of infrastructural planning with postmodern splintering over exaggerated. Some may argue that the availability of mobile technologies such as cell phones, for example, may indeed decrease spatial inequalities. In fact, the range of technologies may prove to be integrative, providing support to heterogeneous populations in the diverse and fragmented urban contexts. Social and economic cohesion facilitated through ICT may, indeed, transcend spatial fragmentation. The diversity of the market terrain, the convergence potential of ICT in particular, the innovation that stems from market demand and the differentiated modes of supply and broad range of demand, may appear a fragmented complex mess. It is, after all, concomitant with social and political processes that accompanied the liberalisation of infrastructure (Coutard 2008). Inherent in this complexity are the many stories of innovation; "…of how a particular technology can be appropriated by various actors in various ways according to a diverse set of consideration" (p. 1817).

Critique levelled at the 'splintering urbanism' hypothesis calls for a more differentiated and contextualised account of the relationship between networked infrastructure and cities. The debate provides a useful framework for understanding the complexities of the relationships between the various actors that are active in the ICT field, space and

socio-economic systems. It provides a perspective that considers cities as socio-technical processes (Graham 2001). Rather than as background and utility, networked infrastructures are seen as co-producers of urban life.

ICTs present opportunities for horizontal networking and simultaneous communication (Castells 2000a). Urban life is too rich to be controlled by strong institutional and infrastructural interests (Graham and Marvin 2001). Mobilization based upon need is likely in circumstances where some are excluded from technology benefits. Indeed, the very same infrastructure that can lead to a splintering urban form can help to mobilize and integrate interest groups, imparting agency in the process. Analysing this at a macro level ignores the ways through which technology is appropriated more locally and individually. Enhanced mobility and differentiated access necessitate an understanding of digitally enabled networks, as well as new understandings or forms of spatiality that emerge.

3.2.2 ICT-enabled Networks

There is an established literature on digital networks that builds on the work on social capital initiated by Putman (1993) and others. The consensus is that it cannot be assumed that once technology is available, appropriation will deepen movement and networking. The literature on digitally mediated networks (reviewed below) suggests that sustainability is an issue. The nature of technologies used, the existing social networks and the purposes for which communication is needed are all factors that will impact. Technology allows for simultaneous and broad networks across space which implies that they tend to favour a bridging function, but that depends on the context (Liff 2005; Weare, Loges et al. 2005).

Literature on ICT-enabled networks in Africa implies a range of priorities associated with immediate survival. The dominance of mobile telephony in marginal circumstances and the blurred boundaries between private/public that that incurs alters the usual make-up of social networks as shown in the few documented African cases (Moyi 2003; Donner 2004). User innovation is tied to cultural and contextual definitions as shown in the work on 'beeping' by Donner (2005; 2007). Cultural diversity is a determining factor. Curiously, this work does not necessarily expand on the development studies literature on social capital.

The term 'virtual capital' has been coined and refers to the social capital established through digital communication. A number of studies in Europe and North America examine the many dimensions of virtual capital (Shah, Kwak et al. 2001; Hampton 2003; Licoppe and Smoreda 2005; Liff 2005; Weare, Loges et al. 2005; Zhao 2006). Whether such a phenomenon exists was the first question to be answered. Initially, anxiety existed on the potential for digital technologies to undermine physical networks, but research indicates that on-line and mobile activity deepens rather than undermines social networks (DiMaggio, Hargittai et al. 2001; Licoppe and Smoreda 2005) Communities transcend the group and community through online use (Wellman 2001). "Cyberspace fights against physical space less than it complements it" (Wellman 2001: 247)

Drawing from the Netville[5] case in North America, Hampton (2002) argues that Internet relationships are, indeed, relationships, if only in unaccustomed forms . They should, therefore, be treated as extensions of existing relationships, "not as entities in themselves as if existing social networks and existing means of communication did not exist." (p. 229). Internet use actually deepens community involvement by encouraging activity at a neighbourhood level. ICT potentially increases place-based community despite the opportunities not to be place-bound and build on "interest-based" networks alone (Ibid.). There is limited agreement on whether new social networks are actually created through ICT use or whether it expands or deepens existing networks. The nature of on-line networks and their sustainability are issues explored in more recent work on digital networks and virtual capital. The impact of online experience is greater as the geographic distance between contacts increases (Ibid.). It is not so much that online networks replace on the ground networks but rather that they co-exist with other networks – "…relations in cyberplaces are joining with relations on the ground" (Wellman 2001).

Networks are not stable; they are often impermanent and contradictory. Putman's definition of social capital as "features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit" (1995: 67) implies stable terms of engagement. It is a problematic term that is seen as being potentially nebulous, simplistic perhaps in its equation with other forms of capital, as well as conceptually problematic in its application across scales (Portes 1998; Fischer 2005).

Notwithstanding contested views on the notion of social capital, Putman's distinction between 'bridging' and 'bonding' types of social capital provides a point of departure for much work on virtual capital. 'Bridging' capital refers to looser relationships with broader reach whereby opportunities are created for the expansion of networks and resources. 'Bonding' capital refers to the narrower kinship networks that provide more permanent ongoing emotional support. Bridging capital loosens, broadens and expands; depth and commitment are more typical of bonding capital but require strong social norms, 'thick' trust and shared values. Bridging capital emphasizes the looser connections largely concerned with increasing agency density and reach (Pigg and Crank 2004).

Weak ties with broader reach are more conducive to the expansion of existing networks, whilst a deepening of local networks can enhance a sense of 'belonging' and strengthen ties. The nature of on-line networks is informed by the purpose of digital technologies, the functions that dominate and the actual nature of those uses. Technology allows for simultaneous and broad networks across space which implies that they tend to favour a bridging function, yet that would depend on the nature of the technologies used and existing networks (Liff 2005; Weare, Loges et al. 2005).

The loose social arrangements facilitated by the Internet are not necessarily of less value than the more intimate, stronger ties that bond. Initial opinions on the relationship between social capital and virtual networks tend to underplay the 'cross cutting nature of community' (Hampton 2003: 418), the supportive qualities of which should not be

5 Netville was the first documented 'master-plan' community that was designed with full Internet access in homes. The Netville experience has been extensively document by Wellman and Hampton: Hampton, K. (2002). "Place-based and IT Mediated 'Community' " Planning Theory and Practice 3(2).

Hampton, K. N. (2003). "Grieving for a Lost Network: Collective Action in a Wired Suburb." The Information Society **19**: 417 - 428.

Hampton, K. N. and B. Wellman (2003). "Neighboring in Netville: How the Internet supports Community and Social Capital in a Wired Suburb." City and Community **2**(4): 277 - 311.

underestimated. Looser network constellations are not necessarily without purpose as shown by Hampton in his work on the Netville residents' ability to unify and mobilize around a common cause. Not only does the actual reach of communication broaden but Hampton also found a denser web of interaction. Online communication tends to deepen existing bonding relations whilst increasing the breath as well as frequency of usual communication. In the Netville example, connectivity was found to be associated with more recognition of neighbours, increased communication and participation in private and public spheres (Hampton and Wellman 2003) When community interest needs to be mobilized, looser connections can be utilised and deepened through the use of ICT.

Seeing ICT as an enabler of empowerment assumes that there are advantages to digital networking. Recognizing that the line between virtual and 'real' social capital is blurred, that digitally enabled communication is an extension of face-to-face contact and communication through other means does pose the 'so-what?' question. Advantages to using new technologies may only deepen that which already exists, whilst uneven access may worsen inequalities. Whatever use is determined, the Internet and e-mail are communication media that enable a wide range of options with regard to information dissemination and exchange. Different modes of communication are combined with a variety of content representations in one medium (DiMaggio et al. in Pigg and Crank 2004). Two-way communication can deepen relations whilst one-to-many communication functions could broaden information dissemination. Information functions are enhanced by the breadth of representational forms.

Harnessing social networks through technology enables the participation of a range of actors engaged in the urban. Digitally-enabled networks increase the reach of information dissemination. The extent to which new networks are enabled is dependent on the actors involved and the purposes for which the ties are forged in the first place. Public actors such as city governments are active in establishing online ties with communities in processes of urban management, for example. Quite how this enables inclusive governance is explored below.

3.2.3 The Digital City

The divisive potentials of network infrastructure, together with the developmental potential of technology, is a driving force for many local government ICT strategies. Local government is best placed to respond to local needs meaningfully and appropriately. Quite how well local government is placed to mitigate digital inequalities is unclear. Frissen (1997) contends that processes of decision-making that favour consensus-driven, horizontal relations contrast with traditional hierarchical structures of command that characterize many city governments.

Generally local government ICT strategies are designed to enhance governance and further the strategic objectives of city government (Odendaal 2003). City ICT strategies generally entail a number of strategies: creating a 24-hour city by providing and sharing information electronically and using new technologies to promote and enable economic regeneration and place promotion strategies are common (Odendaal 2003; Aurigi 2005). Enabling democracy and participation through electronic means, by using the Internet to create virtual spaces for dialogue and feedback are common (Aurigi 2005: 12).

Policy objectives that inform implementation of the digital city concept reflect larger city strategies to attract investment, promote place and ensure more effective governance.

E-governance coincides with New Public Management reforms intended to make city governments more efficient and performance oriented (Odendaal 2003). A study comparing ICT strategies in Australia (Brisbane) and South Africa (Durban) shows that they are intrinsically linked to their Municipalities' organizational culture, their priorities and objectives and their strategic visions (Odendaal 2003). In a survey of nine European cities in three countries, Cohen and Nijkamp (2002) determine that decision-makers' perceptions of their cities, their visions for their cities as well as the substance of city policies have a direct bearing on the form and intentions of urban ICT policy.

There are practical limitations to achieving e-governance. Digital divide factors present a number of challenges. As Bovaird and Loffler (2002: 13) indicate: "all public agencies are also confronted with the 'digital divide' dilemma, having to balance equity and cost implications of traditional versus electronic service delivery and communication policies." The City of Cape Town's Digital Divide Assessment (Bridges.org. 2002) identifies a number of constraints to achieving 'smart city' status, ranging from physical access to technology, affordability, the availability of appropriate technology, capacity and training as well as socio-cultural factors.

E-government options include using web portals for dissemination of information and creating options for inputs into policy documents. More interactive applications include tracking the approval of plans, queries and complaints. There are, however, more substantive dimensions to e-governance initiatives. Outcomes such as fostering local economic development by providing opportunities for small ICT firms or reinforcing city marketing strategies are key elements of 'smart city' strategies (Odendaal 2003). In the African context e-governance has become closely aligned with decentralisation agendas (Misuraca 2007). In the absence of state support and autonomy, information technology provides the means whereby local government can facilitate input into decision-making at the local level.

The involvement of local government in availing ICT for developmental and governance objectives raises the issue of market failure and the role of the state in this regard. Given that digital infrastructures are predominantly under private ownership and management, the role of the State in addressing spatial gaps is relevant. Telecommunications legislation often curtails such initiatives (Gedye 2005a; 2005b; 2006). The relationship between governance and infrastructure has become increasingly contested as privatization efforts and partnerships muddy the waters. Given the contested nature of ICT relations due to market competition and regulation debates (Van Audenhove 2003), digital infrastructure represents a more layered challenge to urban policy makers. These dimensions extend to space and society.

3.2.4 Infrastructure, Space and Society

When considering the relationship between urban space and ICT within cities, the physical infrastructural elements provide a useful starting point. Cyber-technology is not outside human experience, or beyond it. It is contained in the infrastructure, the cables, the antennas that wire homes and work places together. It is a technology that belongs to certain agencies, that is controlled by others and not necessarily available to everyone. The spatial implications of digital technologies that manifest at the household, community and metropolitan levels are due to economic transactions and communication channels. Information transmission is accelerated, not through pure magic, but through

the very hard infrastructure that exists in space.

Networked infrastructures are generally invisible to those affected by it. Besides electricity transmission lines and telephone poles, the pipes and cables that enable distribution of services have largely existed outside the human experience. The decisions that determine their location, the management structures that enable their functioning are hardly ever neutral as shown in the historical overview in chapter 2 and the issues raised under (3.2.1) above. Their spatial impacts have been assumed to be mostly under the control of the planner. Forward planning is an integral part of infrastructure distribution.

Globally, the lines and towers that determine tele-density have shown a strong Northern bias as figures in Africa indicate low land line access rates. Leapfrogging is evident; mobile phone technology proliferates in the absence of land lines. The move to mobile technology is necessitated by need and market penetration but is also indicative of an increase in the mobility of infrastructure. Wireless technology now implies a finer interface between human experience and connectivity. The technology is ubiquitous and extends to a corporeal experience. This finer grained interface between technology, space and society has a number of implications. Mapping wireless technology is difficult. It is ubiquitously ambient as airwaves take the place of wires (Torrens 2008). The denser the wireless access points, the better the service, thus some relationship with physical development exists. Digital technology has become more interactive as greater control is afforded to the individual: the mobile phone can be on or off, it can roam, it can take messages, photos and send text messages. Mobility across space is physical and virtual. Physical movement is less encumbered by infrastructure; virtual movement is enabled through a closer relationship between the body and a technological device.

A more interactive relationship between technology and human input is discernible in the new generation Internet (Web 2.0) as information can now be uploaded by the user and a continuous dialogue between humans and technology is facilitated. Applications such as mashups and blogging have yielded a range of shared urban experiences on the web (Hardey 2007). These shared urban experiences are accompanied by an implied reciprocity between technology and the personal. Human actors have more control in this instance; the relationship between a person and a machine carries agency.

The ubiquity of everyday computing also has implications. The microchip is a small device embedded in the utilities and hardware that inform everyday living. Literature on the Human-Computer-Interface (HCD) and more recent urban studies provide a largely exploratory account of the societal implications of ubiquitous computing (also discussed in Chapter 2). The mobility of computer technology and its assimilation into lifestyles implies a generative capacity that influences mobility and spatial legibility:

"Urban information technologies and their infrastructures continue the legacy of environmental features like church bells in creating an informative, interpretative environment" (Williams and Dourish 2006: 42).

Does it denote a new spatiality? The computer is no longer delineated in a box, in a mainframe, on a desk or even on a lap. It is contained in the mobile phone, in access gates etc etc. Our everyday experiences are augmented with digital capabilities (Dourish and Bell 2007). The line between infrastructure and personal experience is blurred: "… when computation moves off the desktop, we are forced to understand something of the

spaces into which it moves, and the practical and cultural logics by which those spaces are organized" (Dourish and Bell 2007: 415). The cultural organisation of space interface with practical concerns. Space becomes visible through connectivity or network capacity and therefore in terms of electronic 'locality' (Ibid.)

There is a darker side to "the growing invisibility of socio-technical power" (Graham 2004: 23). It allows for surveillance. As we interface with online shopping sites, purchase with credit cards, move in public spaces under CCTV camera observation, send text messages and engage in online networking sites we leave 'bits' of ourselves (Mitchell 2003). Our shopping patterns, tastes in music and literature, physical movement patterns and contact details become increasingly accessible to third parties.

Does a new spatiality emerge from this? Crang and Graham (2007) explore the notion of 'sentient cities' as the collective of spaces of interwoven digital and real experiences in addition to the usual processes of substitution and encounter. These 'hybrid spaces' (Kluitenberg in Crang and Graham 2007) enable visibility as ICT "allow spaces to both remember and anticipate our lives" (Crang and Graham 2007: 791). Space is no longer a backdrop for interaction (Crang and Graham 2007); it carries agency. Much more research is needed on how space and digital technologies are appropriated and reconfigured concurrently (Graham 2001b). Exploiting the interface between the digital and the real in order to enhance human experience can also be intentional as documented in some of the initiatives in art and design; enhancing public space through digital experiences and providing path-finding devices such as interactive tourist maps. Recombinant design provides means whereby digital devices augment the more traditional fixtures of urban design (Mitchell 1996).

Many of these initiatives bode well for enhanced urban experiences in cities. There is developmental potential in augmenting urban movement, information transmission and knowledge sharing in the African context. The South African context contains better technology access and stable infrastructure despite income differentiation and resource scarcity as reflected in deepening spatial divides. This research explores how this could be addressed through harnessing new technologies.

3.3 Conclusion

ICT allows for movement of information and assists in communicating the necessities of daily urban existence. That much is clear. It is implicit in the economic relations that determine global networks and how they manifest in space. It represents infrastructural investment tied to particular market interests. These broader scale factors are closely tied in with what is available to those living on the margins. What is required is a better understanding of the ways through which ICT is appropriated to enable inclusion from the bottom up. Research on this in the African urban context is limited, as has been shown.

Whilst research on networks and ICT exists, literature in the African context is scant and does not always engage with the specifics of associational networks in African cities. What is required is an approach that examines the relationship between ICT and cities from the inside out, from the bottom up. Engaging with space is not enough in this regard, since power relations and economic networks contribute to the creation and demarcation of space. Space is not static, hence the need to engage with movement and networks. A perspective that considers the African, and South African, context in this regard is essential. Again, the literature on this in the South African context is limited.

Literature on ICT and cities remains based largely on experiences in Western European and North American cities. Contextual elements of digitally informed economies are indirectly explored but technology appropriation is still largely seen as a given. How and for what purpose ICT is used is explored in the community informatics literature such as Day (2005), Liff (2005) and Williams (2006). This gives an understanding of digitally-enabled social networking at a local scale and whilst it draws on cases in the South African context, it nevertheless lacks a conceptual engagement with the nature of associational life and livelihoods in urban spaces.

There is a welcome departure from modernist assumptions about the relationship between African cities and their northern counterparts, but reference to ICT is in relation to its structural input into economic relations rather than its input into an alternative African modernity. Similarly, the literature on digital technologies in South African cities is limited. There is a need for theoretical and empirical work that considers the relationship between urban change – in all its forms – and technology appropriation in what is a context of rapid change and flux. This work needs to be informed by the power relations, institutional dynamics and livelihoods specific to (South) African urban spaces.

What is important to understand then, is how ICT access and technology formats intersect with networks, enables information transmission and mobility. Whilst local innovation can, indeed, be facilitated through ICT, it nevertheless requires a physical organisation that accommodates it. As Graham asserts:

> *…We are experiencing a complex and infinitely diverse range of transformations where new and old practices and media technologies become mutually linked and fused in an ongoing blizzard of change" (2004:11). In order to understand the extent of that in urban life, we need to move beyond infrastructural debates and try and achieve a finer understanding of the "intersection between digital technologies and urban life…(bid.).*

The following chapter explores what constitutes the conceptual elements of such an approach.

4 Towards a Relational Understanding of the Digital City

> *…No technology is ever found working in splendid isolation as though it is the central node in the social universe. It is linked – by the social purposes to which it is put – to other humans and other technologies of different kinds. It is linked to a chain of different activities involving other technologies. And it is heavily contextualized. (Thrift 1996: 1468)*

Material artefacts have an uncanny way of becoming enmeshed in the day-to-day exchanges of city life. In Chapter 2 an overview of the interface between society and technology explores the nuances of that exchange. The modernist project was in many ways premised on the evolutionary nature of technology: faith in invention as a means to progress. The inevitable extension to technological determinism has permeated thinking on scientific invention, from the telegraph to the Internet. Each wave of innovation has brought with it a cluster of ideas that proclaim paradigmatic shifts. Whether dystopian or euphoric they share an approach that separates human experience from the material. It cannot be denied that the telegraph, the telephone, the Internet and the cellular phone have contributed to revolutions in economic production, distribution, communication and information transfer. These material functions are tied to the institutions, networks and systems that determine the coordinates of the economic, social and cultural however. The day-to-day exchanges matter.

Chapter 2 concludes on the centrality of cities, as clusters of innovation as well as manifestations of the structural unease that emerges from uneven technology distribution. Ironically, this is the very feature of contemporary life that was proclaimed to be solved by new technologies. The 'death of distance' enabled through cyber travel never happened however. Air travel has increased and mobility is a dominant feature of contemporary life (Urry and Sheller 2006). Despite the transcending power of new technologies, spatial constraints remain central to the urban experience.

The nature of the relationship between cities and new technologies was explored in Chapter 3. There are gaps in this literature. What is lacking is an engagement with the specificity of marginal conditions, with the contextual elements of African, or with regards to this research, the South African urban condition. Literature on the latter indicates increased fragmentation and the suggestion that not only are urban transformation and integration incomplete, but is impossible. Quite how that relates to ICT distribution and access is unexplored; and is the central purpose of this research.

How then is ICT best understood in the South African urban context? A quantitative analysis of the distribution of handsets, keyboards and screens will reveal the extent of the digital divide. A structural analysis will reveal the unevenness distribution of economic gains. These are important issues but tell only part of the story. Distribution is influenced by these macro features and increasingly city policy is complicit in neo-liberal agendas. There are two problems with technologically determinist argumentation. One, it

assumes that we adapt to technology passively; technology is in fact socially constructed, market-mediated and individually interpreted Two, little normative work is done on the consequences of this relationship. An emphasis on structure replaces technological determinism with social and political determinisms and still maintains a division that assumes technology to be objective and value-free (Bingham 1996: 640).

This research departs from structural and determinist approaches for three reasons. One, literature reviewed in Chapters 2 and 3 reveal the importance of associational life in information exchange and resource access. The agency dynamic that flows from network connections needs to be uncovered. The role that technology plays in that dynamic is explored in a substantial literature on virtual networking (Wellman 2001; Hampton and Wellman 2003; Liff 2005), some of it focusing on African countries (Moyi 2003; Mwesige 2004). Further exploration is needed in the South African context. Two, the distinguishing feature of new technologies is that they blur the experiential line between infrastructure and cognition. The touch of a computer key can transport the user into another world. A mobile phone call turns a public space into a private moment. Increasing convergence enables infrastructure to be more intimately connected with human agency. Three, how technology is appropriated in the livelihood dynamic between human agency and artefact is integral to understanding the empowering potential of ICT. Why are some technologies used and others not as indicated in more recent debates on the digital divide (Bridges.org. 2002; Crang & Graham 2006; Kwaku Kyem and Kweku LeMaire 2006; Selwyn and Facer 2007)? Interrogating market trends and distribution of infrastructure is not enough. A relational understanding that scratches the interface between human agency and technology appropriation is more appropriate.

Science and Technology Studies (STS) provide an avenue for such an enquiry given its early contestation of the objectification of scientific artefacts and knowledge production processes. The initial emphasis was on the social and political processes that underpin what happens in the laboratory and the powerful influences beyond its spatial confines. Bruno Latour's early work on Pasteur explored how power is produced and reproduced beyond the laboratory as human and non-human actors are tied into networks enabling scientific facts and artefacts to transcend distance (Murdoch 2006: 61). Actor-network theory as a cluster of debates that fall within the realm of STS expanded to include work on innovation, power relations (Foucault is an influence), mobility and space. Its origins are in STS and sociology, but its reach has expanded to information science, geography and recently urban studies.

Law (2007) writes of the semiotic relational approach adopted by ANT. In heterogeneous networks material and human elements shape and define one another indicating processes whereby meanings are attached to things, places and people. This is not the intersubjective approach taken by humanist scholars. The ANT relational approach affords equal measure to human and material agency (Ibid.). The implication for research into ICT in South African cities is that a deep contextual understanding is enabled through recognition of the value that people attach to technology and how they appropriate it. How ANT represents a means towards an insightful understanding of transformative practice in South African cities is explored in the first section of this chapter. This is followed by a discussion of the key tenets of ANT. An emphasis on space and the work that falls within the realm of urban studies and planning is emphasised. The chapter concludes on the hypotheses explored in this research, informing the methodology presented in Chapter 5.

4.1.1 A Relational Understanding in the African Context

Literature on African cities examines the way in which social networks function as critical livelihood arteries in the ongoing survival strategies of the poor. These transactions cannot be defined in space or frozen in time. This terrain comprises a divergent range of intentions, communications and movements exchanged between a multiplicity of actors making sense of their life worlds; negotiating, scheming and bargaining. Urban life continues to be reinvented at the margins, despite prevailing exclusionary economic and social forces. The potential exists for harnessing these strategies for developmental aims, building on the social capital created despite the absence of, or in addition to, the usual resources available for survival. Using ICT to harness these energies creates the potential for the true digital city to emerge: a place where communication and exchange are facilitated through technology access. The 'real-time' communication, information transfer and exchange functions facilitated by mobile phones, e-mail and the Internet create the potential for informed decision making around the use and distribution of scarce resources. To merely view ICT as a resource, however, is analytically problematic.

Approaching any form of intervention in African spaces, should take note of the workings of associational networks. There are no absolutes, no models, and no fixes. Considering the digital networks as potentially enabling inclusion and empowerment clearly requires a perspective that acknowledges this. This may be difficult since networks are not necessarily stable and tied to particular places. If one adds the agency of material actors to this dynamic, it remains to be seen if network become constant or are destabilised. The transactional spaces created to bargain and negotiate do not necessarily correspond with the physical spaces impacted upon since they often assume permanence; "African identities also display a remarkable capacity not to need fixed places". (Simone and Gotz 2003: 125). Mobile technologies may increase the ephemeral quality of networks. Research on this is needed.

Activities in cities relate to survival in specific spaces, but enabling the engagement with the specifics of the local often entails the negotiation of social spaces across boundaries, markets and local places. Urban areas can be linked to "national, regional, and global markets as well as different modes of production and spatial organization." (Simone, 2004: 239). The local and the global co-exist. The negotiations necessary to survive in particular spaces do not necessarily lead to connection to place. Becoming does not necessarily lead to belonging (Ibid.). Associational networks are not employed as 'capital' in a 'bank' of strategies intended to reinforce attachment to place; they are often fleeting exchanges, temporary alignments of interests (Tostensten, Tvedten et al. 2001). Despite their lack of guaranteed permanence, these social networks provide the vehicles for information sharing, resource negotiations and support in precarious living conditions.

Human agency is employed in conditions of political crisis and instability (Simone 2005). Some of the alliances are informed by questionable normative relations, as Watson's work (2003) on community networks in relatively stable Cape Town shows. The subtleties of human endeavour are informed by more than the linearity of resource need and access. Contextual factors, histories, intentions, perceptions and the agreements that underpin associational ties contribute to a layered human intention. They are often of the moment, and are deeply circumscribed by circumstance.

Culture is a dimension explored by Pieterse in his argument for a 'transgressive' urban politics that uncovers the relationship between agency and culture; "language, discourse

and symbolic meanings" are extensions of agency (2005: 140). Whilst ethnic prescriptions may potentially exclude, drawing on cultural resources, argues Pieterse, potentially provide the means whereby the disciplinary boundaries imposed by the 'governmentality' framework (posed by the state and its allies) may be challenged. Here he uses the Foucauldian definition of the term 'governmentality' (Philp 1985) to denote relations of power between policy and the local. The cultural discourses that constitute these 'subaltern practices' (Pieterse 2005) can however discipline in the creation of spaces of inequality and disempowerment in social networks. Agency is informed by the energies that inform the ability to act, to contribute. In cultural settings where rules and norms are not determined through consensus, variables such as gender, age and religion may lead to exclusion rather than empowerment. These limitations are not necessarily external to the actor since:

> *Discourses provide a lens on the world, our everyday spaces and us. … we internalize discourses about what is appropriate to think about how to think (or believe) about the issues we should think about, and how to act in consistent ways with what we believe. All this comes to us as unquestionable truths and that is the core of the power of discourse." (Pieterse 2005: 158)*

Pieterse's work departs from the exclude/include dichotomy raised in earlier work on associational networks. Human agency is informed by how cultural norms and values are internalised. The meaning associated with material artefacts as an extension of culture relates to this research. The semiotic attachment to things relate to individual and inscribed norms and values. How these influence technology use and selection is, from an ANT perspective, best understood by following the actors, uncovering the network that enrols these relations.

Power and discourse are important considerations. Foucault's contribution to the study of power relations in the resource battles that determine the African context is useful. The ways through which power operates locally, constantly being produced and reproduced together with insights into the processes whereby discourses are internalized and reproduced offer valuable conceptual insights (Foucault 1989). This subtle understanding of power allows for a localized perspective. It does not explicitly address networks however. Assumptions regarding networks as constellations of reciprocity do not allow for deeper investigation into how power is produced and reproduced in networks, or, how the rules of networks display power through internalized discourses that guide action and expectations within a network. This is the contribution of ANT as is shown in the remainder of this chapter.

This research examines the inclusion of technology in networks in marginal conditions. Much of the ICT for Development (ICT4D) literature assumes technology to be empowering. A Foucauldian lens reveals the interesting power/knowledge dynamic that emerges where technology favours the educated, the skilled, the powerful. This can change. Technological knowledge can dominate but it can also emancipate. However, it is evident that technology does not sit 'outside' us. Technology can only be considered a meaningful development tool if it is incorporated as ongoing input into the day to day decision-making of the poor. The social appropriation of technology and network strategies people employ to manage and access resources require consideration. This departs from a technologically determinist notion that the provision of hardware is enough; that broad availability of cell phones, computers and Internet access will enable digital networking

and resource procurement. Our personal, social and economic life worlds are informed by improved means of communication and more immediate means of connecting.

Technologies get appropriated in different ways, which in itself is informed by context and agenda. ICT inform and enrich networks (sometimes it may undermine them) but the technology itself is also part of an economic network relation: a web of ownership patterns, regulation and corporate relations. An analytical frame needs to take cognizance of the various scales of networks yet be malleable enough to allow for insights into the local. Material inputs, sociological processes and psychological barriers have bearing on the relationship between the social and technological.

Maintaining a sense of belonging whilst at the same time constantly becoming, implies a dynamic interplay between human action and urban space. The late 1990s saw a beginnings of a post-structural trend in human geography that sought to reveal relations between beings in space as networks, chains or associations (Murdoch 1997: 322). 'Associationalist' forms of analysis in economic geography moved beyond binaries. The study of heterogeneous associations examines how people and 'things', structures, systems are "….'stitched together' across divisions and distinctions" (Murdoch 1997: 322). Understanding these heterogeneous associations allows for analytical movement between the macro and the micro, the local and the global, the social and the material (Ibid.)

Actor-network theory (ANT) enables a perspective that is meaningful in this regard. Murdoch (1997) defines ANT as comprising strands that study science and scientific knowledge, technological development and general theory (mostly situated in sociology). There are many dimensions to ANT but of particular relevance is the lens it provides for understanding the relationship between actors and networks, how actors are defined, the role of technology and the functioning of networks in space and across scales. ANT is not necessarily about networks….or technology however (Latour 2005). As shown in this chapter, this is perhaps the least interesting thing about ANT for it constitutes a relational approach that is open-ended and contingent. This chapter outlines the primary components of ANT that relate to this research.

4.2 Actor-network Theory

Enquiry into appropriation of technology in South African urban spaces needs to be contextually rich, acknowledging the interaction between technology and human as reciprocal and dynamic. Drawing on Latour and Law, Bingham argues how "machines, texts, buildings: all of these, as well as people, come to be seen as (potentially) embodying networks, and thus (potentially) the loci of 'action'." (1996: 647). These various entities are therefore not seen as separate objects that can be manipulated from the outside, but all of them are actors, or in ANT language, human and non-human actants.

Actants are engaged in a heterogeneous network where any actor, whether person or object, or institution, is equally important in the maintenance and protection of the network (Law 1991). The relationship between the 'bits and pieces' referred to above, is not stable however, but engaged in "connection, interdependence, mutuality, and….relations, above all" (Bingham 1996: 644). An actor-network is fluid, where a change in one of the actants could have an impact on the identity and relations between actors; "every actor is also a network" (p. 647) whilst agency refers to the impact generated by a network. Maintaining the integrity of this network would depend on how well it responds to a change in any of its components. An inherent instability results from the fact that the network is open-

ended. These relations are fluid, dynamic and potentially unstable, according with much of what is written about associational networks in African cities.

The emphasis on agency makes ANT a powerful analytical tool. The understanding that "technologies only have contingent, and diverse, effects through the ways in which they become linked into specific social and cultural contexts by linked human and technological agency" (Graham 2004: 69) reminds us that physical infrastructure, ICT 'bits', are ascribed value in a multitude of contingent actor-networks. The material semiotic is enabled through an analytical equivalence imparted to material and human actants, recognition of the heterogeneous composition of networks.

This represents a departure from what Graham (2004) refers to as the substitution and co-evolution perspectives that have dominated earlier ICT-city debates. The former refers to the notions that the "space and place-based dynamics of human life" (p. 67) are in danger of being replaced by cyberspaces and cyber geographies. The latter entails a parallel view of electronic and territorial spaces as being produced together – influencing one another yet also evolving within the context of political and economic forces. Both these perspectives maintain an adherence to objectified notions of technology and a remaining technological determinism. They nevertheless assist us in understanding the larger socio-political imbalances brought about by the economic order facilitated through ICT (work by Castells and Harvey for example).

ANT is criticized for underplaying structural conditions and normative concerns (Walsham 1997). Do we behave in accordance with larger norms and values solidified in institutions and systems or do we act voluntarily and contextually? The relationship between structure and agency in ANT differs from work by Giddens on structuration theory in that institutions and organisations are seen as encompassing networks; actors and actants enrolled in accordance with agreed upon terms. They are static, stable entities but subject to change and pressure. Whereas Giddens emphases the reciprocal influence of structure and agency, ANT sees this as an unnecessary binary. Law argues that the relationship between agency and structure is irrelevant, calling for a 'bonfire of the dualisms' (1999). Analysis is best focused on the networks that encompass elements of structure allowing for layered descriptions of their operation (Mutch 2002).

Understanding local action in relation to structural forces that seemingly operate at a broader scale is necessary but difficult. Murdoch (1997) argues that the ways in which the systems of power and structures associated with the macro scale interface with micro-level action is not altogether clear – "….interaction is opaque and it is this very opacity which gives rise to the dualisms of micro-macro and action-structure" (p. 323). Dualisms emerge, such as structure/agency, macro/micro, and local/global etc. Structuration theory essentially draws these together through the concept of structuration – referring to the dynamic nature of the relationship between structure and agency – where structure is constantly being produced and reproduced – essentially mediated by human action (Ibid.). Structure is not static, it is continuously reproduced; action is enabled through that reproduction.

Murdoch (1997) argues that the physical is not made explicit in structuration theory. Technologies, buildings, material resources are assumed to be part of the manifestation of structure – the very structure that is continuously reproduced through voluntary action. Giddens's emphasis on social interaction recognises the physical world as having a constraining effect but does not really move beyond that (Murdoch 1997). The analytical

issue emerges when trying to understand the extent to which structure as manifested in space, as experienced in the physical, impacts on action. The opaqueness of this interface in structuration theory, argues Murdoch (1997), does not allow for the constraints imposed by the physical on human agency to be made explicit. This implicit divide between social and material is problematic.

The relationships between the material and social are referred to by Murdoch as 'heterogeneous associations' (1997: 325). Heterogeneous here refers to the nature of the relations as well as the actors involved. Interaction between structure and agency occur at many scales, take many forms and can be mutually beneficial or exclusive. The physical world constrains and permits. Power is imposed, contested and recreated. These are not simply dualities. These heterogeneous associations include actors from the material and non-material world; human and non-human. Agency is underpinned by how actors relate to one another; by intention, anticipation as well as action. Actors are joined by the networks that evolve from these interactions. Non-human actors represent the actions of the past and therefore have agency. Interaction never just happens locally and it is not a-historical; it occurs at varying scales and carries implication from different times. Moving across temporal and spatial boundaries is what makes ANT a particularly powerful analytical tool. Analytical movement between scales is facilitated through consideration of technology as an actor as part of a network. For example, when examining mobile phone use amongst informal street traders one would include considering the mobile phones they use, the cell phone operators that enable this use and the airtime vendors. In addition to enabling analysis that moves beyond dualities, the consideration of ICT as actor opens up network possibilities and may reveal relations previously not considered.

Time is considered elastic where histories and anticipated futures influence action. The incorporation of technology into social networks is not just deepening process where ICT is an additional resource factored into the equation. It carries history, expectations, definitions and intention. The functioning of social networks is revealed as an unstable process that can be highly volatile yet also reassuringly supportive of livelihood strategies. Considering ICT as part of these networks requires deeper insights into how these networks stabilize and evolve and how digital technologies may alter these dynamics. ANT contributes through a deeper understanding of the interplay between actor, agency and structure (Latour 2005). The following sections examine further the main concepts that apply to this research and how they impact analytically.

4.2.1 Actors…actants

The interplay between actor, agency and structure is imbued with meaning and interpretation. Notwithstanding the material factors that influence human agency; appropriation, interpretation and negotiation of those factors carry energy and impact. What motivates and defines the actor is uncovered through the examination of relations within the network. A critique that actors are not adequately described and defined in ANT focuses attention on its strength as an approach that uncovers the varying functions and forms ascribed to the actor in a network (Callon in Law & Hassard, 1999). The varying forms and functions an actor takes on is semiotic; the symbolism and meaning ascribed to the actor in a network needs to be uncovered within the context of the network.

The post structural influences on ANT are revealed in the need to study the 'what' of phenomena, as well as the 'how' (Murdoch 2006). Following an actor allows for examination of associations and processes of ordering, connection and disconnection (Van Der

Duim 2007). The role and function of the actor is related to how those connections are maintained, constructed and reconstructed. The notions of symmetry, agency and translation are important concepts in this regard.

4.2.2. Symmetry

ANT requires that "….everything, more particularly, that everything you seek to explain or describe should be approached in the same way" (Law 1994: 9-10). The ANT notion of symmetry is contentious in that it argues for analytical equality in the treatment of human and non-human actors. It is misunderstood. Networks are considered heterogeneous, comprising human and non-human actors or 'actants'. The distinction between 'actor' and 'actant' is not without consequence. Human and non-human agencies are not equivalent in terms of character and intention (Rose and Jones 2005) but deserve equivalent interrogation with regards to understanding networks that contain technological elements. Material and human elements are enrolled into a network in order to maintain it: "…things act in concert with humans; humans act in concert with things" (Murdoch 2006: 67).

Symmetry does not constitute 'equality' and does not assume similar character, argue Rose and Jones (2005), it considers non- and human agency in equal measures. Equality is measured in terms of the 'power to act' due to its position in a network (Rose and Jones 2005), as a component of a network; stabilizing and maintaining those networks. Thus, machines do not have human characteristics, but in the process of acting, in the process of network formation and maintenance, human and non-human agency becomes entangled in ongoing interaction. They derive their form and characteristics, as pertaining to that network, as an outcome of their relations with others (Van Der Duim 2007). The perceived autonomy of machines is misleading. It is the interpretative process that accompanies the perceptions that machines are autonomous as they become more advanced, more embedded in networks, and the intentions that evolve from this interpretation that matters. Intention informs action, which in turn constitutes agency.

4.2.3 Agency

Agency in ANT language differs from traditional conceptions of agency as evolving from autonomous individuals driven by their own values and inclinations unless constrained by other forces. The actor-network definition of agency sees it emerging from network relations, relations perform agency (Murdoch 2006: 68).

Non-human actors are equal contributors to the agency dynamic; they have 'transformative capacity' (hence the term 'actants' – to move away from the association of agency with humans only) (Rose and Jones 2005). A distinction is drawn between the attributes of human and non-human agency and the contribution that agency makes to network formation:

> *…Humans and machines can both be understood to demonstrate agency, in the sense of performing actions that have consequences, but the character of that agency should not be understood as equivalent. Human agents have purposes and forms of awareness that machines do not. The two kinds of agency are not separate, but intertwined, and their consequences emergent. Those consequences are also the subject of human interpretations which provide part of the context for future actions. (Rose and Jones 2005: 27)*

Rose and Jones develop a 'double dance of agency' model that consider the properties, processes and conditions that underpin networks (2005). This is useful since it reveals

the way in which machines and humans act, as well as the relations that distinguish them. Machines are used as tools, proxies and automata; they are not reflexive. Yet, the awareness and interpretation of their value, the innovation that accompanies their design are human qualities. Discourses and the embedded nature of meaning through attribution of value are human endeavours. Machines contribute to this dynamic.

Latour (1987) makes the distinction between mutable and immutable mobiles. The former are malleable, more able to be integrated with network needs and function. The latter carry rationalities of rule beyond the institution, what he calls the 'centre of calculation' (Latour 1987). Machines are what enable the exercise of power from the centre through networks.

4.2.4 Actor Networks

The processes by which machines act as explored by Rose and Jones (2005) go beyond the traditional functions of enabling and constraining. Machines posit a situation through which humans may be compelled to act. The act of network formation – network making – would most likely be informed by not only what is possible, but what is perceived to be possible by individuals. Intentions as well as aspirations are informed by the perceptions and prior experiences of technologies. The 'fit' between machine and human would also determine the outcome of such processes; "….some human intentions fit more easily than others with the design trajectories of the machines…" (Rose and Jones 2005: 30). But what informs those design trajectories? Markets, research networks, profit motives, policy. Outcomes are seldom informed by one type of agency. They are unpredictable and multi-layered. Furthermore, network making through the development of actor-networks moves across scales and through increasingly complex associations (Murdoch 1997). The inclusion of ICT as part of a network is pertinent in this regard. Given that new technologies facilitate transcendence of place, their inclusion conceptually in an actor-network potentially creates spaces for analysis across … space.

The ANT notion of agency is open-ended; actors are incomplete agents in a social space defined by networks and associations; "Action is therefore the property of associations rather than human agents…." (Murdoch 1997: 330). Personal histories and broader social structures contribute to agency and evolve (emerge) through the process of agency creation (Rose and Jones 2005: 31). The 'dance' metaphor implies action and interaction; fleeting unions of artistic expression are imprinted on the minds of the audience and carried through into the next performance. Relations perform and it is in their performance that agency is created (Cordella and Shaikh 2006). It is the interplay, the energies that are generated, that should be considered as essential in the shaping of relations and networks: "…the movement, the dynamic interaction of actors in the circularity of the interactions between human and non-human entities, and in their 'mutual constituency' in the process…" (Cordella and Shaikh 2006: 7).

Thus, the processes through which socio-networks are created are as important as the actual outcomes of these processes. The open-ended nature of these processes through which these relationships are defined and redefined means that; 'the actor is generated in and by these relationships" (Cordella and Shaikh 2006: 9). This implies that nothing can be intrinsically assumed as a priori and that actor-networks are potentially unstable. Furthermore, actors are contributors to networks, but they also emerge as outcomes of those relationships. More important (ontologically) is that the actual relationship becomes an actor/actant if relations are stabilised. This is enabled through translation.

4.2.5 Translation

Ongoing maintenance of networks entails definition, interpretation and negotiation. Network elements need to have interests in the network; actant goals need to align. This process of translation enables ongoing maintenance of the network. The notion of interest is particularly important in understanding how translation is operationalised. For translation to be functional, there needs to be a convergence of interests between actors (Murdoch 2006: 63). This is the means whereby associations continue to exist through attribution and definition of roles, functions, systems and processes (Van Der Duim 2007: 966). This process redefines and reasserts the position and functions of the actants in the network on an ongoing basis. The emergent process redefines reality which is "achieved through the interplay between different actors, both human and non-human, with equal constitutive characteristics." (Cordella and Shaikh 2006: 14). 'Becoming' a part of a network is ongoing, 'belonging' is not a static condition but one that is continuously negotiated and redefined; 'being' refers to the continuously dynamic state that constitutes human experience.

The energies created by the interaction between technology and society constitute a layer of inputs, contributions and outputs that sometimes deepen, sometimes constrain and potentially broaden human experience. "Translation is a definition of roles and the delineation of a scenario" (Callon, in Van Der Duim 2007). How that scenario plays itself out can only be understood by tracking the network, following its process and revealing the role definitions and assignations that take place during the process. The heterogeneous nature of associations and how they are defined in a network requires that "the tactics of translation" be uncovered (Van Der Duim 2007: 966). Translation can either be negotiated consensually or imposed coercively; stabilisation of these conditions is best achieved through material artefacts since they are stable. "In short, technologies can make good disciplinary machines" (Murdoch 2006: 66). This entails an exercise of power.

4.2.6 Power

Power in ANT is investigated as a relational outcome within actor-networks; invested in associations, not things. Defining power as a dynamic that is translated (not diffused) accords with the Foucauldian conceptualization of power. Power is significant when considering the entry of ICT into a network in the developing context. Interactions with machines are not neutral; they are imbued with disciplinary power, discourses and aspirations. In a resource-scarce context the relationship between technological knowledge and power can potentially influence the outcome of a network relationship in ways contrary to its original intention (Odendaal 2002). An engagement with power that sees it as more than a function of translation is required and here ANT needs to be supplemented by a more suspicious yet sophisticated conceptualization of how power works in networks. There is similarity between Foucauldian and ANT notions of power in that it is not seen as a resource, but as a dynamic that derives from process. Discourse making is key to the former whilst ANT sees power being drawn from how resources are mobilized and deployed across space and over time through network translation. The two ideas are not unrelated.

Foucault's emphasis on institutions and how they contribute to discourse formations is valuable in a context where planning in urban spaces is considered. It is also useful when considering the power/knowledge dynamic that may arise from an actor-network containing ICT. It deepens an understanding of how disciplinary knowledge can impact on associations. Like ANT, it does not pose spatial or temporal constraints. The method

of genealogy can reveal the development of power relations over time. Spatial relations of power provide useful entry points for understanding the interface between institutional decision-making, relations of capital and local experience of place. Where ANT would define it as an outcome resource mobilization and is represented in institutions that seemingly 'hold power', a Foucauldian perspective would argue that power is an outcome of discourse formation that is deepened and translated through institutions and disciplines (Foucault 1989). The production of power within and by institutions and disciplines are critical contributions of Foucault's work. The circulation of power beyond and between these entities is explored by ANT (Murdoch 2006: 56). Early ANT work in particular was concerned with the power relations within scientific communities and its ability to control beyond its disciplinary boundaries; relations between the laboratory and the outside environment (Ibid.).

There are many parallels between the ANT and Foucauldian views of power, particularly the similarities between the notion of discourse formation and translation. Negotiating, demarcating and defining network elements is an exercise in power. These processes of translation are not dissimilar to the ascriptions that entail discourse formation. How power operates outside these processes, or beyond, the effect of power needs to be considered also (1991). Whilst a Foucauldian analysis gives a useful account of the ubiquity of power, the distribution and creation of power requires a departure from the dichotomous approach that either sees power unified in domination, or in its strategic operations in conflict (p 169). Power can be stored, it has capacity, it can change and translate as an effect or product (Law 1991: 170).

Space represents the territorial manifestation of resource consolidation. Representations of power (whether in political parties, institutions etc) are resource bases that have been created over time, "…a capability or series of capabilities that have been produced through an ongoing process of mobilization. Resources are territorially embedded, but they are also mobilized through networked relationships" (Van Der Duim 2007: 967). How the relationship between territory and networks translates in space is an important contribution of ANT, in particular through the work of the late Jonathan Murdoch.

4.3 Actor-network theory and Space

There is no absolute space (just as there is no absolute nature, no absolute society, no absolute time); only specific space-time configurations, conditioned by the rationalities and relations that run through networks." (Murdoch 2006: 74)

There are three contributions that ANT makes to the study of relations in space: it forces an engagement with context, it moves beyond conceptual dualisms (such as macro/micro, local/global etc) and it provides the means whereby associations across different scales can be understood (Campbell 2005). Space is inherent in translation processes as the actor agencies in one place impacts on another through networks. The term local refers to the translated practices within a particular locale, as well as the "…strategies of 'localization' being employed as places are 'lined up' within a given network' (Murdoch 2006: 70). Local and global are determined in accordance with the extension of networks.

Analysis of space is not just concerned with the physical, but the various energies that influence movement and place making. It is concerned with the relationships between elements, their functions (Van Der Duim 2007). Conversely, actor-network analysis will always have spatial implications since heterogeneous relations are able to connect social

actors across distance (Murdoch 2006: 3). Scale is determined by the length of the network.

The exchange between society and space works both ways. The collective activities of actors contribute to the creation of space; networks relations determine creation of place through investment decisions while space represents the material manifestations of what has been negotiated over time and what could be.

> *Societies – and spaces – emerge from the collective activities of these heterogeneous actors between which powers are distributed, responsibilities are allocated, actions are constructed and spaces configured. It is the distributions, allocations, constructions and configurations which should catch our attention. (Murdoch 1997: 334)*

The interstices that define the interactions between actors, within actor-networks, are shaped by the social as well as the material. This is where ANT departs from other perspectives. Following the chains of interactions, the networks, could take the analyst through time and across space. Action that informs these networks could come from human and non-human actors – depending on the associations within the networks (Ibid.). Like power, size is manufactured as part of the workings of the actor-network. This implies a particular conception of distance. Distance becomes malleable in ANT; "Once distance is linked to process then it must be assessed from within such processes" (Murdoch 1998: 358). Murdoch (1998) uses the term 'topological textures' to describe what emerges when space and networks are combined in analysis, particularly within an analysis that recognizes heterogeneous associations within these networks. Following a network may reveal complex relationships between space and time that defies the conventional understanding that tends to be static. "There is no one time or space, rather there are a number of co-existing space-times" (Murdoch 1998: 360).

