The Impact of Advanced Telecommunication Technologies (ICTS) on Transport and the Built Environment

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Abstract: *There is an obvious need to look into how developments in information and telecommunications technologies (ICT) may affect transportation and the character of cities given how these technologies are changing how people live and work. Researchers need to comprehend and articulate how ICTs are changing the urban environments in which people live and work. The adoption of new telecommunications systems is advancing more quickly and becoming more pervasive in society with each passing decade. The need to be somewhere certain at a certain time will become less and less of a necessity as time goes on, and even the transmission of place itself will start to be feasible. The purpose of this article is to provide an overview of how developments in ICT and related technologies may affect cities in general and transportation in particular. The article examines a few ICT application areas and connects them to trends and realities in South Africa. The findings of the study could be applied to future planning and policy-making in the South African setting. Given the absence of recent and pertinent local knowledge on the subject, several areas for additional investigation are also proposed. Living online will involve decreasing amounts of dependence.*

Keywords: ICT

I. INTRODUCTION

The way we work, shop, learn, enjoy ourselves, and engage in many types of social contact are all being changed by the new information and communications technologies (ICT). Transport operations have historically been connected to performing these tasks. To complete them, we must either go or physically transmit and collect the items. Urban areas are being transformed by ICT, so it is imperative to look into the potential effects these advancements may have on transportation and the character of our cities. The second half of the 20th century saw the rapid development and fusion of IT, telecommunications, and broadcast technologies, opening up a host of new opportunities for conducting business "virtually" and, in theory, without the need to travel. The need to be somewhere certain at a certain time will become less and less of a necessity as time goes on, and even the transmission of place itself will start to be feasible. Therefore, virtual accessibility might be increasingly important in the future. This essay is based on a report by Maritz et al. (2004) titled the influence of ICT on transport: An overview, which sought to better understand the nature of ICT and its potential effects on travel and transportation. The study discusses the key trends and developments in South Africa (SA), and investigates certain ICT application sectors where transport plays a role, including E-Commerce, Telework, E-Education, and E-Banking.

II. OBJECTIVES AND METHODOLOGY

Because the impact of technological advancement on transportation is not always evident, concerns related to ongoing technological advancements, such as ICT, are rarely consciously examined or taken into account. The goal of this project was to conduct a thorough background investigation on the effects of emerging ICT and related technologies on cities as well as transportation. The study's findings could be utilised to guide future governmental decisions and planning about the applicability of ICT to transportation. The reader of this essay is assumed to have a basic familiarity

with the terms, technology, and related subfields that make up the ICT field. Figure 1 depicts the magnitude of the study.
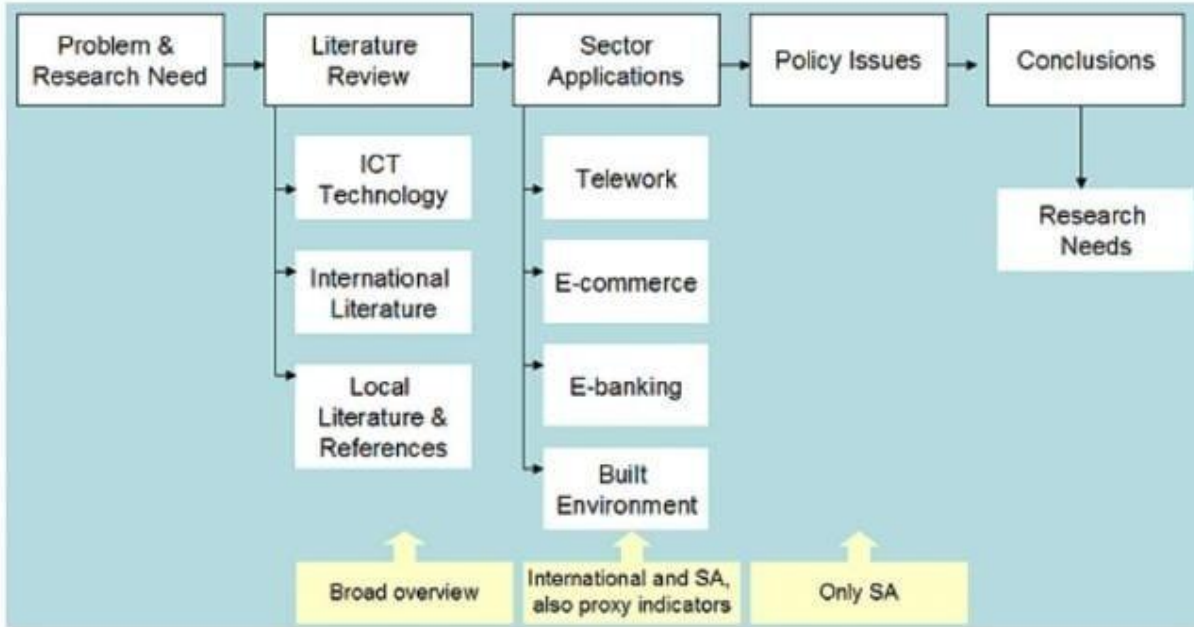
Since there is a sizable body of pertinent international literature on the subject, a comprehensive literature review was conducted. After reviewing this material, it was necessary to confront the reality of the South African situation. Since there is so little local information available on this subject, extra data was gathered through a series of discussions and interviews with important organisations or experts in the ICT sector. Telkom, Vodacom, Standard Bank, MTN, Sentech, Siemens, and numerous government agencies were among the important companies named. In addition, pertinent CSIR employees who have experience in the field of Intelligent Transportation Systems (ITS) were also interviewed.It must be emphasised that, given the overall dearth of pertinent information, it was not the goal of this project to estimate the magnitude of the influence of ICT on transportation. The literature analysis and the interviews made it abundantly evident that there are additional non-transportation-related concerns that need to be discussed since they indirectly affect either transportation or the use and adoption of ICT. Given the scenario in the area, these would prove to be very pertinent. A brief discussion of transport policy issues was also given in light of potential long-term ICT effects on transportation. The paper concludes by highlighting some significant findings from the literature and local realities.