The complex constellations that emerge from such an analysis captured in a particular interstice may therefore refer to histories, global references within local contexts, impressions of the future, fears for the future, present intentions etc. What pulls them together are the networks between actors. Analyzing a particular moment in networks may reveal neighbors to be distant, the global to be local and the foreign being 'here'. Latour (1994) argues that the inclusion of non-human actors in the creation of networks that provide the conceptual tools to analyze across space and time. The materiality of non-human actors can solidify networks into structure. This is particularly important when considering ICT given its complex layers of capital and institutional relations.

The way that a network may configure the actions of its associates over time could then stabilize into an actor-network translated into space at a particular time. If these networks are stable they become actors themselves, consolidated entities that Murdoch (1998) refers to the ways in which spaces are enrolled into networks: places are arranged and ordered in line with the terms established by the actor-networks. Space is 'arrived at' therefore. It is also a manifestation of 'means of arrival'. Translation refers to the processes whereby relations between actors, places and things are established (Ibid.). Space is an outcome and manifestation of process.

4.3.1 Topological Space

In his later work, Murdoch draws a post-structural distinction between topographical and topological spaces (2006). Topographical (Euclidian) space is defined by the physical, signified by the points, polygons and lines that define features on maps. Post-structural

geographers use the term topological space to refer to,"…the relational complexities that lie 'underneath' spatial forms" (Murdoch 2006: 12). Decision making and influence within networks have spatial implications in that influence is exercised from beyond. Where agreed network imperatives align with local discretion, the influence of the network is extended (p. 83). The spatial constellation that emerges from stabilized network relations becomes fixed through punctuation; spatial identity is defined in the 'here and now' through foregrounding particular features and characteristics (Munro 2004). Alternative positions and definitions may then co-exist and function simultaneously (Murdoch 2006: 85). Places have multiple identities and functions. These identities are results of stabilization in different networks; they can compete or co-exist.

The process of translation could entail contestation however as relations of power play themselves out where roles and functions are negotiated. Some spaces lend themselves to negotiation as interaction is fluid, varied and potentially unstable. Some spaces are less open to negotiation as political rules, social norms and the influence of capital for example determine very distinctive boundaries. To distinguish, Murdoch (1998) uses the terms 'space of negotiation' and 'space of prescription'. The former refers to the less circumscribed circumstance that permit greater freedom to define and renegotiate, the latter refers to the more formal constellations that reflect agreed upon unity between actors. The latter appears to be more stable, yet Murdoch (1998) contends that the two can merge into one another. There is always room for negotiation outside the confines of network prescriptions. Looking beyond a physical geography of space shines light on the actors and groups that subvert and appropriate space in oppositional practice and / or as a response to hegemonic conditions (Murdoch 2006: 13).

In addition to topographical and network spaces, Mol and Law (1994) define 'fluid' space, referring to spatial relations in flux, shifting and constantly moving. The purpose is to recognize that spaces can have more than singular identities – they can be containers for the 'other', for diversity and difference. Network relations are informed by multiple experiences, inclusions and exclusions (Murdoch 2006: 88).

Network relations can be simple and defined, or complex and unstable. Murdoch formulates a continuum as an analytical frame for understanding network spaces. The one end is defined by 'singular' spaces in which codified and standardized terms of relations apply; the other is typified by highly fluid spaces in which flux and variation are norms. The place on the network is defined by trade-offs between singularity and multiplicity, topology and topography and the extent of prescription and negotiation (p. 89). The same place with the same network typology may move along the continuum in accordance with temporal conditions.

An ANT lens shines light on the messiness; the contested agendas, the overlapping networks, the informality and the temporary nature of urban existence at the margins. Moving away from dualities and using a poststructuralist lens allows for the story to be told in its own language in accordance with its own rules. Following the story could then take the analyst across time and space; thereby allowing for the understanding of histories and connections between places. It allows for a multi-layered understanding of context.

The conceptual malleability of space provides the means whereby multi-level networks and intertwined spaces can be understood. The principle of symmetry provides the means where material and non-material objects can be considered as co-constructors

of space, as links in the networks that inform space. The actions of non-humans and humans differ or course, intentionality is the key difference between the two (Pickering in Murdoch 1998) and the ways in which they respond to systems of classification and rule making. The dynamic between human and non-human and their placements in a network will determine the extent to which spaces of negotiation become spaces of prescription or vice versa. This also allows for the analysis of power in space – tracking the spatial manifestations of networks will also reveal the topologies of power that underpin spaces of negotiation and prescription (Murdoch 1998). Not only will it reveal connections, associations and time-space relations but it will also consider movement in between.

4.3.2 Mobility

Pervasive computing and mobile ICT implies that technology contributes to the mediation between personal experience and space. Recent work in Human-Computer-Interaction (HDI) grapples with the relationship between the technical and the social (Williams and Dourish 2006; Dourish and Bell 2007). The contribution of a relational perspective is the emphasis on the agency of technology in creating new experiences, leading to new action and relationships. Enhanced and more immediate communication systems have led to new forms of social coordination and connectivity (Sheller 2004). Network configurations alter as communication becomes more immediate, fluid and efficient. Social networks have expanded, yet allow for more fleeting and temporary memberships arrangements (Larsen, Urry et al. 2006). Coordination methods are more fluid and flexible and allow for greater degrees of informality given the immediacy of ICT.

Technologies of mobility and communication are converging allowing for the "integration of various kinds of communicational activities into trajectories of transportation…" (Sheller 2004: 43). Research is emerging on the reordering of social practices in particular social groups and their impacts on the temporal arrangements of space and place. This 'mobilities paradigm' (Urry and Sheller 2006) sees the mechanics of transportation and human movement together with ICT as co-producers of a new way of organizing interaction in particular social settings. "Transport and communication technologies are travel partners" (Larsen, Urry et al. 2006: 124).

The conceptual implications for this research are two-fold. Does increasing mobility enable greater inclusion and does it denote new forms of spatiality that depart from conventional face-to-face norms of interaction? Work on fishermen in Kerala, India, shows that whilst ICT makes various aspects of economic life easier and more efficient, the use of cell phones has actually caused further travel and in some instances…more travel (Foss and Couclelis 2009). This 'externality' does not negate the productive benefits of mobile technologies in accessing market information and enabling distribution. It does, however, raise questions with regards to the expansion of network agents this may entail and the spatial implications with regards to travel densities.

Do new mobility forms enable inclusion? Methodologically this is difficult to judge given the complex relationships between accessibility, physical mobility and social exclusion (Kenyon 2006). Clearly in particular contexts technologies are appropriated in accordance with user needs and livelihoods. How ICT agency translates in particular socio-economic circumstances is a primary aim of this research.

The strands of ANT and relational work on mobility contribute to nuanced understanding of agency, structure and actors. They contribute to a theoretical frame that enables such examination in the South African context and the hypotheses investigated in this research.

4.4 Hypotheses on Relations between ICT and the South African City

The central aim of this research is to gain insights into the relationship between ICT and urban transformation. Literature shows that it is shaped by the many factors that play a role in city change: institutional dynamics, city policies and investment trajectories. These do not necessarily coalesce around the goals of inclusion and transformation. Furthermore uneven technology access prohibits ICT from playing an even transformative role. The technology market terrain is fragmented and contributes to a splintering of urban form (Graham and Marvin 2001). In the South African context uneven geographies existed prior to the privatisation of networked infrastructure. The added layer of ICT does not improve chances for urban transformation; in fact it further entrenches polarisation. This is the first part of the first hypothesis. The value of ANT is in the second part: that which considers the question why? Incorporation of the ANT perspective examines infrastructural elements as part of a larger schema of actor energies and ownership interests. The second part of the hypothesis posits that the agendas of the actors enrolled into the ICT urban terrain do not align around the goal of urban inclusion and transformation. Translation is limited to the interests of a select number of actors enrolled into the network that spans urban governance and ICT.

Understanding what motivates the decisions of actors requires an engagement with agency at the local scale…the day-to-day transformations. A conceptual frame that reveals hopeful engagement with the 'everyday' encounters between people and technology offers opportunities for emancipation; "…an engaged political project that asks evaluative questions about how urban technologies are socially appropriated, why and in whose favour?" (Coutard and Guy, 2007: 731). Technology options such as mobile telephony and text messaging present a broad of communication options at an individual level. As the line between infrastructure and human experience is blurring, it has spatial implications in terms of mobility and the lessening of constraints to movement and transfer of information. The ubiquity of cell phones, the increasingly interactive functions of the Internet and the convergent qualities of ICT signify a relational dynamic.

Does ICT enable transformation at the local scale? The hypothetical response is yes, but this is contingent upon how ICT is enrolled into the actor-networks circumscribed by the livelihoods of those at the margins. With increasing opportunities for convergence and wireless access, new opportunities for inclusion and innovation will emerge, sometimes in unexpected ways, outside the realm of policy making. The degree of innovation would be dependent on the choice of technologies informed by affordability and flexibility and the ways through which translation processes converge around common goals.

These clusters of arguments informed the design of this research project. They are informed by the literature contained in Chapters 2, 3 and 4. ANT constitutes the approach, the 'sensibility', that informs the lens through which these phenomena were examined. Urban change as mediated through ICT is experienced at many scales but not necessarily as progressive, developmental or even resourceful (although that may be the aspiration). A methodological lens needs to allow for an interactive perspective whilst also allowing

for the nature of network energies to be examined. The addition of ICT to the equation necessitates a consideration of non-human agency since the technologically determinist stance that technology sits 'outside' is simply not useful.

ANT concepts provide a frame for understanding ICT appropriation in the contested and fluid circumstances of African cities. The principles of symmetry and actants ensure that the agency of non-material actors are considered. The distinction between mutable and immutable mobiles enable insight into the implications of such agency. Translation refers to the processes of network stabilisation through which power relations are negotiated and established. The geographic dimensions of ANT, developed by Murdoch, facilitates an analysis of space that looks beyond place and beyond physical boundaries. Factoring networks into analyses reveals the limits of topographical readings of space.

Uneven distribution of technologies is not necessary solved through technology provision that assumes even geographies. Access constraints are more subtle and linked to individual perceptions, backgrounds and network relations. ICT is embedded in structural relations of production and ownership that requires a consideration of context and institutional regulation. Simply put: understanding ICT and cities in a particular context needs to be done at varying scales and in its many dimensions. Structure and agency need to be considered simultaneously. Network relations matter: at metropolitan and local scales. The conceptual elasticity enabled through the notions of agency and actor-networks allows for analysis at varying scales and incorporates human experience as well as institutional agency. It creates the conceptual space for an engagement with the complexity, messiness and layered nature of what it is to be human…..and machine.

5 Methodology for Understanding Relations, Networks and Transformation

> *… The actor-network approach is not a theory. Theories usually try to explain why something happens, but actor-network theory is descriptive rather than foundational in explanatory terms, which means that it is a disappointment for those seeking strong accounts. Instead it tells stories about 'how' relations assemble or don't. As a form, one of several, of material semiotics, it is better understood as a toolkit for telling interesting stories about, and interfering in, those relations. More profoundly, it is a sensibility to the messy practices of relationality and materiality of the world. (Law 2007: 2)*

Social, political and cultural dimensions layer the relationship between technology and society. The relationship between urban change and ICT is explicit and implicit. The former refers to the spatial dimensions of infrastructure distribution, the latter to the many dimensions of the digital divide. The hypotheses deal with urban change at the metropolitan scale as well as with the strategies employed at the local level that enable inclusion, the networks between actors at the local level and the technologies that contribute to these dynamics.

The contemporary city is composed of flows and places. The creation and maintenance of place, and contributions to flows are not two separate processes independent of one another, but inter-related and mutually reinforcing network creations where each actor in this process is potentially also a network.

Chapter 4 entailed the exploration of heterogeneous networks. Actor-network theory, despite its name, is not a theory in the abstract sense. It does not entail assumptions, concepts, or propositions that form a theoretical whole. It does not seek to explain as a meta-narrative. In this research it has framed the toolkit for identifying, examining and telling a number of stories that give insight into the relationship between urban change and ICT. This terrain is layered, messy and infused with many agendas. The aim of this research was to gain insights into the relations that underpin this complexity and understanding the spaces of transformation overlooked by policy makers and planners. ANT informed this approach epistemologically and ontologically.

An epistemological definition of knowledge as that which is constituted and achieved through interaction and exchange allows for a more nuanced understanding of urban informatics. Becoming is as important as belonging as urban dwellers make sense of their circumstances and address livelihoods. Innovation can be overlooked if structure is overemphasized; on the other hand focusing only on local survival may underplay the very real contextual elements that constrain and inhibit. The layering of ICT onto this dynamic further necessitates the need for a relational perspective: the appropriation of ICT is not only locally informed but it has consequence. It is also contingent; informed by the larger networks of capital accumulation and ownership that can constrain but can also be challenged and undermined locally. The emphasis on agency is useful as a conceptual anchor that considers action as well as the roles of various actors in networks.

The ANT ontological position allows the actions to speak for themselves. The researcher does not become an actor in the network through 'putting words into mouths' of respondents but is interested in what emerges from the interplay; "… so in a sense reality becomes 'real' when actors interact." (Cordella and Shaikh 2006: 18). This fits well with the post-colonial need to allow urban dynamics within South African cities to be revealed contextually…removed from the glare of comparative judgments.

In practice terms, the methodology is influenced by ANT in two ways. It influenced the design of the research project in its entirety. The three cases were selected in accordance with criteria appropriate to the research questions and the ANT sensibility. Furthermore, the analysis of data was done in accordance with this approach using the concepts explored in Chapter 4. This chapter outlines the methods used, the cases and approaches to analysis.

5.1 Research Methodology

Using ANT to understand the nature of the relationship between urban change and ICT in South African cities had the following advantages. Firstly, it enabled movement across scales. A quantitative reading of ICT distribution was valuable, but not enough. Local level dynamics were interrogated also. By 'following the network' or by 'tracking the actor' relationships between macros factors and micro impacts were uncovered. Methodologically that translated into an approach that used a range of instruments that enabled a contextual understanding whilst also probing local-level dynamics.

This relationship relates to the extent to which spatial form is impacted upon by the distribution of ICT infrastructure, the actors that are enrolled and access to the actual technology. The latter is facilitated through increased cell phone use and high rates of ownership, increased access to computers through tele-centres and libraries as well as the increase in training opportunities. Thus, from a hard infrastructural point of view, the extent to which 'splintering' urban forms are encouraged through ICT ownership patterns needed to be determined, yet enough technologies exist to perhaps overcome the exclusionary aspects of ICT distribution. Furthermore, whilst spatial fragmentation can be transcended through ICT use; its true power will be determined by how well it accommodates the associational forms that underpin social and economic networking at a local level; at how well it enables these networks to reinforce a sense of belonging and permanence. An understanding of the distributional technological issues was not enough; a deeper understanding of everyday use was required.

This required two levels of enquiry: one that established a contextual sense of urban change at the metropolitan level, and one that dug deeper into the interface between technologies and networks. The ANT approach demanded that they be analysed together; the field work was at two scales, but the final analysis required an approach that enabled movement between the two.

The networks and associational forms that enable the social capital used by marginalised communities to survive can be enhanced through ICT use in a number of ways. A review of literature shows that the relationship between social and virtual capital is not yet fully understood. The value of a relational perspective is a less simplistic and less technically deterministic analysis that recognises that ICT will not necessarily lead to a more stable, predicable network. In fact, the notion of a network is questionable given the volatility of social relations in precarious conditions and the ways in which technologies work.

The addition of technology will subject existing networks to a new set of influences and variables open to change and flux. Recognition of this inter-relatedness required detailed enquiry that unearthed the day-to-day functioning of associational forms with some understanding of how this interface has evolved over time. It required biographical enquiry that relied on subjective narrative to reveal experiential evidence of the extent and nature of the interface between ICT and associational forms.

The literature suggests that the relationship between virtual and social capital in this regard is not necessarily a directly beneficial one, but one where the risk is increasing fragmentation through intensification of power imbalances through technology access, or, on the other hand, the potential for extended and improved networks that may lead to positive changes. New networks can emerge through ICT, but their efficacy and reach is influenced by other actors (actants) and their own network creations. Tracking a process of ICT incorporation into existing networks unveiled the power dynamics, process issues and finer grain relations between virtual and social capital.

The methodology requires an engagement with the notion of the other. Understanding how marginalized groups use technologies revealed the value of ICT in enabling inclusion as a means to probe to central theme of the research question: transformation. Selection methods ensured that marginalized communities were included.

The literature shows that the relationship between ICT and social networks will not confine itself to place, even when relating to a particular space, but to the realm required to maintain those networks, often beyond immediate place and boundaries. Thus, the enquiry did not confine itself to place-based networks, but also examined interest-based associations dealing with particular aspects of African urban life.

Methodologically this approach allowed for reflection, narrative and dynamic interchange between researcher and respondents. Some quantitative enquiry was necessary, but ultimately the value of the research was determined by how well the research engaged with individual experience and process.

An eclectic approach allowed for thick enquiry: layered descriptions of phenomena combined with ample theoretical evidence revealed textured meaning. Thus, some quantitative data was used as background, but the enquiry relied heavily on qualitative method, resulting in an eclectic approach. This overall 'package' was intended to address the research questions and explore the hypotheses from different angles. Each of the research tools are examined in full below.

5.2 The Cases

Three cases were selected. The advantage of the case method is that the focus is on the object of study, the focus of enquiry, not the methodology. The range of methods employed to probe the case is determined by what suits the particularity of it. Enquiry is therefore intensive, rich and deep. It allows for developmental factors to emerge as underlying processes are unveiled. The environment within which the case features requires a layered understanding of context. Thus each of the stories told in this research were given space to speak for themselves.

The aim of this research, however, was to develop a conceptual frame for understanding ICT and cities. ANT was used as an informant, key concepts were used to analyse, but

the ultimate aim was to say something new about technological appropriation in South African urban space. This required an inductive approach that generalised from these cases. The relationship between theory and empirical work employing the case method raises some epistemological questions common in debates in research methodology. Key questions arise from the uneasy relationship between case research and theory; can one generalise from a case? This appears to be a broader question. Stake (1978) compellingly argues that the experiential dimension of case research is crucial for generalisation. Capturing the subjective dimensions of technology appropriation was an integral part of this research. The value of experience as a basis for knowledge is crucial here. Agency and translation processes are informed by values and power relations. Interrogating experience provided a valuable data resource. Uncovering process through probing cases revealed how decisions were made and what the value and power constructs were that informed them (Flyvbjerg 2001).

A case can be a place, a process, a phenomenon or a person. The characteristics of a case are essentially that it allows for 'thick' enquiry, is developmental (in that it tracks process) and focus on context (Flyvbjerg forthcoming). The three cases chosen for this research constitute a place (Durban), a process (web site development for community groups) and a network (street traders).

5.2.1 The Place: Durban (eThekwini Metropolitan Municipality)

Durban provided a rich source of data for understanding ICT and urban change at a metropolitan scale. The city has undergone a number of significant changes over the past two decades. As Africa's premier port city, it has traditionally had a strong manufacturing base, linked to its port operations, but also relied heavily on the clothing and footwear industry (amongst others) for employment in the past. Shedding of employment in this sector due to economic restructuring has perpetuated the unemployment problem. In a city of about three million people, 37% was unemployed in 2006 (eThekwini Municipality 2008).

Despite being the second largest industrial hub in the country (after Johannesburg), the city has had to reinvent itself in developing and accommodating its service sector. This is located mostly to the north of the City where extensive funds have been invested by public agencies (Local Government investment in infrastructure and roads for example) as well as the semi-private and private sectors (in telecommunications and land development). Whilst no primary research has been done into the distribution of telecommunications infrastructure, indications are that ICT availability and access are impacted upon by factors such as affordability, spatial proximity to new economic hubs (such as that mentioned to the North) and income. ICT infrastructure in Durban is good and has capacity for expansion. A subterranean fibre network forms the primary backbone but runs mainly along the Northern and Western investment corridors. Telkom essentially provides the rest of the telecommunications infrastructure, but capacity exists to expand the secondary network into greater areas of the metro through utilisation of electricity infrastructure and using wireless technology (Subban 2006)

Durban's ICT policy is relatively young (about 3 years old) and essentially comprises two objectives. The first aims for ICT to function as an enabler – a mechanism to ensure more effective functioning of the Municipality and the City. Goals are to effectively enable e-administration (Financial systems, Procurement and Human Resource systems, etc) and e-governance (Internet portal and the ability to access services electronically). The second dimension relates to economic development: to nurture and sustain an ICT footprint for

the City. Access is also a key feature of the policy. Besides expanding the infrastructural backbone for ICT, the EMA proposes to enable individual access through making Internet access freely available in all municipal libraries and by distributing affordable products such as Palm top devices with Voice over Internet Protocol (VOIP) capability where calls are charged on a rental basis and access to the Internet. A section 21 company is to be created to sell these products and maintain related services. (Subban, 2006)

The EMA also has a very strong web presence with www.durban.gov.za. The usability of the site has been researched with a strong emphasis on cultural and language accessibility as well as e-governance and e-democracy functions (eThekwini Municipality 2002). The site has an interactive element; residents can e-mail councillors whilst on-line GIS data enables spatial queries. There is also an online Municipal Manager newsletter.

These local government led initiatives comprise important contextual information for the understanding of ICT and Durban, as representative of an African city. The income inequalities, high rate of informal trade activity, mix of rural, peri-urban and urban settlement typologies and cultural diversity reveals the contradictions and tensions embedded in today's cities.

The interrogation of the city's ICT policy in relation to metropolitan access to ICT was the primary objective here. A range of methods was used to collect this data and interrogation Durban as a case.

Geographic Information Systems (GIS)

Geographic data was used to gain an overall sense of ICT distribution in Durban. Three sources of data were used to map access to ICT in Durban:

- Census 2001 data indicating access to cell phones, landlines and computers;
- EThekwini municipal data showing access to community services in libraries and schools as well as cyber labs
- Aerial photography at three intervals between 1993 and 2007 to indicate urban change.

STATSSA's Community Surveys were used to get a sense of more recent access to technology. The sample was not big enough to allow for mapping but it provided a sense of current ICT access in terms of racial and gender breakdowns.

Web Survey

A survey was done of eThekwini's web site users and interrogated what the site is used for; where the Internet is accessed and where surveyed users live. The survey was posted on *www.durban.gov.za* (included in Annexure A) between April and June 2008. Seventy-two respondents completed the questionnaire. Analysis was aimed at establishing a profile of users built around the following: demographic and gender composition, educational background, function for which the Internet is used, where the Internet is accessed and where respondents live.

Perusal of Policy Documentation (Annexure C contains the list of documents)

eThekwini's Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs) were perused to ascertain what the major changes have been over the last 15 years as well as the future growth trajectory of the city. ICT is implicitly and explicitly referred to in these documents and documented accordingly. The city's smart city policy is not documented in a report but in several Power Point presentations. These were examined.

Perusal of Newspaper Articles (Annexure D contains the list of articles)
A search of newspaper articles containing reference to ICT and eThekwini was done also. The time frame was 15 years and the newspapers searched included all local and national publications. The aim was to determine the public face of Durban's ICT policy, the views of actors not explicitly involved and the discourses used in promoting Durban as a smart city.

Open-ended Interviews (all interview schedules are included under Annexure E)
Open-ended, semi-structured interviews were held with Municipal officials engaged in strategic planning and management of ICT infrastructural distribution and planning as well as the Municipal Manager. SmartXchange, an IT incubator emerged as an important actor. The CEO was interviewed.

The aim was to determine how ICT use and distribution as well as its economic impacts have generally interfaced with the city. Staff involved in the EMA's web site was also interviewed to determine how the site deals with usability and access issues and future plans with the site are.

In designing the interview process for all three cases, the level of analysis and content required determined the format of questions. Sampling of respondents was predetermined but some snowballing occurred as other respondents were revealed. Interviews were adapted to local circumstances; as the research process unfolded, a record of alterations was kept.

5.2.2 The Process: Web Site Development in Inanda-Ntuzuma-KwaMashu (INK) and the Southern Basin (SB)

The second case study is a process. It also interrogates networks associated with particular places. From 2006 to 2007 this project was located in two areas in Durban: the Inanda-Ntuzuma-KwaMashu urban renewal project area and the Southern Basin. Both areas are part of the eThekiwni Area-Based Management programme and contain large pockets of poverty.

INK comprises a range of formal residential townships and informal settlements with approximately 510 000 residents (*www.durban.gov.za/INK)* and is a national urban renewal project. The node is one of the five Area Based Management (ABM) Learning Areas in Durban. The project started in 2002, with most of the staff joining in 2003/04. The INK URP/ABM programme operates as a strategic unit and relies on line department within the EMA and other government agencies for implementation.

Four impact areas have been identified in the project: integrated governance, income enhancement, and living environment improvement and infrastructure investment. ICT infrastructure distribution is very limited in the area, whilst there are a number of Digital Hubs and tele-centres as well as libraries in the area. The area has good cell phone coverage – also evident in the many cell phone shops that can be seen in the area. The area has a rich kaleidoscope of community groups and associations that range from church organisations to heritage groups and traders organisations. (INK ABM team, 2006) The project has a very limited web presence with a link to the Durban.gov site mainly outlining project objectives.

The INK area contains some marginalised communities with a strong history of community action. It therefore provides a good departure point for understanding place-based networks and communities and their use of ICT.

The South Durban Basin surrounds the Harbour operations area of Durban. The area includes industrial areas (Bayhead, Jacobs, Mobeni, Prospecton), mixed use areas that include residential, industrial and commercial development (Isipingo, Clairwood) and residential areas (Austerville, Wentworth and Merebank). In addition to the Durban Harbour, strategic land uses such as the Durban International Airport is also included. The area has a conflicted history due to land use conflicts and environmental concerns due to the presence of pollutive industries such as the petrochemical industry. A legacy of Apartheid planning, the area is home to many low income communities employed by local industry. (Iyer Rothaug Collaborative Inc. 2004)

Action Research

Third Year Internet Studies students at UZKN were required to design web sites for community based organisations as part of their course work in 2006 and 2007. The process entailed the following: the researcher worked together with the Internet Studies course convenor, Dr Marijke du Toit, in establishing contact with community groups within these two areas. In INK, the main contact was the INK Area-based management agency, through the researcher. In SB, the community groups were the points of contact, facilitated by Dr du Toit. Meetings were held with the primary contacts, with key persons within those groups and with the community groups involved in the project.

The community web sites were built by undergraduate students from the Internet Studies programme at UKZN and members of the various project teams. The aim of the sites was to provide interactive web presence for community organisations operational within INK and the Southern Basin whilst also allowing for e-democracy and e-governance initiatives.

Each of the web sites (for each of the groups) essentially entailed the following:

- In initial meeting to establish contact, explain the process and formulate a programme (this took various forms dependent on the specifics of the groups);
- A follow-up meeting to determine user needs and aspirations with regards to the web sites;
- At least three training sessions were held with group participants;
- The web sites were then presented where feedback was received
- In some cases follow-up meetings were required;
- Arrangements made for ongoing maintenance.

Participant Observation

The role of the researcher was that of participant observer – studying how the process of developing a community web site unfolds, what content is required, who determines that content, what formatting is required, language and cultural variables as well as understanding what the site will ultimately contribute to associational life through information exchange and on-line interaction. The research revealed the inter-group dynamics in building the site, what was seen as important, what not, and the constraints to doing this. Sustainability issues were addressed by ensuring ongoing maintenance through the projects teams.

The researcher was an integral part of this process. Notes were made on an ongoing basis in case diaries (two diaries were kept; one for INK and another for SB). Minutes of meetings were distributed for comment and filed. Photographs were taken also.

Open-ended Interviews

Two interviews were held with actors central to the INK project: Linda Mbonambi, the director of the INK ABM, and the director of the INK Digital Hub. The latter was interviewed at the beginning of the web development process while Mr Mbonambi was interviewed at the end of the project (in order to enable reflection).

Focus Group Interviews

There was no need to interview individual respondents in the SB project since none of them emerged as actors central to the research. However, in this process the students involved in the web development process played a central role. Two focus group interviews were used to gather their views and experiences (guideline questions are in Annexure F). Each included two student web developers and Dr Du Toit. The intention was to gain a deeper understanding into the process constraints, the power-knowledge dynamic that emerged from the technology introduction process and the interpersonal energies that were generated by the processes.

5.2.3 The Network: Informal Traders

In order to ensure that informality is considered, research included the use of ICT by street traders. The selection of street trader organisations has been done for three reasons: they are operational across the city and internationally, they include members from other African countries and they represent the interests of particularly marginalised groups. Furthermore, informal trade activity is ubiquitous across the continent.

Two organisations were selected as entry points into the workings of informal traders. The first is StreetNet, an umbrella organisation that has international standing, and plays a global networking function. The second is Siyagunda a body comprised of street barbers that are mainly from the Democratic Republic of Congo (DRC). Siyagunda is active in the Durban CBD, Isipingo as well as Warwick Junction, the central transport hub of the city.

Open-ended Interviews

In looking at the use of ICT by StreetNet, the web site emerged as an important tool for ongoing mobilisation and information dissemination. Two respondents were interviewed in this regard: the StreetNet director, Pat Horn, and the web master Lou Haysom. The intention was to determine the genesis of the site, its central function and how this intention had shifted over time.

Focus Groups

Focus group interviews enabled a free flow of information. Given the emphasis on associational life, it presented an opportunity to examine group dynamics within groups.

Two focus groups were held with foreign street traders associated with Siyagunda. The intention was to determine the value attached to ICT, how ICT is used to support social capital and changes that may have occurred to associational dynamics since the introduction of ICT. The use of a French interpreter (DRC participants) was used with Siyagunda respondents.

As an instrument, focus group interviews allowed for interactive exchange that revealed information not necessarily available from individual interviews. By allowing "a space in which people may get together and create meaning among themselves" (Babbie and Mouton, 2001: 292), more nuanced information became available whilst opportunity for more narrative accounts provided subtle insights.

Photography

Photography was used to document technology use in the informal sector, in public spaces, in the Durban Central Business District (CBD) and Isipingo Rail, a transport hub to south of the city (in the SB area). The aim was to gain an experiential understanding of how ICT services are used and sold in well used and informally traded public spaces. Here the researcher was more an observer than participant. The aim was also to understand the spatial typologies that were generated by the informal sector, and the ICT layer implicated in that. Photographs were taken on two occasions; on a weekday morning in the CBD, and in the late afternoon (when commuter traffic is most intensive) in Isipingo Rail.

5.2.4 Reflections on the Role of the Researcher and Limitations of the Methodology

The instruments discussed represent a broad range of methods and approaches. Throughout the research process the role of the researcher ranged from that of technical interpreter (in the case of GIS mapping) through to participant observer (web design project). Table 5.1 summarises the methods used, the research questions they respond to as well as the extent to which the researcher was involved as participant. Objectivity was not a concern, given the relational perspective that informed this research. However, it is necessary to understand the role of the researcher with regards to each of the methods. Involvement varied on a continuum from highly participatory to high levels of objectivity. This continuum is represented in the table with colour. This is a summary table intended to indicate how the methods address the research questions through the various cases. The full tables that list every meeting, interviews etc are included in Annexure B.

Limitations of the research are mainly associated with the eclectic nature of the methodology. Depth of enquiry varied across methods leaving some possibility that important details may have been overlooked. Highly qualitative methods provided insights but are sometimes limited in their applicability in other contexts. This is not seen as epistemologically problematic, since the relational perspective rejects claims of universality. Yet, given that some quantitative methods were used, reconciling the results achieved from the various instruments was sometimes difficult but did allow for triangulation. This was particular true of the movement between scales required.

The role of the researcher as planner, colleague and supervisor in some cases requires reflection. The researcher had a professional relationship with participants from all the cases examined. Ongoing input into eThekwini's ICT strategy and ad-hoc advice in some cases ensured an ongoing working relationship. The INK team include planners and former students with whom the researcher had collaborated on other projects. Participation in all the web design initiatives was done as researcher as well as mentor and academic in some cases. The researcher provided pro-bono planning input to StreetNet and Siyagunda also. In order to mitigate any influence these relationships may have on the outcome of the research, the researcher aimed to be as reflective as possible with continuous reference to the research questions informing this research.

Ethical Concerns

In all the research methods, respondents were briefed on the nature of the research, the research questions and the nature of the PhD production process. The role of the researcher, as participant and PhD student was presented. The researcher's affiliations to the UKZN as well as to Witwatersrand University were clarified.

Interview respondents were asked for permission to record the proceedings of the interview, and again in using their names in documentation.

In the web development processes, all participants were briefed on the researcher's role beforehand. This included students, network members and other institutional role players. The project was presented to city councilors (local political office bearers beforehand). Participants were briefed on the role and actions of the researcher, and where the information would be stored and used.

Street traders were asked to be photographed. Members of focus groups were briefed on the research, and what the data would be used for. Names were submitted but not used in this document. The three members of the leadership of StreetNet agreed to their names being quoted in documentation.

The role of the researcher was reflected on throughout. Table 5.1 provides a record of the position of the researcher in relation to the methods used.

TABLE 5.1: Summary of Research Questions, Methods and Role of Researcher

Research Questions	CASE STUDIES (DATES WHEN RESEARCH WAS CONDUCTED)			Role of the researcher: 1				
	eThekwini (Durban) (2006 – 2008)	INK and SB (2006 – 2008)	StreetNet and Siyagunda (2008)	PO	O	I	PS	SD
Does ICT enable urban transformation?	Policy perusal							
	Interviews	Interviews						
	GIS Mapping							
			Photography					
	Newspaper search							
Who are the actors that play a role in ICT in Durban and what are the relationships between them?	Interviews	Interviews	Interviews					
		Web design						
	Policy Perusal							
What are some of the networks within low income/marginalised spaces in Durban? How are digital technologies used to reinforce these networks?		Web Design						
			Focus Groups					
		Interviews	Interviews					
	Web Survey							
	Interviews	Interviews	Interviews					
		Web design						
			Focus Groups					
			Photography					

KEY

PO: Participant Observer
O: Observer
I: Interviewer
PS: Proxy Survey (survey designed by researcher and executed by other); Analysis of data from other sources (e.g. GIS)
SD: Secondary data

5.3 Analysis

Analysis of the findings of the research is informed by the relational methodological position taken, by the methods themselves and the background literature. This was not a linear process; as the research progressed, notes were made, observations recorded and deductions made. The research was inductive to some extent: whilst the hypotheses provided conceptual markers for enquire, allowance was made for different angles to emerge. This is the value of using the case method; the intensity and contextual engagement allow the findings to speak for themselves.

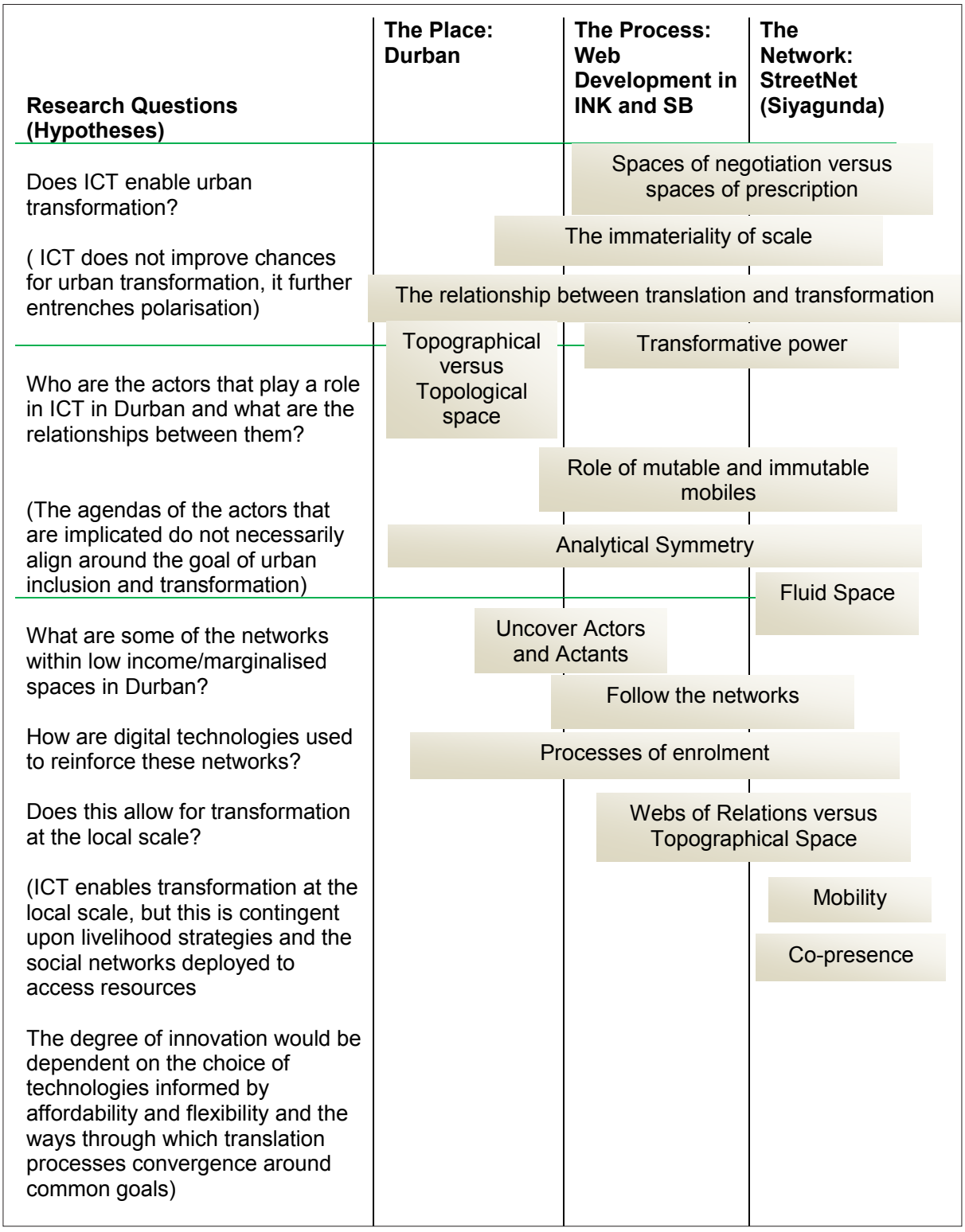


FIGURE 5.1 ANT and Research Questions

Final synthesis was done at the conclusion of the fieldwork. Data was entered into a central depository enabled through NVIVO, statistical software specifically designed for qualitative research. Data consists of meeting notes, minutes, observation records, interview and focus group transcripts and photographs. NVIVO enables all the data to be considered together – thus themes extend across data formats. The GIS data was analysed using ArcGIS whilst the web survey results were collated using Microsoft Access.

An overall analysis and conclusion used the hypotheses (and any additional new responses to the research questions that could be deduced) as anchors for overall conceptual analysis. Research questions conditioned by the ANT approach informed the methods: the choice of cases and instruments used to gather data. The hypotheses provided tentative answers to the research questions and were the conceptual anchors for analysis. The purpose of the analysis was to gain insights into the many dimensions of the research problem, using the hypotheses as foci. The vocabulary of ANT was then used to gain deeper insights into the research problem and contributed to the overall thesis. This is illustrated in Figure 5.1.

5.4 Telling and Understanding the Stories

The design of this research deviates from other approaches to case research in that it does not use the narrative form to report findings. Some narrative accounts have been documented but the reporting is essentially organised in accordance with ANT concepts. Thus some abstraction had already been used in the documentation of findings. Chapter 6 reports on the first case: Durban. Chapter 7 gives a detailed account of the web development processes in INK and SB. Chapter 8 reports on the third case. Chapter 9 contains the analysis and the overall conclusions to this research.

6 Urban Transformation and ICT in Durban

> *…To bridge the digital divide in eThekwini and to become a hub of information diffusion, as well as a centre for economic growth and integration… Bridging the divide is important as it can reduce existing inequalities, which are often based on geographic location, age, gender, culture and economic status (eThekwini Municipality 2008: 59).*

Since the first democratic elections in 1994, South African cities have changed due to local policy directives as well as outside pressures. Tremendous changes have taken place in the domain of local government in South Africa. The restructuring process that began in mid 1990s was guided by the White Paper on Local Government (1998) and represented a new local government dispensation: wall-to-wall municipal boundaries that incorporate a myriad of institutions, committees, districts and regions. eThekwini metropolitan authority emerged out of this process with an enlarged metropolitan area comprising dense urban environments, informal settlements on the edges of townships such as KwaMashu and Umlazi with intermittently populated rural areas on its edges. Thus, urban change has been accommodated by the institutional restructuring necessary to enable inclusion, but spatial change has also been informed by global forces. South African cities have been subject to the same economic pressures as the rest of the Global South. Spatial change has been informed by local objectives, regional constraints and global aspirations.

The aim of this chapter is to examine how spatial change in Durban since democracy relates to access to digital technologies. The city's divergent settlement distribution and social inequalities are factors to consider when comparing the trajectory of urban change over the last fifteen years and ICT. The Internet, improved, cheaper computer technologies and the ubiquitous adoption of the mobile phone as a means to communicate and increasingly recreate, coincides with the last decade and a half of immense change in the urban landscape of Durban. Is it coincidence that these two energies coincide, or is the interplay between digital technology adoption and urban change in the eThekwini metropolitan area more subtle than that?

This chapter begins with a contextual history of Durban, using relevant literature in this regard. This is followed by an overview of urban change in Durban[6] over the last 15 years. It is informed by an examination of the eThekwini Municipality's Integrated Development Plans (IDPs) which contain the city's strategic foci at 5 year intervals as well as secondary literature.

The purpose of the research captured here was to probe the first two-part research question: does ICT enable urban transformation and who are the actors that play a role in ICT in Durban (and what are the relationships between them)? The second part of the question, in particular, was the emphasis of the field work. This is reported upon in a number of sections. The background and context parts are followed by a policy overview of ICT

6 The distinction between Durban and eThekwini is as follows: Durban is the popular name for the city and tends to be used to describe the urban areas within the metropolitan area. The metropolitan area, as designated in the 2000 demarcation process, is known as eThekwini. The two names are used interchangeably in practice, but here Durban refers to the physical city and eThekwini to the municipality.

in Durban; how ICT objectives manifest in the city's strategic planning and what the more specific implications are. Much of this is based on the review of eThekwini documentation whilst the larger part of this chapter draws on field work, drawing on a number of data sources: interviews, the web survey and the newspaper article review.

The section that follows is essentially a mapping exercise that uses GIS data in giving a visual representation of ICT access in relation to urban change and the strategic spatial objectives of the city. A number of sources are used to interrogate the spatial distribution of ICT access and hence gain a more rigorous understanding of the relationship between technology and urban transformation in Durban.

The chapter concludes with thematic outcomes that are revisited in the analysis (chapter 9) in conjunction with the other empirical work. They focus on the degree to which ICT relates to spatial restructuring, how new patterns of polarization may have emerged and how ICT access correlates with the rural/urban continuum. Important also are how ICT strategies relate to city policies that seek to address urban issues. All this is part of understanding the ICT impulse in Durban's transformation.

In addition to being an integral part of the empirical part of this thesis, this chapter also provides the context for the two chapters that follow. It provides the broader governance perspective whilst also giving some sense of the history of some of the geographic foci in chapters 6 and 7: the Southern Basin, Inanda-Ntuzuma-KwaMashu (INK), and the city centre that many of the street traders operate from. Furthermore, it is the place-based case and the focus is on Durban as city, as place.

6.1 Understanding Durban

Durban is Africa's premier port city and the second largest industrial production centre in South Africa. Its development as a port city is intrinsically linked to the growth of the gold mining industry on the Witwatersrand in the late 1800s (Freund and Padayachee 2002). Unlike Cape Town or Pretoria, Durban was never an administrative centre or capital city. Its establishment and growth is due to economic factors as "the rail and ship links that connected the Rand to the world made a critical juncture there." (p. 12). The connection between natural resource extraction, colonial economic needs and the logic of infrastructure investment in African cities is documented in Chapter 2. The development of Durban is a continuation of this historical theme. Early investment in transport infrastructure would provide a solid base for industrialization later in the 20th Century. A strong city administration that promoted the interests of local business elites and merchants was evident at the beginning of the 1900s as the city enabled electrification, telephone services and created its own police force (Ibid.). Alliances between the city administration and business have had a profound impact on the space economy of the city as will be seen in the remainder of this chapter.

The port was always a crucial functional node for distribution and exports as well as imported production inputs. The latter were crucial to the growth of the textile, chemical, automotive, paper and pulp industries. These industries, together with the oil refineries that formed a petro-chemical complex to the immediate south of the port were part of Durban's early industrialization that began in the late 1930s (Morris, Barnes et al. 2002). Crucial to this industrial growth was the establishment of the South Durban Basin by the Durban City Council and the local Chamber of Industries (Wiley, Root et al. 2002). The availability of flat land, its proximity to the harbour made it prime land for industry.

Housing was provided for the industrial labour force in close proximity. The Group Areas Act of 1950 provided the national funding and legal impetus for relocation of Coloured and Indian families to these now formalized residential townships (Wiley, Root et al. 2002). Continued public investment in the local industrial sector during the 1950s and 1960s, as part of an import-substitution trajectory, continued the industrialization of the city. Establishment of townships such as Umlazi and Lamontville enabled ready sources of labour to capital. Lamontville was one of the first African townships to be developed in the city (in the 1930s) whilst Umlazi was the location of forced removals from inner city areas such as Cato Manor in the early 1960s. The land use tensions between residential land and industry, the ideological premise that informed the racial complexion of these residential areas and the mobilization of civil society around environmental health concerns contributed to what remains a highly contested terrain to the south of the city.

The port and the central business district adjacent and the Southern Basin form the nodal point of Durban's industrialization and associated settlement geography from what is known as the 'white T' unfolds (Morris, Barnes et al. 2002).

The two 'legs' of the 'T' are formed by the two national freeways that cross near Durban's centre: the N2 north-south axis and the N3 that connects the city westwards with the Gauteng city-region (which includes Johannesburg and Pretoria).

The Apartheid zoning emerging from the Group Areas Act of 1950 followed this pattern: economic and industrial development along the two National Freeways (the N2 and N3) flanked by traditionally white middle-to high income suburbs, with Indian neighbourhoods located at the corners of the 'T" and African townships scattered beyond. Some of these townships, such as Inanda to the north, were located outside Durban's municipal boundary (falling under the erstwhile KwaZulu homeland administration) prior to local government restructuring. The racial dimensions of this settlement pattern have remained largely intact (Schensul 2008).

The city benefited from import substitution, the high value of South African mineral exports and availability of cheap labour. Global economic shifts during the 1970s and 1980s revealed a need to address restructuring, represented by a downturn of industrial activity; the city's once dominant textiles sector being particularly affected by job losses. The contradictions of Apartheid coincided with a new economic order that favoured partnership models more familiar with the neo-liberal global climate of the time. Economic changes were accompanied by pressures for political change. The1980s was particularly tense in this regard. The city experienced enormous political tensions on the ground, with places such as Inanda essentially becoming war zones as the tensions between grass roots political factions and civil society organizations became increasingly violent (Hughes 1987).

The latter Apartheid years saw substantial growth of peripheral townships such as Kwa-Mashu, Ntuzuma and Inanda (Todes 1998; Freund and Padayachee 2002). This growth was largely informal. Late Apartheid local government was simply unprepared for this in-migration that essentially occurred as the political will to control urbanization through influx control diminished. Growing shack settlements in peripheral Durban was, however, a signal that a pro-active approach to city management was necessary. Socio-political change within a changed global economic climate demanded careful consideration of Durban's economy, in addition to the endemic and visible urban poverty. As a port it

would remain a dominant player in the regional economy but its manufacturing role needed revision.

The unbanning of the ANC in 1990 and the anticipated political turn created a climate of governance uncertainty. Local commercial actors such as Tongaat Hullett (a global player in the sugar industry) partially financed strategic planning efforts such as the Operation Jumpstart initiative that would contribute to a reconsideration of the city's role nationally and internationally (Freund and Padayachee 2002). A partnership approach where local capital was increasingly seen as an important role player in the city's future (culminating in the construction of the International Convention Centre, the first of its kind in the country, for example) emerged. The Tongaat Hullett Group (THG) would remain one of the central role players in the city's future. Owning much of the sugar land north of the city, it is the most influential private land owner. In 1995 it was the largest real estate developer in KwaZulu-Natal, the province within which Durban is located (Freund and Padayachee 2002: 26).

The relationship between the THG and the city administration is profound. Conversion of sugar cane farming land to the north of the city into what is now Umhlanga Ridge (essentially an edge city) was accommodated by infrastructural upgrades and development control provisions put in motion by city government. Freund (2007) argues two related points with regards to the emergence of Umhlanga Ridge in Durban. One, it is indicative of the internal divisions that emerge in cities internationally as a result of the tensions between global economic forces and local development imperatives. Two, Umhlanga remains an integral part of Durban and cannot "….escape the fiscal and political dictates of City Hall in the manner of U.S. suburbia" (p. 191). The difference between Umhlanga Ridge and other edge developments is that consolidation of it was due to a partnership between eThekwini and the private sector; i.e. city government is implicit in its development.

The development of Umhlanga is an element of Durban's process of spatial reorganization since the early 1990s that has been characterized by residential and commercial decentralization. The port side central business district has experienced an exodus of knowledge-intensive firms (including those involved in the financial services, software development, corporate recruitment, as well as scientific research and development) in favour of peripheral commercial nodes in the north (La Lucia, Umhlanga Ridge and Mount Edgecome) and the west (Westville, Hillcrest and Kloof) (Freund 2007). Middle- and upper-income residential development has, to a large extent, mirrored this pattern of dispersal. Gated residential development is prevalent in much of the new residential extensions to the north and west of the city.

Industrial investment has also exhibited a tendency towards decentralization, as expressed by the post-1990 appearance of large industrial nodes (adjacent to major transportation infrastructure) to the north of the traditional city centre (the port area). In the same way that the establishment of Durban was closely tied to transport linkages, so also is the future growth trajectory of the city influenced by these factors. The construction of Dube Trade Port and King Shaka International Airport 30kms north of the city is intended to: "…effectively become a significant element in the further entrenchment of KwaZulu-Natal's position in the global supply chain" (www.dubetradeport.co.za). This development has been planned since the 1970s when land was expropriated by the state from the THG (Freund and Padayachee 2002). The new airport falls outside

the eThekwini metropolitan boundaries. Its influence on the city's growth trajectory is, however, evident.

The South Durban Basin remains the city's primary hub of manufacturing and distribution-type industry, where the investment logic of large international companies, such as Toyota, continues to recognize the accessibility advantages offered by the close proximity of well-developed sea, air, and road and rail infrastructure. The Southern Basin remains a space of contest, however. The location of heavy industry in close proximity to residential areas has led to many battles between the South Durban Environmental Alliance (SEDCE) and industry. Electronic communication has contributed to these battles being fought on a global platform of ecological activism and consciousness raising (Wiley, Root et al. 2002).

Outward dispersal of commercial and residential development has been a common theme of Durban's post-1990 spatial change. Areas lying to the north and west of the traditional CBD have displayed the greatest degree of commercial and residential growth, with some spill-over of industrial activity occurring along north-bound transport axes. Growth to the west on the N3 prior to local government consolidation was facilitated to a large extent by an entrepreneurial Pinetown town council that offered favourable land deals and rebates to firms willing to locate there (Freund and Padayachee 2002). Spatial changes in the south have been far less obvious due to the 'hemmed-in' nature of pre-1990 development, which has provided limited areas of vacant land for large-scale commercial or residential investment.

Ongoing concerns since the first local government elections are documented in eThekwini's strategic plans. The spatial extent of the metropolitan area changed dramatically with demarcation, as did the city governance structures. Understanding ICT policy and access in relation to these changes is important.

6.1.1 eThekwini's Strategic Objectives

Durban's city administration is no stranger to shrewd financial management and strategic positioning. Prior to the early 1990s, Durban's strong British colonial origins and close ties with institutions and city planning traditions in its imperial base contributed to a municipal style of management and associated discourse that distinguished it from other urban centres in South Africa (Freund and Padayachee 2002). Tight fiscal management and strong local government control were traits associated with the city's management under a number of leadership regimes. Political leadership was quasi-liberal with the white liberal Progressive Federal Party playing a strong role in the city from the late 1970s (Ibid.). Within a global climate where the realm of urban development expanded, Durban's municipality was well positioned to be deal broker and developer in the new dispensation.

The South African post-1994 transition was based on a new constitutional order that identified local government as the kingpin in development. Two principles informed this. The notion of developmental local government, firstly, saw municipalities as playing a central role in social and economic development. Secondly, the principle of cooperative governance, prescribes a collaborative relationship between local, provincial and national government. The practical implication of local government restructuring saw the division of the country into wall-to-wall Municipalities through a rationalization process where over 800 local authorities were collapsed into 284.

There are several characteristics of local government that increase their status in the development equation. Atkinson (2002) identifies three dimensions in this regard. Firstly, local government is mandated to deliver on social and economic development goals, thereby requiring it to be multicultural in its approach, bringing together the many resources in pursuing overall development goals. Secondly, the political system of representation is such that local government can indeed be considered 'closest to the people'. The ward representational system, in particular, provides for decentralized political decision making and opportunity for local accountability. Thirdly, spatially, local government is, theoretically, most accessible to local residents in the process of development that requires continuous interaction between beneficiaries and officials. Hence, local government is best placed to respond to local needs in an appropriate and timeous way.

The primary tool intended to facilitate development in this regard is the Integrated Development Plan (IDP), a five-year strategic plan aimed at addressing short term goals within a framework determined by a long term perspective. Based on an outcomes-based approach the IDP incorporates a Performance Management System (PMS) that requires municipalities to formulate delivery targets within a framework set by medium-to long term planning. In addition to a vision, development analysis, the formulation of strategic priorities as well as projects and programmes are required to comply with the aforementioned. The IDP incorporates a Spatial Development Framework (SDF). This spatial 'arm' of the IDP is intended to include the spatial vision of the municipality whilst providing parameters for more detailed planning such as land use management. The 'IDP package' is intended to assist the municipality in its ongoing management and decision making. It is revised every 5 years to coincide with municipal elections, and reviewed annually to ensure ongoing relevance.

Implementation of IDPs, the bureaucratic processes of financial and management system integration, as well as demands on human resources have been difficult challenges. Capacity is understandably an issue, given that some new municipalities have very limited technical resources, whilst limited capacity at a political level may have led to inappropriate decisions in some instances (Atkinson 2002).

There is a tension between the need for ongoing interaction between development agencies (local government) and local residents, and the spatial delineation of municipal areas. Demarcation has resulted in large metropolitan areas where the spatial concentrations of urban pockets are interspersed by rural hinterlands. Communities are often located as far as 50 kms from municipal offices (Atkinson 2002: 9). A ward participatory system allows for political decentralization, yet access to programme management resources is contingent upon a two-hour round trip, in some cases on public transport

eThekwini is a good example of this configuration. An initial two-tier system of metropolitan and local governments resulted from the amalgamation of around 60 government entities that transverse previous racial boundaries, some of them provincial (Freund and Padayachee 2002). This 'UniCity' municipal entity was replaced by a centralized metropolitan authority (now known as the eThekwini Metropolitan Municipality) in 2000, responsible for governing a large geographical area (approximately 2300 km2) including the city centre, peripheral townships and nearby satellite towns such as Umhlanga (eThekwini 2002).

The 2000 restructuring essentially enlarged the municipal area by 68% (see Figure 6.1) with a small population increase of 9% due to the rural nature of the incorporated areas (Ibid). Layered upon a fragmented topographical base are the settlement patterns and spatial manifestations of the end of a political era and the beginnings of another within a world economic order that has had profound implications for cities such as Durban.

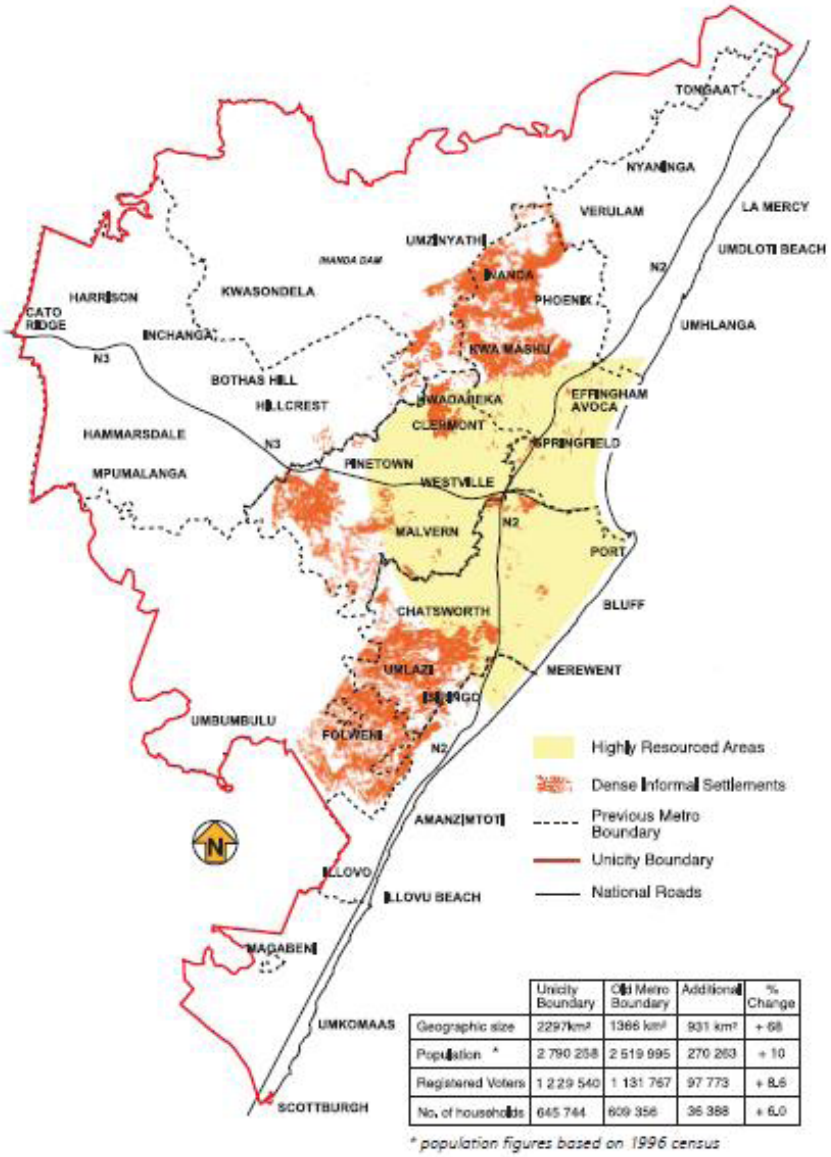


FIGURE 6.1: eThekwini Metropolitan Area

Key concerns expressed in the three IDPs perused include access to employment and economic, educational and recreational resources for the majority of the city's population that live in townships and remote peri-urban areas. Sustainability of natural systems, the cost of sprawl and an inefficient public transport system are some of the associated issues addressed in the city's spatial frameworks (the Spatial Development Frameworks that form part of the IDPs). The economic growth to the north of the city is acknowledged with investment in economic clusters such as the Southern Basin. Landmark developments such as the sports precinct surrounding the new stadium are intended to consolidate the investment benefits of the FIFA World cup in 2010.

The increasing dominance of the Umhlanga/Gateway node to the north of the city is recognized in the city's plans. The intention is to augment these nodes whilst enabling

mobility to more remote and economically marginalized areas in the metropolitan hinterland. The delicate balance between facilitating private investment (in areas such as Umhlanga), accommodating employment growth through strategic public investment in areas such as the Port and the associated Southern Basin whilst actively encouraging local economic development in previous townships is a core value. Enhancing mobility between all these nodes is the underlying intention embedded in the spatial frameworks that guides the city. A decentralized system of governance through area-based management (the selection of five districts assigned to relatively autonomous local government teams) is intended to facilitate more meaningful intervention in areas of need and those of strategic importance.

The following section provides a more detailed examination of the city's strategic objectives, based on systematic examination and analysis of eThekwini's IDPs and SDFs.

6.1.2 The eThekwini Spatial Development Frameworks and Integrated Development Plans

The eThekwini Municipality produced four Spatial Frameworks in the period between 1998 and 2008. A Spatial Development Plan (SDP) was prepared in 1998 and SDFs for years 2002, 2006 and 2008. These plans were compared and summarised; core objectives and changes in strategic direction were noted (Annexure G contains the tabular analysis).

Given the size of the municipal area and its fragmented spatial configuration, transport linkages were a priority. A strong emphasis on development corridors is discernible: regional corridors with mobility routes between them in addition to a tourism corridor feature in the 1998 SDP. The 2002 and 2006 SDF speak of 'investment corridors' with feeder routes between them. The 2008 SDF (Figure 6.2) categorizes three corridors: a coastal corridor that links the central city with Umhlanga and the new regional airport and Dube trade port further north as well as several mixed use corridors and a tourist route. The corridor system is supplemented by a high priority transport network.

The changing role and emphasis on specific nodes/places within the metropolitan area emphasize the growth trajectory to the north of the city. Whilst Umhlanga is acknowledged as having potential regional importance in the 1998 plan, its strategic role increases in the later plans as a major investment node. The new regional airport (King Shaka International) and the associated Dube Trade Port are initially mapped and noted (in the 2002 and 2006 plans) but later revised in the 2008 plan as fundamental to the investment direction northwards. This is combined with efforts to focus investment in particular areas of need reflected in the area based management system first mentioned in the 2002 IDP. Five areas were defined in this regard: the inner city, Cato Manor, the pockets of rural land included in the municipal area in the last demarcation, the Southern Durban Basin and Inanda-Ntuzuma-KwaMashu (INK).

Other important areas of economic activity include the industrial nodes Pinetown and Westmead to the West (along the N3), noted in all four plans, and Hillcrest, a once semi-rural enclave, now the locus of a large number of gated communities and commercial decentralization (recognized in the 2002, 2006 and 2008 plans).

INK and SB provide the spatial milieu for the field work reported in Chapter 7. The Southern Basin remains an important distribution and industrial node and of course, a transport hub given the harbour. Regeneration is a focus given the demands of economic

restructuring and degeneration in residential areas. INK, a combination of a number of residential townships that are home to 500 000 people (Ethekwini Municipality Area Based Management and Development Programme 2005) is noted as a mixed investment node and Presidential project (in terms of the national government urban renewal programme) with KwaMashu town centre seen as an investment catalyst in the 2006 plan.

An important element in the overall strategy to functionally integrate INK with the rest of eThekwini is Bridge City (initially termed 'Link City'), a mixed use development that includes an underground railway station integrated with a 40 000 sq m shopping centre, a Magistrates Court and Hospital together with residential development at varying densities (Rhubarb Productions 2008). The emphasis on linkages reveals the need for connection within and beyond Durban. Mechanisms to achieve this are transport routes and feeder routes…reliance on physical transport infrastructure. No mention is made of the potential for ICT infrastructure to enable spatial integration. The backbone communications networks are not mapped, nor is it mentioned in the narrative. Essentially no link is made between communications networks and spatial development.

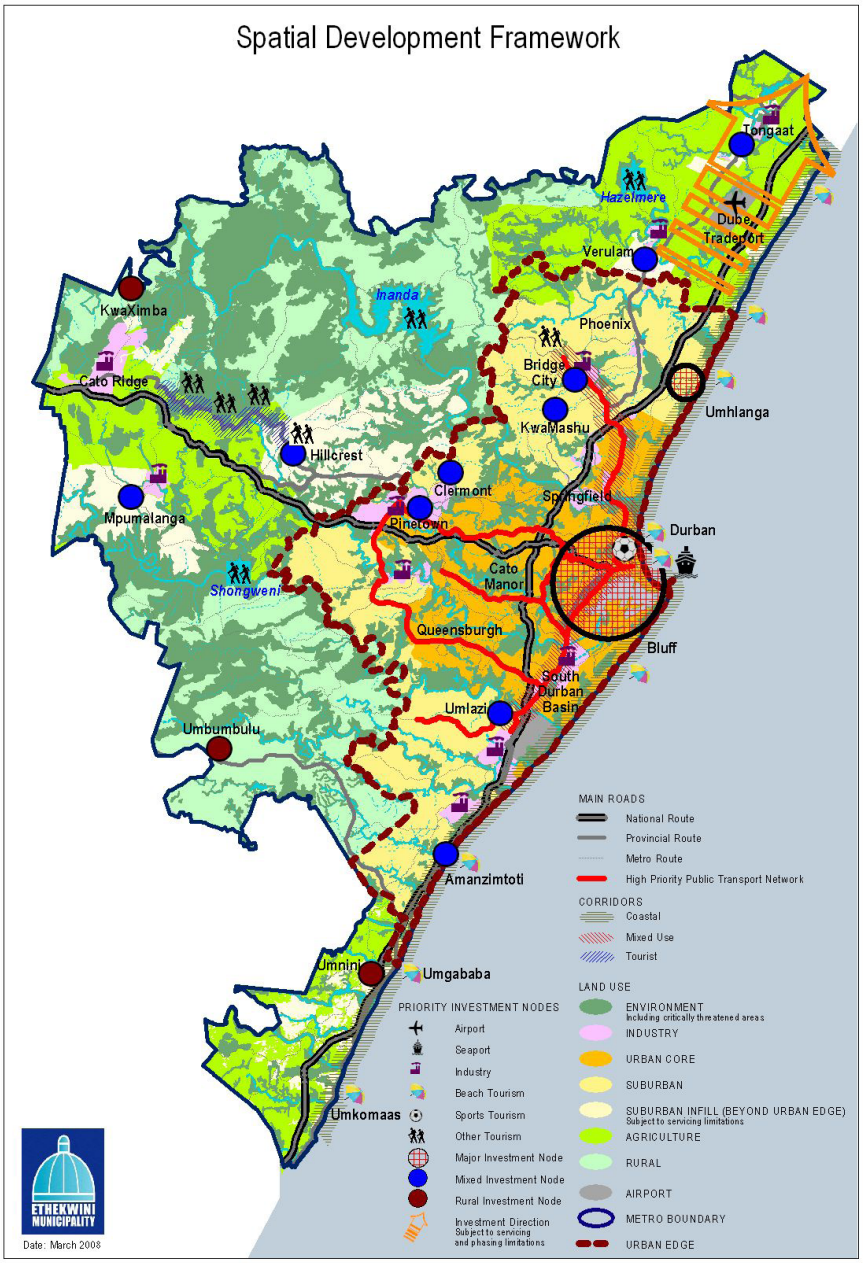


FIGURE 6.2: eThekwini Spatial Development Framework

IDPs provide the institutional and operational 'container' for the spatial plans. An interim IDP was prepared in 2001 by the Durban UniCity Council before final demarcation. A full IDP was prepared by the newly formed eThekwini Metropolitan Council for the period 2003 to 2007, and another for 2006 to 2011.

The former comprises a 5-year sustainable development strategy that is underpinned by an eight-point plan and concomitant programmes for implementation; the eight strategies that comprise this plan are as follows:

- Creating sustainable economic growth and job creation, as well as building strong and vibrant local economies;
- Regenerating existing residential areas to ensure a higher quality of life for all citizens; Balancing new development with renewal and maintenance;
- Mainstreaming responses to crime, HIV/AIDS and poverty alleviation;
- Focusing and integrating city delivery;
- Developing a financial strategy that balances developmental expenditure with a strategy to grow income;
- Ensuring local government is more accessible and accountable, assists citizen action and aligns all spheres of government to ensure co-ordinated and integrated delivery;
- Maintaining the ecological integrity of the city.(eThekwini Municipality 2001a)

The eight-point plan shifts in the recent version (2006 to 2011) to include the following eight strategies:

- Sustaining the natural and built environment
- Economic development and job creation
- Quality living environments
- Safe, healthy and secure environment
- Empowering the citizens
- Celebrating cultural diversity
- Good governance
- Financial viability and sustainability.

(eThekwini Municipality 2008)

The two IDPs simultaneously reflect the aim of achieving economic growth, bottom-up development and ecological sustainability. The incorporation of ICT provides an interesting 'slice' of using a particular sector in achieving this balance. The following section outlines the eThekwini ICT strategy within the context of the eThekwini Municipality's strategic objectives.

6.2 ICT Policy in eThekwini

Durban's ICT Policy is not explicitly documented. It is embedded in the City's strategic objectives for growth and development, evident in the IDPs as well as implicit in the city administration's functioning. The following section gives a systematic account of Durban's ICT strategies. It is based on the following:

- **Secondary documentation** (the IDPs, Power Point presentations and city marketing literature)[7] In addition to the IDPs, 2 Power Point presentations that document the city's ICT strategy were sourced. Both were presentations to municipal council structures by the municipal manager (2006) and the manager of the Geographic

7 Two prior publications by the author document some of these findings; Odendaal (2003) and (2006). These publications are referred to where appropriate.

Information and Policy Unit (2002). The documents were used as core information sources for the open-ended interviews that were held with key actors.

- **Open-ended interviews** (Annexure E contains the interview schedules)
  The city manager, Dr Michael Sutcliffe, a key actor in the ongoing strategic decision making of eThekwini and a champion of the city's ICT policy, was interviewed early in the process (in 2008). The interview lasted approximately an hour. Discussions focused on the city's ICT policy, key actors and negotiations with those actors in implementing the policy, strategic issues surrounding Durban's development and ICT and challenges.

  The manager of the Office of Geographic Information and Policy was interviewed after the city manager (also in 2008). Ms Subban is an urban planner, responsible for implementation of the ICT policy. The interview lasted 1.5 hours and centred on the operational aspects of the policy, the constraints and negotiations with key actors.

  A key actor that emerged out of the two interviews, as well as in the media, was SmartXchange, an IT incubator set up to assist in the implementation of the eThekwini smart city policy. The CEO of this organisation, Ms Robynne Erwin, was interviewed in 2009. Not only was this an opportunity to probe the role of SmartXchange but it also served to update information on the ICT policy in general. The interview lasted 1 hour and focused on the genesis and role of SmartXchange, its evolving functions, relations with eThekwini, other actors and its members as well as the constraints experienced.

- **Newspaper Article Review**
  An article search was done in all local and national newspapers using online media databases http://www.sabinet.co.za/, http://www.iol.co.za/ as well as the eThekiwni publication 'Metro Beat'. Key words used for the search were smart city, ICT, information technology, communications technology, digital technology and IT in combination with Durban or eThekwini. The date range covered was from 1995 to 2007 when the search was first documented. Articles featuring interviews with Dr Sutcliffe, on the ICT policy and Ms Subban were also sourced.

  Articles sourced are summarised in Table 6.1. The following publications featured:

  The Daily News, a daily newspaper based in Durban

  The Sunday Tribune, a weekly Sunday newspaper based in Durban

  The Sunday Times, a national Sunday newspaper based in Johannesburg

  Business Day, a national business daily newspaper based in Johannesburg

  Other publications include *Enterprise*, a monthly news magazine, *The Cape Times* and *The Star*, dailies based in Cape Town and Johannesburg; *City Press*, another daily based in Johannesburg, and the *Sunday Independent*, a national Sunday newspaper.

TABLE 6.1: ICT and Durban in the Media

Year	No in articles in Publications / Titles					TOTAL
	The Daily News	*Sunday Tribune*	*Sunday Times*	*Business Day*	*Other*	
1998	3					3
1999	1					1
2000		1				1
2001					1	1
2002			1	1		2
2003	2			1		3
2004	2				2	4
2005					2	2
2006		5			2	7
2007	1	1	1		5	8
TOTAL	9	7	2	2	12	32

Thirty-two articles in total were examined and analysis focused on the actors revealed, the language used in describing the role of ICT and the emphases of the articles. Attention was also paid to whether the articles were based on press releases or the result of independent reporting (where possible). The aim was to read between the lines with regard to ICT in Durban, determine issues not covered in the policy and uncover actors not referred to in official documentation. eThekwini's monthly publication Metro Beat was also examined.

6.2.1 Documented Intentions

ICT has been a priority for the eThekwini municipality since 2001 when the City prepared its Long Term Development Strategy. Mention of ICT was largely indirect, but recognized digital technologies as important underpinnings to social and economic development (Odendaal, 2003). Access to information, technology and education opportunities were seen as keys to enhancing the quality of life of citizens. A concern with ICT is discernible in the following statement:

> *…in order for Durban to become a globally competitive city, serious efforts will need to be made to upgrade the skills and technology such that Durban becomes a smart city, in touch with its neighbours and the world. (eThekwini Municipality 2001).*

Not much is made of the need for service infrastructure to facilitate this transition. Early documentation reflects a strong institutional emphasis on partnerships, with the private sector as well as communities. One of the key concerns in this regard was the exodus of 60–70% of IT graduates of Durban universities from the city after graduation (Ibid.).

In the framework set by the Long Term Development Strategy, the Council published its draft Integrated Development Plan in May 2002. Explicit mention is made to ICT under the heading "Building skills and technology"; concerns mentioned include the need for upgrading infrastructure, as well as improving capacity and encouraging IT skills training (eThekwini Council, 2002).

The city's intention to become 'smart' was reflected in the local government restructuring process. Central was the creation of an "Office of Geographic Information and Policy" intended to drive the municipality's GIS and IT programmes and integrate all related policy

as well as the consolidation of a centralized and extensive GIS database serving the entire Municipality. An "e-community" Internet project was launched in 2003 with the intention of providing access to the Internet and other computer applications in the city's public libraries. The first was opened in Cato Manor, an area of approximately 93,000 people in inner city Durban, consisting mainly of poor communities.

ICT is also seen as an enabler of social empowerment, as the 2006 IDP outlines a 'learning city' strategy; pointing out the need for a city-wide ICT infrastructural network, low-cost multimedia devices, and a central repository for 'Learning City data' – all as means of bridging the digital divide. In this plan there is a second emphasis on economic development, involving the promotion of local ICT-related businesses to strengthen Durban's knowledge-based resources and facilitate the transition towards a knowledge economy (Odendaal 2006). A process function (administration and information dissemination) is also documented in addition to the substantive outcomes: economic expansion and sector growth. This is a typical feature elsewhere as ICT is incorporated into strategic objectives (Odendaal 2003; Aurigi 2005).

Whilst technology is implicit in the first drafts (2001 Long Term Framework and 2002 IDP) as a contributor to larger strategic objectives, it becomes a more explicit actor in the 2008-2009 Plan. The current IDP (created to direct development until 2011) is more explicit in its mention of technology. As part of its strategic agenda to diversify and expand the economy, it sees this sector as an important contributor to the tertiary economy. Attracting ICT industries and retaining ICT skills are seen as important objectives. Using technology to optimize information access is part of a broader governance agenda. ICT is noted as the means whereby the municipality can be promoted as a 'learning city', promoting a more efficient city administration and disseminating data more effectively within the bureaucracy, (the IDP quotes Dublin in Ireland and Jaipur in India as successful cases) and also using www.durban.gov.za to relay information to other stakeholders such as Non-governmental Organizations (NGOs) (eThekwini Municipality 2008).

A more dramatic departure from prior IDPs is the explicit designation of the smart city objective as a key programme area (under its Strategic Focus area to promote Durban as a learning city).

The digital divide is defined as socio-economic and infrastructural. The latter is directly addressed through the expansion of the city's fibre-optic backbone, the maintenance contract of which was to be awarded in 2009. The next documented step is to facilitate provision of services to residents, using this infrastructural backbone. Quite how this is to be achieved is not documented in the IDP. Nor is the infrastructure mapped in the SDF.

Two distinct agendas emerge from a reading of ICT in the city's strategic plans over the last 8 years since its first IDP. The first is the growing importance of ICT as an element of the city's strategic vision for economic growth and socio-economic development. Second, ICT is treated as an enabler of effective municipal functioning, including the promotion of e-administration (for financial systems, procurement and human resource systems, etc.) and e-governance (with the creation of an internet portal and the ability to access services electronically). The web site has also been a core part of the City's ICT emphasis; www.durban.gov.za was developed as an e-governance and information tool.

Whilst mention is made of civil society and the need to address the digital divide, no explicit programme or project addresses digital inclusion. Interviews were used to probe some of the unanswered questions and confirm the core elements of the strategy. The many actors implicated in the ICT strategy are not documented in the IDPs. The newspaper article review as well as the interviews was used to gather information on this.

Lack of a spatial emphasis is typical of ICT strategies. The emphasis tends to be on e-governance and economic strategies (Aurigi 2005). Spatial planning is largely ignorant of communications infrastructures. Part of the reason is that ICT access and infrastructure are difficult to map and fix in space. Infrastructural elements are under the ownership of different private actors: Telkom and 3 cell phone companies (in addition to the municipality), often in competition with each other. Devising a spatial strategy given this competitive terrain is difficult.

6.2.2 Newspaper Article Review

Early articles reviewed from the late 1990s deal mainly with the Y2K fears with various press statements that eThekwini was Y2K ready. The role of ICT in facilitating large scale events is first noted in 1998 when the Non-Aligned Movement Summit was held in Durban. Focus was on the sophisticated media centre provided and the telephones installed by Telkom (Yoganathan 1998). The importance of technology in facilitating large scale events is reflected in the publicity surrounding the run up to the FIFA Soccer World Cup recently:

> *The 2010 soccer World Cup has added 'vooma' to the city of Durban's vision to a make internet access available on a large scale and at a cheaper rate, putting local business in a good position to increase profit margins ahead of the event. (Dardigan 2007)*

The fibre-optic backbone was seen to be an advantage in providing connectivity for the event. Subban is quoted as saying, however, that the technical personnel arriving 6 months before the event to ensure technical functioning (1200 FIFA appointed staff) will remove all FIFA hardware after the event; "We can forget about getting work from FIFA – that's not going to happen." (Subban in Dardigan 2007). The World Cup was noted as a catalyst for eThekwini driven ICT initiatives and an opportunity for small businesses. ICT is seen as critical to the success of the event.

Durban's ICT policy first received mention in the press in 2005 celebrating the success of the SmartXchange initiative, essentially an IT incubator that partners small IT SMEs with conglomerates such as Dimension Data in upgrading the City's IT system. The initiative is a successful small business initiative, often profiled in the media.

> *SmartXchange is the vehicle through which the province of KwaZulu-Natal will become a major technology hub in Africa. Martin Cele, then CEO of SmartXchange was quoted as saying (Inggs, 2005).*

SmartXchange received a lot of coverage as an incubator and solution towards retaining IT skills in the city and attracting new human resources (Naidoo 2006), as a core actor in upgrading the city's IT system (The Mercury 2005), as a software vendor and innovation hub (Naidoo 2005), as a collaborator with big business such as Microsoft (Inggs 2005), as the catalyst in creating a Silicon Valley in Africa (The Mercury 2005) and instrumental in giving Durban and KZN the edge in investment promotion (Inggs 2006). Coverage continued into 2007 where much was made of the incubator as a key operative in enacting eThekwini's ICT policy.

Overall, the underlying story is one of local success. Investment in Durban, with the "potential of producing high quality software products that could surpass local needs and become a source of export income." (Courtois, quoted in Naidoo, 2005), was reflected in the headline: "Council snubs Microsoft by switching to open-source software" (Sunday Tribune, 2006). Civic pride is further celebrated in coverage of the fibre-optic backbone, as the lifeline that connects libraries and municipal offices; in order for Durban citizens to become part of "…eThekwini's march towards becoming a smart city…All that was required was a wireless-enabled laptop and a library membership card…" (Arde 2007).

Faith in the hardware, in the power of networked infrastructure, is reflected in a number of articles from 2005. Subban is quoted as saying that "Durban's telecommunications capability was ahead of any other city in the country because of the extensive fibre-optic infrastructure that already existed in the Municipality." (Dardigan, 2007).

ICT is seen as a developmental tool and a utility (Subban, 2008). This theme often recurs; Durban as a 'smart city', a 'digital city' for everyone, one of access and opportunity. The plan to make city libraries internet hot spots, first mentioned in 2000 as part of the Community Information Link piloted in 18 of the city's libraries (Brennan 2000) is highlighted in the media. This figure was increased to 85 municipal libraries in 2007 (Arde 2007). Another initiative, first mentioned in February 2006, is the intention to use VOIP to enable cheap or free local calls using electricity infrastructure.

Thus, three elements of the documented ICT strategy are specified in the media: the infrastructure backbone, the developmental dimensions and the central role played by SmartXchange. Emerging themes are the focus on events such as the FIFA World Cup and the specific emphasis on providing internet access in libraries. The following section probes the ICT strategy through interviews with key respondents.

6.2.3 Interviews with Key Respondents

The newspaper article analysis was done first in order to correlate with issues emerging from the IDP and ICT policy. Thereafter the interviews were conducted focusing on the perceived relationship between urban change and ICT, the strategic objectives that drive ICT policy in Durban, the future vision for ICT in Durban, constraints experienced and other actors that are involved in ICT policy implementation. Specific issues that emerged from the newspaper search, such as the FIFA World Cup as a catalyst for ICT infrastructure development for example, were also probed

The findings from the interviews are arranged below in accordance with themes that emerged from the field work. These themes relate to the research questions but also allowed for clusters of issues not anticipated. Much of the discussions focused on future aspirations; on what could be what should be and what is planned to be. Reflecting on these elements of a future vision for ICT in the city provided commentary on networks and actors. Agency, as expressed in plans for the future, is a reflection of the energy that emerges from the addition of technology to networks.

ICT and Urban Transformation in Durban

Not many of the respondents commented directly on the relationship between ICT and urban change. ICT was considered so ubiquitous that its association with urban life was considered a given. This question generally received a response on strategy: ICT is essentially seen as something the city administration can use to reinforce larger strategic

objectives. Hence it is seen as revolutionary, due to the potential and pervasiveness of digital technologies. Some commentary was made on the ubiquitous adoption of cell phones (Sutcliffe, 2008). The future potential of smart technologies, the potential for economic growth and social development were seen as important.

When probed on social development, responses were vague. In general there was acceptance (explicitly expressed by all 3 respondents) that for ICT to be meaningful in the urban environment, it needs to play a transformative role. When asked for detail on strategy in this regard, two elements of the ICT strategy were emphasized: SmartXchange and the fibre-optic backbone infrastructure. The former was promoted as an enabler of small business development and economic empowerment. The latter was emphasized as a means whereby 'last mile' access can be achieved.

Mention was made (by Sutcliffe and Subban) of the ubiquitous adoption of cell phones and the potential for governance by utilizing convergence. There was acceptance on all fronts that the digital divide is a reality and that computer access is constrained by cost and education. The view was that this is mitigated by cell phone access (Sutcliffe 2008) and small business empowerment (Erwin 2009). Interestingly, all three respondents acknowledged that personal appropriation of technology is the most effective means to access benefits associated with ICT. When probed on spatial transformation, the value of the fibre-optic backbone was stated as the means through which digital integration could be facilitated. The use of technology in enabling information sharing and networking amongst IT professionals was seen as an example of what could be (Erwin 2009).

The notion that urban transformation through ICT is vested in the future, in the potential and benefits that will be accrued from current initiatives was held by all three respondents. Emphasis was on what could be, not what is. The language of development was dominant throughout (Subban was adamant that ICT is a developmental tool). The increasing emphasis on ICT as an enabler is evident in the IDPs and confirmed that it has increased over the 8 years reviewed as a factor in inclusive governance. There is a stated commitment to harnessing ICT for social development within the policy context of developmental local government. Respondents referred to the information transmission, information access and education potential available through ICT. Many ways through which this is to be operationalised is embedded in assumptions with regards to the other actors enrolled in ICT in Durban. In many ways it accords with a 'trickle down' approach. Last mile access using the backbone infrastructure is to be facilitated through small service providers (Subban 2008); the benefits of developing the small business sector will spread (Erwin 2009). When probed on the use of libraries and social facilities, the view was that this is an ongoing initiative but not a feature of the ICT strategy as emphasized in the media (Sutcliffe 2008).

Constraints to Technology Access

Respondents were specifically asked to give their views on the constraints to employing ICT for urban transformation. One of the biggest constraints mentioned was the lack of human resources; people to drive ICT strategies (Sutcliffe, 2008) and develop the ICT sector (Subban 2008). The skills gap is evident at the level of implementation as well as on the ground. More insidious barriers mentioned were the limited understanding of the potentials of ICT and the suspicion of technology (Erwin, 2009). The latter also refers to appropriate content and meaningful applications in a developing context.

Developmental factors such as lack of resources to access computers and the Internet, limited education to use computers and engage online content and the necessary skills to process information were commented upon. The limited participation of civil society in ICT initiatives was vocalized as being due to the fact that mobilization and organisation around digital issues on the ground is limited (Sutcliffe 2008). Civil society's voice with regards to digital issues was seen as silent.

The nature of the ICT sector was noted as highly problematic and complex, a highly competitive sector that differs from other utilities (Sutcliffe, 2008; Erwin, 2009). The legislative context that has largely reinforced the Telkom monopoly legacy was seen as one of the central barriers to universal access and meaningful change. The difficult legislative environment in a contested market terrain was agreed to by all respondents as the biggest constraint to policy implementation. The ability of local government to intervene developmentally (for example to provide services at a lower cost than commercial service providers) has essentially been curtailed by legislation that, until recently, did not allow for local government or service providers besides the two licensed telecommunications firms (Telkom and Noetel) to enter the market. Lack of clarity on central government policy was seen as a part of the same problem (Subban, 2008).

eThekwini's ICT Strategy

All three respondents commented on the smart city initiative in detail. eThekwini's ICT policy/strategy rests on two legs with a third emerging. The first is an emphasis on local economic empowerment in the ICT economic sector. The City contracted small service providers to develop software for the city's administration. The intention is to export these as locally developed solutions to other municipalities (Sutcliffe, 2008). The Section 21 Company, SmartXchange, was established as an incubator for small ICT firms and assists the municipality in implementing its ICT strategies by forming partnerships with the ICT industry. The importance of SmartXchange as a flagship project is immense in this regard and seen as a success by all three respondents.

SmartXchange's role has extended beyond that of incubator. Current CEO Erwin (2009) describes it as the vehicle through which to turn Durban into an ICT hub, set up to stimulate the ICT sector. The company partners with industry and also facilitates forums. Many small firms within the incubator develop software for the municipality. Using open source resources to build software for use within the city administration is seen as an opportunity to export this knowledge and software to run and manage cities (Sutcliffe, 2008).

Emphasis is on the local, on Durban as a city and eThekwini as a region. Interviews reflect a preoccupation with developing local solutions to city management systems and developing Durban-based ICT capacity. Multi-national companies such as Microsoft are viewed as partners. A large part of SmartXchange's mandate is to attract ICT skills to Durban and promote it as a lifestyle hub for ICT professionals (Erwin, 2009).

Part of this story is the 'African-ness', the local nature of this initiative and its preference for open source software as an alternative to the usual market software, avoiding 'the North taking over the South' (Sutcliffe, 2008). The overwhelming focus is a definite regional one – keeping ICT skills in the region, exporting products and expertise and encouraging investment in the city of Durban especially.

The second 'leg' of the ICT strategy concerns the need to make Durban a 'Smart City', with the necessary broadband ICT infrastructure web (Sutcliffe, 2008) also noted in the IDP. This entails using the Council owned fibre-optic cable which connects all municipal buildings in the metropolitan area as a backbone that can then include the broader populace. Despite the lack of spatial data and mapping in the SDF, spatial dimension of the ICT strategy was emphasized by the two spatial planners (Subban and Sutcliffe 2008). The backbone stretches across the municipal area, with 8 municipal offices (one of them in KwaMashu) located as nodes on this digital 'artery'. 'Last mile' access from here is intended to be facilitated through the participation of ICT business. A phased approach applies to the latter; the infrastructure was to be upgraded first (just finished at the time of writing up this research), access is to be expanded to include business (firstly) and then to social facilities such as schools and libraries (secondly). This expanded access is intended to facilitate access to consumers and households. (Subban, 2008) Once the backbone is in place, other technologies will be enabled that could start drawing on mobile telephony for example (Sutcliffe, 2008). The 'metro-connect' backbone has been operational since October 2008. Many contend that this is what distinguishes Durban, the fact that it has the infrastructural capacity to enable universal access (Sutcliffe, 2008; Erwin, 2009). A connected municipality was essentially the first goal in building the smart city. The availability of this network opens up opportunities in a number of economic sectors, argued Erwin (2009).

The third strategic objective that is emerging is the relationship to major events such as the FIFA World Cup. The catalytic benefits of using an event to leverage infrastructure delivery in 2010 and beyond has been beset with difficulties as negotiations with Telkom ensue on ownership and leasing of networked infrastructure developed for the event as well as who the main service provider would be: eThekwini Municipality or Telkom? (Sutcliffe, 2008).

Actors and Networks

The role of municipality with regards to ICT access is revealing. ICT is seen to play a developmental and utility role (as discussed above) and therefore falls within the Constitutional ambit of developmental local government. Local government departments appear to engage in the usual inter-silo arrangements and inevitable conflicts as coordinated service provision is negotiated (Subban, Sutcliffe 2008).

The role of business is important given the nature of the ICT industry. The role of the EMA was first to be a driver (given the fragmented nature of the industry), by creating an opportunity for IT businesses, it then became a facilitator and as these relationships mature it becomes a partner with ICT industry players (Subban and Sutcliffe, 2008). An emerging role of the municipality is that of provider and ICT market competitor as the legislation permits increasing competitions (Subban, 2008).

The role of the ICT industry is clearly a market one but lack of policy cohesion on behalf of National government essentially results in a situation where slow deregulation has kept prices high and access limited whilst lack of suitable policy integration has limited universal access. National departments that are implicated in the ICT industry are expected to provide policy direction and enable deregulation and access. Private business is expected to pursue profit but the assumption is that increased competition will enable inexpensive access. Where access is difficult, social facilities are expected to play a role, again focusing attention on the public sector. There is a clear indication from respondents

that some control is necessary to ensure that business does not control the ICT environment and that some public intervention is necessary to ensure access.

SmartXchange emerges as a strong actor in the media and in interviews. Partnerships with business, the city and some academic institutions are part of the 'Skills Corridor' – an initiative using an e-learning platform for training small entrepreneurs. The organisation's autonomy is important but its mandate is to some extent influenced by eThekwini funding. It also sees itself as a convener; "we sort of integrate everybody…" (Erwin, 2009). The physical hub is important in this regard. Within the physical hub, participant firms have formed their own SMME Committee to network independently of the SmartXchange management. Part of the SmartXchange initiative's success is the seemingly paradoxical combination of autonomy and firm support of the eThekwini municipality. Both are essential to remaining innovative yet being able to pursue ambitious goals (Erwin, 2009).

The role of civil society is not entirely clear, partly due to the fact that as a collective there appear to be no stakeholder groups that champion digital technology access. The units that comprise civil society include individuals, households and particular groups and demographic categories that use libraries and schools. The provision of ICT access becomes more elusive as the emphasis shifts from the latter to the former; ubiquitous access to the individual would be the 'last mile' whilst making access available to groups in social facilities is relatively straightforward.

The Future Smart City

Durban as a 'smart city' remains a goal that continues to be pursued as the infrastructural backbone is consolidated, web site functionality extended and the ICT industry grows. An intriguing narrative that emerged fairly recently is the emphasis on the FIFA 2010 World Cup and Durban's e-readiness for this event. The discourse of a smart city as an efficient world class city is discernible in the media whilst interviews with role players recognize the importance of Durban's digital presence. Yet the glamour of being seen as a connected city is tempered with a cautionary awareness of the exclusionary impacts of clustered ICT access that favours those who can afford it.

The findings show that the eThekwini Council's ICT policy seeks to address this through roll out of a high quality infrastructure backbone, accommodating VOIP, through making ICT available in public facilities, and providing web content that is relevant to its residents' needs. The 'smart city' narrative is imbued with two discourses. The first relates to City promotion and marketing such as the association with the preparations for the 2010 FIFA World Cup. Making Durban a smart city will place it on the global map, initiatives such as SmartXchange places it on the IT map. However, a secondary discourse emerges. The digital city is a place for all Durbanites – eThekwini will only be truly digital once all its residents have adequate access to ICT. This is in keeping with the fine balance that the Council seeks to achieve between economic investment and developmental objectives. With regards to implementation though, the emphasis remains on economic partnerships.

The issue of partnerships is high on the ICT agenda for Durban, and difficult to negotiate given the terrain. Relations with Telkom are tenuous as eThekwini (like other municipalities) push the legal boundaries in terms of telephony access. The battle with Microsoft yielded an arrangement that fosters local economic development in the ICT sector

through SmartXchange. Ongoing negotiation of these relations requires a firm hand from local government – clearly in this case facilitated through strong leadership from city management. However, household access remains poor and spatially skewed. Addressing this imbalance would require an intensification of the battles with the telephony industry and a more rounded approach to the management of social facilities intended to facilitate digital access. Convergence will also play a role as the ICT industry consolidates its market interests.

The term 'smart city' is useful for marketing purposes, positions Durban as a player in the global economy, as an innovator (Sutcliffe, 2008). Erwin argues that "what a smart city is a paradigm shift…" (2009). It requires a different way of thinking, of doing business. Certainly the media portrays a narrative that signifies connectivity, inclusion and innovation. This is supported by other respondent interviews.

How smart is Durban really? The ICT policy has essentially been in implementation for 8 years with two essential elements in place: SmartXchange and the metro-connect backbone. The reach of the latter cannot yet be determined. Negotiations around contracts to start the last mile access process could take a further 3 years to finalise given the legislative constraints (Erwin, 2009; Subban, 2008).

6.3 Durban Online

Durban's online presence is encapsulated in www.durban.gov.za. Probing the site was an important factor in understanding how digital technologies have become a core part of the eThekwini governance machinery. The web site is part of a network comprising an online community. Data was collected through the following:

- An open-ended interview with Angela Spencer, the www.durban.gov.za web master (until 2009);
- An analysis of the site, in 2003 and 2010 to allow for comparison over time from when the site was first consolidated and when this research concluded;
- An online survey of web site users;
- A review of '031 Online' (031 is the national dialling code for Durban) was examined. This was a regular column that ran for 6 years. The aim of this column was to report on what was new on www.durban.gov.za.

The review of '031 Online' is reported upon in combination with the interview with Ms Spencer.

6.3.1 The Background and Function of www.durban.gov.za

Durban's electronic presence is a major factor in how the city positions itself and the reach it has through electronic governance. The interview with Spencer revealed that the city web site provides a means whereby Durban's residents can become part of the digital age through information and service access. The city's web site as a source of information and e-governance tool was first mentioned in 1999 as a "world class Durban Experience" and "the most comprehensive city web site in South Africa" (Spencer 1999). The intention of 031 Online was to share information about updates on the site. This column continued until December 2005. The intention was to provide a view of Durban via the Internet (Spencer 2005b) focusing on interesting links in the site itself and other web sites of interest. Certain site functionality is highlighted such as its link to municipal

tenders and notices (Spencer 2005a), support structures for the informal economy (Spencer 2004b), and nominations of sites of the month. Guidance is given on how to use Google effectively and the location of IsiZulu browsers (Spencer 2004a).

The genealogy of eThekwini's web site is an interesting reflection of how electronic governance had become an extension of city management. The site started as an amalgamation of a number of departmental sites intended to be logistically more efficient. It was initially a tourism site aimed at providing local information and services to visitors and the tourism sector (Spencer, 2008). Later it became a city site aimed at catering for different audiences with current functionality including access to GIS mapping (on a separate server), utilities information and reporting as well as the City Manager's newsletter and information on political leadership. As the site matured, demands changed. At the time of the interview future plans included making the site more accessible through cell phones (Ibid.). The site was seen as a part of the City's communication strategy, one of the many vehicles providing information on the city and extending its service provision.

In addition to serving an e-governance function, www.durban.gov.za was considered the public face of digital Durban. The policy objectives of the site align with the larger goals for a smart Durban, general governance objectives together with developmental goals. Whether the site was used as envisaged was determined through the online survey.

6.3.2 Content and Composition of www.durban.gov.za

In 2003 the official eThekwini web site had been active for 4 years and allowed for a number of municipal functions: payment of services, queries, visual representations of land use zoning plans and other maps as well as information on councillors. Maintenance reporting was enabled through a drop-down menu (Odendaal 2003).



FIGURE 6.3: eThekwini Web Site in 2003 *Source: www.durban.gov.za (accessed January 2003)*

User groups were defined beforehand, focusing on visitors, business and residents. The majority of functions were intended for residents, some services for investors and news and information on local events and weather forecasts for visitors (Odendaal, 2003).



FIGURE 6.4: eThekwini Web Site in 2010 *Source: www.durban.gov.za (accessed January 2003)*

The site was a product of Web.01; information sharing is generally one sided with some, but very circumscribed interactive functions. The site's information service function was further enhanced in its links to and from the Provincial web site and potential investors could access the site through the Durban Investment Promotion Agency's site (Ibid.).

In 2010 the site is dominated by news and information on the FIFA Soccer World Cup. The site is organised in functions but behind it sit the assumptions with regards to users of the site. 'Discover Durban' provides information on events in the city, public transportation information (for the 'People Mover', the bus line that serves mainly the beach front area and other tourist attractions). 'Invest Durban' focuses on trade and investment in Durban, with a link to the Business Support and Markets Unit and Economic Development department of the municipality. The latter includes links to the Durban Film Office, Durban Investment Promotion Agency and Bridge City and the public investment node in INK (discussed in chapter 7). 'City Government' is an informative link that shares information on the IDP and other departmental plans and policies. It also includes a link to the Ombudsman's office (including an isiZulu access point) that can be contacted directly. The City Manager's newsletter is also available. Past letters are archived. Frequency is ad-hoc, intensified when controversial issues such as the Warwick Junction conflict (discussed in chapter 8) emerged.

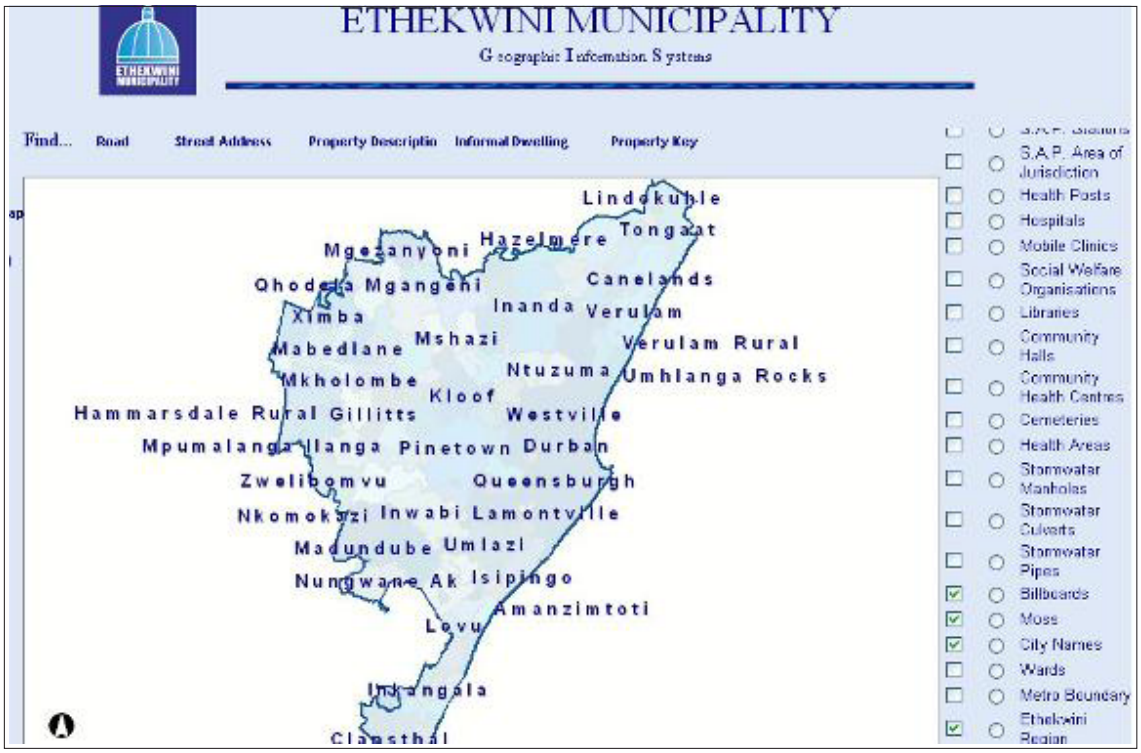


FIGURE 6.5: Geographic Information Systems Functions

Source: www.durban.gov.za (accessed April 2010)



FIGURE 6.6: The Two Versions of Public Transport in Durban

Source: www.durban.gov.za (accessed April 2010)

The interactive functionality of the site is uneven and related to departmental inputs (Spencer 2008). The most interactive part of the site is the link to the eThekwini GIS. Datasets can be loaded onto a viewer enabling the online creation of maps. Over 30 data layers are available ranging from natural features and topographical data to zoning information and utilities.

The link to the 'Development Applications and Approvals' function under 'City Governance' offers downloadable information specific to user needs: various downloadable development application forms, property-specific zoning certificates and information on land use categories. The section on by-laws is very thorough. However only one document is translated into isiZulu: the 2010 FIFA World Cup By-laws.

The site's unevenness applies to the contrast between its functionality with regards to the tourist-centred

'People Mover' bus service in comparison to Durban's transportation services for the whole metropolitan area. The former is a city-run initiative closely tied to its FIFA preparations, the latter a privately outsourced bus service. Under 'City Services', the bus time table link shows telephone numbers for the offices that provide time table information and one is left with little understanding of where to find information on the relevant bus route (or which routes apply). The 'People Mover' link offers a comprehensive site on routes, time tables and locations.

Two sets of issues require further exploration with regards to the Durban web site: how the site relates to the geographic and thematic areas covered in this research. INK, SB and the inner city are geographic foci further investigated and the themes of ICT and informality are also probed.

A detailed emphasis of the site is the Area Based Management (ABM) Programme, under the 'City Government' menu. The five areas are listed with outline information on each of the five focus areas, including the Southern Basin and Inanda-Ntuzuma-KwaMashu (INK). One potential area of interaction and empowerment is the 'Opportunities Database' home page…inaccessible without a login name and password. The viewer is left with no explanation as to the purpose of this link.

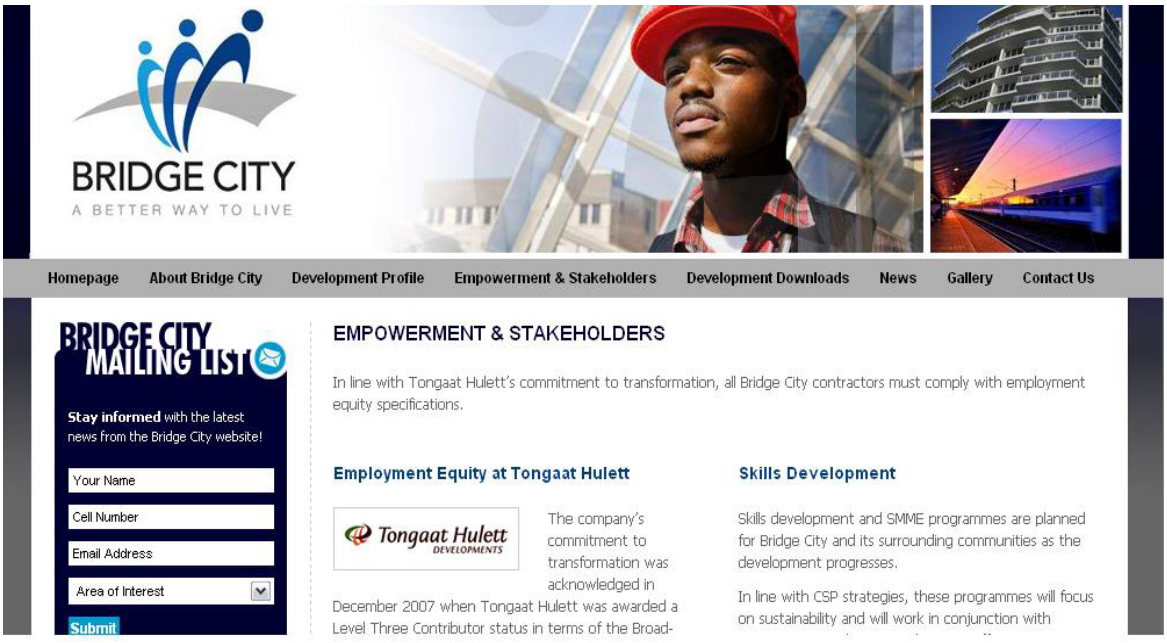


FIGURE 6.7: Bridge City Web Site *Source: www.bridgecity.co.za (accessed April 2010)*

The SB link offers access to a newsletter, downloadable in PDF format. The INK link is informative but also not terribly interactive. One component links to a database of businesses active in the area. Interestingly, the link to the Bridge City site is not from the INK menu, but under 'Invest Durban, through the 'economic development' link. This project is portrayed as a flagship empowerment project, yet absolutely no connection is made to the INK ABM initiative, or the INK team. INK is a geographic area, host to the communities that would be empowered through INK. It is a partnership between Tongaat Hullett and eThekiwni. (http://www.bridgecity.co.za/ accessed in April 2010).

The inner city is covered by the Inner Thekwini Regeneration and Urban Management Programme (iTrump). It engages with informality through the 'case studies' link that showcases collaborative initiatives between the iTrump team and various groups engaged in the informal economy. One such case is a reflection on the facilitative approach taken by the team in managed public health issues and externalities that emanate from the Warwick Junction area. Included in this document is the upgrade of the Early Morning market, a listed building dating back to the early 1900s used by Indian fresh fruit and vegetable traders. This building features in another part of the web site: the City Manager newsletter.

The market is currently the subject of conflict. The site, owned by eThekwini, is in the process of being re-designated for a shopping mall. The conflict is not the focus of the research (and is further explained in Chapter 8) but the web site plays host to a contradiction that emerges from recognition and celebration of the collaborative approaches taken by the iTrump on the one hand (prepared by the erstwhile project manager who left the project in 2006, uploaded in 2009), and a scathing retort to academics who were critical of the city's heavy handed approach (Sutcliffe 4 and 13 June 2009); the replacement of the market with a privately owned shopping mall is depicted as a necessary part of the urban renewal process in preparation for the FIFA event. No mention is made of the conflict on the iTrump site.

The city's ICT initiatives are projected in two ways: as news items under 'Invest Durban' and 'City Government', celebrating SmartXchange's success, and Ms Subban's primary role as driver and winner of the Computer Society of Africa (KZN Chapter) IT Personality of the Year Award in 2007. Ms Erwin, CEO of SmartXchange was given the award in 2009. A second entry is on eThekwini's role in CIFAL Durban, the South African affiliate of the Decentralised Cooperation Programme of UNITAR, the United Nations Institute for Training and Research, launched on October 4, 2004. Using ICT to improve local governance is a part of this programme and considered part of the skills transfer made available by eThekiwni to other partners such as CIFAL Ouagadougou (Burkina Faso) *(www.durban.gov.za Accessed April 2010)*.

6.3.3 Web Site User Survey

The Durban web site portrays a consistent categorisation of the viewer as visitor, investor or resident. A survey was posted on the site between July and September 2008 (the survey form is included in Annexure H) to gain insight into the user profile.

Seventy-two respondents completed the questionnaire. The demographic profile of respondents was as follows:

TABLE 6.2: Demographic Profile of www.durban.gov.za users

Age cohorts	Male		Female		Total	
	No.	%	No.	%	No.	%
Under 19	1	1.4	0	0.0	1	1.4
19 – 35	16	22.2	22	30.6	38	52.8
36 – 45	5	7.0	7	9.7	12	16.7
46 – 55	7	9.7	7	9.7	14	19.4
56 – 65	6	8.3	1	1.4	7	9.7
66 +	0	0.0	0	0.0	0	0.0
Total	35	48.6	37	51.4	72	100.0

The demographic representation above shows an age bias; just over half of respondents were in the 19-35 age category. The gender balance is fairly even. Few respondents were over the age of 56 (9.7%).

The majority of respondents were University graduates (41; 57%); a further 14 have either completed some University training or were at University at the time. Thus a total of 55 (76%) respondents had some tertiary training.

The survey probed how often users accessed the site and whether they intended to use it again. All the respondents indicated that they would use the site again. Of the 72 respondents, most were regular visitors to www.durban.gov.za; 66 (92%) had used it more than 5 times, whilst 5 had used it between 2 and 5 times, 1 respondent had used it once before.

Respondents were also asked to indicate the purpose for which they used the Internet. Respondents could choose from a number of categories; they could select more than one option and/or other categories. The results are summarised in Table 6.3 below.

TABLE 6.3: Function for which the Internet was used

Frequency – Use of *Durban.gov.za*	Function for which the Internet is used						
	Study	General info	Staying in touch with friends	Making new friends/ meeting new people	Job Hunting	Other	
						Bills / banking e-gov	Work
More than 5	22	48	30	7	30	6	17
2 – 5 times	1	4	2	1	1	0	0
1		1	1				
Total	23	53	33	8	31	6	17

The 'general information' category was the most popular; 'staying in touch with friends' was noted as the second most popular use for the Internet with 'job hunting' also featuring. Six of the frequent users of Durban.gov.za use it to pay bills and check rates accounts whilst 17 respondents indicated they used the Internet for work. Only 8 respondents indicated that they use the web to make new friends or meet new people.

Respondents were asked to indicate their physical location in terms of where they live, and where they access the Internet. The first question was either misunderstood or respondents were not happy with indicating where they live. Twenty-five respondents left the item blank and 23 indicated 'at work' (interpreting the question as enquiring where they access the Internet). Of the remaining 24 respondents, 4 live in Pinetown (to the west), 10 in Durban itself or in the suburbs immediately adjacent to the CBD, 1 in Umhlanga, and 4 outside Durban (including 1 in Australia). No-one claimed to live in any of the townships surrounding Durban or the peri-urban areas on the city's fringes.

The question on where respondents access the Internet was more fruitful; responses are recorded below in Table 6.4. The majority of respondents access the Internet at work, whilst very few used Internet Cafés.

TABLE 6.4 Location of Internet Access

	No.	%
Home	20	28
Cell	2	3
Home of friend	3	4
Combination of the above	5	7
Work	33	46
Internet Café	3	4
University	6	8
Total	72	100

The number of responses to the web survey was disappointing but gave some indication of the user profile. The site does not play a developmental function. Users are largely educated, are able to access the Internet either at home or work, with the Internet used to access general information, job hunting and staying in touch with friends. The e-governance functions of the site featured; whether the site was used to stay abreast of council affairs was not mentioned.

The frequency with which users returned to the site and their intentions to use the site again indicate that the site was successful in enlisting them as users (or enrolling them into the www.durban.gov.za network). The location of users tended to be in established areas. Access to the Internet was mainly enabled at work. Users were reluctant to indicate where they lived.

The following section probes the spatial distribution of ICT access in Durban.

6.4 ICT Access in Durban

6.4.1 Data Sources

Mapping ICT access was enabled through a number of data sources:

Secondary Data on National Trends

- Secondary data from two documents was used to determine the overall patterns of ICT access in South Africa in order to gauge demographic and other trends that emerge. The two reports were both produced by the Human Science Research Council (HSRC), a semi-public research organisation active in producing knowledge on pertinent social issues. 'Slipping through the Net: Digital and other Communication Divides within South Africa' is a chapter in a survey of social attitudes, published in 2006 (South African Social Attitudes: Changing Times, Diverse Voices). (Langa, Conradie et al. 2006). In 2007, the organisation published an atlas of national ICT access in Mapping ICT Access in South Africa (Tlabela, Roodt et al. 2007). Together with reference to other secondary literature these documents provide a representation of ICT access nationally.

Primary Data on National Trends

- The most recent census results that were available stemmed from the 2001 National Census conducted by STATSSA the South African statistics agency. This data was used to map ICT access together with geo-referenced information (see detail below).

Data from Statistics South Africa (STATSSA) South African Community Survey for 2007 was used. A total of 284 000 households were surveyed across the country randomly sampled within all different enumeration areas as demarcated in the 2001 Census, (excluding those classified as institutions and recreational areas) – these figures were then used to project population distributions across municipal areas. Households are defined as a group of persons who live together and provide themselves jointly with food or other essentials for living, or a single person who lives alone (STATSSA 2007).

Geographic Data

- Many attempts were made to access telecommunications infrastructure data. The following service providers were approached: TELKOM, two cellular companies and the eThekwini Municipality. None of these agencies were forthcoming with data. Telecommunications data is considered valuable in this highly competitive market environment. Cell phone companies map their coverage for marketing purposes but this is not at a scale appropriate to this research. A second national service provider was in the process of being introduced at the time of research; accessing data was impossible.
- Sample data from the Community Survey was used to determine more recent access but is based on a very small sample and disaggregated to municipal boundaries. This data was useful in determining overall trends in terms of access in eThekwini compared to other municipalities. The data used to compile this comparison was taken from the Statistics South African Community Survey for 2007. A total of 284 000 households were surveyed across the country randomly sampled within all different enumeration areas as demarcated in the 2001 Census, (excluding those classified as institutions and recreational areas). These figures were then used to project population distributions across municipal areas. Households were defined as a group of persons who live together and provide themselves jointly with food or other essentials for living, or a single person who lives alone (STATSSA 2007).
- More detailed mapping was done based on 4 Census 2001 data sets: access to cell phones, telephones, computers and the Internet. The enumerator areas data base was used as the anchor spatial data: The mapping was intended to provide a spatial overview of ICT access and compared to investment trends mapped using aerial photography. The mapping process is explained more thoroughly below.

6.4.2 The Urban Bias in ICT Access

- Secondary sources report an urban bias in the distribution of ICT access (Adam 2004; Mwesige 2004; Tlabela, Roodt et al. 2007). Reports on the South African context shows that Internet access in particular, is largely confined to urban areas. Race, age, income, gender and education are important informants; the majority of Internet users in South Africa are younger than 50, have a tertiary education and are white and male (Langa, Conradie et al. 2006).
- Despite the low rate of access to computers, an exponential growth in access to cell phones is identifiable in 2003; total cell phone subscribers increased from 6 per 100 inhabitants in 1999, to 30 per 100 in 2003 (Ibid.). By contrast, a decline in land line connections resulted from the increase in telephone tariffs (an average increase of 24% per annum) from 1997 to 2004 (Ibid.).

- The spatial distribution of ICT access nationally shows a predictably urban bias with Gauteng and Western Cape dominating the provinces. In KwaZulu-Natal, ICT is strongly concentrated in eThekwini and Msunduzi. (Tlabela, Roodt et al. 2007).
- Tele-centres are sparsely distributed; only 500 000 people (approximately 13% of the total population) are within a 5km radius of each of the 3 public tele centres in Durban (Ibid.). The 6 cyber labs in schools serve on average of about 145 000 pupils between the ages of 15 and 19 (ibid.). Composite indicators that combine three forms of private ICT access (households with land line access, households with access to mobile phones and households with access to computers) shows that eThekwini falls in the highest access cohort (in KZN) with average access per household between 28.51 and 42.64%. A composite indicator of access to ICT through public facilities such as libraries, Cyber labs, tele centres and Multi Purpose Community Centres (MPCCs) indicate eThekwini falling within the second lowest defined rate of 0.03 – 0.06 public ICT services per 1000 people nationally (ibid.).

The Community Survey data was used to compare Durban to two other metropolitan areas – Cape Town and Johannesburg. eThekwini, Johannesburg and Cape Town are essentially the three primary metropolitan areas in South Africa with respective estimated populations of 3 468 086, 3 497 097 and 3 888 180. These are extrapolated figures. This data was also used to compare Durban to 4 surrounding local municipal areas. The purpose was to test the urban bias of technology by comparing the city to surrounding predominantly rural municipalities as well as the second most populous city in KZN, Msunduzi (also the capital of the province).

The four local municipal areas selected are shown in Figure 6.8 overleaf; they are:

- Umdoni,[12] (population1: 74 437) immediately south of eThekwini, its main urban centres are Scottburgh (a coastal holiday village) and Umzinto (essentially a service centre for surrounding rural areas, including many sugar plantations) and functionally it has strong links to Durban given its proximity to the current Durban International Airport as well as the Southern Industrial Basin.
- Umzumbe, (population: 176 287) immediately south of Umdoni and also contained within the Ugu district municipality. Umzumbe was selected due to its largely rural character; land uses are mainly agricultural (commercial and subsistence) and settlement is scattered on land largely under traditional tenure.
- KwaDukuza (population: 162 055) is located immediately north of eThekwini. The future Dube Trade Port is located within this municipal area. The area's location on a pristine coastline, its good service infrastructure and association with the growth trajectory to the north of Durban has made it the focus of large scale private residential development, mainly gated communities or 'eco estates'. Large-scale commercial development has focused on Ballito, its urban centre, whilst its rural hinterland remains relatively impoverished.
- Msunduzi (population: 616 730) contains Pietermaritzburg, the administrative capital of KwaZulu-Natal, and the second largest urban conglomeration in the province.

12 Population estimates are taken from STATSSA projections contained in the Community Survey report of 2007.

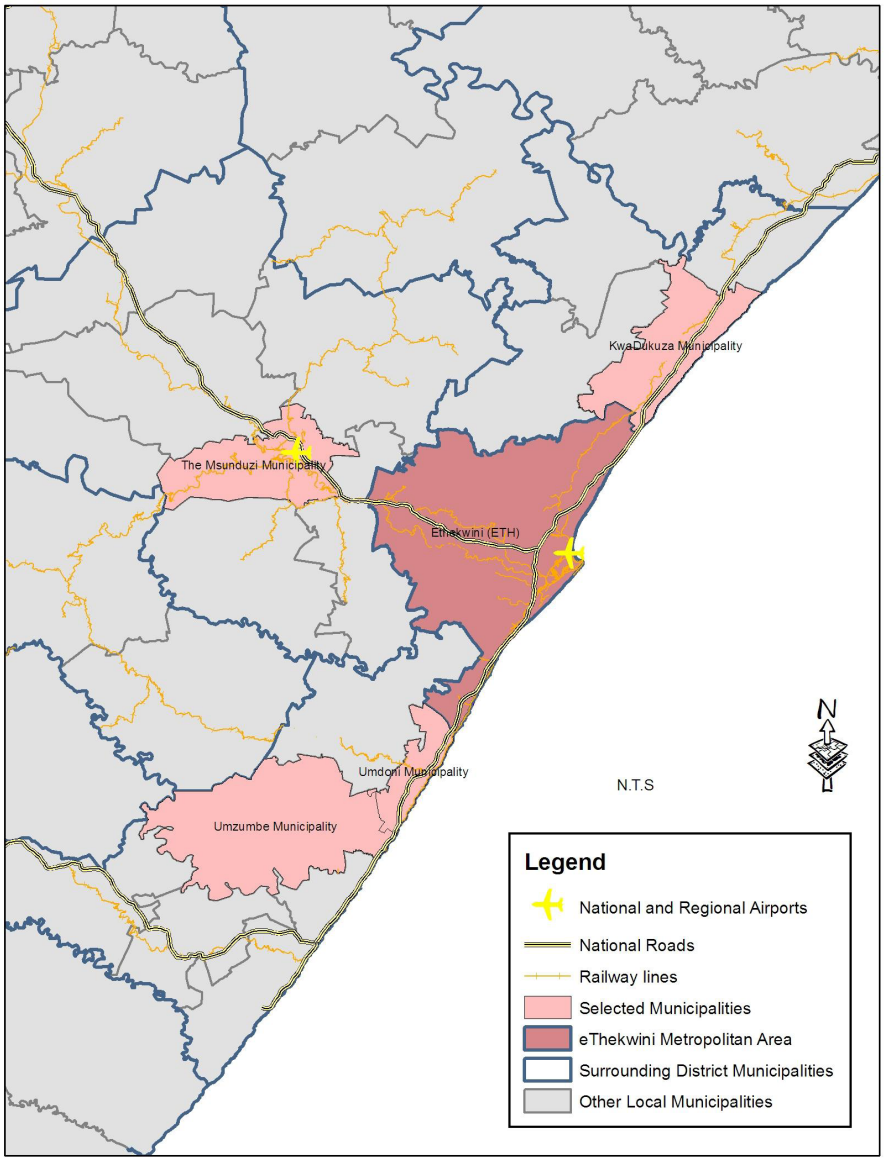


FIGURE 6.8: eThekwini and Surrounding Municipal Areas
Source: GIS Data, Municipal Demarcation Board 2008

Data from the 2007 Community Survey are represented in Table 6.5 (overleaf), which gives a comparison of ICT access in Durban in relation to the other selected municipalities.

All the municipal areas show a high proportion of cell phone access in comparison to other technologies. Of the metropolitan areas, Johannesburg shows the highest prevalence at household level, with eThekwini second. Umzumbe, the most remote of the selected local municipal areas, shows a relatively low cell phone access rate of 56.6%. Access in urban areas is no doubt facilitated by good commercial coverage.

Access to telephony in the form of fixed lines in Durban (32.4%) is almost ten times that of access in largely rural Umzumbe (3.4%), but lags behind Cape Town at 47%; Johannesburg shows a lower access rate at 28.7%. Interestingly Msunduzi and Umdoni show similar rates of 28.7 and 28.9% with KwaDukuza at 20.5%.

Access to the Internet and computers is exceptionally low generally, with Cape Town showing the highest figures; Internet access in Durban is at 18.9% and households with access to computers at 34.3%. The lowest figure, not surprisingly, is Umzumbe, whilst eThekwini shows lowest access figures of the three selected metropolitan municipalities.

TABLE 6.5: ICT Access in Durban compared to Johannesburg and Cape Town

	Yes		No		Unspecified		Overall total	
	Sub-total	%	Sub-total	%	Sub-total	%	TOTAL	%
eThekwini Metropolitan Municipality								
Access to cell phones	647472	77.6	179670	21.5	6718	0.8	833860	100
Access to telephones	270404	32.4	559743	67.1	3712	0.4	833859	100
Access to the Internet	76858	9.2	750966	90.1	6034	0.7	833858	100
Access to computers	162111	19.4	671748	80.6			833859	100
City of Johannesburg Metropolitan Municipality								
Access to cell phones	950768	81.6	203876	17.5	10369	0.9	1165013	100
Access to telephones	334185	28.7	824055	70.7	6774	0.6	1165014	100
Access to the Internet	165989	14.2	991064	85.1	7960	0.7	1165013	100
Access to computers	303540	26.1	861474	73.9			1165014	100
City of Cape Town Metropolitan Municipality								
Access to cell phones	695295	77.1	198239	22.0	8745	1.0	902279	100
Access to telephones	424097	47.0	473340	52.5	4841	0.5	902278	100
Access to the Internet	170860	18.9	725422	80.4	5996	0.7	902278	100
Access to computers	309188	34.3	593090	65.7			902278	100

Source: STATSSA Community Survey 2007

Table 6.6 : ICT Access in Durban compared to surrounding municipalities

	Yes		No		Unspecified		Overall total	
	Sub-total	%	Sub-total	%	Sub-total	%	TOTAL	%
eThekwini Metropolitan Municipality								
Access to cell phones	647472	77.6	179670	21.5	6718	0.8	833860	100
Access to telephones	270404	32.4	559743	67.1	3712	0.4	833859	100
Access to the Internet	76858	9.2	750966	90.1	6034	0.7	833858	100
Access to computers	162111	19.4	671748	80.6			833859	100
Umdoni Local Municipality (KZN212)								
Access to cell phones	10971	67.0	5304	32.4	108	0.7	16383	100
Access to telephones	4707	28.7	11652	71.1	24	0.1	16383	100
Access to the Internet	1028	6.3	15236	93.0	119	0.7	16383	100
Access to computers	2279	13.9	14104	86.1			16383	100
Umzumbe Local Municipality (KZN213)								
Access to cell phones	22978	56.6	17501	43.1	99	0.2	40578	100
Access to telephones	1377	3.4	39063	96.3	139	0.3	40579	100
Access to the Internet	377	0.9	39947	98.4	255	0.6	40579	100
Access to computers	632	1.6	39947	98.4			40579	100
The Msunduzi Local Municipality (KZN225)								
Access to cell phones	94084	70.0	39538	29.4	768	0.6	134390	100
Access to telephones	38840	28.9	94994	70.7	556	0.4	134390	100
Access to the Internet	10088	7.5	123059	91.6	1243	0.9	134390	100
Access to computers	25670	19.1	108721	80.9			134391	100
KwaDukuza Local Municipality (KZN292)								
Access to cell phones	30963	69.6	13383	30.1	133	0.3	44479	100
Access to telephones	9105	20.5	35213	79.2	162	0.4	44480	100
Access to the Internet	3468	7.8	40947	92.1	66	0.1	44481	100
Access to computers	5041	11.3	39440	88.7			44481	100

Source: STATSSA Community Survey 2007

When considering a racial breakdown of ICT access figures within Durban, a strong racial digital divide emerges. Table 6.7 refers.

TABLE 6.7: ICT Access in Durban by race

Technology	Race breakdown	Yes		No		Unspecified		TOTAL	%
		Sub-total	%	Sub-total	%	Sub-total	%		
Access to cell phones	Black	426694	76.3	126951	22.7	5296	0.9	558941	100
	Coloured	18396	85.1	3216	14.9	0	0.0	21612	100
	Indian/Asian	118036	76.3	35853	23.2	907	0.6	154796	100
	White	84346	85.6	13650	13.9	515	0.5	98511	100
	TOTAL	647472	77.6	179670	21.5	6718	0.8	833860	100
Access to telephones	Black	71756	12.8	484826	86.7	2359	0.4	558941	100
	Coloured	11727	54.3	9553	44.2	332	1.5	21612	100
	Indian/Asian	110594	71.4	43750	28.3	452	0.3	154796	100
	White	76327	77.5	21614	21.9	569	0.6	98510	100
	TOTAL	270404	32.4	559743	67.1	3712	0.4	833859	100
Access to the Internet	Black	9661	1.7	545400	97.6	3880	0.7	558941	100
	Coloured	3361	15.6	18161	84.0	89	0.4	21611	100
	Indian/Asian	18840	12.2	134862	87.1	1094	0.7	154796	100
	White	44996	45.7	52543	53.3	971	1.0	98510	100
	TOTAL	76858	9.2	750966	90.1	6034	0.7	833858	100
Access to computers	Black	33028	5.9	525913	94.1			558941	100
	Coloured	7958	36.8	13653	63.2			21611	100
	Indian/Asian	56461	36.5	98335	63.5			154796	100
	White	64664	65.6	33847	34.4			98511	100
	TOTAL	162111	19.4	671748	80.6			833859	100

Source: STATSSA Community Survey 2007

Differentiation in terms of cell phone access is not dramatic; between 76% and 86% of households have at least one cell phone per household. The more pronounced difference emerges in considering other technologies. Land line access to black households in eThekwini is at a low rate of 12.8% - a quarter of that of access amongst 'coloured' households with white and Indian households displaying an access rate of 77.5% and 71.4% respectively.

Internet access is low in general: only 1.7% of households reported access to the Internet, with the highest rate of access (45.7%) amongst white households. Access to computers shows that the highest rate of access (of 65.6%) is almost double that of the next highest number – 36% amongst 'coloured' and Indian households. Only 6% of black headed households were reported to have access to computers.

A number of important findings emerge from this data. There is indeed an urban bias to technology access not surprisingly given the need for high cost infrastructure as well as the nature of settlement distribution in places such as Umzumbe. Secondly, a comparison between technologies shows a high uptake of cell phones – again not surprisingly given the low rate of land line access and the nature of infrastructure that is less hampered by topography.

In terms of the three metropolitan areas, Durban has the lowest rates of Internet and computer access. Within Durban there is a very strong racial bias with regards to ICT access. ICT access within Durban is presented in the following section.

6.4.3 GIS Mapping: Comparing Urban Change and ICT Access in Durban

Three GIS mapping exercises were conducted, and then compared:

Household Access to ICT

- The first mapped ICT access using Census 2001 data showing: household access to land line telephones, to mobile phones, and computer access.

Spatial Investment Trends

- The second exercise constituted mapping areas of growth over the last 15 year period. Three sets of aerial photography were used, taken in 1990, 2000, and 2007. This information was cross-referenced with the spatial analyses contained in the SDFs',

Communal ICT Access

- The third group of datasets indicates location of schools and libraries with ICT access.

ICT access represents figures from the 2001 Census, whilst the mapping illustrates development up to 2007. The latter should be read as part of spatial trends that continue from the early 1990s onwards. ICT access has most likely changed most significantly in terms of cell phone access, but the overall spatial pattern is unlikely to be substantially different given the high household cost of telecommunications.

Spatial change has been most pronounced in the west and to the north of Durban in the last 15 years. Whilst the whole Durban area was mapped, the north-eastern part and a portion of the west of the eThekwini metropolitan area were selected for analysis given the current growth trajectory of this sub-region. Included in the mapping are Umhlanga and INK to the north, Cato Manor and the CBD in the centre, Pinetown and Hillcrest to the West and a portion of the Southern Basin to the South. As noted in the overview (under 6.2) above, decentralisation of industry began in the 1970s (Morris, Barnes et al. 2002) largely due to limited land available in the south. Spatial change to the south has also been limited in the years since 1994.

Household Access to ICT

The distribution of ICT access was mapped using the spatial boundaries of the Enumerator Areas (EAs) used in the Census. These boundaries contain an ID field used to join its database table with other datasets: access to computer access, land line access and cell phone access. Joining tables is enabled through ArcGIS and effectively allows for a-spatial data to be mapped given that there is a common field used in the spatial data.

The numbers of households with access to these three technology types was mapped using percentiles and were divided into 5 categories which were then automatically generated by ArcGIS using natural breaks in the data. The mapping presented here was generated using highest and lowest cohort for each technology type only. The lowest cohorts of land line access shows that 2 to 17% households have access to a land line, 16

to 24% of households have at least one member that has access to a cell phone and the computer access cohort is between 0 to 6%.

The highest access cohorts are defined by: 60 to 79% land line access, 39 to 53% access to computers and 60 to 73% access to cell phones. What is immediately discernible is that cell phone access is the most available technology and computer access rare. Figure 6.9 shows the location of the areas with the lowest and highest access cohorts for the three technology types.

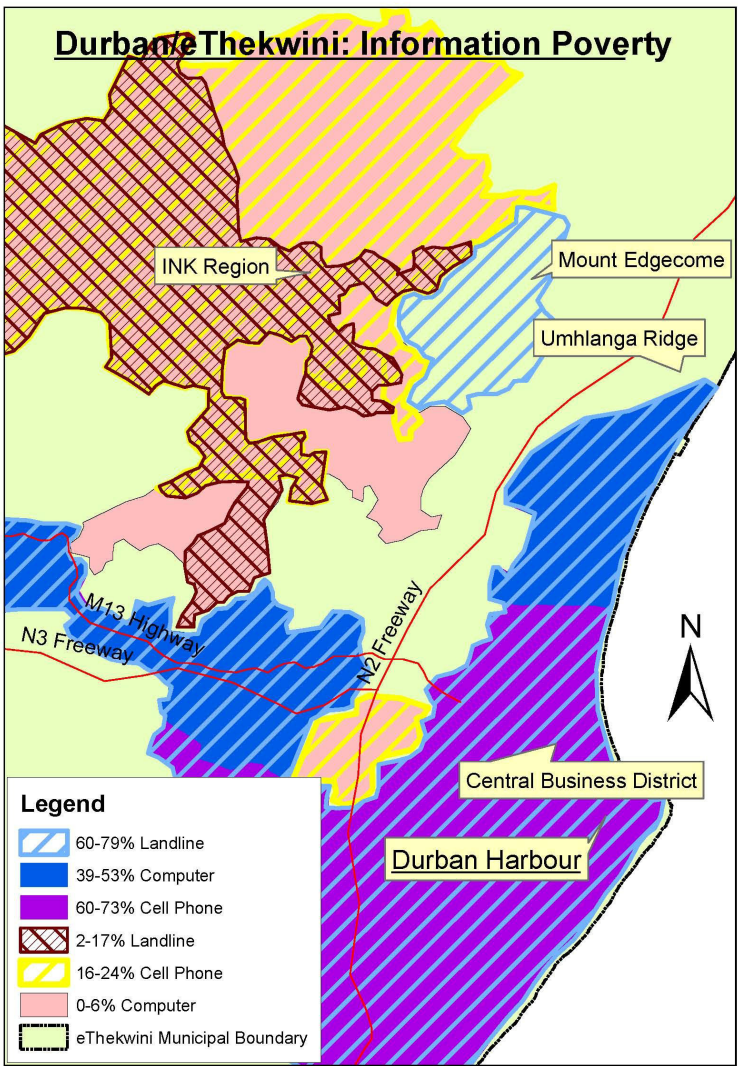


FIGURE 6.9 eThekwini Information Poverty

In order to spatially depict the combination of these six factors: 3 lowest and 3 highest cohorts for cell phone, land line and computer access, 6 composite indicators were developed. The common denominator is the enumerator area boundary; thus one enumerator area can contain a high incidence of cell phone access, low computer and land line access. By developing a matrix that uses variations of access in combination with the 3 technology types, 6 composite indicators were developed.

Areas that reflect three information poor variables, lowest cell phone, land line and computer access are defined as the poorest in terms of access to ICT. The areas corresponding with the presence of three information rich variables, highest computer, land line and cell phone access are considered the richest. Variations in between account for the other four indicators.

This is illustrated in Table 6.8 showing the matrix variations in variables, coded in colours that correspond with Figure 6.10

TABLE 6.8: Composite Indicators and mapping legend (Fig 6.10)

Composite Indicators	Variables					
	Information poor – values			Information rich - values		
	Computer access 39 – 53%	Landline access 60 – 79%	Cell phone access 60 – 73%	Computer access 39 – 53%	Landline access 60 – 79%	Cell phone access 60 – 73%
3						
2						
1						

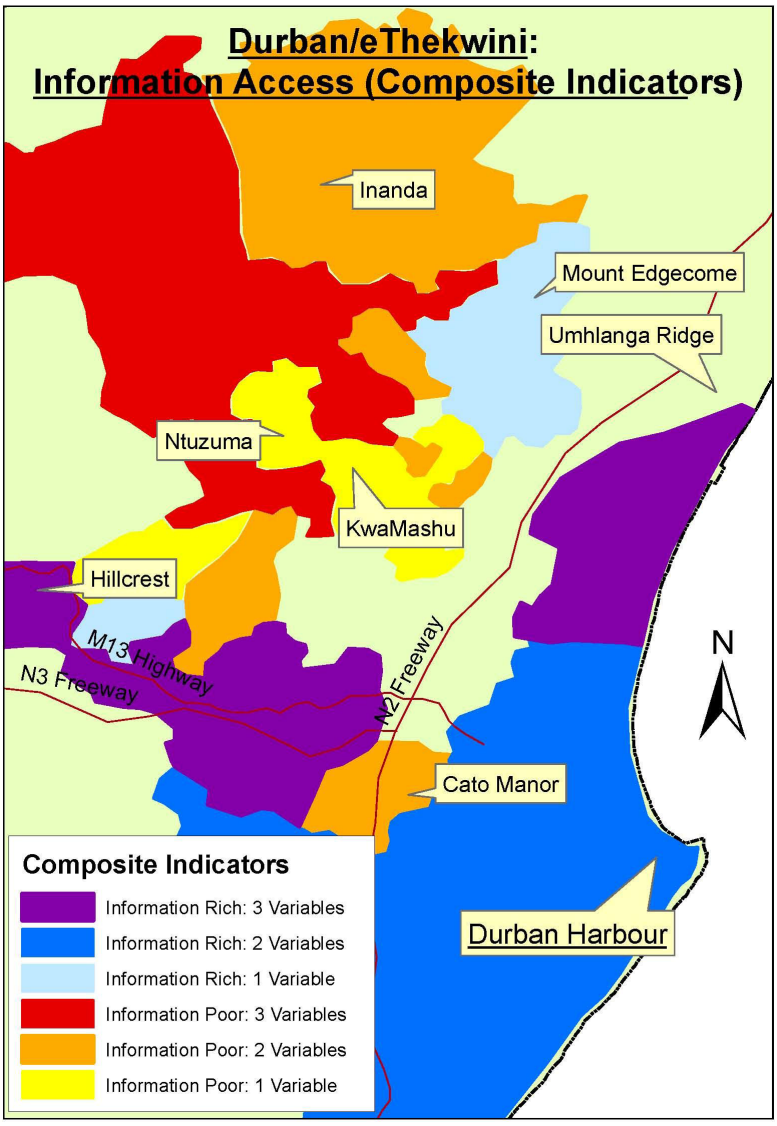


Figure 6.10 shows the main freeways and land marks in Northwest Durban. The result when mapped shows ICT access gradually declines away from these two transport corridors and the 'T' geography emerges.

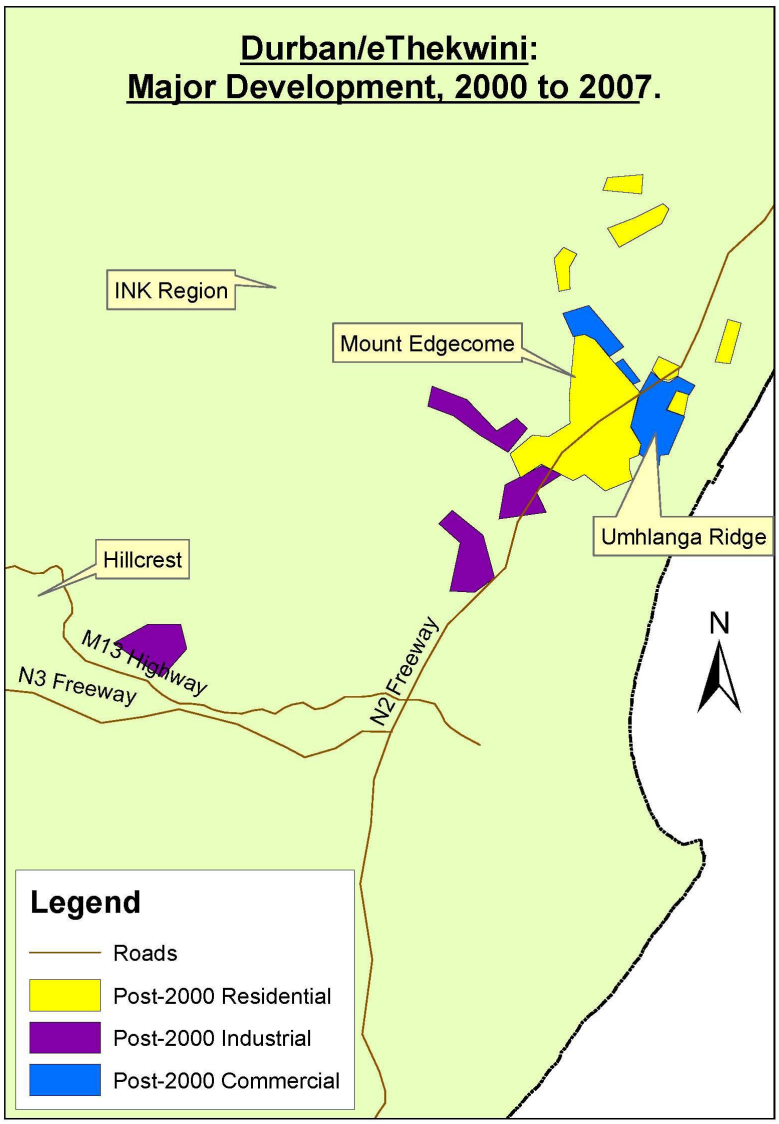
The most information rich enumerator areas are located in Umhlanga Ridge, Durban North and surrounding high income neighbourhoods. The others are located along the N3 freeway, location of high income neighbourhoods Westville, Kloof and Hillcrest as well as some of the decentralised office space typical of the northern suburbs. The exception is Cato Manor, a low income urban renewal project located at the intersection of the N2 and N3 freeways.

FIGURE 6.10: Information Access (Composite Indicators)

The city's CBD shows medium technology access. The technology poor are located in the peri-urban outskirts of INK. Inanda shows second lowest access and KwaMashu and Ntuzuma the third lowest. The INK area included as part of eThekwini's ABM is nationally recognised as an area in need of special intervention through the national urban renewal programme.

Spatial Investment Trends

The second mapping exercise mapped investment trends using aerial photography from 1998, 2000 and 2006. This information was digitised and geo-referenced in order to compare it with ICT access. The data was cross checked with spatial analyses contained in the IDPs. Figure 6.11 shows the location of large scale investments.



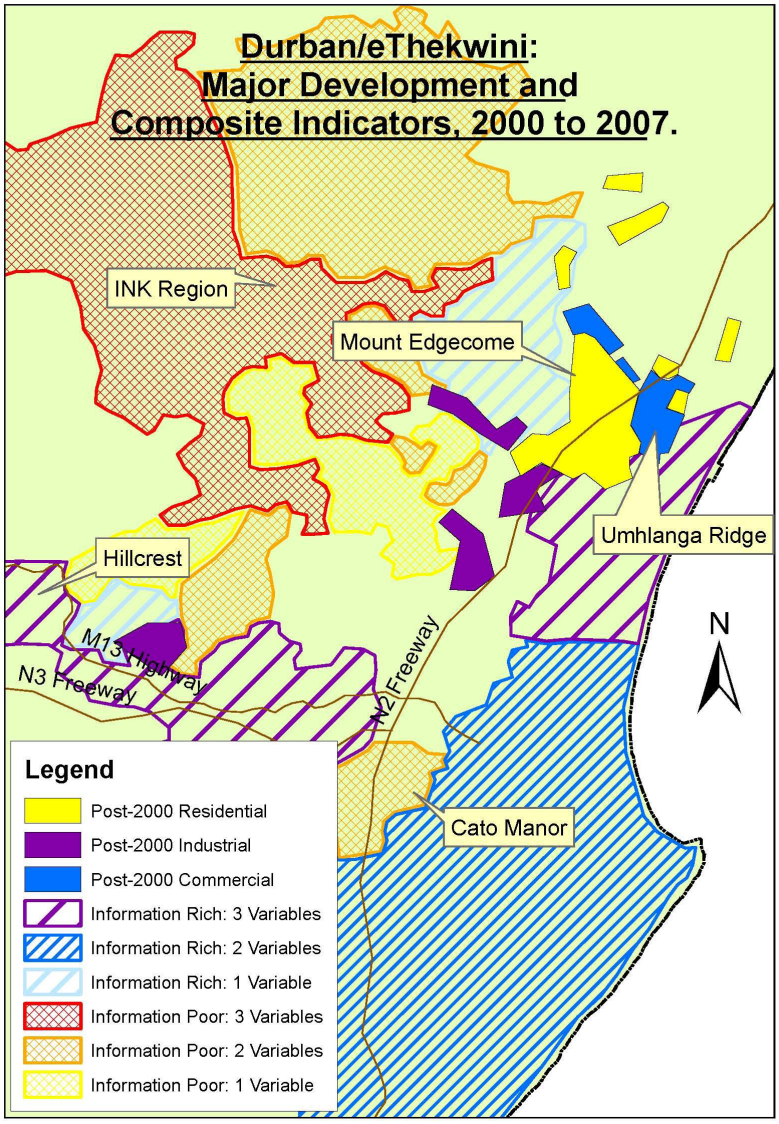
This data was overlain on top of the ICT access composite indicators in order to determine the relationship between public and private investment and ICT access.

The result is a confirmation of the spatial trends depicted in the SDFs of the eThekwini IDPs. Investment continues to the north of the city with some on the western axis. The two freeways remain important arteries in the future growth of the city.

FIGURE 6.11: Location of Major Investment

As shown in Figure 6.12 (overleaf) this correlates with ICT access. People who live in poorly serviced areas outside the investment trajectory of the public and private sector are information poor; in 2001 they had the lowest access to cell phones, computers and land line telephones. When comparing ICT access to patterns of urban change and investment, a correlation emerges between the location of clusters of private investment in Umhlanga Ridge and the inner and outer west areas, with the N2 and N3 corridors clearly demarcating the main corridors of investment. The picture that emerges is identifiable with a 'splintering urbanism' where ICT access correlates strongly with clusters of

private investment. More recent data on cell phone access would no doubt show a higher access rate in remote areas as leapfrogging occurs. More recent geo-coded data is unfortunately not available.



Community survey data indicates that despite the high uptake of mobile telephony, cell phone ownership is lower in remote rural areas than in urban clusters. Nevertheless, if ICT access is to be measured by access to the range of technologies then access away from the investment corridors in greater Durban diminishes. The community survey data shows that a racial bias remains in terms of ICT access.

FIGURE 6.12: Major Development and Composite Indicators of ICT Access

Communal ICT Access

The inequalities of the investment trajectory is addressed by eThekwini in its IDP and in particular its ABM as a form of decentralised governance. Bridge City is intended to create a connection between INK and the rest of Durban.

From an ICT perspective, broader access is to be facilitated through the fibre-optic cable that links the municipal offices and libraries across the metropolitan area. The assumption is that this will provide the backbone for small service providers that will provide last mile access.

The use of libraries and schools as internet and computer access points is a further means through which this dimension of ICT access can be made more broadly available. The following two figures use 2001 Census data to map land line access (again in accordance with enumerator areas) and overlays schools on Figure 6.13 and libraries in Figure 6.14 based on data sourced from the Municipal Demarcation Board (based on 2001 Census figures also).

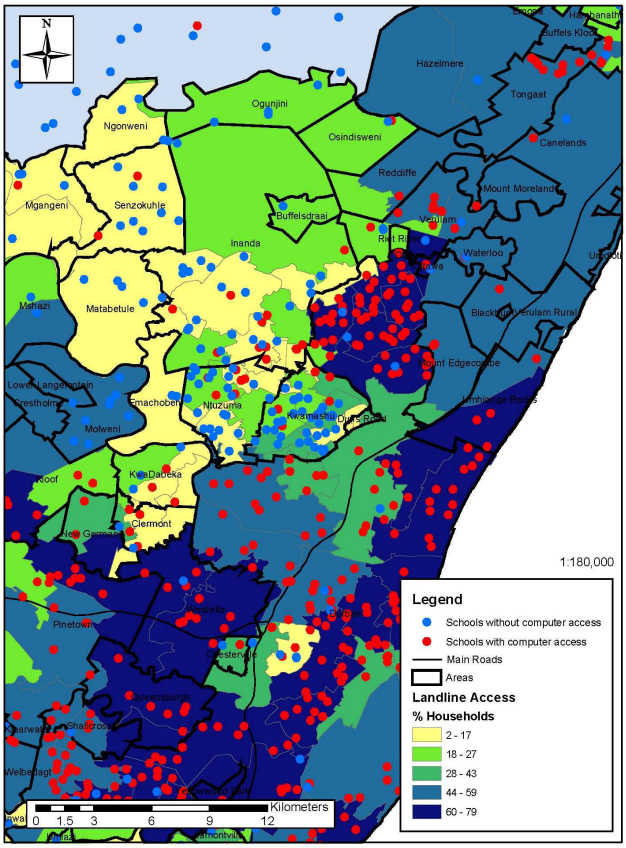


Figure 6.13: Schools with Computer Access (and landline access)

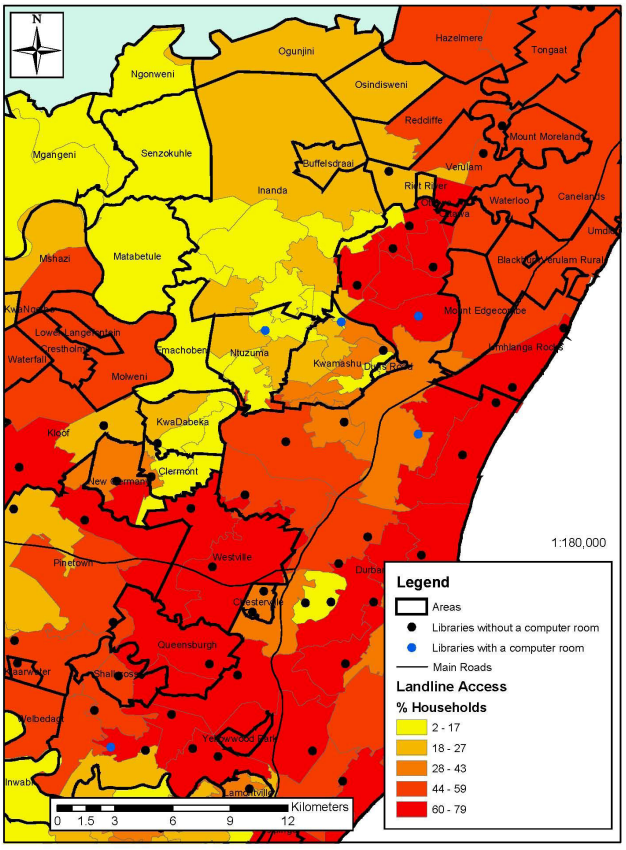


Figure 6.14: Libraries with Computer Access (and landline access)

The location of schools and libraries with and without computer access are overlain on spatial distribution of land line access given the dependence on 'dial-up' connections for Internet access.

At the time of the Census in 2001 very few libraries had computer rooms; two of these were located in the INK area. There are not many libraries in the deeper INK area, the more peri-urban edges. The majority of schools without computer access are located in this area. Schools are more evenly distributed and provide potential for broader communal access.

Communal access, facilitated through computer access in schools and libraries, carries some potential for addressing these imbalances. Predictably, and with the odd exception, libraries and schools with computer access are sparsely distributed in the information poor areas.

The findings above are not altogether surprising but the stark picture that emerges nevertheless exposes a worrying trend where investment correlates with high ICT access…. and of course the converse. Comparing this with ICT policy objectives would give a fuller account of the reality of a smart Durban.

6.5 Digital Durban and Beyond

Spatial shifts in Durban have been informed by private investment decisions and global market trends that favour the tertiary sector and undermine the City's traditional manufacturing role. The last 10 years have seen massive growth to the north of the City, particularly surrounding the Umhlanga Ridge development. Notable investment is evident in

the Outer West area (Hillcrest in particular) with office and commercial development catering for the needs of increased residential populations housed in gated communities as well as beyond. The N2 and N3 (and in the west the M13 also) provide the arteries that enable access. Underpinning these spatial trajectories are the global forces that influence the investment decisions of firms, economic pressures that direct public accommodation of these investments through planning and infrastructure upgrade and the political agreements that accommodate and persuade. Urban place making is a messy terrain that is no longer under the exclusive visionary direction of the planner but subject to deal making and coordination of vested interests. Analysis of the IDPs and SDFs confirms a northwards investment trajectory and an underlying belief in the corrective action necessary to address marginalisation. The ABM is one way through which decentralised governance is intended to do this.

The initial overview of change in Durban indicates how adept its city government has been in combining its networked infrastructure investments with economic trends. This investment together with residential development in accordance with Apartheid zoning has resulted in a geography where affluence and access to connectivity through transport infrastructure are closely related. New networked infrastructure in the form of the new airport and investment supports a growth trajectory to the north. The active participation of the THG in this dynamic is important as its role as developer extends beyond its own land holdings to that of other developments such as Bridge City.

In the city's ICT policy, in its IDP and in media reports, technology is depicted as a developmental tool that can enhance inclusivity. Like all networked infrastructure the intention is to unify but actor interests determine otherwise. The added 'layer' of ICT deepens this dynamic. As an economic sector it is a contested terrain fraught with competitive advantages and historical monopolies that keep prices high and contain high quality access. eThekwini intentions are to use ICT as a developmental tool but thus far those benefits have accrued mainly for the small business sector through SmartXchange and the many commercial partners that are part of that dynamic. The completion of metro-connect is a step towards Universal Access but indications are that the 'last mile' is not mere unfolding. Unlike other service infrastructure, ICT is part of a policy realm that is fragmented, informed by divergent government agency agendas that frustrate implementation. As a social objective, an essential service, its reach is limited. The spatial manifestation of this is clear (and perhaps not altogether surprising); ICT access correlates with higher incomes and clustered private investment.

A deeper analysis using the ANT frame follows. The intention is to gain relational insights into the dynamic between ICT and urban development.

6.5.1 The Many Spaces of Durban's ICT Policy

The two centrepieces of Durban's ICT Policy are the infrastructure backbone and SmartXchange. Whilst the web site is considered an important tool, it is not noted as a part of the city's smart city policy. Thus, the extension of Durban into cyberspace remains strangely independent. The fibre-optic backbone provides the means, by which municipal offices and libraries are connected, as well as the opportunities for future distribution of ICT access to a broader range of users. As a utility it has a physical footprint, occupying the topographical space taken up by its cables, linking physical offices. It has a switch, complicated settings enveloped in a small office located in the Office of Geographic Information and Policy. As a tool for enrolment of users for last mile digital access

it is dependent on the market; on the future negotiations between eThekwini and small service providers. Despite its geographic character, it is not noted in the SDF; it is not mentioned, nor is it mapped. Reference to the ICT Policy in the IDP is largely associated with economic development and addressing the digital divide.

The infrastructure defines a topographical space, a space of enrolled actors and relations between them, which differs from the topographical expectations. This material artefact does not appear in the SDF because the actor-networks engaged in doing the analysis. Planning and negotiations surrounding this plan do not include the ICT actors implicated in this research. The IDP and ICT Policy may be driven by the same department, but they occupy different topological spaces. The actors enrolled in this network are eThekwini and its service providers, small businesses that seek to buy broadband capacity from the municipality, the libraries and municipal offices connected, and those lucky enough with laptops and a library card able to take advantage of the Wi-Fi facilities at libraries. This is not the focal point of the strategy, however, as noted by the city manager. The emphasis is on business able to take advantage of what is essentially an economic opportunity. Who is enrolled into this network depends on negotiations with the city, whether through purchase of broadband capacity or the necessary measures to access a library card. (There is also a temporal dimension; library hours of operation for example.) Thus, this is a highly contingent space.

When comparing the geographic distribution of ICT access with spaces of investment, thinking of space topologically provides the lens for understanding the correlation between access and investment. Despite large scale public investment in INK and Cato Manor, ICT access is low (in keeping with other socio-economic indicators). Different constellations of investment feature in the Outer West and Umhlanga: private investors (such as the ubiquitous THG), multinational firms and commercial actors. The enrolment of Telkom, cell phone companies and the municipality into this topological space is enabled by a favourable market terrain and realistic profit thresholds.

The policy discourses that emerge from this field work are identifiable with a developmental agenda. Access to its cornerstone spatial element, the infrastructure, is circumscribed by the actor-network that results from the various actants enrolled into its network. It is not an open space; topologically it is defined by the vested interests that define participation.

Durban's ICT Policy is closely attached to place, however. Closer examination reveals a discourse that sees ICT as an active actor in 'putting Durban on the map', promoting the city as an industry leader, attracting investment and strengthening international connections. Media reports, interviews and a review of the Durban web site reveal a preoccupation with this policy space that is essentially about the city's image and projection to the outside world. The (potential) visitor to Durban is enrolled into this network that has very little to do with the everyday; the portrayal of public transport in two guises is an interesting example of that.

Civil society is markedly absent from the Durban ICT policy arena. Actors enrolled into this network are small businesses, multinational actors such as Microsoft and Dimension Data and the Office of Geographic Information and Policy with SmartXchange as anchor. The centrality of the latter, and the shifts in roles played by others in what is essentially a governance terrain, are analysed in the following section.

6.5.2 Actants Uncovered

Thus a number of actors emerged out of this research process. The role of eThekiwni is not only that of facilitator, but also entrepreneurial. The fibre-optic backbone is intended to be an income earner to compete with Telkom. Relationships with other actors, such as Microsoft, for example, are negotiated around market access and competition. Given the many actors and the market terrain of ICT, the local government role as negotiator has increased. As an actant ICT in the form of computer and Internet, plays a role in a number of ways; it influenced the formation of a new city department, it is seen as an enabler of investment, it formed the basis of a new strand of economic policy and it created SmartXchange. Its role is paramount to the ICT trajectory of Durban.

SmartXchange was first mentioned in the media in 2005 and initially established as a small business hub for IT firms and it evolved into the driver of Durban's ICT policy. As a 'mutable mobile', a non-human enrolled into the network (although it is a network in itself) it has been malleable and pliable in adjusting to changed circumstances. Internally its functioning allows for actor enrolment in accordance with particular objectives. As an actor in Durban's ICT Policy it is a successful economic empowerment vehicle and according to eThekwini, its ICT social development arm.

Latour's earlier work was specifically concerned with power exercised from afar through deployment of technology. SmartXchange is located in one building in central Durban and constitutes a number of offices, meeting rooms and video conferencing facilities. It is a physical space but plays a strong network enrolment role. It is also closely tied to promotion of place: of Durban (catalyst of 'Africa's first Silicone Valley') and KZN. Its reach is enhanced through negotiations with business partners, ongoing service provision to eThekiwni municipality and mobilisation of events such as the biennial Smart City conference. Events such as these are important points of mobilisation and network gelling that is discussed in the next section.

6.5.3 Events

An emerging element in this research is the role played by events in mobilising networks. Events serve as actants, mutable mobiles that can be marketed, packaged and promoted to serve particular network purposes. They serve as leverage for eThekwini in negotiating ICT access with Telkom and provide a core strategy of translation. Events are focal points for the ascription and designation of actor roles in a network. The FIFA Soccer World Cup is particularly poignant in this regard, and underpinned by complex institutional arrangements that extend into the technology terrain. Much of it is also tied to place as the special web site, marketing surrounding Durban as attested by the extent of information available to visitors on www.durban.gov.za . Events such as the FIFA World Cup are catalytic in bringing these constellations to the surface. The early focus in the media on the potential Y2K crisis served as a reminder that anticipated events also carry power.

ICT plays two actor roles with respect to events. On the one hand technology is seen as enabling and facilitative, a crucial element of logistical and communicative support. Within the actor-network surrounding the event, ICT is an immutable mobile crucial to translation and enrolment. Within the actor-network of the ICT policy terrain, the event is the actant used to negotiate and translate roles and objectives. How much of this carries transformative potential? This is discussed in the following section.

6.5.4 Transformative Power

The distinction between mutable and immutable mobiles determines how much transformative power is enabled through the enrolment of an actant into a network. Mutability imparts flexibility, malleability and can more easily be manipulated. SmartXchange is an important example since it comprises its own network of small business firms. A flexible governance structure, strong leadership and an enabling environment created conditions for innovation. Members play enough of a role to feel themselves to be a part of the network and this allows for appropriation.

The Durban web site is another example of a mutable mobile, but less successful in enrolment of users and fulfilling its more developmental e-governance objectives. In a way it is almost too malleable as can be seen in its unevenness in terms of content and functionality.

The broadband infrastructural web is immutable and limited in its reach. It forms part of a network that is highly circumscribed that may undermine its developmental objectives. Current network enrolment is associated with the market value of this utility, not its transformative potential. Yet it is a powerful actant in leveraging support from private ICT actors. This power is controlled centrally however, by eThekwini municipality, in accordance with its agenda. It differs from the dispersed, Foucauldian play of power in more dissipated network constellations such as the web site. Appropriation of technology towards transformative objectives is associated with more democratic processes of translation associated in the research in this chapter, with employment of mutable mobiles as actants.

6.6 Conclusion

In answering the first research question – what has the impact of ICT been on Durban? – it emerges that this relationship is a reciprocal dynamic one. Durban's development is informed by developments in technologies yes, and as shown in this research, the result is an intensification of the fragmented urban form that planners are becoming increasingly concerned about. Furthermore, the institutional and market dimensions are amplified given the nature of the industry. Underpinning ICT-informed spatial form is a mesh of business networks, local government initiatives and policy directives that mould this mesh. This mould is pliable however, but requires public direction and vision and opportunity for negotiation. Much of this vision is contained in the good intentions of ICT policy but a closer look at the operational foci of these strategies reveals greater success in the commercial realm. Last mile access and a deeper engagement with civil society have not yet been achieved. Analysis shows that the topographical spaces assumed to be evenly available through ICT simply do not correlate with the topological spaces that entail the actor-networks studied.

A response to the second part of the research question, - who are the actors that play a role in ICT in Durban and what are the relationships between them? – unveils a terrain not that different from the past. The contested market environment of ICT (elsewhere and in South Africa) does not necessarily contribute to new metropolitan patterns of exclusion. Yet, technology access, at this stage, does not necessarily lead to a more integrated city either. If anything, the spatial trajectories correlate with ICT access. The actors that emerge are largely commercial with the municipality playing a strong role in negotiating commercial interests towards a more inclusive market terrain. The word 'market'

is crucial, however. The emphasis of the ICT policy is city marketing and investment promotion, building the ICT business sector and attracting the necessary skills to do so. The emphasis is on building a smart Durban, but how inclusive that is of civil society remains to be seen. The municipality will be relying on small service providers to enable last mile access, which will most likely result in an uneven geographic range of services if mobile telephony is anything to go by. The networks that inform ICT in Durban are largely commercial with some strong connections emerging between SmartXchange, national business and to a limited extent academia. The role of local government as actor is interesting, as part of the developmental state, its policies profess a universal access agenda, but a deeper probe reveals an entrepreneurial vision that relies heavily on the private sector in meeting its developmental goals. Agendas do not necessarily converge around transformative goals, often informed by the actants enrolled and their malleability to fit different agendas.

The hypothesis to the first two research questions is that, one, new patterns of exclusion emerge, and two that actors associated with ICT are tied into networks that are not necessarily supportive of urban inclusion through ICT. The former is not necessarily true; existing patterns of exclusion are corroborated, but new patterns of exclusion do not emerge at a metropolitan level. The second part is indeed true: new networks created through ICT do not necessarily lead to a more egalitarian metropolitan landscape.

This is not the whole story, however. A further part of the hypothesis (informed by the review of literature) states that with increasing opportunities for convergence and wireless access, new opportunities for inclusion and innovation will emerge, sometimes in unexpected ways, outside the realm of policy making. The best way to examine this is at a local scale. A true reflection of how technology interfaces with urban life would necessitate a finer analysis of the appropriation of ICT at a personal and inter-personal level. The following chapter focuses on a process as case: what happens when technology is introduced into networks?

7 Website Development for Community Organisations in Inanda/Ntuzuma/KwaMashu and the Southern Basin

> *…It will be interesting to examine the interaction between the networks and their functioning and the web sites; do the web sites tell the community stories? Is the technology ahead of the story; each of the networks is very different and need to be treated as such. It would be interesting to see how the web sites reflect that. (Mbonambi, INK meeting 2007)*

In order to understand how ICT influences urban transformation in the African context, Durban was examined as a case. A number of dimensions were examined: eThekwini's strategic objectives, specifically its ICT policy, the city web site and distribution of ICT access in relation to investment trajectories. ANT concepts were used in analysing this data. Distinguishing between topographical and topological spaces revealed the extents to which actor-networks enrol actors into different spaces, distinct from that assumed geographically. The translation processes that define enrolment and continuous functioning in these networks are not necessarily supportive of inclusivity. Actants were uncovered and the value of their malleability in allowing for appropriation was revealed in the case of SmartXchange. The role of events as points of mobilisation in network formation was revealed. Hints at transformative practices could be detected.

Chapter 6 was also contextual. It probed the first, and to some extent, second research questions. ICT distribution reflects current patterns of polarisation and the actors implicated in these relationships are tied into networks that are not necessarily supportive of urban transformation through ICT. The second part of this hypothesis contends that with increasing opportunities for convergence and wireless access, new opportunities for inclusion and innovation will emerge, sometimes in unexpected ways, outside the realm of policy making. The degree of innovation would be dependent on the choice of technologies informed by affordability and flexibility. Some of this is discernable in the SmartXchange case as well as the innovation displayed in the ICT policy with regards to partnerships with private actors. In order to fully understand the extent to which the inclusion of ICT as actant could enhance innovation, it is best to follow Latour's advice and 'follow the actor' (source), or follow the network. This was achieved through an engagement with practice. Practice was best uncovered through an understanding of process.

This case is a process that was executed and tracked over two years. Its emphasis was on answering the second set of research questions in addition to understanding innovation (transformative practice): what are some of the networks within low income/marginalised spaces in Durban? How are digital technologies used to reinforce these networks? This was examined through an action research process, with associated interviews. Web sites were developed for community groups in Inanda-Ntuzuma-KwaMashu (INK) and the Southern Basin (SB). Thus, the collective case is essentially one where technology is introduced into networks.

The ANT emphasis is on how technologies interface with network maintenance and change, the roles of various actors and the role of technologies (actants) in enabling associations. More subtle underpinnings include the dynamics between actors, between actors and actants (non-human actors) and how these relate to livelihoods. Literature on mobilities is used to reflect on space and the motivations for ongoing co-presence as well as the importance of place. Thus, the role of ICT in negotiating space and creating place are also explored. This chapter is structured to accommodate this interrogation. Unlike Chapter 6, where the disparate data sources required that ANT concepts be introduced in the final analytical section, here ANT concepts area have been used to code data and reported accordingly.

The first section provides a background to the two areas and a description of the research process that occurred over two years. It also outlines the institutional context. Thereafter the networks are discussed: those existing before, new networks and the dynamics within them. Processes of translation are uncovered. Actors – human and non-human – are identified, discovered and followed. Actants are understood in terms of their fluidity and malleability in order to gauge their transformative potential.

Space and place are focused upon in order to determine whether digitally enabled networks makes space more acquiescent, if new 'spaces' are created and how inclusion and mobility are enabled. Spaces of prescription are compared with spaces of negotiation.

Notions of innovation and empowerment inform the final section. The aim is to explore how ICT's are appropriated to enable livelihoods and what innovative practices emerge. Similarly, barriers to appropriation and innovation are described.

7.1 Background to INK and SB

Despite its definition as one urban renewal project, the area comprising INK contains divergent histories and legacies. Inanda sits on the outer west boundaries of INK. Much of its edges are peri-urban with undulating topography and dense pockets of informal settlement. Unlike Ntuzuma and KwaMashu, established as formal townships under Apartheid, Inanda developed organically on privately owned land adjacent to a mission reserve. African labourers lived in the area from the late 1800s and were later joined by Indian market gardeners (ex-indentured workers) (Hughes 1985). There were a small number of African land owners in the area in addition to tenants. Indian land ownership increased at the turn of the century (Ibid.). The Indian influence was strong enough to convince Mahatma Ghandi to establish his Phoenix Settlement there, today the site of a heritage centre. There are other historically significant sites in the area: Ohlanya, one of the first African secondary schools in the country, and the site of the Shembe African independent church (Hemson 1996).

Remaining farmland until the 1950s, urbanisation of Inanda began as an outcome of the forced removals from Cato Manor further south. The direct catalyst was the establishment of KwaMashu, the township to which many from Cato Manor were moved. It is located adjacent to Inanda, and the extension of the Durban bus service to KwaMashu made commutes from Inanda to job centres in Durban viable (Hughes 1985). The growth of Inanda, on the periphery of Durban, was a symptom of the city's expansion in the 1960s. Unlike KwaMashu, or Ntuzuma (established in 1973) no local administration took

control of the area whilst it remained outside the city of Durban's administrative boundaries (Ibid.).

Inanda's exclusion from local government decision making reinforced the lack of public intervention and neglect that would accompany rapid urbanisation in the second half of the 1900s. By the late 1980s over 250 000 people were living in informal housing in the area (Hemson 1996). Lack of cohesive administrative rule continued until 1996. In its place political activism flourished alongside fragmented jurisdictions and traditional rule… "Inanda in many ways is a gathering of villages encapsulated in their own social networks and concerns" (Hemson 1996: 76). Much of the academic literature specifically focused on Inanda uncovers the violent political conflicts that plagued this area in the 1980s (Hemson 1996; Hughes 1985). Political insurrection was not a unified endeavour here. Hemson (1996) frames the youth's opposition to traditional leadership as an expression of liberation struggle outside Zulu traditionalism, which was later reflected in the struggle between ANC and Inkatha supporters (p. 81-82). In the latter part of Apartheid a conflict between a militant youth (Inanda comrades) and emerging ANC structures ensued (Hemson 1996). Legitimacy and inclusion remained issues (Van Horen 2000). The developmental challenges post-1994 not only entailed the provision of services and housing but more profoundly, managed the aspirations and expectations of a fragmented population.

KwaMashu and Ntuzuma differ in history. The former, a township designed according to New Town principles, was built by the then City of Durban between 1957 and 1968 to accommodate those forcibly removed from Cato Manor (in the centre of Durban). The first families moved into KwaMashu in 1958, the area then being administered by the department of Bantu Administration. In 1977, the KwaZulu government took over the administration and control of the area (Mohammed 2002). It was reintegrated into eThekwini after 1994. The township is known for its high levels of fractured political activity and violence in the 1980s (Brewer 1985), specifically in the infamous hostels on its edges (Zulu 1993) and has subsequently become known for its gangs and criminality. Ntuzuma was built by the City of Durban in the 1970s and is the youngest of the three areas. It is known to be a fractured area due to variation in tenure arrangements, service levels and political affiliations (eThekwini Municipality Area Based Management and Development Programme 2005).

INK comprises a significant area with a population of over 500 000. Mobilisation has always been strong amongst communities, in Inanda in particular. A history of violence and political struggle accompany the many issues that plague townships in South Africa: economic and social marginalisation, spatial disconnection and continued urban poverty (Pernegger & Godehart 2007). KwaMashu and Ntuzuma are not as peripherally located as some of the larger townships in other South African cities, but they suffer lack of transport connections to nearby Umhlanga (Ibid.) The Phoenix industrial area is located in close proximity, but provides limited opportunity to employment. Reliance on self-employment in the informal sector is an important aspect of livelihood strategies in townships like KwaMashu (Godehart 2007). Not surprisingly, much of the INK URP/ABM initiative is focused on skills development and local economic development (eThekwini Municipality Area Based Management and Development Programme 2005).

The two neighbourhoods that form the context for the 2007 web development process are Wentworth and Lamontville, both located in the Southern Basin (SB). What was

known as the South Durban Industrial zone was developed in close proximity to the port in the early 20th Century to accommodate the needs of the Durban Town Council, the port authority and the manufacturing industry (Scott 2003). Land in Wentworth for industry and residential development was acquired by the Council as early 1925. A housing scheme in Merebank and Wentworth was planned in 1939, construction of which was interrupted by the war (Scott 2003). Gradually a plan emerged for 'productive zones 'interspersed with racially divided residential areas to create a "rationally planned space for economic growth and progress…" (Scott 2003: 251). Implementation of the vision of industrialisation continued after the war, driven by construction of physical infrastructure. Opposition to the many phases of the overall plan for South Durban was met particularly in response to the segregated nature of the proposals and the land use conflicts between industry and residential development. The area has in fact been the site of the most virulent environmental conflicts in Durban in recent years (Freund 2001). One of these is the reaction to sulphur dioxide omissions that had risen to dangerous levels from the Engen refinery located in Wentworth. Lamontville is located to the south of Wentworth and was the second African township established in Durban in 1923 as a source of African labour for nearby industrial areas (Torr 1983). Like a number of townships around Durban, including those in INK, Lamont was the site of immense internal political struggle and oppositional politics in the 1980s.

The South Basin is known for a high degree of community mobilisation, with sustained action against industrial pollution intensifying since 1995 (Barnett 2002). A significant actor in this regard is the South Durban Community Environmental Alliance (SDCEA) formed in 1997 as an umbrella organisation of conservationists and local political activists. This organisation has become adept at using more traditional forms of mobilisation such as mass meetings and newsletters with internet and e-mail action and the use of text messaging (Barnett 2002: 17). The organisation also has a web presence: http://www.h-net.org/~esati/sdcea/. Essentially a network of activist organisations, SDCEA has been successful in enrolling support internationally for what is essentially a place-based conflict (Barnett & Scott 2007).

INK and SB are now integral parts of the eThekwini area-based management programme, created in 200* to enable decentralised governance through dedicated programme teams committed to 5 areas within the metropolitan area. They are recognised as areas requiring special attention, containing marginalised spaces. They also have a history of social networking and political mobilisation and therefore provide an appropriate contextual backdrop for the development of community web sites.

7.2 The Web Design Process

INK and the SB provided the geographic and socio-economic context for the web development process. The full research process unfolded over two years. Each of the processes lasted 9 weeks. The 2 processes involved the same actors from the UKZN: the researcher (then employed at the School of Architecture, Planning and Housing as a senior lecturer), Dr Marijke du Toit, a senior lecturer in History and Internet Studies at the same institution and students of the University of KwaZulu-Natal (UKZN). Third year undergraduate students from UKZN's Internet Studies programme were required to design web sites for outside groups as part of their course work. The researcher collaborated with Dr du Toit on this initiative, and assisted in facilitating the interaction with outside organisations.

Students were briefed and examined on this process. They were required to use DRUPAL, open source software that uses a database structure for the management of online activity. As a result, it is effective in enabling online networks due to define access protocols in a hierarchical format. Both processes were intended to be ongoing as subsequent student groups assisted in ongoing training in web site maintenance and other student groups within the Internet Studies programme reflected on the web design experiences as part of their curricula. The data that informs this chapter draws from the actual web site development process not the subsequent interactions between students and community groups (many of which were still in progress at the time of writing). Nor does it analyse the actual web sites.

7.2.1 Inanda-Ntuzuma-KwaMashu (INK)

In year 1, 2006, 8 students participated in designing 4 web sites for 4 community organisations in INK. The students worked in pairs. The process was initiated in late 2005 when the researcher, working on another project with the INK URP/ABM team, discussed the idea of community web sites with the leadership of the team. The researcher had an established working relationship with the team members of the INK URP/ABM node, having done professional consulting work for the unit. The initiative was embraced with three goals in mind: as a means whereby community groups could access valuable computer skills, whereby nascent community networks could be enhanced and the project administration assisted through improved communication and exposure. Right at the outset it was decided that this would become an extension of INK URP/ABM activity.

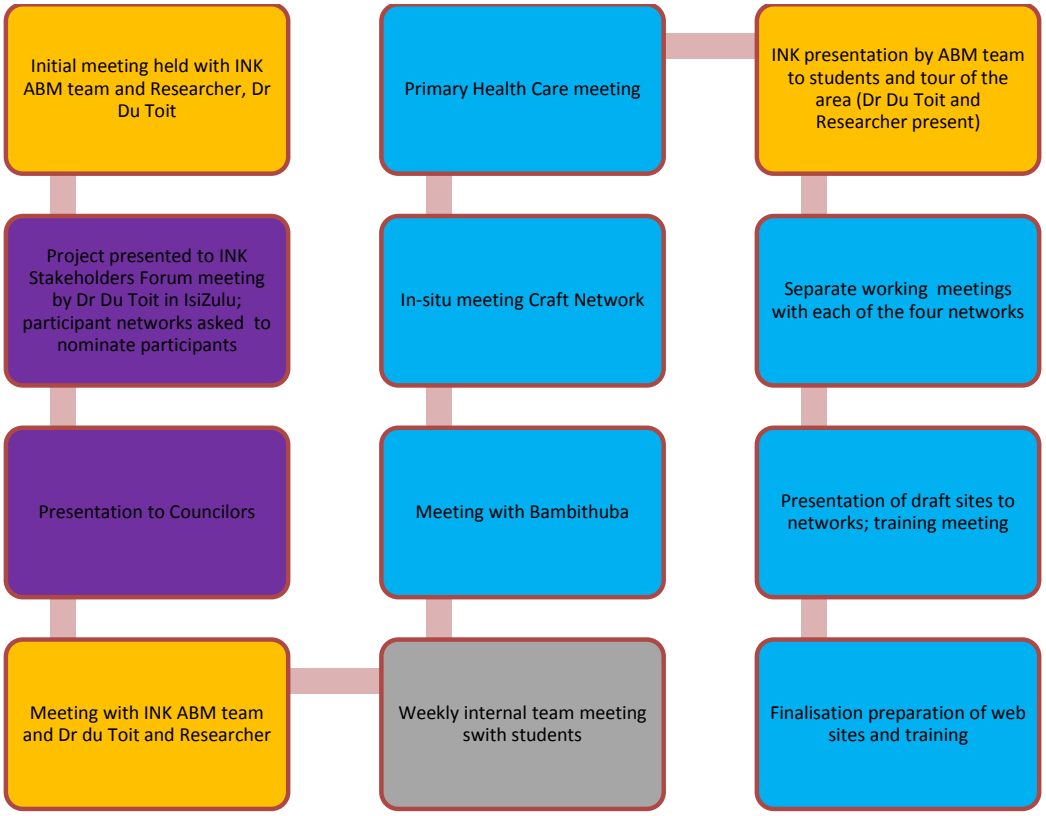


FIGURE 7.1 Web Development Process

The web development process commenced in October 2006 (the second semester of the academic year at UKZN) and concluded late November in time for the summer holiday. The process unfolded as illustrated in Figure 7.1 (above) and is indicated as follows:

Four types of interactions were executed. Meetings were arranged between Dr Du Toit and the unit members to enable arrangements to meet with community groups (in orange). Broader forums with stakeholders were attended including a presentation to the 18 Ward Councillors that represent INK on the eThekwini Council (purple). Internal meetings (grey) and training sessions with network members were crucial to the exercise (blue).

Throughout the process, notes of meetings and observations were documented in a project diary by the researcher. The following categories were used:

- Activities: structure, succession, explanations
- Questions from network members
- Noteworthy emphases of the student presentations
- Dynamics between network members, between students and network members: verbal interaction and body language
- The experiential interface between network members and the technology: ease, body language and tactile interaction
- Spatial aspects were documented with sketches and photography.



FIGURE 7.2 INK Forum Members



FIGURE 7.3 Presentation to the Forum

Students were required to prepare reports on this process. This was also used as a source.

The choice of community groups to be included in the project was made with the INK team who facilitated the networks in anticipation of the project. Each of the networks had a representative from the INK team that provided information to the web design team and arranged meetings when necessary. The groups varied in scope and size. Figures 7.2 and 7.3 contain photographs taken at the first meeting where the project was presented to INK Forum by members of the INK team and Dr Du Toit.

The Greening Network

This was a group of 20 schools engaged in a market gardening and a tree planting project in KwaMashu. The INK team member responsible for the management of the project was the primary contact person in setting up meetings and training sessions.

The Primary Health Care Network

The Primary Health Care network was a collective of clinics and health care workers active in decentralizing primary health care in Ntuzuma. It was enabled through

participating clinics and health officials. This was a large network and loosely convened. It involved many role players: the INK URP/ABM team, clinics staff, the Department of Health from the provincial government and the municipality as well as a number of community health activists. Given the diversity of the group, the students relied on contact with the INK staff member that coordinated the project.

Bambithuba

Bambithuba is a group of female home-based care workers that primarily provide support to HIV/AIDS victims in their homes. It is a small organisation with strong leadership and a vivid history. The web design team engaged directly with the organisation.

The Craft Network

The various craft producers were organised according to production and then formed into a network for the project.

Web developers were able to access the network directly.

The site of the training meetings was the Ohlanga Digital Hub in Inanda. It is located on an arterial route that connects Inanda with KwaMashu and accessible by public transport. Initial contact was made with the Hub Manager (interviewed also) and arrangements were made for using the centre's facilities. Despite an expensive satellite connection, the researcher's laptop was used for demonstrations since audio-visual facilities at the Hub could not be connected to the Internet. The researcher's mobile 3G connection was used for Internet access.

The Process

The purpose of the first meeting was to gain information on the needs of the site, what participants expected of the web site and essentially provide information on what a web site is, what it can do etc. A draft site was presented at the second meeting, feedback was given, notes made and changes made. Third meetings were held to present changes and determine who would participate in ongoing web site maintenance.

The project was not sustainable. The web sites were developed and are active but are neither maintained nor used. Only one of the groups, Bambithuba, nominated a person for ongoing maintenance. (Ongoing training has been facilitated in this regard.) Three subsequent meetings were held with the INK team in 2007 to take the project forward but this was not followed through. Interviews were also held with the CEO of the Digital Hub and the Project Director of the INK URP/ABM. Upon reflection, the reasons for the limited delivery of the project provide interesting reflections on the unpredictability of action research.

The role of the researcher was that of participant-observer and requires reflection. In INK relations with the ABM team had been established beforehand; members of the team and the researcher are part of the same professional community (urban and regional planners), two members were erstwhile students of the researcher. These relations needed to be managed. Roles were not clearly defined; INK team members were uncertain as to the input required from them whilst students had limited capacity to intervene. The researcher did not have the capacity to play a project management role and did not deem it appropriate. However, upon reflection during the interview with the ABM team leader (), it emerged that a leadership role from the researcher was expected. This was not made explicit. The researcher's prior relationships with INK team members as academic,

consultant and/or teacher cannot be ignored. They had an implicit impact on the process.

Input from the INK team was variable. Not all team members were forthcoming with information and assistance. The project was not considered a priority amongst other more pressing (and budgeted) programme concerns. This unevenness was closely linked to personal commitment to the process.

The networks themselves were problematically defined. Two dimensions pertain to this problem. One, two of the networks (Primary Health Care and Greening) were formed to facilitate design of the web sites, they did not exist beforehand. Two, some of the structures (in particular the Greening Network) were simply too big to engage. Bambithuba was the most successful engaged in the project. It was also the most well established and focused in function and geographic scope. It had the strongest leadership.

Lack of computer skills and capacity were simply underestimated. Whilst the INK team facilitated training of community members through a training workshop at the Digital Hub, this process was also beset with difficulties. The main problem was drop-outs due to the fact that not all members could afford the transport fees to get to the Hub.

The follow up process in 2007 was never implemented since continuity was lost. Students from 2006 had moved on to different courses and were not available to continue the process. The 2007 process was intended to build on the learning from the INK engagement.

7.2.2 Southern Basin (SB)

Four community networks in SB were engaged in the second web design process. Dr Du Toit facilitated contact with the groups in this area; she had engaged with groups in the area through prior research. The decision was made to choose an area located in closer proximity to the University (approximately 5 km as opposed to 25 km in the case of INK), smaller groups (necessary also because only 4 students were available) and existing networks.

Fairvale Secondary School in Wentworth was the physical base for the training. Two of the groups were located at the school; a voluntary organisation and an environmental interest group. The latter was particularly poignant given that the school is located across from the Engen Oil Refinery, within a neighbourhood known for its environmental activism. The other two groups were based in Lamontville. The groups were: 'Rising Stars', a soccer team, and Tembalethu, a non-governmental organisation that runs a clinic and is involved in Primary Health Care. Contact with the former two organisations was made through the School, one of the teachers assisted in setting up the process. The latter two organisations were contacted directly, enabled through prior relationships between Dr Du Toit and the manager of the Rising Stars, a community leader that had a long history of activism in Lamontville. Thus, the groups differed from those engaged in 2006: they were smaller, had been active for a long time and contact was made with the groups directly, rather than relying on another institutional actor to facilitate this.



FIGURE 7.4 View of Engen Refinery from Fairway School

The web development process started in early October 2007. Four students were involved and met with the researcher, Dr Du Toit and Fairvale Primary School first; a later meeting was held with Tembalethu and the Rising Stars. Training was done at Fairvale School Computer Laboratory, a facility donated by Engen, the multinational petroleum company that is situated directly across from the school (a view from the school onto the Engen laboratory is shown in Figure 7.4 above). After the initial meeting with each group where user needs and expectations were determined and the concept of a web site presented, three training sessions took place with each group. The aim of the sessions was to access content for the sites, show participants how to upload information and get input on the design of the site. Given the outcome of the 2006 process in INK, particular attention was paid by the researcher to participant commitment to the process for the development of the second group of sites in the Southern Basin in 2007. The same documentation process was followed; a diary was kept with notations on the categories outlined under 7.2.1 above and illustated in Figure 7.1.

The sites were completed and presented to participants. Maintenance training was ongoing at the time of writing and done through the Internet Studies Programme at UKZN.

The project had achieved limited success at the time of writing. In order to inform a more nuanced understanding of the efficacy of the process, focus group interviews were held with students In addition to the views obtained from participant observation.

Scholar participation in the project was variable and motivated by teacher directives rather than interest. Furthermore, the Engen laboratory had intermittent Internet coverage and the facility was not continuously available to scholars as it was only open during class and workshop times. As with INK, computer literacy was overestimated particularly with regards to the 2 Lamontville groups. Accessing information for the web sites was very difficult, particularly from the school groups.

Nevertheless, the process proved less onerous than in INK. The groups were smaller, more cohesive and therefore easier to deal with. They already existed as groups, had internal communication procedures and members knew each other. The spatial extent of Lamontville and Wentworth also played a role. Both areas are smaller with community activities easier to define spatially than in INK. The areas are also located closer to the University making access for students less problematic.

The following section presents the data systematically and analytically. Data was sourced from the diaries, associated reports, meeting notes, interviews and focus groups. The data was collated and analysed using NVIVO, qualitative research software that enables coding of all data in one 'project' or file. Coding themes were based on the ANT approach to research and analysis. The themes used were the following;

Networks, Associations and Translation

It was essential to explore these since they provide the means whereby space is transcended and resources shared and accessed. Again, a number of these existed before the web development processes began, but some formed just before and during the processes.

The way through which members were enrolled in the web development process, the process by which the processes themselves became actor-networks and significant moments of connection and translation, were noted. Reflections on what worked, and what did not, proved to be a valuable means to reflect on translation processes.

Actants implicated in the web development process

Human and non-human actors were determined beforehand but also emerged as various roles in the web development process were revealed. They carried agency and their actions had a bearing on the overall outcomes of the processes. Emerging actants were particularly interesting since their roles evolved as a result of the web design process.

Co-presence, Space and Place

Transcending space through technology is an often cited theme in debates on cities and ICT. The role of place and a need for physical co-presence has been explored in recent work on mobilities (informed by ANT). Given Murdoch's work (2006) on heterogeneous spaces and the distinction between topological and topographical spaces, attention was paid to these dimensions within the 2 geographical contexts.

A number of 'free-standing- themes emerged from the field work:

- **Constraints:** in addition to the constraints of the processes discussed above, there were a number of constraints particular to the substance examined.
- **Convergence** is a theme that emerges from the literature and is noted specifically here since it is so pertinent to the future of the relationship between cities and technology.
- **Technology myths, metaphors, analogies and discourses:** notions of technology and embedded 'truths' are explored separately since these contribute to how people interact with one another and with technology in networks.

7.3 Research Findings

7.3.1 Networks and Associations

Two new networks were created in INK in order to facilitate the web site initiative: the Greening Network and the Primary Health Care network. These were loose affiliations formulated by outside institutions. INK URP/ABM manages the tree planting and market gardening programmes in schools in Inanda, Ntuzuma and KwaMashu (10 schools in each) as part of their sustainability and food security programme. The KZN Department of Health created a number of distribution sites for health kits for home-based care givers which informed the formation of the Primary Health Care network facilitated by the INK team. The other two groupings, Bambithuba and the Craft Network, already existed. The former is essentially one organisation, with a shared history and strong leadership. The craft producers had economic imperatives that provided an important focal point. Both groups are under strong leadership.

Of the four INK organizations, the Bambithuba interaction proved to be the most sustainable. The group has strong leadership in the form of Mrs. N, a formidable woman that started the group in 1992 with the aim of enabling women to help themselves through small economic initiatives. The primary objective of the initiative was to empower the disempowered through training and the creation of income-generating opportunities. She initially taught women and the youth, beadwork, sewing and gardening skills and later extended the project to include knitting, candle-making and dressmaking. The organisation is essentially a network of small groups operational in Ndwedwe (an adjacent peri-urban area outside INK) and Inanda where self-help expanded to home-based care and AIDS orphan care. Expansion of the project to Ndwedwe was due to personal networks that extended to this geographic area.

The Craft network was a loose affiliation of 15 craft producing cooperatives containing 160 members active in INK. The network was formed by the INK team to enable marketing opportunities. There was a direct association with the INK initiative where the craft network was part of a craft project contributing to the economic impact in the areas. As a network it had been functioning before the web development process. During the negotiations around the web site, the beading group was dominant. This was due to strong leadership and a pro-active effort to market the group's work. This group invited the students to take photos of their work for the web site. Observations showed, however, that the assertiveness of the beading group leader alienated some of the less technologically astute members of the network.

The Greening and Health care networks involved a bigger range of institutional role players. The former connected teachers with the Department of Environment and Tourism, a local university involved in horticultural training and community garden groups. The latter involved the Department of Health, local clinics and home-based care workers. One of the main aims of the Primary Health Care Network was to enable distribution of primary health care kits to households. In both instances the web development process was more ambitious than in the other two cases. Development was frustrated by lack of clarity on who to engage and train, how the networks were comprised and the roles of the various member groups. The web development process was, again, dominated by one member who was more computer literate than the others.

Ambitions and Aspirations

Ambitions for the web sites, as expressed by network members, were modest. Bambithuba and the Craft network emphasised publicity, visibility, fund raising (for the former) and marketing (for the latter). The two Greening and Primary Health Care network participants had more ambitious visions of connecting across organisations, allowing for new organisations to join, mapping and programming. These ambitions were vocalised by the institutional role players, not network members. Telling stories, enabling visibility of volunteers for example, and giving some public recognition featured as agreed-upon objectives of the process. Visibility in particular, was seen as very important to all the groups. The INK team through Linda Mbonambi was curious about the ability of the sites to capture the histories of the networks.

Contradictory Expectations: Technology does not a Network make

The web development process was anticipated to be a contributor to network making. As the project progressed, it became apparent that the composition of networks was essential to building an effective web site. Given the prowess of DRUPAL in enabling user hierarchies and determining levels of participation, the actual network was seen by the developers as a starting point. Site management was seen to be dependent on how organizations are comprised and how the hierarchy works. A tension emerged: INK URP/ABM expected the web development process to reinforce networks, the UKZN group, on the other hand, relied on the smooth functioning of the associations in order to effectively design the web pages.

> *We need to understand how the web sites have provided the impetus for the networks to be formed in the first place; are the networks functioning – are we the rationale for the networks to exist in the first place? (Mbonambi, INK meeting 2007).*

Working with the Primary Health Care and Greening networks in INK was frustrating. There was a lack of clarity on roles as well as the actual structure of the networks, how the various organisations related to one another. The components of the network, schools as part of the Greening Network, and clinics as part of Primary Health Care network, were grouped together as a result of their participation in these initiatives.

Subscription to a common project, formulated by an outside agency, was not enough. Formulating a common objective around development of the web sites did not work as a means to mobilize groups. The web initiative could possibly have provided the focal point for network relations to be deepened, but that needed leadership that was lacking in the process. The web designers were simply not positioned to take a leadership role, which needed to come from either the INK URP/ABM team or the actual network members.

Enrolling Technology

Ongoing engagement with Bambithuba enabled continued functioning of the web site but only for as long as students were involved. Transfer of maintenance and ownership was unsuccessful. At the feedback sessions in early 2007 it was agreed stronger leadership was necessary to ensure ongoing functioning of the site. It was also agreed that access protocols were necessary to enable differential access to community members and INK URP/ABM staff members. This was a process at which roles and responsibilities could be clarified since it was to be negotiated with community network members. Again, this process was not concluded due to a lack of leadership.

Reference to broader networks were mentioned and implied at a number of points. The interview with Mbonambi mentioned the possibility of using technology to solidify 'Bridge City' and attract investors to this metropolitan initiative. Linkages to the City's backbone infrastructure was mentioned a number of times as a means whereby INK could become connected. The ties between the INK URP/ABM office and the eThekwini's Office for GIS and Policy were strong and solidified through professional and personal linkages between the leaders of the two (Mbonambi and Subban).

Training of community members took place at the INK Digital Hub, a tele centre managed by an NGO. An interview with the CEO, revealed the network configuration of the hub and the smaller centres connected to it, referred to as spokes. During the project efforts were made to access funding for including schools as part of this scheme. Overall cost of ICT parent infrastructure becomes cheaper the more spokes there are. This project was in progress at the time of writing.

Translation

The learning gained from the INK experience informed a reduced scale in the choice of community groups for the web development process. All four groups had been in existence for a while and were contained.

The two school groups were voluntary associations; the one a loose association of interest groups (art, debating and support for learners in drug rehabilitation) and the other an environmental pressure group. Both were not very active, contrary to what the web developers were led to believe. Essentially the learners do not drive the organisations. The latter appeared to be particularly relevant due to the environmental issues that plague the area. The former was disparate and more attuned to teacher agendas than initially anticipated; the latter was also contingent upon the efforts of one teacher. The 'idea' of how active students are in environmental advocacy was contrasted by the actual activity of students. The web design process revealed that one of the groups was essentially not part of the school (Rotary) and the environmental group was driven mainly by one teacher. Aims for both groups were tied to teachers' agendas entailing environmental advocacy for one, and curricula development for the other. Students saw the exercise as part of their class work.

The Rising Stars Soccer club was very specific in its aims. It sought marketing, publicity and visibility. What was interesting was how the group expanded with the addition of the daughter of Mrs J, (the Club chairperson) when the web development process started; the group 'expanded' as a result of the technology addition.

Tembalethu appeared to be a cohesive group with a specific health care objective, with strong leadership from its leader Sister M. Some community farming is included at the site of the clinic for income generation. The clinic provides the physical space where home care givers and volunteers convene and access resources. The aim was to create a site that recognised the efforts of volunteers and enabled fund raising. When an effort was made to photograph and publicise the volunteers there was resistance, however. Many were suspicious of the student (armed with camera and notebook) and distrustful of the web initiative. A number of home-based care workers do very sensitive work with HIV patients and simply did not want the exposure.

Web development and maintenance processes continue for the two latter organisations, mostly due to the established relations between the UKZN students and Sister M. and

Mrs J. The teachers from the two school groups have continued their interest in the project mainly as part of their curricula development in computer studies subjects. None of the learners from the schools expressed an interest in continuing the initiative. The web development process was essentially seen as school work, discontinued after hours.

7.3.2 Actors and Actants in the Web Development Processes

Actants were documented in the web development process. This is significant, conceptually and empirically. The networks described above were altered (in some cases created) through the addition of the web development process. Treating ICT with analytical symmetry (in keeping with the specification of ANT as discussed in Chapter 4) uncovered how the dynamic of relationships between human actors shifted during the web development process. The aim was also to get a more nuanced understanding of the interface between technology use and livelihoods; i.e. how technologies are appropriated.

In addition to the participants, a number of actors emerged from the process. Both categories are discussed below; actors are sorted in accordance with the roles they played. The two cases, INK and SB, are engaged with simultaneously.

Web Designers as Facilitators…and Experts

The 12 students engaged in web design played a central role despite the fact that they did not assist in designing the overall processes. Their collective role was to source information for the sites, design them and assist in training community representatives to maintain the sites. The latter was stressed as important in meetings: students were not responsible for the ongoing maintenance of the sites. Students were to meet with members and get information from them. The idea was to build a collaborative web site and transfer skills so that the site can be used and updated. A question and answer method was used to access information. The general approach was that students 'partner' with community members in building the web sites and enabling ongoing maintenance.

The students' roles were defined upfront: building the web site was defined as a non-transferable skill (the expert domain of the students); authoring onto the web site was considered transferable. Nevertheless, students saw themselves as 'experts' that needed to guide community members on web structure and content: "…we had to make it very simple in the way that they can say like 'okay, this is what we need'…" (Student web site developer, SB). This was reflected in the two focus groups done with SB students and the following report excerpt from the two students involved in web site development for Bambithuba:

> *This was the meeting we really got into what we were expecting to achieve from the website. We also decided that there should be profiles of members: all the activities that the organisation are engaging in will be arranged by categories. The profiles will serve the purpose of introducing the members and acknowledging them as being part of the organisation. One of the reasons for this is because all people involved should also be given an opportunity to be exposed to the public; this is another way of giving exposure to all members that will not limit only few members to take all the credit of the good job being implemented by the organisation as a whole." (Student web site developer, INK) (Emphases added)*

The student in this group in particular took ownership of the process; this could also be interpreted that they took control of the process. Despite this, the students were vocal in

8 Student web site developer, SB

their understanding that this was to be a collaborative process:

> *Desmond who is the Bambithuba's administrator, is been meeting with us (sic). The reason for this is because we want to be able to show him the development of the website. But most importantly for us was to be able to show him how the editing of the website works. We also felt we should not exclude him on things like the design of the website because this is their website. (Student web site developer, INK)*

The students' relationship with Bambithuba in INK was particularly interactive. The administrator of this CBO was very enthusiastic and had good basic computer skills.

> *A meeting was arranged between D and me in order to illustrate the foundations of Bambithuba's website structure and the necessary future developments of the website which hopefully Bambithuba would have learnt to administer and run independently. (Student web site developer, INK)*

"I am the boneless skeleton, you guys are going to put the body on"[8]

The relations between web developers and network members varied in accordance with the level of commitment from both parties and perceptions on the roles of both parties. Students generally felt that they were assisting with a developmental agenda. They were 'helping', 'assisting', and building capacity as reflected in the quotations from a student report and the focus groups:

> *The meeting was a resounding success and is helping to evolve Bambithuba into an organisation that is technologically aware and competent" (Student web site developer, INK).*

> *I didn't go there in order to be a teacher; I went there in order to help them… (Student web site developer, SB)*

This is evident in the focus group interviews with students responsible for the SB web sites. Two groups were held with 2 students and Dr Du Toit present in each. In both groups students were disappointed with what they interpreted as a lacklustre response from the participants: "…some are more interested than others" (Student web site developer, SB). One student in particular had a difficult task accessing information for the site she was responsible for:

> *… We had to get there, we had to build the thing, we had to make a plan, and we had to discuss how to work the interface… But I think they also don't realize how lucky they are in terms of the ……website they have to employ somebody to build the website for them … and the people do this for a living and then make money out of it. (Student web site developer, SB).*

Despite the disappointments, students were committed to the process. Two of the students were particularly interested in following through the following year, either through voluntary work or further study. Some were sensitive to the power dynamics that could evolve between student and participant:

> *Well when I went there I remembered my high school days and basically the one thing that you hate is that if someone comes in there like big, stout and powerful behaviour (sic). That's one thing school kids hate. (Student web site developer, SB).*

This student was particularly committed to the process, employing friends to assist him and constantly emphasizing the collaborative approach used.

The variation in capacity within the group of participants impacted on the students' experience of the process. In the SB process working with pupils and with teachers yielded different experiences:

> *… J doesn't only have to work with learners, I mean he did work with learners once and he got nothing out… He's got an enthusiastic teacher whose passion is about the… and an organisation that's also interesting.* (Student web site developer, SB).

Cultural differences played a role. In the INK process, the matching of a participant that was enthusiastic and skilled with the only IsiZulu-speaking student resulted in an ongoing exchange. A foreign student involved in the SB process expressed discomfort with working in Lamontville.

Language used in communication between students and participants was an issue, especially in INK. Of the 8 students involved in the INK process, only 1 was conversant in IsiZulu; of the 4 students involved in SB, not one could speak the language. When attempts were made to speak IsiZulu by Dr Du Toit (the researcher is not conversant in IsiZulu), appreciation was expressed: *"it means that you are willing to learn"* (INK community member at stakeholder group meeting).

Some students had not been exposed to the areas in question before (townships) and felt it a real challenge to assimilate as part of the process. They often drew on their own experiences to feel comfortable and secure – one student designing for the school explicitly drew on his own experiences as a past pupil. Another saw participants as difficult clients:

> *I guess if I look at it overall it's actually quite hard when speaking to a client that you don't know or, when you're talking to someone who sort of doesn't seem to have any sort of experience. (Student web site developer, SB).*



FIGURE 7.5 The Craft Network at work

9 Quotation from Bambithuba member expressed at meeting

'…He is young and it is technology…'[9]

In observing the networks' members, power relations and perceptions regarding technology emerged as important factors. Ease with computers was informed by confidence and perceptions of who would be most at ease with computers. In INK the Bambithuba director (*'…Bambithuba is run by N, an inspiring elderly woman with the strength and energy of someone half her age…'* - Student web site developer, INK) and her administrative assistant were very active. The assistant is the youngest member of the organisation and the only male. His nomination as the trainee in the process was motivated on the basis that he was young and male (Bambithuba member, INK). Students found him enthusiastic and pro-active. Whilst making this observation, the researcher challenged this perception, noting the members' ease with their mobile phone…technological artefacts also. The response was simply…*'These are our phones; they are ours…"* (Bambithuba member – emphasis added).

Some network members were more assertive, more confident to engage. The chair of the 'beading' group in the Craft Network emerged as a strong participant. She subsequently invited the two students and researcher to take photographs of the craft production process, in a container adjacent to a school field in KwaMashu. The beading group, operating from a container located on a Primary School property (see Figure 7.5) was dominant in the craft web development process. Observations at training sessions indicated alienation of other members indicated by limited representation at further meetings.

In the SB, the manager of the Rising Stars soccer club was identified beforehand as a contact person. With the design of the web site, however, she included her daughter in the process considering her more suitable for training due to her stronger computer literacy. She facilitated inclusion of Tembalethu, the clinic and primary health care group. Whilst the director of the clinic was the initial actor involved, as the web design process unfolded, the administrator of the clinic who was considered more computer literate emerged as the more dominant role player in the process. Yet, when negotiating with volunteers to have their details included on the Tembalethu site, she was ignored (volunteers felt uncomfortable with providing their details) and the director had to intervene.

Fairvale Secondary School involved a number of learners and teachers. The initial contact in the school, Mrs M, assisted with the initial set-up but was not a participant in the web development process. Two teachers were involved, one was active with the environmental group and present at all the training sessions whilst another observed. Neither took a particularly strong leadership role: students deduced that limited computer literacy and ongoing access were reasons. The learners were present at all the training sessions with some clearly more proficient than others. All of them were entirely comfortable with using their mobile phones, however. At various stages in the demonstration process at the first meeting with scholars, web developers referred to cell phones to make a point with regard to using menus, connectivity and finding information.



FIGURE 7.6 INK Digital Hub Brochure

Institutional Actors

Two actors were particularly active in the processes in INK: the CEO of the INK Digital Hub (the brochure shown in Figure 7.6 shows the various institutional affiliations of the Hub), and Linda Mbonambi, the project director for INK URP/ABM. INK URP/ABM as an entity also featured as an institutional actor. As an organisation it plays a leading role in driving development and setting the agenda for delivery. SB did not have a strong institutional or local government presence due to the fact that the process was driven by community organisations. The one institutional actor is the Fairvale Secondary School. Its role as a participant through students and staff was solidified through the web design training taking place (for the Lamontville sites also) in its computer room. As a school it has a relationship with Engen that is tricky. On the one hand Engen is a donor having installed the computer room; on the other hand, it is seen as a major polluter by the Environmental Group members.

Interviews were held with Ms M (director of the Digital Hub) and Mr Mbonambi. Meetings with the INK team provided insights into INK as actor.

Ms M is a resident in Amaoti, and had been active in the labour movement and in Local Economic Development (LED) initiatives in INK. She assisted community members in

developing a business plan for an Internet Café in the area which led to her involvement in establishing a digital centre in Amaoti (a severely impoverished neighbourhood within Inanda). She then realised that this may be a solution for dealing with the information needs of her LED programmes and use the Amaoti initiative as a point of information distribution. With a business partner she expanded the idea, providing a database of e-mail addresses of small businesses. The final Business Plan was submitted to the Department of Telecommunication's Universal Service Agency (USA) as part of National Digital Hubs initiative.

The model for Digital Hubs is to have a Hub and then several spokes. In this case it was the other way around – the spoke came first – the actual Hub was later established in Ohlanga in 2006 (the site of the web development training in INK). Ms M's participation was a valued contribution to the process; the Hub was made available for training, she facilitated the skills training for INK network members and gave ongoing input into web site maintenance.

She expressed disappointment at the failure of the web maintenance process, seeing it as a function of the University having 'disappeared' from the process. She was not available for a second interview to reflect on the failure of the project.

Mr Mbonambi is a town planner with a long history in local government. His view of the failure of the web development process was that neither UKZN nor INK had taken sufficient responsibility for the process, and that a stronger leadership role could have been taken by INK. He agreed that clearer definition of institutional responsibilities was necessary to take the project forward.

The nature of the process as a voluntary arrangement impacted:

> *…I also think I should have formalised this because it should have been which is the reason why I took an interest.* (Mbonambi, Interview 2008).

Without a clear definition of roles, between UKZN and INK, and within INK, it was difficult to follow through on process. In recorded meetings Mr Mbonambi was particularly enthused about the potential of web-enabled networks, given that there are over 540 community organisations active in INK.

The INK project as a feature in the national urban renewal process and the EMA ABM emerged as an actor in the process. It has a strong brand and very specific goals attached to it. Initial negotiations with regards to the web sites were focused on how the INK project would benefit, how the web sites would complement the various INK programmes. During the process, attempts were made to assimilate the community web sites into the various INK programmes. Assistance from INK came in the form of portfolio team leaders (called 'impact area' coordinators) setting up meetings with the community groups. The UKZN design team relied heavily on their assistance for local knowledge and contact details. Ongoing communication between INK members and the UKZN team was ongoing but intermittent.

On a number of occasions concerns were expressed that the INK agenda must not dominate the web design process. When the feedback on the web design process was reported on in early 2007, suggestions were made to include the INK impact areas on the sites; a debate ensued about the autonomy of the community organisations as displayed on their

web sites (INK Meeting 28/05). The response from the web design team was that the software allowed for a multiple web presence without any domination. Nevertheless, the concern was noted and debated and it was agreed that some reference to the INK initiative be included and that limited access should be given to INK staff members to add content to the sites.

Emerging Actors

Engen emerged as the only non-ICT industry actor in SB, as donors in financing the Fairvale School Computer laboratory…

> *I don't think that Engen has done a bad thing. I think Engen has done a very good thing…* (Student web developer, SB).

The presence of the company across from the school has an impact in terms of pollution reflected in the need for the Environmental group's agendas.

At two INK meetings mention was made of the City ICT strategy driven by Jacquie Subban as an initiative to be taken note of. During the interview with Mbonambi, reference was made to the larger eThekwini initiatives particular to Jacquie Subban's leadership role in enabling broadband access to the INK office in KwaMashu and larger initiatives in making ICT more developmental.

National and Provincial government departments were implicated in a number of the sites. The Primary Health Care site in INK and the Tembalethu site in SB, the Department of Health at provincial and national levels were considered important role players. Representatives were invited to the INK meetings but they did not attend. Links to government departments in both instances were agreed upon.

Networks with funding agencies were explored in a number of cases. Discussion on enabling the Digital Hub to connect with a number of 'spokes', decentralised computer access points, through schools was explored and the Shuttleworth Foundation was considered a potential donor in this regard. The Foundation was contacted but unfortunately the process was inconclusive. Bambithuba and Tembalethu stressed the importance of creating digital links with existing and potential donors through the web sites.

Besides the critical role played by UKZN in enabling the two processes and hosting the web sites, Durban University of Technology (DUT) played a big role in assisting the crafters with design training – the impact of which is evident on their web site. Fairvale Secondary School has a link with a school in the UK as one of the teachers was present during the web development process.

Telkom played a role as primary service provider in terms of traditional land line telephony, dial-up Internet services as well as ADSL access in some cases. The latter is particularly limited in INK due to infrastructural constraints. In INK especially Telkom-provided infrastructure was considered inadequate and limited. Mbonambi expressed frustration at connecting the INK office: *"I remember when we first set up shop in INK we were using the Telkom lines and, yes, it was unworkable"* (Mbonambi, interview 2008). Discussion with Telkom in terms of enabling broader access across the INK area was not fruitful – the service provider was not seen as a partner to the development process. In the SB, no reference was made to Telkom, but field work in Lamontville showed a proliferation of

10 Student web developer, SB

cellular shops with very few Telkom call boxes present. The ones present were not in use.

Non-human Actants in the Web Development Process:

…Technology is not scary![10]

Observations on site, in the surrounding areas and interviews revealed varying roles played by the non-human actors. The dominance of cellular phones is shown in the many mobile phone containers in the area (Figure 7.8).



FIGURE 7.8 Vocacom Container in Amaoti

The cellular phone played a dominant role in the web development process as a communication enabler and information provider: "before I'd gone there, I'd SMS the day before that I was coming. So she knows that someone would be coming" (Student web site developer, SB). Sometimes it was a constraint also: *What happened last week was a pity, if I added an extra digit to Mr. M's number on my phone. I only noticed when I phoned him yesterday, an extra zero or something. So I texted it in … it didn't go through.* (Student web site developer, SB). Due to the fluidity of the processes (students moved between lectures and field sites), Dr Du Toit and the researcher had to continuously keep in touch and web site beneficiaries simply did not have land line numbers) contact and information flow was possible. Thus, procedurally it played an important role as an instrument of enrolment and communication.

Mobile phones were also used as reference points in the web design process. Since most participants had cell phones it was considered a useful entry point for familiarizing them with ICT. Designers in the SB web development process, particularly those engaging learners, referred to the computer as a technology as easy to use as cell phones and encouraged participants to access the Internet on their cell phones. One student in

11 Ms M, INK Hub Director, Interview 2007.

particular reminded learners of the ease of technology by making reference to mobile phones: in attempting to ease the web development process.

As a matter of substance, cell phones were often referred to as an example of ICT distribution in marginalized areas, as a success story and a critical communication tool. In INK, Mbonambi noted the rapid rate at which contact with community members in remote areas was now enabled through SMS distribution and general cell access (Mbonambi, interview 2008). He remarked in particular on the flexibility of access options: from personal handset, to shared handset to community phones) yet was concerned about the abuse by outsiders in sending bulk SMS's to INK community forum meetings using the INK lists for example:

> *I've been worried about the integrity of that process, especially when you work in an environment that is opportunity hungry and I'm part of meetings where bulk SMSs gets called to us to go to those meetings… We need to introduce SMS technology but help some norms being built. (Mbonambi, interview 2008).*

Mobile phone technology is ubiquitous in Lamontville and throughout INK. It is discernible in advertising, in the many community phone shops present and their use on public transport and in the streets. Flexible payment options ('pay as you go') dominate and many spaza shops advertise recharge facilities.

The general consensus was that use of traditional telephony is limited; the use of cell phones is becoming ubiquitous. The use of land lines to facilitate dial-up Internet access was seen as a possibility by some respondents.

> *…bringing 'foreign' technology into the area.*[11]

Limited computer literacy was possibly the biggest constraint in both processes. Computers were seen as 'scary' by many participants who simply felt ill-equipped and uncertain in their presence. Two issues emerged from focus group interviews with students: one was that participants simply did not know how to use the computer mechanically:

> *He knew how to turn on the computer but that's it; he had very little control of the mouse, very little control of the keyboard, and there was a psychological barrier to using them … they're scared and excited to use those computers first of all. (Student web site developers, SB).*

A skills survey in INK revealed that computer training was the third most prevalent skill (after cooking and painting) amongst skilled people in INK (Mbonambi, interview 2008). Interactions with community members at meetings revealed a high priority attached to computer training in order to find employment in particular. Many computer colleges (some of them unscrupulous in terms of certification) offer short-term training in basic computer literature seen as essential in order to enter the job market. In the web design process, computer literacy was extremely low. Where participants claimed to have had computer training, the skills displayed were limited and confidence low. For example, a participant in the SB process had exposure to computer programming but lacked experience – as the process progressed her confidence increased. The student web developer was shocked that she did not have an e-mail address.

Perceptions of computers as 'foreign', 'young' and in some cases 'male' were discernible.

Mbatha notes how when the digital hub was first created: "People are unfamiliar with the technology… seen as bringing 'foreign' technology into the area" (Interview, 2006). The INK process with Bambithuba revealed a resistance to ongoing training – the only male and youngest member was seen to be a more appropriate candidate.

The practical issue of access remains important. One of the problems in developing web sites in SB in particular was that the computer laboratory was not available to students in general (it was generally locked and only open for computer classes). General household access in INK is low and community access through schools, libraries and Internet Cafés still very low. Access to these is sometimes difficult due to transport cost as shown in the drop-out of computer training participants in INK.

In the SB students expressed their frustration at the lack of literacy and interest despite the presence of a 'state of art' facility in Fairvale Secondary School. Learners appeared unsure and 'scared' of the technology. One student attempted to engage teachers in the process but found literacy amongst the two teachers responsible also limited. A teacher was due to be employed at the beginning of 2008 to teach computer science and efforts to utilise the computer room effectively were limited.

The use of e-mail was critical to the web development process in the sharing of information and making arrangements. Not many participants had e-mail addresses whilst others used the Internet only for e-mail. The SB student web developers used an exercise of creating an e-mail address online as an initiation of sorts. In some cases participants had e-mail addresses, but never used them due to limited computer access. Mbonambi noted an increase in the number of INK Forum members that have e-mail addresses (interview, 2008).

'Promoting the Public Good'

The hard infrastructure that facilitates connectivity is a strong factor in all the responses. Mbonambi noted that the limited availability of broadband or in some cases telecommunications infrastructure for dial-up Internet access was simply not available. Despite the intentions of EMA to connect the INK office in KwaMashu to the municipal fibre backbone, the team relied on wireless signals from the Umhlanga Rocks office for higher speed access (dial-up is available). His opinion was that ICT infrastructure should be a public resource … *I think ICT, even ICT infrastructure should be geared to promote public good.* (Mbonambi, Interview 2008). He also saw good Internet access as a prerequisite for investment, in particular in the new Bridge City economic node to be developed at the north-eastern entrance to INK.

Ms M from the Digital Hub (interview 2006) noted the difficulty of accessing quality Internet access at the Digital Hub; the facility accessed the Internet through a paid satellite connection.

Limited infrastructure did not emerge as an issue in SB. The surrounding medium income residential development and commercial development attract service providers, making extension into Lamontville and Wentworth viable.

> *…The prospect of having a website is extremely exciting and daunting at the same time.*[12]

The Internet, as a concept, as an idea, needed to be conveyed to participants. Many of the student web developers felt that the language, protocols and underlying logic of the

12 Student report on INK web development process, 2006

Internet was simply too foreign to participants. The SB participants in particular felt that this understanding was necessary to foster an understanding of what is possible and the potential of the web... *"and then you see there are these kids who really don't know what the internet can provide for you… the exposure, I mean it could be that in the next five years not one of them are actually going to access the site"* (Student web site developer, SB). The frustration experienced by the students in what they interpreted as a lack of interest surfaced a number of times…*{Here's the internet explorer, go find Google first, go to whatever encyclopaedia you want, go to school resources and you show me what you did yesterday, and I can tell you what I can do for you" (Student web site developer, SB)*. Students working in INK found that *…" members have never used the Internet, so the prospect of having a website is extremely exciting and daunting at the same time"* (Student web site development, INK).

The web is a medium that requires new rules, means of communicating, ways of interrelating and communicating. In all the web design processes this emerged as a big issue: participants were limited by their understanding of what web sites can do, what is possible and how they can add value as well as their limits. Inherent in that was negotiating an understanding of appropriate formats, texts and information. As a mode of communication it was unfamiliar as was the 'textual world' of cyberspace.

References to libraries and books were often made in web demonstrations in INK, to draw parallels intended to enhance understanding. This seemed more effective than the 'deep-end' approach taken by the students at the Fairvale Secondary School. Internet access at the school was intermittent, however. Whilst the laboratory was of a very high standard the actual Internet connection was unreliable which frustrated the training and consultation process enormously.

The Internet emerged as a terrain where new rules had to be negotiated in INK. During the negotiations with the INK team in 2007 (to take the maintenance processes forward) it was agreed that a set of access protocols needed to be negotiated with each group. This was to be a consultative process with each group having their own set of rules with regards to their web site use: the values and principles that would inform substantive issues such as content and structure, as well as procedural issues such as editorial and administrative rights and access. The aim was also to negotiate user rights in terms of variations of who has full administrative rights and who has limited editing rights in accordance with institutional structures of the INK networks.

DRUPAL, the Open Source software used to develop the web sites was seen to be appropriate given the network format that was followed. The software is particularly strong in enabling a hierarchy of users with regards to maintenance thus making multiple users easier. It allows multiple authorship and can determine levels of authorship in accordance with community-defined criteria. It was also good for listing events and calendars. It is particularly popular in the non-profit sector. Ongoing reference was made to the software; what it can do, what it cannot do; its strengths etc. Arrangements were made to train instructors in the Digital Hub on how to use it.

The need for other technologies such as scanners, cameras and print media for the access of information was felt at a number of stages of the web development process. The need for other information media in accessing information in order to populate the web sites was a constant issue since this information was not always available.

The Products: INK and SB Community Network Web Sites

The web sites created in INK were not used subsequent to the process. The SB process is ongoing with maintenance training currently in progress. The INK group had varying success in accessing information for the sites which was related to the nature of the networks. Bambithuba and the Craft network provided information on an ongoing basis and were participatory. The other two networks were too big and ill-defined to enable ongoing contact, while roles within the INK team were ill-defined.

Two primary issues emerged: access information for the web sites (particularly in SB) and the capacity to understand the functionality of web sites. Students engaged in the SB process in particular were not convinced that school learners would use the sites in future mainly because they did not understand the potential of the sites and had limited computer access. The ongoing negotiations around the sites in INK contributed to the notion of the web sites as 'spaces', access to which needed to be determined beforehand. Whilst the sites were open to the public, access to change and add content was to be negotiated in collaboration with members of the various groups.

The individual web sites were experienced as follows:

- **Bambithuba**'s site was developed in conjunction with one member of the organisation who was extremely enthusiastic and maintained an ongoing relationship with students. The organisation is engaged in a myriad of initiatives ranging from home-based care for HIV/AIDS patients to school feeding schemes. Bambithuba is dependent on the efforts of volunteers. The site was seen as an opportunity to publicise these efforts by including profiles of people involved, 'making it personal' through publication of biographies. Fund raising and exposure to charities were also seen as important. Members had received awards for work done and this was put on the site also as well as connections with other projects, with the INK URP/ABM initiative for example and other educational institutions that were involved in the organisations projects. One contentious issue emerged: the group wanted to publicise the work of Dr Matthias Rath, an AIDS dissident that distributed an herbal 'cocktail' as an alternative to anti-retroviral drugs used in treating HIV. The web design team was uncomfortable with this since Dr Rath's work had been discredited by the medical profession yet Bambithuba members insisted that his tablets work. The information was not included, however.

  Using the site to overcome spatial constraints did emerge as a need mainly related to marketing the organisation … *they are also hoping this form of technology will be what they need and will make their working lives easy as they do not have to travel in order to market themselves in future.* (Student web site developer, INK). The members that were involved in catering saw this as an opportunity to market their skills and procure employment. Some members also made crafts which they sold through the organisation and the site was seen as an opportunity to market that.

  Curiously, the opportunity to network and link with similar organizations did not emerge as a need for the site, other than marketing for potential donors. Students found this frustrating since they saw this as one of the aims of the project…

  Your organisation needs to network – this is why we are offering you all these features… We intend to create a categorical network using the website which would allow Bambithuba the means to communicate with other organisations, benefactors and its members. (through the DRUPAL Taxonomy module) (Student web site developer,

INK).

Furthermore students were of the opinion that the web site would provide a means whereby Bambithuba members would become more computer literature. They were concerned; however, that the site would not be used by members due to limited Internet access. Other technology was necessary, for example a scanner to enable future uploads of images. The web design process catalysed the design of a logo for the organisation.

- **The Craft Network** web design process was dominated by the beading group led by a particularly vocal and enthusiastic woman. The group was particularly keen to market their wares and enable online purchasing. The latter had to be negotiated since it involved banking procedures.
- **The Greening Network** and the **Primary Health Care Network** sites were less participatory mainly due to the fact that membership was not well defined making contact with key people in order to access information for the sites difficult. In the former, involvement of teachers and schools was seen to be important through inclusion of lesson plans, distribution of education material and competition for 'green flag' status for schools that forms part of the school gardens initiative.

  Both sites were also affected by non-involvement of students. Whilst the web sites were designed (their University course work required it), the students simply did not make as much effort to follow through on contacts and make creative suggestions which may have been impacted by the limited clarity on the composition of the two networks. In the meetings with the INK URP/ABM team in 2007, however, enthusiasm for the Greening Network site was expressed. A number of NGOs and government departments were involved in the project and the site was seen as a way of collating information, enabling information sharing and publicising INK URP/ABM's role. It was also intended to publicise the work of gardening cooperatives.
- **The Primary Health Care** site relied on the participation of health care workers at the decentralised distribution sites (National Integrated Programme (NIP sites)) for home kits containing TB and HIV medicines. A number of institutions were involved in this initiative and the site was intended to be a central database of participants and also establish a public profile and gain credibility. The need was expressed to map the NIP sites spatially for ease of reference for home-based care workers…*"web site should indicate which relevant organizations are closest to you"* (INK ABM URP/ABM team member, 2006). Participants expressed the need to publicize what was then experienced as a TB crisis – the site was to remain current and create awareness. It was also seen as a tool to update organizations on the actions of home-based care givers. The point was made that work on AIDS orphans was to be publicized. The site was to allow for additional organisations to be added to the network.
- **Fairvale Secondary School's Environmental Group** was seen to be particularly active given the pollution concerns in the area. The site was to be a publicity tool for events such as 'Clean-up on the Beach' and 'Clean-up on the Canal' campaigns as well as a 'Peace Garden' initiative. The teacher involved in the group and the students had varying expectations of the site. The former was concerned with accurate information and publicity. Environmental health was a big concern to students from a personal perspective. Mention was made of linking the site to the South Durban Community Environmental Alliance (SEDCE) web site. SEDCE is a vocal and powerful community based organisation with a global profile. The possibility of creating blogs for

students to voice their environmental health concerns was expressed.

- The design of the **school groups** (including a debating society, an art group, a sports club and a support group for learners undergoing drug rehabilitation) was constrained by a lack of information on the activities of these groups. Efforts to publish the art group's work on the site were frustrated by lack of access to a scanner for example. The need to publicize events such as a 'March against Child Abuse' was expressed. Student web site designers expressed frustration at the lack of input on the appearance of the sites and the lack of enthusiasm for the task.
- **The Rising Stars Soccer Club** web site was to be used for fund raising and publicity whilst upcoming events in the form of matches were also included. Tembalethu's needs were similar to that of Bambithuba. Visibility through the site was a key requirement: … *We need the web site; we are not known without it; people need to know about us; the web site will assist in this regard.* (Tembalethu member, 2007). Like Bambithuba, creating awareness of the work of volunteers and publishing their efforts was seen as paramount. The underlying need to create a means whereby volunteers could gain recognition and visibility through the site was expressed often. Yet, when an effort was made to photograph the volunteers and publish their biographies on the site, there was a lot of resistance from the volunteers themselves. Fundraising was also raised as an important issue, and visibility to donor organizations.

7.4 Space and Place

The research incorporates observation that interrogate the extent to which place interfaces with digital technologies. Whilst this is not explicit in the research questions, appropriation of technology to overcome physical barriers is important with regards to the overall aim of this research. The findings essentially emerged from the research process as spaces were used for meetings, places experienced and the general conditions observed. Photographic collages collectively illustrate thematic dimentions of the way space is used, starting with the elements that comprise Amaoti Digital Centre in Figure 7.8.



FIGURE 7.8 Amaoti Digital Centre *(Collage created in April 2010)*

Following Murdoch's distinction between topological and topographical spaces (2006), a distinction was made between ICT places and ICT-mediated spaces. The former constitutes the contextual spaces that enveloped the web development process. They signify new land uses in the urban realm and evidence of ICT in public and private spaces. The latter examines the network spaces observed. Following conceptual work on co-presence and the significance of anticipated physical presence in negotiating digital networks, a section on 'events and co-presence' has also been added.

7.4.1 ICT 'Places'

The distribution and use of mobile phones, computer technology and the Internet has led to a number of 'new' land uses that contribute to place making. They include private Internet Cafés discernible in INK and SB. Mbonambi noted an increase in interest amongst young entrepreneurs to establish such facilities in INK. Figures 7.9 and 7.10 illustrate the range in spatial typologies used in offering ICT services: from containers to 'spaza' shops.



FIGURE 7.9 Informal Telephony Shops *(Collage created in April 2010)*

The INK Community Hub where much of the web training for the INK groups was done is located in Dube Village, Ohlanga, a neighbourhood in Inanda. The Hub was critical to the development of the web sites in INK. Services offered at the Hub include: training in IT skills, general telecommunication services such as photocopying, printing and faxing, computer repairs, SMME support services and meeting and video conferencing facilities. The Ohlanga Hub is the second to be established. The first hub was established in Amaoti , also a neighbourhood in Inanda, but closed due to vandalism. It was reopened later. It is now located next to a police station and community hall. Amaoti is known to be a particularly crime-ridden area within INK.

13 The South African term 'spaza shop' refers to informal stalls selling a range of goods and services; normally located in or adjacent to owner's homes



FIGURE 7.10 Phone Shop Container Typologies *(Collage created in April 2010)*

The centre's physical presence is not matched by digital connectivity, which is provided through satellite link-up and it is expensive and intermittent. As noted, throughout the web design process, use was made of the researcher's laptop and a mobile 3G Internet connection.

The vision for the Hub is to ensure that 80% of the Youth and 60% of women are ICT literate by 2015 (INK Digital Hub Date Unknown). The Hub's mission is closely associated with social development: capacity building is an important focus, as is the use of ICT to enhance social services and help grow SMME's (Ibid.). The Hub offers basic computer literacy training and other marketable skills. It is accredited as a SITA and an ICT ICDL testing centre. Its major focus is skills development.

Proximity is important, according to the Hub information brochure. Reduction in transport costs is listed as an important consideration, as are the presence of a clean, friendly and safe learning environment. The Hub is located on an important arterial and bus route

The Home and the Street

Observations in Lamontville and INK revealed a strong presence of mobile telephony in the form of phone shops, spaza shops[13] selling call time and also a small number of homes doubling as phone shops. Phone shop typologies range from informal- (people's homes, on the streets) to formalised containers. The words 'community service' feature on a number of the containers.

Informality

The three primary mobile phone service providers offer 'pay-as-you-go' options in the form of coupons available for sale at makeshift shops attached to homes or associated with phone repairs.

Containers

The containers that offer telephony services are located as stand-alone uses on leftover public space or on sidewalks, or attached to other buildings. They are retrofitted

representing a partnership between operator and cell phone companies.

These containers are often gathering places and provide a colourful reminder of the revolution of mobile telephony; a public presence representing private intervention. Agglomeration contributes to the nodal aspect; when buying vegetables, a phone call can be made and others engaged in neighbourly chat. The marketing approach reflects this impulse as can be depicted from the imagery used in advertising.

Public Buildings: libraries and schools

The importance of public buildings such as libraries and schools where people could access the Internet was important. Library access was part of an EMA project to make broadband services available to larger communities. In Lamontville, Tembalethu and the Rising Stars planned to use the local library to access their web sites for maintenance. In as much as the school computer centre had restricted hours and constrained pupil access, so did the Lamontville library.

ICT Mediated Spaces

Following the actor provides an account of where ICT connects, where it does not, and why. Each of the actants has a story to tell. Examining the INK ABM is an example of the reach (and loss of opportunities) of one institutional actor.

INK URP/ABM is part of two primary institutional networks: the National urban renewal programme and the eThekwini area based management programme. The policy space is enabled through the plans and policy imperatives determined by eThekwini. In terms of ICT infrastructure, the fibre-optic web is intended to link the INK ABM office to other municipal offices and libraries across the city. The INK Digital Hub is not part of this grid. Functionally it played an important role in this research, yet it remained disconnected, in terms of internet connectivity and physically access to it is constrained to the larger public by cost. An opportunity for connection to a broader community is lost. Why? The Digital Hub is not enrolled into the institutional network that comprises the ABM arena, yet it is located less than 5 km from the INK office and shares developmental objectives. These objectives are not part of the larger URP/ABM frame.

A second example of the lack of connection within typological space is the Bridge City development. Despite its location in INK, the marketing literature that proclaims it as a nodal connector between INK and the rest of the city is silent on two fronts. None of the literature promoting the development makes mention of ICT despite the obvious emphasis on networked infrastructures as a means to achieve inclusivity. Second, the Bridge City web link from www.durban.gov.za does not mention the INK programme, the URP/ABM agency or any of the community organisations active in the area. Enrolled in this network are the actors that bear a close relationship to partnerships in Umhlanga: the Tongaat Hullett Group, eThekwini and a number of private sector players.

Events and Co-presence

The need for physical co-presence was emphasised in the expression of identifying events that needed to be publicised in the web development process. Furthermore, the actual development of the sites requires meetings, gatherings and interface interactions. In fact, the project required more face-to-face interaction than initially expected due to the need for training and feedback and ongoing communication on the protocol required for the

sites. Business fairs, exhibitions and workshops were critical events to all the groups and the web sites were seen as a means whereby these could be publicised.

7.4.2 Innovation, Livelihoods, and Constraints

How well does ICT fit with livelihood strategies? Using this field work to determine this is not ideal since it investigates a case where technology is introduced. There are, nevertheless, opportunities that manifested in a number of contexts.

The potential for convergence emerged in particular in the SB case. The ubiquitous presence of cell phones combined with limited computer and Internet access led to an exploration of where the internet can be accessed on cell phones. As one student expressed it:

> *What's also interesting is the whole idea of that one can jump from one form of technological use to another. You know that if people can access… online …on their cell phones then it would facilitate their internet … on their computer. (Student web site developer, SB).*

Constant reference to the mobile phone as a form of advanced technology in the web design process was intended to ease participants and give them an entry point from which to develop greater confidence.

Much potential for ICT was noted: visibility and marketing were the main concerns. Besides unfamiliarity with cyber space and suspicion of computer technology in particular, there were a number of technology myths, metaphors, analogies and discourses that emerged. Discourses around technology that emerged were associated with its being foreign, male and young. The notion of a digital community as being connected and progressive was voiced a number of times in different guises.

References were made by the designers to the fact that participants appeared to be 'scared' or feared the technology…*technology can help you - don't be scared of it"* (Student web site developer, SB). Participants in the INK process were told; "there is no way you can break anything" (Student web site developer, INK).

Frustration at not receiving enough information was seen as a critical problem*: If you don't have all of the ingredients it's not worthwhile going to the kitchen.* (Student web site developer, SB).

7.5 Conclusion

Introduction of technology into the networks had mixed consequences. The findings indicate that material actors in networks have varying influence depending on inter-group relations. The limited sustainability of the project was due to a number of issues. The first was due to procedural arrangements and lack of accountability as well as confusion with regards to the roles of participants in INK. The project in SB continues, but student web developers were concerned that their web sites would not be used due to a lack of computer skill and access. Translation is required for network relations to stabilise, for the actor-network to settle and develop its own agency. There was varying potential in the 8 groups considered here for that to happen.

The actual technologies had an impact on networks but not the extent that some literature would suggest. The efficacy of the web development processes were informed by how well the networks were functioning beforehand (or whether they existed at all).

An interesting issue that emerged in INK was the tension in expectation. INK URP/ABM expected the web development process to reinforce networks, the UKZN group, on the other hand, relied on the smooth functioning of the associations in order to effectively design the web pages. Clarity on roles, on members of networks, and a clear organizational goal was needed in the case of the Greening Network in particular. ICT is not enough to form network, clearly. The terms of enrolment, the need for translation processes to mature were important determinants in the sustainability of the process. This related to all types of actants, human and artefact.

The addition of actants shifted dynamics but did not impact in profound ways. The one possible exception is the Craft network where one member's domination due to increased confidence had an impact. The relationship between power and technology was discerned. Network members with computer skills were more powerful and able to exert more influence in relations. Self-imposed discourses were observed where computers were defined as 'young and male' and in some cases 'Western'. Another example was the inclusion of new members due to computer skills, such as the Rising Stars Soccer Club's leader's daughter.

Some actants were incorporated into networks with more ease. The cell phone was a very strong actor in terms of substance and process. It was often referred to when putting participants at ease with digital technology, was an essential tool of connection and organisation. The notion of convergence did not come across as a possibility to participants, but was voiced by the institutional actors (INK's Mbonambi) and web designers.

The intended process of forming new actor-networks through introduction of web sites into community group functions was constrained in a number of ways. The first is limited hardware access. In INK, the project relied heavily on the Digital Hub, which had its own limits with regards to venue availability and space. In SB, the Engen-sponsored computer room at Fairvale School was not always available to learners and other participants. In Lamontville, access to the adjacent library for computer access was constrained by library hours and availability. These material parameters are immutable mobiles, malleable to some extent but not to the actors enrolled. The line between mutable and immutable can shift, depending on the rules of network engagement.

The second constraint relates to the psychological barriers to digital access. There is an uncertainty and loss of confidence that often permeates interactions with computers. The third deals with an understanding of virtual space: the rules and procedures that underpin communication through web sites, the media textures and the potentials. Virtual space is different. It requires lines of accountability if it is to enhance networks (as found in INK) and it requires an understanding of its norms if it is to be used to its full potential. It requires translation that goes a step further towards ownership and appropriation. The choice of technology used in this regard was predetermined by the nature of the process: web design. However, the cellular phone is an entrenched part of urban life in INK and SB and relate to livelihoods with regards to payment options, access and lifestyles. Choice is impacted upon by computer and web access. Participants rely on public buildings (schools and libraries) and private Internet Cafés (where they are available) for access. Physical travel to those is constrained by transport options and cost, while use is constrained by bandwidth and physical availability. Some technologies are more mutable than others and this affects how possible appropriation is. That in itself is a power dynamic.

The spatial dimensions underpinning these processes are not unfamiliar to the spatial planner. Access, transport routes, defensible space and facility hours of access are all factors that influence digital access. Layered upon this seemingly mundane interaction of barriers and access is an interesting range of typologies that has emerged as a result of ICT. The odd Internet café is discernable, but it is mobile telephony that is ubiquitous. Typologies range from the highly informal facility in the home (often part of a spaza shop) to tables on sidewalks offering telephony to the customised container phone shops leased from one of the three private service providers. These are meeting places and clusters of local people can be seen gathering around these shops. They are often located close to other facilities with some clustering occurring. These are interesting opportunities for empowerment. Availability of mobile telephony in particular has availed spaces of transformation albeit in small local ways.

Examining a process was valuable in determining the formation of actor-networks, processes of translation and the unfolding roles of actants. The location of research provided an opportunity to commence engagement with the physical features of ICT in urban space. The limit to this method was that the process was contingent upon limited time frames, not allowing enough time for network relations to stabilise. The following chapter addresses this limitation by examining an existing network that has stabilised, that uses material tools to advocate and mobilise. It continues examination of ICT in space by focusing specifically on the informal sector.

8 ICT and Networks: Informal Traders

The previous chapter focussed on a process. It uncovered the dynamics that emerged from the introduction of technology into networks. The aim was to understand how communities in marginalised spaces use, and could potentially use, ICT to strengthen networks and enable inclusion. The method used to interrogate this case was primarily action research; two projects were tracked. Interview and focus groups, together with participant observation comprised the tools used to collect data. Not all the networks functioned as supportive structures. The relationship between technology and networks is not necessary transformative.

The relations between technology and networks were socially, culturally and contextually informed (argued in the third hypothesis). They were mediated by the existing dynamics between network participants. ICT cannot create a network; in order for it to augment it, the inner workings of the latter need to be functional in the first place. Inter-network dynamics were altered by digital technologies, but not in a profound way, power dynamics were deepened but as tempting as it is to overstate this factor, this was not the primary finding. The choice of technologies relate to livelihood strategies and economic context. Mobile technologies were ubiquitous; people trusted their functionality and were comfortable with the means whereby they can be assimilated into everyday life. Their physical mobility means that space is not a constraint.

Are patterns of exclusion overcome or entrenched? Is transformation from a local scale enabled? Given the skills challenge, the physical constraints and constrained access to Internet and e-mail in particular, it can be argued that entrenched patterns of exclusion continue, new patterns do not necessarily emerge (as stated in the first hypothesis). The emphasis on networks responds to the assumption that in the absence of the access to resources, given spatial constraints and economic marginality, digitally enabled social networks assist in overcoming material constraints. Findings presented in Chapter 7 indicate that networks are not necessarily augmented by ICT. Whilst the potential exists, the importance of leadership amongst actors and the agency represented by that cannot be underestimated. ICT is not simply a developmental layer of infrastructure. It requires layered intervention if it is to be inclusive. It is dependent on the nature of translation processes, which is enrolled into networks and on what/whose terms.

Actor networks in the ICT terrain are not necessarily supportive of larger goals of inclusion (as postulated by the second hypothesis). This is evident in the work presented in Chapter 6 and to some extent in Chapter 7. The second part of the hypothesis states that with increasing opportunities for convergence and wireless access, new opportunities for inclusion and innovation will emerge, sometimes in unexpected ways, outside the realm of policy making. The degree of innovation would be dependent on the choice of technologies informed by affordability and flexibility. This was difficult to measure in Chapter 7 with the introduction of technology; it was aspirations of participants that were indicative of innovation. Innovation was constrained however by capacity and access. Capacity relates to human resource factors such as training and ICT knowledge. It also related to a

more complex understanding of the intricacies of cyberspace: how web sites work, what they can do and what is required iteratively for them to function effectively. The use of e-mail and the Internet was limited for a number of capacity reasons. Cell phone use, on the other hand, was ubiquitous. Potential for convergence was there but premature. The potential for ICT to enable overcoming physical barriers was there but implementation was beset with the complexities that inform the human-digital interface.

Innovation and appropriation are best explored through the existent use of ICT by an established network. Introduction of technology required negotiation, translation and stabilisation in order for the actor-network to function. Chapter 6 illustrated how this occurs in some networks in Durban, and not in others. Chapter 7 uncovers intricacies of process. This chapter probes the workings of a network, in particular a group committed to making the invisible visible, promoting the interests of the working poor. Whilst Chapter 6 engaged with marginalised spaces, here marginality is explored in a particular group. A further distinction is that the focus is on technologies that exist and are used already.

Two groups were engaged in the field work: StreetNet, a street trader advocacy organisation active internationally and based in Durban. Specific emphasis was on foreign street traders affiliated to Siyagunda, an association with members predominantly from the Democratic Republic of Congo (DRC), consisting mainly of street barbers, also based in Durban. The two organisations are related: Siyagunda is one of the many trader networks that contribute to StreetNet functions.

The research contained in this chapter differs from Chapters 6 and 7 in that the focus is on existing groups and their current use of technology. The distinction is that the actor-network exists. In Durban the ICT policy exists but is in the process of being implemented; in INK and SB the web development process was examined. This does not imply that actor-networks are static. The distinctive feature of the research represented in this chapter is that it examined translation processes that had occurred. It is also the final field work component of this thesis. Chapter 9 presents the conclusions to the work contained in Chapters 6, 7 and 8.

This chapter is based on research that was done over two years. A background section on the actors involved is followed by a discussion of the methodology. Findings are once again presented using ANT concepts.

8.1 Informality in Durban

The increase in the informal economy is noted by the South African Cities Network (SACN) (2006: 25) as taking three forms: use of land outside the parameters set by the regulatory environment, enterprises that operate outside the regulatory environment and informal work. The data contained in this chapter focuses on street traders. The working poor, as Women in Informal Employment: Globalizing and Organizing (WIEGO) calls them (wiego.org Accessed April 2010), are engaged in small and micro enterprises, constitute informal labour as manifested in casual, unregistered, moonlighting and multiple jobs (SACN 2006). Job shedding due to economic restructuring, Structural Adjustment Programmes (SAP) in much of Africa and limited job creation coupled with rapid urbanisation has contributed to an increasing in informalisation.

The contribution of informal trade to the economy is hard to measure given the transient nature of workers and insecurity of work. Despite the seeming exclusion from the

mainstream economy, macro-economic conditions are acutely experienced by street traders. A recent study done under the Women in Informal Employment: Globalizing and Organizing (WIEGO)'s Inclusive Cities programme illustrates this. Shrinking consumption and declining demand have resulted in significant product shrinkage for waste pickers, home-based workers face increased competition for decreasing local markets while street vendors report on a significant reduction in local consumer demand also (Horn August 2009). The WIEGO study reports that in order to compensate workers work longer hours, take on additional risks and cut back on expenditure which often includes essentials such as food and health care. Despite these measures, incomes continue to decline (Ibid.). Street traders earn as little as US$ 2 a day. For example, in Durban's transport hub, Warwick Junction, where the majority of the city's street trade occurs, traders earn between R1000 and R8000 (US$ 135 – US$ 1000) per month (Dobson, Skinner et al. 2009).

In addition to marginal livelihoods, the policy context is often uncertain and official intervention unpredictable. Policy tensions (between local government competencies and national policy) and unclear national directives cause many to work in insecure conditions (Skinner and Hunter 2003). The threat of evictions and harassment by authorities are burdens traders contend with on a daily basis (UNHabitat 2007). Harassment is legitimized through being labelled as unofficial and illegal. The working poor are often cast as temporary and transient resulting in inappropriate or limited policy responses (Brown 2006). The number of foreign traders is significant in number and implications. The lack of formal employment opportunities due to immigration restrictions and limited opportunities leaves limited income choices for cross border refugees and migrants. Foreigners bear the added burden of xenophobia and exclusion from local governance structures (Skinner and Hunter 2003). An added dimension is that an estimated 6 out of 10 street traders in South African cities are women, often in less profitable endeavours such as the sale of fresh fruit and vegetables (Ibid.).

Durban provides an example of how street trade has evolved in city policy. From the 1960s street trading was prohibited in the city; ongoing battles between policy and the informal sector continued in 1973 (Dobson, Skinner et al. 2009). Amendments of the provincial Town Planning Ordinance allowed for limited trading: traders were permitted to occupy a space for 15 minutes, only if it was within 100m of formal business. Grassroots action emerged in the form of the Hawker's Action Committee formed in the later 1970s to contest municipal harassment (Ibid.).

Management of street trade progressed from reluctant acceptance to more active engagement. The commission of a survey in the 1980s by the relatively progressive municipality heralded the start of a phase where the economic contribution and livelihood support of informal trading were recognized (Dobson, Skinner et al. 2009). Active management was frustrated by Apartheid laws that restricted black and Indian economic activity specifically in urban areas for the former. The relaxation of these laws in the 1990s contributed to a growth in informal activity in the city; an estimated 4 000 street traders started operating in the inner city transport hub, Warwick Junction; it is estimated that between 5000 and 8000 traders function in this area currently (Ibid.).

In 1991 a municipal department was formed to manage street trading as part of a larger initiative to develop an informal trade policy (Dobson, Skinner et al. 2009). A more accommodating national policy environment ensued after the first democratic elections of

1994. Under the 1996 Constitution, local government was tasked with human and economic development functions. After the restructuring of local government in the mid to late 1990s, many municipalities paid closer attention to the prevalence and management of street trade. In Durban, the Warwick Junction Urban Renewal Project (established in 1995) represented an integrated approach to the ongoing management of street level issues. The project was recognized as a successful exercise in decentralized and innovative urban management (Todes, Odendaal et al. 2004) and was publicly lauded for its participatory approach (Dobson, Skinner et al. 2009).

Durban embarked on a policy development process in 1999 through consultation with the interest groups that comprise the informal sector (Lund and Skinner 2004). This resulted in a policy on informal trade in 2000, just prior to the first democratic local government elections. The policy drew on experiences from the Warwick Junction project, its consultative approach and the collaborative and creative problem solving the project had been awarded for. It point of departure is recognition of the critical role the informal sector played in economic development, given the income generated at household level and the employment created (Ibid.). Both the formal and informal economies were defined seen as interdependent, with the good health of the one having a positive impact on the other. As such, the city formulated a number of plans and strategies intended to improve the circumstances within which the informal traders work. These strategies included revitalising the Central Business District (CBD), working on safety in the inner city and recognising the informal economy in its long terms plans such as the Long Term Development Framework and IDPs (www.durban.gov.za accessed in 2008). The underlying objective of the long term strategy of eThekwini was to facilitate movement from the informal economy into the formal economy. The policy manifested in upgrades to public spaces, urban design measures to provide comfort and shade to traders, the creation of the Informal Trade and Small Business Opportunities (ITSBO) branch to enable implementation of informal trade policy and the creation of a forum to allow for communication between traders' organisations and the municipality (Lund and Skinner 2004).

The city's engagement with interest groups contributed to a seemingly inclusive policy with StreetNet and the Self Employed Workers Union (SEWU) playing a role in drawing attention to the gaps in national government's approach (Skinner and Valodia 2003). Despite this, management of street trade activity has been beset with conflicts and difficulties. By early 2005 a number of issues arose with regards to implementation of the policy. Harassment of street traders began in earnest in April 2005, in contravention of the policy. Furthermore, the eThekwini Street Traders Forum was established in March that year to allow for ongoing liaison between traders and the city on operational issues. Developmental aspects were simply not implemented by the ITSBO and harassment continued by Metro Police (StreetNet November 2007). A permit system was subsequently implemented with limited success. An inadequate number was provided however (only 6000 catering for an informal trader population of approximately 25 000). StreetNet argues that the application of the permit system is inconsistent; little clarity existed on the criteria used in this regard (November 2007).

At the time of writing, the relationship between the eThekwini Municipality and the street trader community was at a low point, worthy of noting here. The Early Morning Market, a listed building located in Warwick Junction, established in 1910 and a significant landmark to mostly Indian market gardeners is under threat of demolition. In September 2008, a motion was approved by eThekwini to grant a 50-year lease to

a developer in order to develop a shopping mall on the site (Sole 2009). This would entail closure of the market and displacement of street traders that rely on the market as a product source. The proposal was advertised for comment in March 2009, with the planned relocation of traders scheduled for mid-May. Over 50 market gardeners trade from the site and over 600 trading sites surround it (Skinner in Sole 2009). The proposal was marketed as part of Durban's infrastructural upgrade work for the 2010 FIFA World Cup by the eThekwini Municipality:

> *The head of the strategic projects unit, Julie-May Ellingson, said enormous financial and economic gains were already being felt in tourism, marketing, job creation and other sectors… Ellingson said the area around the stadium was being transformed. Designated public lanes had been constructed to improve public transport flow, the new inner city bus system was in its trial phase and the Warwick junction revamp was well under way. (Dardagan January 26, 2009)*

The reaction to this proposal was met with resistance from a number of (some unexpected) fronts. Those opposed to the development include formal institutions such as the KwaZulu-Natal Institute of Architects (KZNIA), AMAFA (the Provincial Heritage Council), a number of academics and StreetNet. Traders and members of civil society that oppose the development voiced their opposition on several public meetings, through picketing action and protest marches. At the time of writing the Market had been closed (at the end of July 2009) but protest action continues unabated. Several court orders from interest groups had been lodged with the Durban High Court to discontinue the destruction of the Market. At the time of writing all work had been suspended until determination of the Hearing date.

8.2 StreetNet and Siyagunda

StreetNet International is a network of street vendor organisations that includes unions, co-operatives and associations. The organisation was launched in Durban in November 2002. The intention of the network is to facilitate exchange of information, mobilise support and play an advocacy role. The organisation facilitates international campaigns for more inclusive policies such as the current 'World Class City for all' campaign that counters the 'World Class Cities' approaches taken by many South African cities in preparation for the FIFA World Cup 2010 (StreetNet International 2009).

The StreetNet network includes organisations from Africa (21 affiliates), Asia (5 members) and Latin America (8 member organisations). Affiliates include local organisations such as the Nairobi Hawkers Alliance, the Kisumu Alliance of Street Vendors and Informal Traders in Kenya, and the Alliance of Zambia, Informal Economy Associations. International partners are the Self-Employed Women's Association (SEWA) in Ahmedabad, India; the Self-Employed Women's Union (SEWU) in Durban, South Africa; Women's World Banking in New York, and the International Coalition of Women and Credit in New York. (StreetNet International 2009)

A local network pertinent to this research is Siyagunda, an association of street traders in KwaZulu-Natal, was launched on the 16th of December, 2005. Many members in Durban are foreign nationals from the Democratic Republic of Congo. Discriminatory practices and red tape prohibit refugees from earning a living in the informal economy. Part of the purpose of Siyagunda is to tackle these problems through negotiation and discussions with local government. The issue of permits to refugees to foreign national is

a central issue (StreetNet September 2006). Foreign street barbers were refused the right to apply for permits due to lack of ID and the limitations of the public health policy on hair cutting in public spaces (for example, agglomeration with other commercial activity is not permitted due to the hygiene issues associated with cutting hair) (Bikombo 2007). In May 2005, the municipality started to crack down on those without permits, and with this came the eviction of some street traders as well as the seizure of their trading equipment. Subsequent legal action saw the court rule in favour of the municipality.

According to Siyagunda, the municipality has 'yet to recognise [the] street barbers as traders engaged in a legitimate economic activity' (StreetNet International 2009). Siyagunda was formed to give street traders this voice. As a voluntary association, it aims to negotiate with the local authorities in order to reach joint solutions, and educate the members about health issues associated with haircutting. One of the lessons learnt due to the legal action instituted in 2005, was that the outcome may have been different had action been taken by an organization or an organized group of traders (StreetNet International 2009). The organisation provides support in the face of xenophobia and police harassment. Many traders have tertiary qualifications unrecognised in South Africa. Working as barbers provides them with a flexible income. Innovations such as using battery driven clippers have enabled them to provide a broader range of cuts faster. This has caused resentment amongst some of the South African barbers. (Dobson, Skinner et al. 2009)

8.2.1 Data Sources

Data sources were selected in accordance with a number of analytical criteria: the aim was to establish the extent to which mobile phones, computers and the Internet are used to network amongst informal traders. The field work consisted of three sets of activities:

Photographic record of informal trade activity in Durban CBD and Isipingo Rail

Informal trade in Durban's CBD has expanded to beyond designated spaces in markets and sidewalks. The range of activities has broadened also, and now includes telephony services. Two photographic records were made; one on a week day (Tuesday) mid morning (10am) in the Durban CBD; the other in Isipingo Rail, a nodal area at an intra-city railway station in South Durban, in the late afternoon (16.00). The two locations were selected on the basis of the intensity of commercial informal activity there. Attempts had been made by the municipality to designate space for traders in both area; the former initiative more successful than the latter.

The photography focused on capturing the following through walking, talking to traders (including asking their permission to photograph) and noting specific features a shown in Figure 8.1.

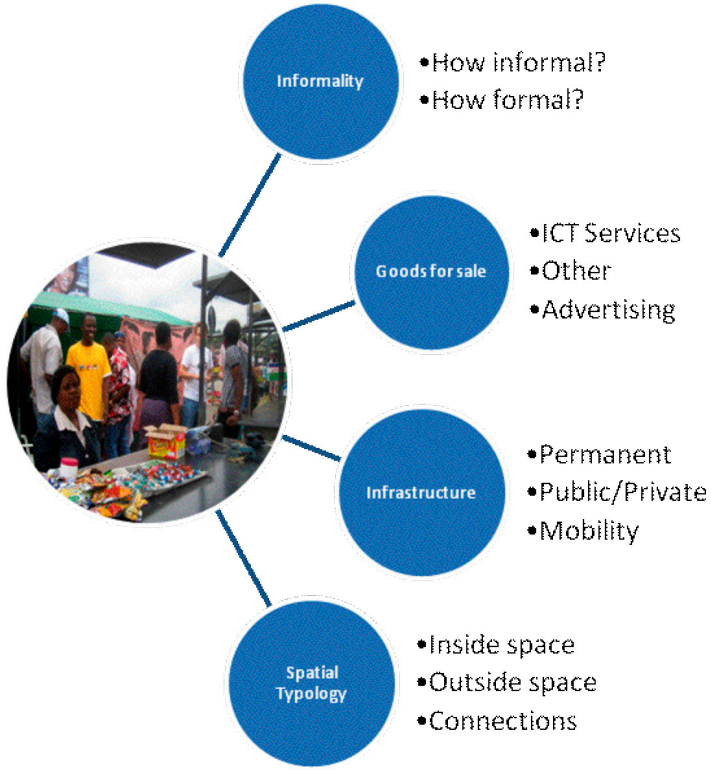


FIGURE 8-1: Features captured in Photography

Examination of StreetNet web site

The aim of looking at the StreetNet web site is that it has evolved into an advocacy tool for the street trader networks worldwide. The web site is managed and maintained in the organisation's office in Durban. The web site was analysed for content and format. The web master and StreetNet's director were interviewed together. (Interview questions are included in Annexure L).

The aim of the interview was to establish the genesis of the web site, the actors involved in setting in up, the networks that are intertwined and evolved from the site. Other technologies used in conjunction with the site were also identified. Newsletters and the web site were examined over the two year field work period: 2007-2008.

Interrogation of the use of technology by street traders

The use of technology street traders, mainly from the Democratic Republic of Congo, was documented. Siyagunda was used as a means to gain entry into the network of foreign traders that are active in Durban. Whilst not all focus group participants were street barbers, all members were affiliated to Siyagunda by virtue of its status as a network that invested time in protecting the rights of foreign street traders in Durban.

An open-ended interview was held with the chairperson of the organisation, Gaby Bikombo. The data gathered from this exercise provided biographical detail on an important actor in this case. In following Mr Bikombo, an actor-network is revealed that spans across country boundaries and temporal fixtures.

Focus group interviews were held with two groups from the organisation: one active in the CBD (group 1) and the other active in other spaces such as the Isipingo rail (group 2) area south of Durban. (These are also the two spaces photographed.)

Group 1 consisted of 11 members aged between 18 and 60 and included 3 women only. All the men were street barbers, the women were market sellers with one woman supplementing her trading activities working as a car guard also. All, except 2, are from the DRC and are refugees. The two are from Burundi. One woman is a musician, another is a nurse; there was one student present a part-time translator.

Proceedings were translated into and from French; Gaby Bikombo translated. The meeting lasted 2 hours. All those present had cell phones; 5 members had e-mail addresses. Proceedings were interrupted 5 times by people taking cell phone calls. The ubiquity of mobile telephony was tangible.

Group 2 contained 6 members, aged between 18 and 40. It included 2 women; one was a housewife and the other a student (in nursing). The men included two car guards, an IT person that worked from home (fixes computers and cell phones), and a student worked part-time as a car guard. All the members are from the DRC. Proceedings were conducted in English; the smaller groups enabled slower proceedings that facilitated this. All members had cell phones. All but one member had e-mail addresses. The meeting was conducted over 1.5 hours.

As in Chapter 7, data was collated and analysed using NVIVO, qualitative research software that enables coding of all data in one 'project' or file. Coding themes were based on the ANT approach to research and analysis discussed in Chapter 5.

- **Actants implicated in the web development process**: translation processes human and non-human actors that were determined beforehand but also emerged as playing various roles in the web development process. They carry agency and their actions have a bearing on the overall outcomes of the processes. Emerging actants are particularly interesting since their roles evolved as a result of the web design process.
- **Networks and Associations** are essential to explore since they provide the means whereby space is transcended and resources shared and accessed. Again, a number of these existed before the web development processes began, but some formed during the processes.
- **Co-presence, space and place**. The difference between network (typological) and physical (topographical) spaces were documented. Transcending space through technology is an often cited theme in debates on cities and ICT. The role of place and need for physical co-presence has been explored in recent work on mobilities (informed by ANT).

A number of 'free-standing' themes emerged from the literature and were explored in the field work: constraints, convergence, technology myths, metaphors, analogies and discourses.

All the methods informed the presentation of the findings, organized under the following headings:

- Overview: the presence of ICT in Informal Durban
- Networks
- Actor-networks
- The importance of co-presence: advocacy and mobilization using ICT
- Space and Place.

8.3 Research Findings

8.3.1 ICT in Informal Durban

The appropriation of ICT by traders operating outside the usual confines of formality is manifested implicitly and explicitly (Odendaal 2008). Implicit uses relate to how traders use ICT for social and economic functions pertaining to their livelihoods and lifestyles. The outward or explicit manifestation of ICT and informality is evident in the many ICT services on sale in public space, and the use of ICT by members of the public. Photographic documentation indicates a range of services. The purpose of this section is contextual; a visual backdrop. Whilst the emphasis of this chapter is on the network of street traders under StreetNet, photography was used to capture evidence of ICT in informal work and on the street.

The photographs, presented in thematic collages on the following pages follow a route from the public areas surrounding the Workshop, a shopping centre located in a renovated railway workshop, on the edges of the Central Business District (CBD), along a walkway along a number of core public building (the main city Post Office, the City Hall) and the city centre.

The second area follows a circular route near the bus rank and railway station at Isipingo Rail in South Durban. The evidence is provided in photographic format with captions commenting on the ICT use aspects.

Each of the following sections below discuss a theme that emerges from the observations on the use of ICT in the city in unregulated spaces and by the informal sector. Collages (with the exeption of Figure 8.4) illustrate each of these themes using the photography from the two routes.

ICT Services Advertised

The presence of mobile telephony is evident in the use of phones in public spaces but also advertised as an integral part of the urban experience. The imagery (captured from the following page onwards) depicts a youthful and diverse membership of a network of connected and informed individuals. Text is in isiZulu and the rainbow emblem is a reminder of the integration ideal. Mobile telephony dominated public space and advertisement of Internet services was limited to privately owned Internet cafes.

The juxtaposition of ‘community chat’ advertised (the idea of ‘chat’; connection and recreational use of the phone - see Figure 8.1 - top right corner) using a service provider brand and an informal makeshift sign displaying the availability of an array of services. The notion of community in the former is interesting – using a cell phone to connect makes one part of a community. In the top-right physical comfort is advertised as a value added and implies some privacy when engaging telephonically. Repairs and starter packs are also available.

Informal advertising is accommodated on an old sheet around the corner from where the above photos are taken. Cost is emphasised and some attempt at branding is made.



FIGURE 8.2 ICT Services Advertised *(Collage created in April 2010)*

Boards are placed on walkways; sheets are erected on lamp poles. Branding is important. The network brand is always advertised; users know what is on offer but the marketing messages promises comfort, connection and economy in varied instances.

Agglomeration and Clustering

Telephone services are offered within a context of other services. The photo to the right below shows a phone kiosk in a container next to a street barber's tent. On the left cellular services are on offer in addition to a locksmith, small general store and others within a formal building. Location of services is associated with foot traffic, clustering enables maximisation of markets.



FIGURE 8.3 Agglomerations and Clustering *(Collage created in April 2010)*

Diversification

Phone services are extensions of a range of products on sale. Fresh fruit and vegetables are available once that important phone call is made (payable at a by-minute rate) as are sweets and packets of crisps. The flexibility enabled through cellular technology enables incongruous mixes of products – people who make a phone call may well be compelled to extent their spending. The phones take up little space, are easy to manage and it is in the service provider's interest to maintain handsets and infrastructure. Every call on the network contributes to the service provider's profit….and may contribute to selling an extra bag of oranges. Call time vouchers are also available for sale.



FIGURE 8.4 Diversification

Social Spaces

The collage in Figure 8.5 shows telephone services provided by a trader in a public area adjacent to a shopping centre. Chairs are provided for customers; clothes are for sale adjacent to telephony.



FIGURE 8.5 Social Spaces and Public/Private *(Collage created in April 2010)*

These service clusters are social spaces as customers and traders interact and chat. Talking is sociable after all!

The Public versus Private

The use of cell phones provides a dynamic of the relationship between public and private. An image of someone comfortable in public space whilst engaging in a long private interaction shows the fine line between the public and private experience. A stool is provided for his comfort. (A service provider advertised in the background is a reminder of the ubiquity of the mobile telephony experience.)

Boundaries between public and private are porous. Below is a street barber customer who chooses to interrupt his haircut, inside the enclosure provided by a tent, to conduct his business telephonically outside in a public space (until a nosy researcher interrupts…).

Infrastructure

The various infrastructural elements manifest spatially in many ways. Infrastructure starts with the mobile handset attached to body as calls are made in public space. The line between public and private can disappear in a moment and reappear once the handset is switched on. The corporeal is extended to include infrastructural elements that connect and transcend space.

Makeshift tables provide telephony amongst other services whilst municipality-provided stalls are used to do the same. Small branded trolleys have umbrellas attached to provide shade in the warm sun outside whilst containers are retrofitted accordingly whilst providing advertising. Infrastructure is provided by the private and public sectors determined by the dominance of services on sale. Phone services co-exist with other infrastructures: the battery operated haircutters used by the barbers in the tents that they trade for example.

FIGURE 8.6 Infrastructure *(Collage created in April 2010)*



Meanwhile landline phone booths stand empty or are left to rust. New kiosks (in blue and green top right) are unused in the same way that demarcated trading areas are left vacant in favour of more appropriately located sites near the foot traffic that provide markets for the range of goods and services on offer.

Reflections on ICT, Informal Trade and Space

The photographs portray land uses and spatial configurations indicative of a physicality linked to communication. Mobile telephony expands the repertoire of informal traders and allows for diversification of trade.

It also gives insight into a different kind of space; an in-between space where the private interfaces with the public; whether outside a street barber's tent, sitting on a stool in the middle of a public space or talking on a fixed handset at a makeshift table on a sidewalk. The line between public and private recedes as conversations are initiated and resumed after interruptions. Talk attracts talk as booths become meeting places and the chatter extends from the private conversation to the face to face public chat. For those seeking privacy, telephony is available in formal booth housed in shops – for which advertising is not necessarily that formal. All this activity is indicative of an urbanity celebrated in advertising on colourful billboards. The urban metabolism that Townsend refers to (2004) is increased through ongoing communication and talk in public space.

New spaces are created as 'old' infrastructures are discarded or neglected. Networked spaces of communication and voice transfer as they manifest in physical spaces sit on a formal-informal continuum. The explicit translation of digital technology into space is represented by internet kiosks and cafes, phone shops and physical evidence of ICT such as mobile phone use in public places. Internet Cafes do exist but are housed in private offices or shops. They are general formal businesses located in commercial and office space.

The addition of digital technology constitutes new land uses and economic opportunities. Some of this economic activity is highly informal and entrepreneurial such as the makeshift phone tables on street corners whilst others are multi-functional spaces such as libraries where internet access is available. The typology of informal ICT services range from the highly informal to the more secure locations in containers. If the informal



Figure 8.7 Telephony and the formal-informal spectrum

economy is seen as a continuum from the more to less formal, then ICT services occupy a number of points on that spectrum (as indicated in Figure 8.7 below). On the one end of the spectrum, phone services are advertised on sheets, offered on fold-up tables on sidewalks, a more formal representation is found in the kiosks and containers sporting service provider logos and internet cafes and phone shops in office buildings represent ICT in the formal sector. Throughout the continuum, ICT infrastructure remains formal.

Movement between these points is facilitated through physical movement but also underpinned by the social networks that enable participation in the city's activities. Communication between these physical spaces is facilitated through the mobile telephony that is imprinted on the urban dweller's consciousness through billboard advertising. The rental of the infrastructure that enables the sale of telephony services is facilitated through agreements with service providers or their proxies. Cellular technology is able to accommodate the varying physical configurations that best suit the trader and buyer.

The flexibility afforded by mobile telephony enables the appropriation that translates into new 'spatialities'. It starts with the body. The line between the corporeal and public is blurred; a private conversation links the individual to another space while he sits on a small tool in the middle of a physical place designated in front of a shopping centre. It extends to community…albeit transient community as pedestrians go about their business, stopping to make a phone call at a table with an umbrella located on a paved space and then extending the chat to an interchange with the vendor and fellow callers. The space can become private again as booths in shops allow for separation from the bustle of city life. Throughout this experience the ubiquitous availability of mobile telephony and an extended array of services is advertised; ICT enabled communication is never far away physically, or from our consciousness.

How technology appropriation interfaces with the social networks informal traders use to enable functioning and communication is presented in the following section.

8.4 Actor-networks, ICT and Informality

The shaping of the physical places and the network spaces that extend beyond that which was photographed is enabled through communication, mobilisation and information transfer. Data collected from the interviews with StreetNet Director and its web master together with the focus group interviews with street traders were supplemented by perusal of the StreetNet web site and newsletters. This informs the analysis of actor-networks that emerge from the relationships between actors and actants documented in this field work. A number of overlapping networks emerge and ICT through cell phone use and the Internet intervene, enable, translate and create relations in many ways.

8.4.1 Networks

Networks play a number of roles with their functions overlapping in a number of instances.

Advocacy and Support of Street Traders globally

The network facilitated by StreetNet operates internationally and links "Membership-based organizations (unions, co-operatives or associations) directly organizing street vendors, market vendors and/or hawkers among their members" (StreetNet International 2009). The StreetNet web site was established in 2001 by a staff member of the University of KwaZulu-Natal. A StreetNet staff member was designated in 2002 to manage the

site. The site is available in three languages: English, Spanish and French.

A number of core functions are ascribed to the site. The site contains a database of membership organisations, an archive and photo gallery. Publications include academic papers, reports and government documents and policies. The site also includes present and past newsletters of the organisation.

Mobilisation and Advocacy are important functions also. The site contains a number of notices of events and campaigns facilitated by StreetNet and membership organisations. Strategies for organising are also included as a resource. Events are used as kingpins for mobilisations, such as the FIFA World Cup and StreetNet's associated 'World Cities for All' campaign. News on events and particular pressing issues (such as the threat to the Warwick Early Morning Market) is included.

The site is used in conjunction with a number of other technologies to network and mobilise. Cell phones are used in conjunction with the web site; e-mail is often accessed through cell phones or through web sites. Technologies work in tandem with one another. The newsletter remains an important resource and according to the director, in remains the primary information dissemination resource especially to traders unable to access the Internet. Cell phones are often used in conjunction with the web site as initial news of a crisis is relayed to the StreetNet offices via SMS and then included on the web site. Events such as the World Social Forum provide platforms for web-based interaction.

The site was initially intended as a news and information resource but gradually adopted an advocacy function as connectivity increased and its potential in this regard became more apparent. The advocacy function is deliberate. Attempts to make the site interactive include the awarding of 'yellow' or 'red cards' to cities that are pursuing 'world-class city' status at the expense of street trader rights through online voting were underway at the time of data collection.

According to StreetNet staff, new networks are not created through the StreetNet web site but the site provides a platform from where members can engage in electronically mediated network activity. The site certainly enables the introduction of new members to StreetNet and its affiliates and it has facilitated the expansion of StreetNet's network base.

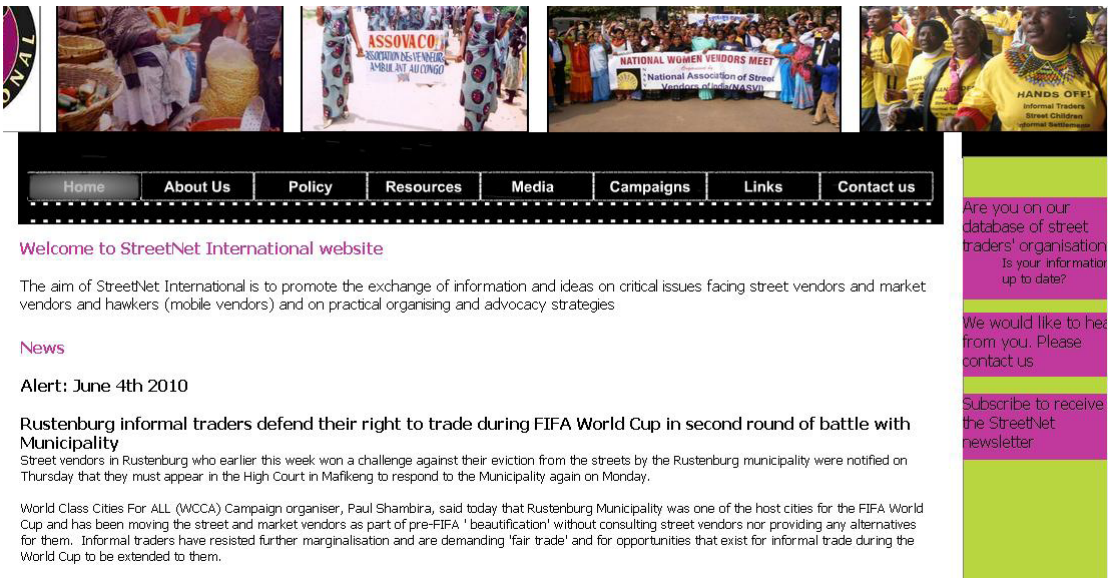


FIGURE 8.8 StreetNet web site

The use of technology in supporting the activities of member organisations is illustrated in its relationship with Siyagunda. The organisation assists in new barbers finding work (often trained by existing barbers who then share their business) and assimilating. As an advocacy organisation Siyagunda works closely with StreetNet in negotiating with local government structures. The organisation claims to be open to all nationals but most members are from the DRC. Meetings are arranged through SMS. Important news relating to conditions that affect the functioning of members is also relayed through text messaging.

Familial and kinship networks; Personal Mobility and Support

The interface between technology and kinship networks is influenced by a number of factors. Flexibility with regards to cost as well as technology is important. Traders lead transient existences and mobile telephony is best suited to communication on the move and when in crisis. A range of payment options enables access. Temporal aspects are also important. The moment when connections are made relates to the technologies available for tapping into networks. Sometimes this moment is very short and immediacy is a priority.

How networks overlap and where they intersect is best illustrated by following one particular actor and noting alliances and roles. Respondent 1 is a DRC National in his 40s who left the country during its civil war in the later 1990s. He had received training in agricultural engineering but visa restrictions constrained him from practicing his profession in South Africa. He worked as a street barber when he first arrived in Durban. Subsequently he became the founding leader of Siyagunda and now works part-time for StreetNet. His leadership status was enabled through command of English, his education and contacts with StreetNet necessitated by municipal harassment that required mobilisation.

…Have the presence of someone…[14]

The networks that these 3 respondents have encountered on this journey reach across scales and provide the means whereby space is traversed. How technologies are used reveals the many relational encounters in actor-networks. Cell phones enable the micro-relations of organising members of Siyagunda. Contact with loved ones in the DRC is facilitated through telephony, text messaging and e-mail. Information transfer during times of crisis is best served by the immediacy of SMS. At the time of the xenophobic violence in South African cities in 2008, text messaging was used to alert foreign nationals to the location of attacks and how best to behave in public places.

A hierarchy of technology emerged. E-mail is associated with distance, the more urgent an interaction becomes the more immediate the communication is that is required and cost becomes of lesser importance. International phone calls are made in emergencies. Cell phones also provided important forms of contact when war ensued in the DRC; SMS and missed calls provided to means to establish that *"…he is still alive"* (Focus Group A Respondent, 2008).

The choice of technology is also dependant on the nature of communication and what is available. Cell phones are generally used to SMS contacts and loved ones in the DRC. Internet use is limited by little or no connectivity in rural DRC; often electricity is not available to charge cell phones. Voice-over-Internet Protocol (VOIP) enables cheap phone

14 Focus Group A Respondent, 2008

15 Focus Group B respondent, 2008

calls at Internet cafes; calls translate to R1.50 per minute for Burundi, R2.50 – R3.00 for the DRC and R1.00 for the United States.

> *…People are living day to day*[15]

Business networks were found to be enhanced through the use of cell phones and the Internet. Street barbers use cell phones when they are away from their tents to check on business and also to make customer bookings. Communication between 2 barbers that work from the same site is facilitated, or in cases where they work alone, a neighbour could contact him/her when a customer arrives. Four of the focus group members were engaged in more than one trading activity: two offered translation services as well as hair-cuts, the third, Mr Bikombo, worked part-time for StreetNet also; a fourth worked as a car guard and entertainer. The mobile phone assisted in negotiated the different economic activities. In the case where members had more than one phone it was to save cost by using Sim cards from different service providers. Calling on one network was considered cheaper.

The use of Internet business purposes was not considered practical. Being away from trading sites for extended periods is simply too much of a business risk. Time is money:

> *…By the time you have found an Internet Café, logged on, figured out how to use and then sent e-mail, you have lost substantial income…people are living day to day. (Focus Group B respondent, 2008).*

Traders were found to rely mainly on pedestrian traffic for business; physical presence was therefore considered to be important.

Cell phones assisted in administering the networks that enable employment access and training. Street traders spoke of training new recruits and then sharing their business – cell phone communication enables keeping in touch and coordinating training schedules. The latter for example refers to car guards that are trained on quiet days in the week by more established ones. Cell phones help new immigrants contact acquaintances and find jobs.

Illegal business networks were mentioned but not elaborated upon. Stolen cell phones proliferate in the informal sector due to their relative small cost and the ease with which they are enabled through the purchase of airtime. At the time of field work Siyagunda had started an active campaign to warn members against the purchase of stolen goods.

Crisis networks

The process of network enrolment is sometimes fleeting and ephemeral. Fleeing war and/or uncertain economic and political conditions requires tapping into familial and kinship networks that are underpinned by tenuous circumstances. The short moment when a phone call is answered, a text message acknowledged or an e-mail exchanged can make the difference in determining choice or location when embarking on the emigration journey. The context of crisis insists on a quick coupling and uncoupling of networks as travel plans are made, unmade or remade on the basis of information exchanged across phone lines and cellular networks. The process of translation, where technology plays the communication actor in enabling connection, is associated with the purpose of communication at the stage of the emigration process. Two stories illustrate this.

Two respondents (participating in Focus Group A) described how technology assisted

them in contacting associates in establishing themselves in Durban. Respondent 2 first came to South Africa with the first wave of violence in the DRC in the late 1990s, Respondent 3 after 2005.

Respondent 2 used letter writing to establish initial contact with a friend of a relative initially, and then used a landline phone to make contact upon arrival in Durban. Respondent 3 used e-mail to make initial contact. This was followed by SMS to establish more specific arrangements once she was in Johannesburg and then cell phone calls to make her final arrangements to get to Durban. Interestingly, when she left the DRC her original destination was Mozambique due to the presence of a relative there. Durban was decided to be a more favourable option once she had made contact with friends of family whilst on the move (and in the absence of contact from her relative in Mozambique). The technology enabled her to remain in contact through SMS. Once she required a more immediate response when arriving in Durban, the phone was used to establish voice contact. Respondent 2 noted the fear and frustration that accompanied him on the journey, given the open-endedness of the communication. Respondent 3 acknowledged the empowerment granted by the immediacy of the mobile phone, its size made travel easy, and Sim cards were available en route. The translation process was more finely grained. There were more connection points between human user and technological artefact. The power that emanated from that exchange was associated with the extent to which the technology could be appropriated. As a mutable mobile (Latour's term) its malleability enabled the flexibility she needed to remain connected whilst working at survival.

The 2 focus groups were held early 2008, 2 months after a month-long period of devastating xenophobic violence in Johannesburg and Cape Town in particular. Mobile phones were used to exchange information on pending threats and location of incidents. Text messages provided information on how to behave on minibus taxis in order to not be noticed, and how to dress in order to avoid harassment. Web sites were used by certain members for updates from news sites and e-mails. Text messages were then sent to foreign nationals in extended networks to warn them of danger. Existing networks were used to exchange phone numbers and extend the reach of information webs. The crisis precipitated quick translation processes; goals were formulated, information gathered and the nature of information seen to be essential agreed upon. This was done on the fly, during crisis as required. The collective anxiety, the need for survival and urgency for information contributed to a temporary actor-network needed in that particular moment in time. Whilst this provided an important resource it also increased anxiety amongst foreign nationals (Bikombo 2007). The immediacy of information sharing enabled through cell phones is prone to impulsive text messaging and alarmist responses to small incidences, understandable given the volatility of the situation.

The heterogeneity of spatial relations was revealed. Temporal bounds circumscribed by particular events determined an enrolment of actors across physical space. Danger in physical space was real. Mitigating it across scales was considered essential for survival. The role of technology was to enrol actors across space, whilst engaging with the specificities of place. Not only are the elements that contribute to new spaces (even if they are tenuous and temporary) multiple in types, but the topological spaces circumscribed by actor-network interface with the topographical spaces defined by place. Law's notion of fluid space (1999) is appropriate here. Spaces of exclusion, of the other, were danger zones in terms of place. The fluidity extends to the topological spaces created through crisis.

8.4.2 Actants, actors, relations and actor-networks

The notion of the actant is indicative of the conceptual equivalence afforded to human and non-human actors in networks. Latour (1998) claimed that ANT is not about networks, not is it a theory; it is in fact a sensibility, an emphasis on relations.

Unlike the systematic deconstruction of the units that make up the action research case in Chapter 7, the smaller research population under scrutiny here allows for closer examination of the energy, the agency that arises from the relations between actants and networks. The collective agency that emerges from the interaction between actors in a network means that the network becomes an actor. This implies transformative potential. ANT refers to the concept of translation as the process whereby network relations are negotiated. This is important in practical terms. The actor-network that emerges could become institutionalised to the point of becoming a more general player in broader relations (policy making, advocacy for example).

Evidence of this in the field is documented by 'following the actor'. Each section examines the formation of an actor-network from the point of view of a particular actor as the starting point.

StreetNet

StreetNet is a network. It is also an institutional actor. An encounter with the UKZN Webmaster at a congress provided the seed for the idea of a web site. This collaboration led to the establishment of StreetNet.org – an actant that plays an integral role in the local and global advocacy role played by the organisation. The addition of web technology to this network resulted in a number of shifts: the addition of a new actor (the web site), redesignation of the role of a staff member (to maintain the web site) and a new function to be reported on, debated at staff meetings and accounted for.

The addition of the website to the network created a nested set of energies available to play a local, regional and international advocacy and information sharing role. Yet, respondents went to great lengths to emphasise the importance of the newsletter, SMS as well as e-mail communication as a package of tools for network members. News of local crises is often sent to the StreetNet webmaster by SMS; details are confirmed by e-mail and posted on the web site; leading to local action.

The malleability of scale depicted in the workings of these two sampled networks indicates the fluidity of movement across space facilitated by ICT. Practical issues persist, and often associated with physical constraints such as limited access to the Internet. The mobile phone is, again the bridging mechanism that enables physical and electronic movement.

Siyagunda

The narrative above describes the choice of technologies used and their relation to function, urgency and livelihoods. The use of technology to manage risk during crisis times is important. Privacy emerged as an important factor in this regard: respondents noted that in addition to the time, physical and financial constraints in using e-mail, lack of privacy in Internet cafes bothered them. Anxiety during the xenophobic violence was sometimes increased by too much information, according to one respondent.

The expansion afforded by a cell phone in particular plays an important role in the lives of street traders; one trader noted 'her best friend is her cell phone; she was without one

for a couple of days and felt like a sick person' (Focus Group Respondent, 2008 - translated from French).

Following one actor, Gaby Bikombo, chair person of Siyagunda reveals many of the iterations afforded through networks that include ICT. Initial contact was established through networks using landline and telephones. The agricultural engineer became street barber as mobile and street infrastructures were combined with the mentorship of an acquaintance from the DRC to create a street barber. Connections with fellow countrymen, the availability of cell phones and network interaction with StreetNet enabled the creation of Siyagunda. The combination of StreetNet's online and offline advocacy, Siyagunda's mobilisation and mobile phone technology makes ongoing agency input into advocacy work. Translation as actor-networks stabilise through the allocation of roles and entrenchment of systems and procedures allows the actor-network to become an actor with agency. The relationship between Bikombo and other barbers from the DRC in the face of oppositional practices from another actor, the eThekiwni Municipality, contributes to the creation of Siyagunda for example. Mobile phones provide the communication capacity that enables ongoing community between spaces and within the 'space' of oppression.

Interestingly, all four actor-networks depicted above 'gelled' in times of crisis. The first was precipitated by the war in the DRC, the second by Diaspora needs for employment, the third by harassment by the metropolitan municipality and the fourth was the recent xenophobia crisis.

8.4.3 The need for Co-Presence: Advocacy, Mobilisation and Crisis

The role played by crisis situations in mobilisation actors and networks, and in some cases creating actor-networks that play durable roles in ongoing crisis management is illustrated above. The special case of street traders from the DRC illustrates the extent to which fragile livelihoods are best accommodated through flexible, mobile and accessible technologies. These technologies are best appropriated when it suits livelihoods illustrated in extreme contexts such as severe crisis. A number of pertinent issues need to be highlighted here when related to larger questions of ICT and urban spaces in Durban and elsewhere.

Mobility

Street traders face uncertainty of place; much of their livelihoods are dependent on the ability to be mobile: adjusting trading spaces to foot traffic, clearing a space in the face of harassment and negotiating daily life with friends, family and colleagues. Mobility is really important to the street barbers; they have to be on site because they rely on passers-by trade. Thus e-mail is just not practical during the day. Street barbers also use cell phones for customer bookings, and to check their sites if they are away from it. It allows for contact between car guards; between supervisors and co-workers on coordination and alerts.

Respondents acknowledged this with regards to the functionality enabled through cell phone use:

> *…You have contact on the go …*and *Let people know where we are, where we are going and where to find the best people for that location. (Focus Group A Respondent, 2008).*

The preference of cell phones over e-mail also relate to the fact that phones and private and discrete whilst being mobile. Within a context of uncertainty and angst, especially

when first entering the country, the mobile is indeed the 'best friend' that allows for connectivity in transit.

Co-presence and the malleability of space

The 'always on' aspect of mobile telephony provides a secure space for members of a network in insecure surroundings. The notion of co-presence denotes the function of being present digitally but not physically. When loved ones in the DRC are in danger, when colleagues in Durban are under threat or when police harassment continues in Nairobi, a digital presence allows for mobilisation and support.

A correlation exists between choice of technology, function and urgency. The need for immediate contact, enabled through cell phone calls is a luxury, especially where prices increase over distance. VOIP calls are cheaper but not practical when there is an emergency since they are only available in Internet Cafes. SMS messaging provides and immediate and informative alternative. E-mail plays the role of a letter: introductions to relatives across countries, news from home and bulk messages containing important information needed in detail are choices of functions. Two respondents (in two separate focus groups) indicated that technology enabled through cell phones provides a barometer of relationships: a 'measure or indicator of love' as digital presence accords interest.

Advocacy, Mobilisation and Events

The advocacy function of StreetNet is enhanced through StreetNet.org but supplemented by other forms of communication: the newsletter, e-mail and text messaging. A core factor in mobilisation online is working towards an event in space such as the World Social Forum, Anticipation of an event and organizing around that is important. The World Social Forum is an example; as is the FIFA Soccer World Cup and the 'World Class Cities for All' campaign associated with that. (Online meetings are important however, as those attended by StreetNet in preparation for the World Social Forum.) Sometimes a crisis event in space precipitates engagement, such as the Warwick Junction conflict.

The role of face-to-face interaction remains essential (such as anticipated meetings at events). StreetNet leadership met UKZN web designer at conference and he offered to create a web site; all parties realizing the importance of a site in advocacy. StreetNet staff meeting every Monday where web site is discussed; surveys been done thrice; the addition of technology increases the need for face-to-face interaction.

8.5 Conclusion

This chapter examined existing networks and the ways through which material actants are enrolled into those networks. The roles ascribed to ICT, the ways through which mobile phones, computers and other artefacts are incorporated into the lives of these marginalised groups is contingent upon livelihood strategies. The immigration and assimilation process of foreign traders was punctuated by stages, each associated with different dimensions of technology use. Strategies that focus on everyday survival require tools that are malleable. The research found that the flexibility, immediacy and affordability of the cell phone best suited informal livelihoods.

The field work shows the appropriation of space through use of ICT extends from the private spaces created in public through mobile telephony and the nodal points create through telephony and other sales. These small physical transformations are important contributors to city life. The networks documented in this field work all contribute to

transformative spaces that allow for the individual to exercise agency. Thinking about urban transformation could begin with a different set of spaces in mind. Not only can the same spaces be contingent upon the actions of different associations, but "….differing spaces can emerge from the same networks….within these networks such spaces can shade, dissolve or flow into one another" (Murdoch 1998: 364).

Physical space is important to the informal trader; service is provided to footloose traffic and mobility is essential. Not just the ability to move however, but the ability to remain connected whilst moving; not just connected to clients and co-workers, but to friends, family and loved ones in other spaces. The notion of co-presence is vital to the foreign trader, as s/he remains a part of many spaces across physical boundaries. How movement across that space is negotiated depends on cost, livelihoods and the communication codes that inform modes. Space matters, as a resource, as livelihood and as a point of negotiation with other actants are the subject of ongoing negotiation. Mobile telephony contributes to the flexibility to achieve this. Internet use relates to a more grounded and solid form of communication; when something has to be documented articulated and explained.

The addition of technology to networks enables new actor-networks that stabilise, translate into dynamic entities that carry agency in the world of the marginal. In the absence of the usual resources, under the tyranny of misguided and ill implemented city policy, actor-networks evolve quickly. Mobilisation becomes meaningful when the event or cause is defined. And in the world of the informal, there are causes aplenty. These threats, these displays of power, provide the impetus for actor-networks to translate into actor, and carry agency. The addition of ICT enables a malleability of space, and a temporal awareness that makes meaningful input into mobilisation. Power is translated into further actor-networks. This power is potentially transformative. The question perhaps is to whom.

New networks are created by ICT but only insofar they merge into actor-networks that translate and stabilise. For example; no new networks were created by the StreetNet site but it provides a forum for existing networks to function and multiply as combinations of actors rally around a particular cause. Functions of technologies change as the roles of actants and the agency carried by actants evolve. The StreetNet web was initially created as information resource but later adopted advocacy qualities (it was created before the days of web 2.0). The advocacy function has now become deliberate and is a key informant of civic interaction in Durban.[16]

In conclusion then, the addition of ICT to informal networks has become a key enabler of livelihoods and mobility. The latter is an important factor; space becomes background to relationships, romances, work arrangements and travel plans. The life of the informal trader is precarious. Social networking is important as is the support enabled through advocacy. Technology assists in both. It also leads to a metamorphosis of both as actor-networks evolve and translate. Somehow these processes are precipitated and in many cases accelerated through crisis which in many cases deepens networks and expands networks across spaces. Where the INK case in Chapter 7 needed a well functioning network to receive technology, informal networks increase in efficacy in volatile contexts. Actors are

16 At the time of writing the Warwick Junction conflict led to the formation of two online groups on Facebook, (one with over 1000 members across the globe) several YouTube videos and an SMS campaign. The local became global and local again as picket action evolved from online mobilisation.

created through actor-networks in these times as the translation function speeds up due to necessity. The mobility afforded by digital technology, ironically, enables the grounding necessary to defend space.

This chapter concludes the reporting on field work. The 3 cases explored the nuances and functioning of ICT in actor-networks. It examined the policy space in relation to household access in metropolitan Durban. The process of web development delivered insights into the introduction of material actors into community groups. Examining the use of ICT by informal traders provided insights into the appropriation of technology as ongoing inputs into the day-to-day lives of marginalised groups. Chapter 9 contains an analysis of all the field work and reports the key findings that contribute to a cross-disciplinary understanding of ICT and urban transformation.

9 The South African City and ICT: Insights and New Perspectives

Throughout the relationship between society and technology reviewed in Chapter 2, technology is seen as powerful, a little foreign at first but seemingly able to transform and shift paradigms. The evolution of the relationship between human and machine is punctuated with declarations of renewal and modernist progress. Adoption accompanies other societal changes as scientific outputs are embedded and translated by context. Uses for which innovation was not intended, such as the appropriation of the telephone for social purposes by women in the early 20th Century, and the popularity of text messaging, show that appropriation cannot always be predicted. Societal change is complex; the interface with material artefacts is relational. Technology does not cause anything; that determinist notion has been firmly debunked by this and other research. The interesting insight here is how the individual adopts these tools, how this leads to further innovation and what the broader impact is, or could be.

Despite the ability of society to adopt and appropriate technology, access has been, and still is, uneven. The 'right of entry' is influenced by structural factors. More recent work on digital divides also acknowledges ethnographic dimensions and the impact on Ideological agendas; literature on the historical distribution of networked infrastructures in Africa shows a close correlation between the agenda of Empire and location of investment. Today, access to ICT is mediated by the cost and availability of infrastructure, education and socio-cultural barriers. Those constraints extend to impressions, suspicions and fears. What is interesting is why some technologies are appropriated, and others not. Innovation is linked to adoption, lifestyles and livelihoods; the lens through which best to understand this dynamic was examined in Chapter 4.

Chapter 2 concluded on the essential urbanity of technology, discussed in detail in Chapter 3. Compilation of this review entailed combining debates on ICT and cities, mostly located in the north, with consideration of African and South African cities. Metropolitan inequalities are perpetuated by networked infrastructures whilst new patterns of exclusion emerge. Urban splintering best describes the spatial configuration of clusters of wealth able to function in disjointed isolation from the surrounding urban fabric (Graham and Marvin 2001). Recent literature challenges the applicability of this thesis to the southern context. Many cities in developing countries are splintered, rather than splintering as a result of historical legacies in infrastructure decision-making not neo-liberal market trends (Kooy and Bakker 2008). It is nevertheless important to consider the roles played by various actors: the capacity and willingness of government to accommodate even access, related policies such as housing and control over urban development, and access to land (Coutard 2008). In the South African context, pro-poor policy discourses advocate the very modernist ideal that Graham and Marvin (2001) contend has been replaced by neo-liberal differentiation. Nevertheless, the spatial manifestation of splintering is discernible. This is confirmed by this research. There appears to be an unexplored middle ground here; the policy interface between public directives and private investment.

How best to achieve the necessary framework (and what is necessary) for progressive private intervention within a comprehensive public framework? This research shows that whilst policy ideals for ICT in Durban speak of inclusion, interrogation of practice indicates an interpretation of empowerment that extends directly to business, assuming a trickle down to the masses.

The literature reviewed included the relationship between ICT and livelihood strategies, largely confined to literature on community informatics and development studies, but fail to engage with the larger theoretical questions on urban exclusion. Efforts have been made to link this with theory (Schech 2002). Whilst earlier work on technology in developing countries tended towards a technologically determinist stance celebrating its transformative power, later work provided a more critical engagement that exposed the digital divide as a subset of structural global inequalities. Studies of grass roots strategies to bridge the digital divide are available but are not necessarily placed within a framework of urban life in Africa. The points of connection between individual livelihoods, their networks and larger city processes are enabled through communication and mobility. A geographical reading of the networked infrastructure that enables this tells only part of the story. The field work reported on in chapters 7 and 8 indicate that the there is variation in the transformative potential of ICT; that it is highly contingent upon the functioning of networks, enrolment of actors, processes of translation and structural factors such as access. Quite what determines and enables appropriation is related to the nature of technological artefacts as much as it is associated with the functioning and composition of networks

ICT differs from other networked infrastructures in three significant ways. One, not only does the digital arena enable communication, but it facilitates transfer of data. The formats of this data have expanded as convergence and innovation broaden this range. Two, ownership and institutional arrangements are finely interwoven with private sector agendas. Three, the articulation of technology is meaningful at a human scale. The Internet broadens and expands human experience; the computer is integrated in the many dimensions of day-to-day life (Williams and Dourish 2006; Dourish and Bell 2007). It is this third quality that emerged as being particularly poignant in this research. Technological appropriation towards meaningful urban encounter was closely tied to the human scale. These small transformations are meaningful and relate to the overall thesis of this research.

9.1 The Scope of Research

Three research questions were asked. The first was broad: does technology enable urban transformation in Durban? The particularities of ICT infrastructure yield a particularly messy market terrain and are linked to a range of agency agendas, not entirely disconnected from the problematic past of South African cities. In understanding the relationship between digital technology and urban transformation in Durban, a second question was: who are the actors that play a role in ICT in Durban and what are the relationships between them?

Strategies are sometimes employed (often inadvertently) to exclude and marginalise, but the networks that connect and disconnect are important livelihood arteries for those at the margins. The third research question centred on the extent to which ICTs facilitate these strategies: how are digital technologies used to reinforce the social infrastructure and networks employed by the marginalised in Durban?

Chapters 2, 3 and 4 informed the hypotheses examined in this research. The first hypothesis posits that the role ICT plays in transformation is limited; distribution does not cause fragmentation in South Africa cities, but deepens it. In answering the question, why, the thesis is that the extent of this dynamic is tied to the agendas of the many actors that influence policy and location of investment, as well as the nature of the ICT industry. As an actor, closely tied to policy and local dynamics (given South African constitutional imperatives), local government is well placed to address market imbalance as part of its larger goals towards achieving meaningful urban change. Actors outside the realm of big business and government are influential in enabling ICT access; the relationships between them are defined by networks (which often include public actors) that impact on city change and transformation at all scales. The important fact to consider is that the motives for these network relations are not necessarily aligned towards broader transformative goals.

At a local level, the appropriation of technologies by individuals within a network is informed by livelihood strategies and priorities. The roles that digital technologies play in social networks are socially, culturally and contextually informed and have a bearing on power relations. Recent works on virtual and social networks, as well as work on associational networks in cities that tend towards a more ethnographic understanding of urbanity inform this view.

Chapter 4 explored Actor-Network Theory (ANT), the body of literature that reflects the sensibility, the approach to this research. Its methodological implications were incorporated into Chapter 5. The choice of ANT as a conceptual frame related to the following elements: symmetry, independence of scale, translation, agency and power.

The ANT principle of symmetry requires that technologies be treated as actors ('actants') in a heterogeneous network. This allowed for a more nuanced approach to understanding that revealed what happens when technology is either the focus of a network (mobilisations around ICT policy for example such as the StreetNet case) or when technology enters a network (the web development processes). Treating technology as an actor revealed the agency that emanates from the relationships between human and non-human actors.

ANT argues that the network defines the space in which enquiry takes place (Murdoch 2006). Spatial conventions that separate the regional from the local are insignificant and inappropriate. By following the network, the spaces of actors were revealed as they pertain to a particular dynamic, as seen in the work with Siyagunda. Thus, discrete spaces are relationally tied together across space, a much more useful approach to understanding technology and cities given the diversity of points of articulation of ICT encountered in the three cases examined: on the body, in the local neighbourhood, in the city and the metropolitan region.

The notion of translation in ANT refers to the negotiations and processes of stabilization that take place in assigning and negotiating roles of various actors in a network. Foucauldians would refer to this process as discourse formation or the evolution of discursive practice. The ANT view allows for a more dynamic view that warns of the dangers of embedded practices and the emancipatory potential of stabilisation processes. The entry of a new actor could destabilize a network. Once the actor-network is stabilized it becomes an actor. Thus agency, in ANT, is not an outcome of structure, is not endemic or implicit, but an evolving function of the actor-network. Given the concern

with transformation in this research, this angle allowed for a more hopeful understanding of human agency.

The notion of power in ANT is similar to that developed by Foucault. Power is seen as a dynamic force where complex alignments of heterogeneous elements contribute to forces operating outside the confines of the network. Uncovering the spaces of resistance within contexts where powerful coalitions tend to the hegemonic was the aim of this research. How technology as an actor could enable this was uncovered in the work on StreetNet.

The methodology outlined in Chapter 5 was designed to allow for a layered enquiry with an ANT sensibility. Three cases were studied: the Durban metropolitan area, where a mix of quantitative and qualitative methods was used to uncover the actors and networks implicated in the city. The second case focused on the process of web development in two township areas that form part of Durban's area-based management (ABM) system of decentralized governance: Inanda-Ntuzuma-KwaMashu (INK) and the Southern Basin (SB). The third case considered informal traders operating throughout the city, but in particular in the Central Business District (CBD) and Isipingo (both areas are also part of the city's ABM). It examined the experience of StreetNet and Siyagunda.

Empirical understandings and theoretical insights are titles that best categorise the conclusions of this thesis. The field work told a number of stories that converge around a number of themes. These themes relate to the research question-hypothesis clusters. This work contributes to three propositions following in (9.3) that encapsulate the theoretical contribution of this research.

9.2 On and off the map: empirical insights into the relationship between ICT and Durban

The research was concerned with ICT and urban life at varying geographical scales. Metropolitan change was considered in Chapter 6, and more specific experiences were documented at a local scale. The epistemological point of departure is that scale should not matter conceptually. The relational perspective enabled through use of ANT concepts enabled the exploration of thematic relationships across space. This is the approach taken in this last chapter. Sets of issues surrounding research questions are explored in relation to the hypotheses. This interrogation is based upon the findings documented in Chapter 6, 7 and 8.

9.2.1 Here, There and Everywhere: Physical and Policy Spaces in Digital Durban

A number of key findings emerged from the work on metropolitan Durban and ICT reported in Chapter 6. Many of these represent a continuation of earlier phenomena noted in the literature; spatial fragmentation and clustering of the service sector in decentralised nodes. ICT correlates with the northern trajectory of Durban's commercial expansion in two ways. It enables the spatial decentralisation that couches edge city development, many of the firms that establish themselves in Umhlanga and La Lucia Ridge are associated with the service sector best served by ICT; the new airport incorporates an ICT-enabled trade port 30kms north of the city (King Shaka International Airport and Dube Trade Port) intended to augment the role of this new node as an international hub. These features are supportive of the 'splintering urbanism' thesis, but also a function of other factors that influence location: the role of a major private sector player in releasing land for development (Tongaat Hullett Properties), the geographic legacies of Apartheid

Durban and the location of transport arterials. Efforts have been made to correct these uneven geographies as shown in the investment in INK, the Bridge City development as well as ongoing work in the SB. The field work on Durban supported two recent challenges to the splintering urbanism thesis: public policy often seeks to correct these infrastructural imbalances, albeit at the planning stage in many cases, and Durban was in many respects splintered before the neo-liberal economic trajectory further influenced infrastructure distribution.

Split Agendas not Splintering Urbanism

A second correlation arising from the field work concerns the relationship between ICT access and investment patterns: the 'splintering urbanism' phenomenon. Spatially referenced data was used to determine the relationship between urban investment in Durban and access to cell phones, computers and the Internet. ICT access correlates with private and public investment trends. This is most prominent to the north of Durban. Highest metropolitan access is discernible in Umhlanga Ridge where considerable public and private resources have been invested to support the city's growth trajectory to the north. Essentially ICT corresponds best with patterns of investment in the areas favoured by apartheid. This also accords with household incomes; ICT access is higher in these areas. Public driven investment such as that discernible in INK is not accompanied by favourable ICT access. Durban is indeed splintered; local government efforts to address market imbalances are not reflected in ICT access patterns.

Quantitative findings were considered in relation to data gleaned from policy documents and interviews with key actors. The purpose was to determine how eThekwini's ICT policy addresses infrastructure distribution and to understand its underlying objectives. The role of eThekwini municipality is crucial here. An increased interest in the new international airport to the north of the metropolitan area and growing strategic planning for development to support this is apparent in the last three municipal Integrated Development Plans (IDP) prepared for the city. As the actors, actor-networks and their agencies are revealed in this research, it emerges that this statement also holds with regard to 'smart city' imperatives. Interrogation of the 'policy space' of digital Durban revealed a strong local government role, supportive of selected larger strategic city objectives.

The Durban ICT policy space consists of a number of layers. The outer layer contains the strategic elements that are intended to be supported by technology: e-readiness for FIFA 2010, positioning Durban as a worldwide destination, a globally competitive city and attracting skills and expertise in the tertiary sector. As part of its agenda to diversify and expand the economy, IT is seen as an important component of the service sector. The next layer constitutes city infrastructure; developing the city's fibre-optic backbone. Stage one connected all municipal offices; stage two will expand the backbone to the rest of the city through private expansion. An inner layer incorporates a more developmental focus through Local Economic Development (LED) interventions facilitated through SmartXchange, the IT incubator.

Constant references to the digital divide and technology inequalities imply a community focus. This was not revealed in implementation, however. The assumption was that broader community access will be enabled through the private sector. The initial focus included making Internet services available in community centres and libraries; this was no longer a focal point of the city's ICT strategy. Unevenness with regards to web site functionality is also evident. Users (albeit from a small sample), generally middle class

and employed, use www.durban.gov.za for general information and access the Internet at work. Seeking information on public transport on the site would be difficult if you are not a tourist using the 'people mover'. The site is not constituted for developmental use but it plays important e-government functions.

The eThekwini Council managed to negotiate a strategic approach in what was initially a hostile national policy environment and difficult market terrain. The overall thrust of the suite of ICT interventions is on local business and capacity. SmartXchange is a success story that owes much to strong leadership within the city (including the City Manager), visionary direction from two directors, and a balance between autonomy in selection of incubator firms, internal operational systems and city facilitation. Although not its initial role, it is seen as the enabler of the eThekwini's ICT policy, particularly for its objectives in attracting IT skills to the city and promoting Durban as a lifestyle hub for professionals. ICT was considered an essential part of networked infrastructure: necessary in enabling and leveraging investment.

There are some contradictions that emerged from the research. Much of the rhetoric is developmental: newspaper reports spoke of overcoming the digital divide, enabling integration in Durban, while interviews revealed endogenous solutions and ubiquitous access as priorities. The policy landscape revealed a strong reliance on the private sector. Civil society organisations were conspicuously silent in these processes. StreetNet's on – and offline advocacy efforts were internally driven and often organised in opposition to municipal strategies.

There were opportunities 'lost' as well as those unimplemented observed in the research process. Development of a school environmental advocacy web site in the Southern Basin was intended to link with Southern Durban Environmental Alliance (SEDCE) initiatives, which did not transpire. FIFA-related ICT objectives evolved mainly around city marketing and e-readiness. One of the networks outlined in Chapter 6, the Rising Stars Soccer Club, sought web presence in order to facilitate publicity and visibility. An opportunity existed for using the FIFA 2010 moment to enable online promotion of community football clubs, for example.

Absent also were efforts to marry ICT policy with decentralisation of governance. The eThekwini web site is a valuable information resource; research shows, however, that most respondents surveyed were educated and able to access the Internet at work signifying limited grass roots community reach. Marrying smart city objectives with decentralisation approaches such as ABM was absent. An opportunity existed for using developments such as the Bridge City Node in INK to attract high quality IT access and distribute it accordingly. The marketing literature for the development revealed no ICT dimensions despite claims in an interview that Bridge City was an opportunity for attracting IT sector investment into the INK area. The strategic objectives of the INK project, for example, evolved around integrated governance and infrastructure investment. Examination of the web site shows no mention of the INK URP/ABM or any of the INK community organisations. The opportunities for ICT as focus of investment as well as enabler of decentralised governance were under-explored. Furthermore, ICT infrastructure was limited in the municipal office in KwaMashu despite efforts to expand the fibre backbone to all member offices. In INK and SB, student web developers reflected on their need to build capacity, 'helping' and 'assisting', yet were frustrated by limited computer literacy and inability to engage with their expertise.

Despite the transcendent potential of ICT, physical barriers were encountered in the research. In INK, in particular, training was frustrated by the cost of transport to the Digital Hub, as libraries and community halls with computer access were sparsely distributed and internet connectivity at the Digital Hub was intermittent. In SB, access to the school computer laboratory was restricted and library hours did not allow for after-hours access. The work with street traders revealed an uneasy relationship with Internet Cafés. Leaving a trading site where income is reliant on physical presence was considered simply incomparable with visiting Internet Cafés. Furthermore, privacy was raised as a concern, particularly after the xenophobic attacks. Personal communication within a public environment was considered risky and uncomfortable.

To be seen … to be heard, and to disappear

A correlation emerged with regards to the relationship between informalisation and availability of telephony. There are three dimensions to this: street activity in Durban has increased and ICT services are provided as part of this activity, either solely as a stand-alone service or as an extension of existing trade. The sale of telephony sits on various points of the informal-formal enterprise continuum. Secondly, street traders rely heavily on mobile phones (and sometimes the internet) to conduct business, stay in touch with friends and family and as tools of survival in times of crisis. The network space that is created through such interaction goes beyond country boundaries. Third, StreetNet, as a social movement that supports street traders worldwide, and based in Durban, use a combination of its web site and mobile telephony to mobilise and disseminate information.

Whereas foreign street barbers welcomed anonymity, some of the INK and SB web design participants sought it through their web sites. The community web sites were seen as an opportunity to become part of a global conversation. Aspirations were tempered by fear and misunderstanding of cyber space, however. The network capacity of the net, the typologies and reach were found threatening in some cases. Certainly eThekwini's ICT policy was primarily concerned with visibility, enhancing Durban's status as a global city. Mobile telephony was used by informal traders to become invisible during the xenophobic violence.

The very same respondents that displayed discomfort with computer technology were adept at using mobile telephony. Simply put, ICT access is dominated by cell phone access. Private individuals use flexible payment options provided through private service providers to access telephony. Community services are enabled through less formal to highly informal provision of telephony through phone shops and kiosks. Local government has nothing to do with these interventions. Central government policy requires mobile phone service providers to enable some community intervention. That is the extent to which the state is involved. New spaces have evolved as phone shops become meeting places and side walk fixtures (discernible in INK and Lamont). Often these services are accompanied by other services and goods. In many cases, they have become nodal meeting points. The Digital Hub in INK is called a hub for exactly that reason. It is, therefore, curious that these energies are not harnessed for a development such as Bridge City – intended to 'connect' INK to its metropolitan context.

In summary, ICT does not increase polarisation in the Durban metropolitan area, but follows current patterns of spatial fragmentation that are informed by investment decisions of private actors and the enabling environment created by local government. ICT policy

purports to support inclusion, but the policy focus is essentially outward looking with some local focus in terms of backbone infrastructure provision. The latter is reliant on the very same market energies that underpin current inequitable access. Yet, the market has enabled the leapfrogging phenomenon identifiable in cell phone distribution (as opposed to land line telephony) in remote parts of the metropolitan area. Part of this is facilitated through the nature of cellular networks that can be reticulated despite topographical constraints. The regulatory environment for mobile phone companies is not less contentious but it is less difficult to negotiate. Business models allow for flexible payment options whilst government insists on community outreach. Essentially what emerges is a regulatory environment that allows for private telephony choices from a range of options. These choices are not inexpensive for lower income earners, but they allow for choice that enables personal expression and communication together with connectivity. The dominance of mobile telephony is not just due to availability of infrastructure. Handsets and cellular networks enable seamless travel from the corporeal to the neighbourhood and beyond. This would not be possible without the constellation of actor energies and agency agendas that allow for ubiquitous adoption.

9.2.2 'Where the Action is'[17]: Actors, Networks and Agency

The roles of actors and the agency created through relationships between actants and actors (and the possibility of how these relations become actors themselves) were discernible in all three sets of empirical work. Durban's northward trajectory was not an accident of land use. Relations between the Tongaat-Hulett Group, the city's biggest land owner, and the municipality have facilitated the northwards investment trajectory. ICT was implicit as part enabler of decentralisation, whilst the IT industry is well represented in Umhlanga Ridge. Dube Trade Port is not located in the eThekwini municipal area but its reach will nevertheless have a substantial impact. Networked infrastructures were focal points in the city's spatial strategies (transport linkages, 'investment corridors', King Shaka International Airport) whilst the fibre-optic backbone was intended to facilitate digital roll-out across the city. ICT features as facilitator of investment, growth and development; this emphasis became more pronounced with each iteration of the Integrated Development Plan (IDP). The broader theme in relation to this thesis is the role of local government in negotiating the arrangements that have such profound spatial implications. The incorporation of ICT as actor was the emphasis of this research.

The increasing prominence of technology in governance led to the establishment of the Geo-information and Policy Unit in eThekwini municipality as the key strategic policy unit. The Unit, together with the municipal manager engaged private sector actors from the beginning of the formulation of the ICT policy. Interviews revealed negotiations between role players such as the EMA and Microsoft, and the ongoing battles with TELKOM with regards to control of bandwidth. Early documentation on ICT strategies revealed the strong institutional commitment to partnerships with the private sector and communities. The EMA was in a powerful position with regards to the former; the existing infrastructure enabled expansion into a broadband framework, used to leverage support from the private sector. Thus, the former alliance works well; the latter is markedly absent.

17 Title of book by Paul Dourish on the interactive aspects of computation: Dourish, P. (2001) Where the Action is: The Foundations of Embodied Interaction. MIT Press, Cambridge.

Technology and Networks

Two prominent networks were examined. SmartXchange was established as an incubator by the eThekwini Council and has become an important regional player in technology development. Internal relations and management allowed for networks within networks as participant firms were encouraged to caucus as a collective. The 'skills corridor' referred to by the SmartXchange CEO in an interview entailed an e-learning platform for small entrepreneurs. It is also an appropriate metaphor for its growing influence beyond the confines of its offices in central Durban. A large part of this initiative's success was the balance achieved between operational autonomy and firm support from eThekwini. The sense of ownership that accompanied this arrangement and the varying roles played by various actors within the ambit of a common goal of profit motive and ICT promotion enhanced the functioning of the network.

StreetNet was investigated as an example of a civil society network using technology to its advantage. Here, alliances with the University of KwaZulu-Natal, network formations shaped in relation to a common underlying concern – the protection of street trader rights – and using other technologies to augment relations, put it in a powerful position.[18] Of interest is the use of other technologies in conjunction with the Internet. The distribution of a paper newsletter was still considered important. The use of mobile phones to relay information in real time to the webmaster and ongoing updates both ways, i.e. distribution of information via e-mail to cell phones and via cell phones to the web site, ensured that StreetNet member networks stayed up to date and acted accordingly.

Other Actants

The use of Metro-Beat, the eThekwini newsletter, to promote the city web site revealed the importance of 'older' technologies. Electricity was seen as an early catalytic role player in enabling VOIP and providing the launch pad for more sophisticated technologies first touted in 2006 and the use of print media to promote www.durban.gov.za is another example (it was first mentioned in 1999). Analogies of libraries and books were used to explain the Internet to participant organisations in the web design exercise. Actants co-exist in networks; one technology does not necessarily replace another.

The StreetNet web site and SmartXchange examples indicate the extent to which networks can be enhanced, expanded and in the case of SmartXchange created. At a local level it emerged, however, that simply adding technology to a collective did not lead to the creation of a network. The relations between other actors and technologies were essential in enabling networks. Networks needed reasons to exist in the first place; simply introducing technology to solidify shared interests was not enough. Those reasons, the underlying objectives, do however expand and change when actants are introduced. The terms of engagement varied also. For example, the two networks created in INK (for the web design project) lacked the cohesion and actor energies to function effectively. Offering web site services was not enough. The actual human actors were crucial to more effective functioning particularly in the other two cases in INK. Efforts to use the web design process to solidify fledgling networks were simply unsuccessful. Reflections through interviews indicated this loss of potential as due to a number of factors: lack of leadership in following through on the web initiative objectives, conflicting agendas, limited computer capacity, technical difficulties and lack of a common goal. ANT would refer to this as an incomplete translation of the actor-network.

18 At the time of concluding this thesis, StreetNet was in the process of conducting a census of street traders in Durban, enabled through funding from the Gates Foundation. The information is intended to inform oppositional practices in relation to what is considered repressive practice towards traders

Co-presence and Events

It is worth dwelling on the notion of co-presence and events as contributing to network formation. Events were important fixtures in motivating action and investment. They were also important hooks for mobilization. Interviews with StreetNet actors for example, indicated an emphasis on specific moments as catalysts to advocacy. Whilst the role of civil society is not terribly clear in city policy, the role of organisations such as StreetNet and SEDCE in the Southern Basin was enhanced through the network capacities of ICT in enabling action. This action was often informed by specific events. Focus groups with street traders raised the importance of cell phone connectivity in mitigating xenophobic violence in 2008. The transmission of information on these events as well as the connections necessary to respond was facilitated through ICT, albeit temporarily, in the street trader case. The annual ICT conference convened by SmartXchange was considered an important fixture for expanding and solidifying network relations.

Some actors were more dominant than others. In some cases this is constructive such as for the formation of the project in the first place which was the outcome of network relations between the researcher, the EMA ABM office and the project leader in INK; in other cases it can undermine through power relations such as that identified in the craft network. Power in ANT is potentially a resource, an outcome of actor relations that can be used constructively. Harnessing power can have positive outcomes but can also impact on the relations between individual actors and technologies.

Dominant Actors… and Actants

A partial objective of the research was to reveal the various roles played by actors. Local government and central government agencies played an enabling role, with networks between them creating spaces for more localized intervention. Interestingly, the two constellations that emerged constitute two very different partnerships. The relationship between the INK ABM and EMA translated into intentions to enable ICT access through the provision of backbone infrastructure, and networked connectivity through transport linkages in Bridge City. The latter also involved private actors. eThekwini municipality played an entrepreneurial role in using its infrastructural resources in mobilising private sector support in achieving public objectives. The individual actors were important as exemplified in the leadership role played by the municipal manager and the manager of the Geo-Policy Unit. Partnerships between local government and the private sector are important as shown in the case of SmartXchange and negotiations with Microsoft around city software. Negotiations between TELKOM and local government around VOIP are contested whilst those around the infrastructure necessary for the FIFA World Cup appeared to be more constructive (but were difficult to judge given the timing of this research).

Relations between civil society organisations and government were unclear and could be considered a weakness of the eThekwini ICT Policy. In some cases it was fraught with difficulty especially with regards to advocacy in the case of StreetNet. Advocacy and more regional involvement as facilitated through ICT were shown in the use of the StreetNet web site and connections between traders from the DRC and their relations in their home country. The one NGO that was strong in the web development process was the INK Digital Hub; it provided the location for training and its director and staff were very supportive. The agency of individual actors was important: the director of the Digital Hub, the leader of one of the INK community organisations and her appointed proxy for the web development process, and the leader of Siyagunda as well as the director of StreetNet.

The community networks enrolled in the web design processes varied in type and efficacy. Strong leadership and a clear mandate were factors that contributed to the reach of organisations such as Bambithuba and Thembalihle. Technology additions were discernible in increased use of cell phones to organise and mobilise, but the web design process yielded limited results and simply did not encourage follow-through.

Relations between civil society and the private sector translated into interesting scenarios at different scales. The case of a private sector actor that provided the very technology (in the form of a school computer room) that was then the platform for mobilization in opposition to its polluting practices provided an interesting example of shifting relations. At the local level partnerships between individuals and cell phone companies, for example, allowed for the flexibility necessary to appropriate technology in ways appropriate to livelihoods. At a city scale SmartXchange transpired as a successful partnership between private actors as enabled through local government.

Technology itself, as a collective, as 'ICT', was revealed as an important actor. The relations between ICT and the city built new networks, enhanced certain roles of the local authority, formed a new unit and enabled new initiatives. Certainly at a metropolitan level ICT was considered a catalyst for growth, empowerment and global connection in accordance with strategic objectives.

At a local level the results were interesting. Relations between individuals and between actors and actants were informed by the roles taken on in particular contexts, informed by relations to technologies used. Relations of power were informed by 'expert knowledge' but evolved as relations stabilized. Sometimes this can be frustrating to some as shown in the web site development processes where student designers were unprepared for the training required. In other instances, individuals not necessarily in leadership roles were able to guide as their technology proficiency evolved.

Web sites as actants varied in their efficacy. The StreetNet site was considered a platform for electronically mediated networks whilst www.durban.gov.za provided an information resource. The relations between types of actants provide a more effective platform for action. The StreetNet site is used in conjunction with SMS and Facebook groups to organise. Print media was used to provide the initial impetus for www.durban.gov.za. The sites developed in INK and SB had limited reach. Lack of follow-through and maintenance curtailed their efficacy. The actor-networks containing these sites were unstable and too open-ended. Limited translation reduced their impact.

Mobile telephones are ubiquitous in all three dimensions of the research. They were the connectors, the communication media and emerged as important actors in a number of respects. They constituted corporeal identity, were used as business tools, enabled social connection across borders and facilitated entry into new countries. Where computers were distrusted in many respects in the web development process, cell phones were constant reminders that technology sits close to the body and the personal experiences of most respondents. In the absence of landlines, cell phone access was broader and ignores categories of gender and age. The addition of mobile telephony entailed new land uses, new spatial configurations and product/service expansion of many traders.

Actor-networks and Agency

Did some of these networks become actors? ANT argues that relations between actants and actors in heterogeneous networks, once stabilised in an actor-network, can lead

to the creation of new actors. The research showed that information transmission and mobilization enabled through network activity were important dimensions of the agency created through actant-actor relations. Some of this was discernible in the solidification of SmartXchange as a regional ICT player, the evolution of the StreetNet web network as a player in regional relations between street traders and the creation of new informal spaces through sale of telephony.

ANT argues that ongoing maintenance of networks requires ongoing definition, interpretation and negotiation of roles. This process of translation defines a particular moment in a network and incorporates relations of power as positions are negotiated.

The evolution of the concept of the smart city has evolved in the city's IDPs. Initial mention was indirect; the most recent IDP referred to ICT as a developmental catalyst. So also events such as the FIFA World Cup and the creation of the Durban web site www.durban.gov.za. Structures can thereby be created as shown in the SmartXchange case. Such a constellation was seen in the activities, discourses and negotiations surrounding the FIFA World Cup preparations in Durban. Such an event, tied to a particular local government agency (the powerful Special Projects Unit in eThekwini Municipality) in partnership with other players such as Telkom becomes a structure in itself (if only for one more year) used to motivate other activities and had implications for the longer term. The materiality of non-human actors can solidify networks into structure and are sometimes evident in space. What happens between these spaces is often the result of the power relations that brought the structures about in the first place.

Appropriation of technology is important in the translation process. The introduction of technology in networks in the web development processes was unsuccessful in creating new agency. The most dominant aspirations emanating from the groups were visibility and broader publicity. Connections with other organisations featured as potential future relations with funding agencies but did not dominate, nor did the possibility of expanding current activities. Expectations were curtailed by a limited understanding of the web and its power; many respondents were simply intimated by the technology. A tension emerged in the INK development process in particular: the web development process was intended to augment and expand current networks whilst web developers anticipated the smooth functioning of networks as a prerequisite for the development of the web sites. Misunderstanding of the autonomy of schools learners in the SB process frustrated that project. The factors that contributed to the more successful execution of the web development project were: strong existing networks with strong leadership and clearly defined roles, an active interest from one or more members of the network, computer literacy and cultural and language commonalities between web developers and respondents. Students able to converse in isiZulu were able to engage more meaningfully.

Missed opportunities could also be interpreted as lack of translation. They were not restricted to the web development process. Opportunities for using the ABM initiative as a means to decentralised, electronically mediated governance were unexplored, despite the network configuration of area based management intended to govern and develop marginal areas.

9.2.3 The Spaces Between

The notion of 'the spaces between' in this research refers to the in-between physical places not well served by ICT infrastructure, where essential services are lacking and

in some cases, cell phone access provides the only opportunity for digital connectivity. It also refers to the blind spots in policy and governance. In this regard, this research focused on the informal sector, in this case foreign nationals subject to harassment and violence outside the landscape of 'legitimacy' and economic inclusion. Addressing these spaces is normatively linked to urban transformation.

Despite the policy rhetoric to enhance the developmental qualities of ICT, these spaces remain. 'Lost' space referred to the missed opportunities mentioned: the potential for augmenting decentralisation efforts through the ABM using ICT, for example. The Bridge City development as a connector between INK and the rest of the metropolitan area is intended to be facilitated through networked infrastructures such as rail and road. Reliance on the private sector to invest, to develop (the THG is the primary driver), market and populate is supplemented by investment in public buildings such as a Magistrate Court. High quality Internet access is expected to follow; quite how the benefits of this development permeate to the rest of INK remains to be seen.

Emphasis on Durban's global connections rather than its internal permeability signifies an outward concern. The infrastructural web created through the city's backbone contains the potential for broader access and small business empowerment. However, the assumption that this will lead to 'last mile' access is perhaps over-optimistic and reliant on market factors. Certainly, the empowerment potential of ICT was realised through Smart-Xchange in its incubation function. Technology is operationally defined as economic empowerment despite claims in policy discourse that it is a developmental tool.

The online space provided by www.durban.gov.za essentially performed an e-governance function. A degree of political transparency was discernible in the inclusion of municipal council minutes and the city manager's newsletter. Users surveyed tended to be educated, informed and used the site on a regular basis for general information and follow through on plan submissions for example. Cyber space was unfamiliar territory for the uninitiated, however. It simply is different. Follow up meetings showed that it required lines of accountability to enhance networks in the web development exercise and required an understanding of online norms in order to realise its potential. Its media textures represented alien cultural norms despite the increasing interactive capacities of web 2.0.

The historical spatial distribution of telephony access was characterised by unevenness. Geographic data shows that cell phone access is beginning to fill these gaps, albeit still biased towards the urban. Mobile telephony resonated at individual, community and broader scales. For the individual it incorporated many functions: daily communicator and connector, crisis manager and companion. At the community level it facilitated mobilisation with partnerships between cell phone companies and enterprising individuals yielding communal access. These partnerships took place within a policy framework that allowed for some flexibility. Varying typologies manifested spatially as pavement tables containing one phone to kiosks in township clusters signifying a closer relationship with livelihoods on demand and supply sides. Providers offered a range of options; customers had flexibility. There emerged a range of entry points for the user and entrepreneur.

The spaces between were reliant on social networks for information, resources and collaboration. These 'outside' spaces became 'insiders' in webs of relations that enabled inclusion, some fleetingly as in the case of foreigners in transit and those under threat of violence. These networks provided important entry points as shown in the ways through

which they are employed by refugees from the Democratic Republic of Congo (DRC) to find employment and shelter in South African cities. A hierarchy of technologies was employed in ongoing network relations with family far away (e-mail; text messaging mostly for relay of ongoing information; phone calls in times of emergency), in facilitating access to South Africa (an initial e-mail, followed by text messages and concluded with phone calls). Translated actor-networks were of value and functioned for a short while (during xenophobic violence) and in more established contexts.

The range of social networks in the INK and SB cases was testimony to the diversity of interests that concern the 'spaces between'. This research probed the workings of technology as an actor, or in ANT terms an actant, in these networks. The actual presence of technology was not enough. Simply introducing the web development process as an opportunity in a participatory and consultative fashion did not lead to the 'buy-in' from network members required to ensure the sustainability of the project, nor did it contribute to the intended enhancement of fledgling networks. The relations between actors and actants were important as were the usual factors that negotiate personal experience and technology appropriation. Cultural and language issues were important in determining uptake. The psychological barriers to digital access were underestimated; uncertainty and loss of confidence permeated interactions with computers. To some extent this could be contributed to the more subtle dimensions of the digital divide, but relations between actors and the network maintenance that that entails is as, if not more, important.

The constraints to accessing the Internet were mundanely practical. Transport costs constrained use of Internet Cafés and the Digital Hub in INK. Venues were not always available. In SB, the Engen-sponsored computer room at Fairvale School was not always available to learners and other participants. In Lamontville, access to the adjacent library for computer access was constrained by library hours and availability. Street barbers prefer to use mobile phones to connect since accessing the Internet in cafés exacts a cost: time away from the street, the place of work. Physical space matters.

New spatial configurations have emerged from ICT. Interstices on the streets where umbrellas and trolleys combine in physical space to provide telephony to the passer-by co-exist with containers situated on open spaces often providing community focal points. Telephony extends the repertoire of goods for sale by hawkers as they diversify and agglomerate. Boundaries between the public and private became blurred as a pedestrian takes a moment to have a telephone conversation in a public space. The informal-formal enterprise spectrum incorporates a number of entry points for the telephony trader: from second-hand mobile sales to side walk phone booths and sponsored container shops.

Thus, new spaces were created but old barriers remain. The notion of co-presence featured strongly in the findings in the form of existing and potential use. Probing the aspirations of respondents in the web development process yielded an interesting array of expectations. Visibility emerged as an important aim: the need to be seen recognised and be part of the larger urban and global fabric. Foreign street traders preferred to be invisible given the constant threat of harassment and xenophobia. Mobile phones assisted in conveying information on how best to achieve that. On the other hand, SMS functionality reassured Diaspora communities that loved ones in conflicted home countries are safe; "…you have the presence of someone" were the words of a focus group respondent. Flexible and affordable means to enable connectivity is important in times of crisis. ICT in the form of mobile telephony for vulnerable foreign traders and facilitated through a

web site and associated media used by StreetNet proved to be highly resourceful in crises. Quite when it moved from being a connector to being an essential part of the social infrastructure people employ to access the city depended on how well it fitted in with the day-to-day strategies of the marginalised. Field work with street traders revealed a sliding scale of use; as the need to communicate became more urgent, cost as a deciding factor decreased in importance. A correlation existed between choice of technology, function and urgency.

The range of findings offered expected and unexpected responses to the research questions posed at the outset of this research. Clearly the incorporation of new technologies into urban life was not a straightforward cost-benefit equation. It promised a lot and delivered to an extent, but sometimes in unexpected ways. ICT in the form of mobile telephony, computing and the Internet are different from other networked infrastructures and historical means to communicate. The lines between personal and public, between the corporeal and outwardly physical are blurred and this has implications for the experiences that permeate the urban. The following section uses these findings in a contribution to literature in order to arrive at the final conclusions of this research.

9.3 Transcendence: Relational Spaces that Matter

The notion of relational space follows on from the ANT perspective that focuses on relations between artefacts as defining a network space; defining how discrete spaces (or places) could be linked together (Murdoch 2006). The empirical findings of this research revealed various relationships in space in Durban. Understanding transformation requires an engagement with space. Interrogating the relationship between meaningful urban change and technology entailed an understanding of agency; what motivates and drives change. Urban change in South African cities is meaningful when addressing marginalisation; this research was concerned with how ICT enables this.

The following 3 propositions are presented as insights gained through the empirical work in this research. Space offers a pertinent departure point and Murdoch's (1997, 1998, 2006) work is particularly pertinent here.

9.3.1 Space Matters

The advantage of using ANT to gain insight into the relationship between ICT and the urban is the focus on heterogeneity. The post-structural conceptualisation of space defines space topologically and topographically (Murdoch 2006). Findings in this research show that the geography of Durban does not alter significantly with ICT. The northward trajectory of development is an outcome of processes that have evolved over time. ICT access corresponds with investment, but mainly where investment patterns correlate with historical trajectories. Where there are concerted efforts to readdress the Apartheid landscape, little or no attention is paid to digital technology. Where there are spatial implications in the ICT policy (such as the fibre-optic backbone) no connection is made with spatial planning. Policy provisions that impact on physical place are not aligned with the instruments used to implement. Moments for connection and alignment are lost. These lost interstices fall between the actor-networks that are enrolled into policy agendas. They could be opportunities for meaningful spatial policy making.

Spatial policy does not result in place when topological and topographical spaces do not align. In fact, they seldom do. Implementation of a physical intervention such as the ICT

infrastructure backbone is dependent on the actor enrolled to make it work. The claims are that this would enable broadband access to a broad population. Last mile access is dependent on relational understandings with service providers and market uptake, however. The stability of this actor-network, its efficacy in terms of its stated goals, is dependent on how well those assumptions hold…how well the intentions of small service providers align with the overall objectives of the initiative.

Ironically, despite the ability of digital technology to transcend place, the barriers to enabling access remain banally physical. Space matters, but in ways that differ from the planner's usual definition. Agency grows from the incorporation of technology, and when an actor-network stabilises, surprisingly interesting ephemeral spaces evolve. Physical change emanates from a combination of factors tied into actors' decision making processes. New spaces are created outside the realm of direct governance. Street vendors and container tenants occupy spaces that through telephony transcend the side walk and forgotten public places. Physical delineation belies the transformative quality of the engagement they offer. The less formal ones are not tied to place, physically or telephonically. These spaces do not exist due to well intentioned plans; they exist as a result of innovation and appropriation that involve actor-networks that include the private sector, and the informal vendor. These spaces are clusters of activities that transform throughout the day. They are dynamic. Decisions taken by actors impact on configurations in sometimes unexpected ways.

New spaces are created, some more fleeting than others. They are topological in nature, not the territorial surfaces defined by lines, polygons and points on maps. They are the 'processes of spatial emergence' (Murdoch 2006) that reveal the complexities beneath. An example is the immediate transcendent space enabled through the cell phone. A definition of space in terms of how it is experienced and documented and the processes by which spaces are delineated are as important as their physical geographies. Examining actor-networks within the contextual realm of ICT and cities reveals some interesting variations in this regard. At times of crisis transcendent spaces are enabled as hastily reconstituted networks mitigate uncertainty and fear.

Not all transcendent spaces are appropriated, however. The reluctance and apprehension regarding cyberspace encountered in the web design exercise is an example. When respondents were probed, it emerged that gaining visibility, becoming known, was considered a core requisite for engaging in cyberspace. The need to network or communicate was secondary. Engagement with cyberspace needed to be stabilised and defined before engaging in network activities on the Internet.

The same respondents that displayed unease with the Internet were comfortable with a range of functions of the mobile phone. The reach enabled from a corporeal vantage point reflects an ease and intimacy that is best described by one respondent upon losing her cell phone as akin to being sick, losing a body part. Not only does the addition of technology here at the personal level avail the opportunity for new relations between the self and other, it is flexible enough to allow for movement from the intensely personal to the global. Integration takes place between scales, between places, immediately… now. Space is malleable when an actor-network stabilises, when that space is transacted. Flexible relations between actants (mobile phones, cellular infrastructure), individual and market actors are enabled through ongoing negotiations that best suit all concerned. As the technology is adopted, it is adapted which feeds into an information loop that enables

new innovations and market responses. The heterogeneity of socio-technical relations accommodates small moments of interaction and innovation which enable the transcendence of spatial constraints in real time. Distance is indeed malleable when it is "…linked to process…assessed from within such processes" (Murdoch 1998: 358).

Analysis of particular moments in the network relations contained in this research reveals that neighbours can be distant, the global can be local and the 'foreign' can be 'here'. A number of networks are covered in this research; hence a number of topographical spaces are uncovered. Extending the analysis into topological space means that local means contextualized space AND the place from which actors are enrolled; for example informal traders are part of a space that includes family from the DRC. Scale is malleable in the relations between ICT and the urban, but only insofar as space is stabilised within the context of a network. Space is an actor, but it requires translation to become part of an actor-network. Only transacted spaces are malleable. That can happen fairly quickly; for an event or in times of urgency for example.

Technology enables a degree of translation to occur to the point where it stabilises: the StreetNet web site is an example. Spaces of marginalization can become spaces of empowerment if translation occurs. The meaning and identity that emerge from the translation processes are worth emphasizing. Spaces do not hold singular identities; they pay tribute to complexities. Space is a verb and a noun. Space matters, but in ways that differ from traditional understandings. That space matters in the ICT realm reveals topological intricacies that are potentially transformative. However, for space to become transcendent, translation needs to extend to appropriation.

9.3.2 Translation, Appropriation and Innovation

In order for topological spaces to become transformative, network relations need to be stabilised. This is not a straightforward negotiation process. The addition of non-human actors into networks does not automatically yield results… "scientific objects are not only 'technically' manufactured in laboratories but also inextricably symbolically and politically constructed." (Murdoch 2006: 59). The web design project was unsuccessful because translation did not occur. The 'rationalities of rule' described by Latour (1987) were not negotiated. The circulation of technical facts was incomplete. Goals did not align; the web development process did not further respondents' interests enough to ensure appropriation; Latour argues that 'interests' are important, critical in fact (Ibid.). Power relations were not stabilised.

A method of maintaining associations must be established, a fact recognised in the intended second phase of the web development exercise for INK. Networks are precarious (Knox, Savage et al. 2006) whether they become institutionalised or not depends on translation. This research finds that relational processes in networks need to go a step further; technology needs to be appropriated.

The need to appropriate technology in order for it to become stabilised in a network is best illustrated by two examples from the research. SmartXchange is a well functioning network that illustrates how an actor-network can become an actor as its role has evolved from incubator to policy implementer. The mutual concerns of profit and economic empowerment fit nicely with the flexibility of digital infrastructure in doing so. The relationship between local government and small businesses is particularly interesting here. City bureaucratic systems were presented as an opportunity for small ICT businesses.

An alignment of goals extended into ownership. Facilitating network formation amongst participant firms without being too prescriptive allowed for new negotiation spaces.

The other solidified network space involving ICT in the research is the StreetNet web site. The web site itself has become an entry point for the use of mobile phones for activism and communication. It has become a referral space for the distribution of the StreetNet newsletter. The web site has not evolved into an autonomous mobilisation space. Livelihoods and lifestyles of informal traders require mobility and immediacy, most appropriately enabled through the mobile phone. The crystallisation of information into a newsletter is more meaningful than a constantly changing web site. Paper can be carried and attended to when necessary. Web sites are accessible only at Internet Cafés in many cases or on expensive cell phones. Appropriation is intimately linked to livelihoods and the day-to-day decision making of this marginalised group.

The market is particularly adept at aligning lifestyles and personal goals with commodities. This is best illustrated through the findings on mobile phones in this research. It also emerges in looking at Durban as a whole. The review of newspaper articles and the interview with city manager reveals the growing importance of mega-events such as the FIFA World Cup and its relationship to telecommunication infrastructure implementation. The appropriation of discourses around ICT networks and the ongoing negotiations with Telkom on ongoing ownership is couched in a market environment based on this one event. Quite whether this yields a network that has sustainable (and transformative) results is one of the unanswered questions of this research. This can happen fleetingly and functionally (such as the quick formations required ensuring survival of foreign street traders) or simply be part of a marketing ploy. The contention here is that in order for network relations to be transformative, they need to be stabilised into an actor-network. Translation is not enough with regards to the inclusion of technology. Non-human actant technologies need to be appropriated. This entails an exercise in power.

9.3.3 Symmetry is not equality

Analytical symmetry prescribed by ANT in understanding the role of non-human actors is essential to understanding the topological spaces, the relational spaces that are core to them becoming transformative. This has been a particularly useful analytical tool in this research. However, it emerges that symmetry is not quality. Appropriation suggests power relations between non-human and human actors that are not equal. In order for actor-networks to become transformative, the role of technology is circumscribed by the needs, livelihoods, definitions and circumscribed roles assigned by human actors. Latour (1987) argues that building networks requires that enrolled actors identify with the networks. This can happen through consensus or coercion depending on how it reflects their interests…or not. Once enrolled, relations need to be stabilized, often a role imparted to technologies. Technologies make good disciplinary machines as defined by human actors.

Material artefacts carry 'rationalities of rule' – they become delegates but in order for them to become meaningful they must carry aspects of the enrolled localities back to the centre of the actor-network. This did not happen in the web design exercise, a goal directed intervention that was relatively well resourced and planned. It happens amongst street traders and foreign barbers that live precariously and rely on fleeting moments of connection. The distinction between mutable and immutable mobile is important. Malleable artefacts allow for appropriation. Yet, it is not the technology alone that distinguishes (cell phones are after all able to connect to the Internet), it is the transformative power

enabled through the mobile phone as it aligns more appropriately with the reality of the street trader.

The shift from translation to appropriation is an exercise in power. Taking ownership of a material artefact, suiting it to lifestyles and livelihoods, entails more than translation. It requires a mobilising voice in agreeing terms and conditions of enrolment. The malleability of the mutable mobile enables such power to be exercised. The true transformative potential of ICT is enabled through these day-to-day empowerments.

9.4 Answers … and More Questions

> *How is one to conceive of both the organization of a city and the construction of a collective infrastructure? (Foucault 1984: 239)*

In the above quote, Foucault makes the link between the conceptualisation of the city and infrastructure. This research focused on ICT and its relationship "...to the organisation of the city" as well as its contribution to the "construction of a collective infrastructure..." (1984: 239). Foucault's notion of a collective infrastructure includes the discursive practices of the institutions that contribute. The intention of the primary research question was to understand these intricacies in relations to the transition of Durban.

The answer is layered and only partially supports the hypothesis. ICT access follows patterns of polarization in South African cities but those trends are onward trajectories from history. Durban is splintered, not splintering due to technology. However, ICT policy in Durban has a distinctly neo-liberal emphasis and does not address uneven distribution of digital technologies. If anything, it has added a layer of complexity to the city governance framework as can be seen in answering the second part of the research question: who are the actors that play a role in ICT in Durban and what are the relationships between them?

The answer is threefold: the range of actors has broadened with ICT; private software companies, small IT firms and fibre-optic contractors are now part of the city governance conversation. The second part of the answer to this question is that this is not an inclusive dialogue; civil society is notably absent. ANT shows that network stabilisation and inclusion is determined by common interests, goals and intentions. The underlying interest in promoting and building digital Durban may be promoted as developmental as its transformative qualities extend to local economic development. The third answer to this research question supports the part of the hypothesis that argues that network relations are determined by aligned strategic agendas; the unexpected discovery is the leadership role played by eThekwini municipality and how well it accords with private sector agendas with regards to ICT.

This research began with the premise that ICT can only be considered a meaningful development tool if it is appropriated as ongoing input into the day-to-day decision-making of the poor. It is at this scale – the local, the individual, the social – that the appropriation of digital technologies was examined. Transformative qualities lacking in official policy could well be countered by civil society networks. In examining how digital technologies are used to reinforce social infrastructure and networks employed by the marginalised in Durban, the research focused on relations between actors in networks. Here the findings support the hypothesis: the addition of ICT to social networks has implications, and are socially, culturally and contextually informed; the impact on power relations is important.

There are many nuances to this. The implications of technology inclusion are informed by context and, more importantly, by the extent to which technology is appropriated, taken ownership of, controlled and embedded in social practice. Mobile phones best illustrate this. Furthermore, these networks do not necessarily solidify. They are sometimes fleeting and play a temporary role, and then dissipate. Cellular phone technology is particularly adept at accommodating this. Appropriation can be innovative. Transformative practices have modest beginnings, but can contribute to new topological and topographical spaces. This is perhaps the most profound finding of this research. It is also likely to be the most overlooked aspect of public policy on the city. The 'politics of hope' Coutard and Guy refer to (2007) often escapes the politics of rhetoric.

How then does technology become transformative at a policy level? More pertinently, how could technology carry the transformative power necessary to achieve a normative goal such as empowerment or integration in cities? The tentative answer of this research is through intervention in the topological spaces. A first step would be the identification of the lost interstices, the contradictions and tensions that emerge from the unease, the non-alignment between topological and topographical space. An engagement with transcendent spaces is necessary, an experiential understanding goes beyond what can be mapped or written up. It requires a commitment to exploring the experiential interface between human and material actors. How to do that is best uncovered through case research, achieving ethnographic insights through in-depth enquiry.

Further research is necessary on how and when transcendent spaces become transformative. The vocabulary of translation and appropriation enables an engagement with the range of agency. This research examined this range with regards to the incorporation of ICT into network. Using this language to understand the composition of functioning of networks containing other artefacts such as other networked infrastructure for example, will reveal different typologies.

Relational space has implications for planners since geographical delineation of space entails entrapment. ICT in this research has provided the entry point for negotiating a relational understanding of space that is transformative. Quite how that translates into transformative practice is unclear. Research is necessary in revealing the potential spaces of empowerment where planners can intervene. A recent paper refers to the value of 'intermediaries' in affecting change through infrastructure distribution (Moss 2009), on the broadening landscape of actors in governance in Europe. More work is needed on who these intermediaries are in other contexts, particularly in contested governance landscapes where they could play a special mobilising role.

Durban was an intriguing case, but more work is needed in contexts where local government is not as strong and capacitated and general infrastructural failure undermines the transformative potential of ICT. Engagement with more contested landscapes will reveal greater unease between topological and topographical space. What happens when these interstices are so absent that total failure occurs? A recent publication, edited by Graham, explores the notion of 'disrupted cities' (2009) in this regard. Mention is made of Lagos, known to be a mega city where infrastructure has failed. Is there a point where the spaces of empowerment translate only at the local level, where policy spaces are irrelevant? Research on mega-cities in the global south that take a relational perspective will provide a more nuanced understanding of socio-technical networks instead of the alarmist views expressed in popular and academic literature. These fleeting spaces of transformation do

not compensate for infrastructure failure but they do provide clues as to where intervention could be most effective.

The limits of the city, to return to Mumford's imagery captured at the outset of this thesis, are not defined by walls, cadastre or topography. ICT as metaphorical orator defines the limits of the city as that which is circumscribed by the relations, energies, connections and interactions between those enrolled in its networks. Negotiating the spaces between is the true challenge of transformation.

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