III. LITERATURE REVIEW

3.1 A Review of The Book

Application Fields The way we work, travel, and pass the time is influenced by ICT technologies and will continue to be influenced by them. Let's now examine recent research on ICT application to estimate the anticipated scope of transport impacts. We'll also look at the circumstance in the backdrop of South Africa. The application areas of telework, e-banking, and e-commerce are briefly discussed.

3.1.1 Telework:

A situation known as telework refers to one in which a person works somewhere other than their conventional office. **Telework** (also known as telecommuting) frequently refers to formal agreements between employees and their employers regarding work done at home or at a remote location that is more convenient for the employee than their primary workplace. The idea of telecommuting emphasises an effect on the commute from home to work. The idea of telecommuting emphasises an effect on the commute from home to work. According to various international studies

cited in a paper by HOP Associates (2002), telework can significantly reduce the amount of time each teleworker spends travelling, as indicated in Table 1.

Table 1. Examples of commuting distance savings.

Study	Reduction in commuting travel per teleworker
Mitchell & Trodd (1994)	181 kilometres per week
Lyons et al (1997)	93 kilometres per teleworking day
Mokhtarian (1998)	82 kilometres per teleworking occasion (centre-based) 55 kilometres per teleworking occasion (home-based)
British Telecom (2000)	149 kilometres per week for car users 230 kilometres per week for rail users

Source: (HOP, 2002)

Additionally, teleworkers typically spend about 1.5 days per week away from the "main office," which is roughly similar to avoiding six round-trip journeys per month, according to research. One of the main presumptions in the literature is that teleworking seems to be suitable exclusively for particular types of workers. As a result, it has been determined that teleworking is best suited for "knowledge workers," managers, and professionals, as well as those whose jobs do not necessitate their full-time presence at particular locations. It is important to distinguish between teleworking's primary consequences and its secondary, or indirect, effects. We may define the "direct consequences" of teleworking as any additional trips made by the teleworker or anybody else, as well as any trips that were eliminated by the teleworker due to his/her teleworking, individual. From reading the literature, it is evident that the traffic-reduction benefits of teleworking will be somewhat offset by teleworkers' or other household members' taking other trips that they otherwise would not have taken or would have taken as part of a commute. The location of one's residence and place of employment may be influenced by teleworking opportunities, which in turn may affect travel demand (Niles, 1994). Planners and legislators are drawn to telecommuting because it suggests a decrease in commuting travel at no expense to the infrastructure and transportation services. Overly optimistic predictions of telecommuting can result from the possible role of new IT in aiding teleworking, which also assumes a technological solution to the congestion problem. There are no precise statistics indicating the level of telework in South Africa. When precise direct statistics cannot be obtained, a variety of proxy indicators are frequently utilised. These include things like the number of people who are self-employed, home Internet connection, etc.

3.1.2 E-Banking

With varying degrees of success, banks have accepted and deployed new technologies. The Internet is the 'new' technology that is employed in the banking industry the most. Customers who use internet banking can access their accounts from anywhere, at any time, using the service. At the end of 2003, there were one million online bank accounts in South Africa. An estimated 2004 banking of 30% (World Wide Worx, 2004). Making monthly transactions online has become the standard and a routine part of life for the financially savvy. Few people use Internet banking given the size of the "banked" population. A large portion of the approximately 11 million banked people who have registered for access online are best characterised as superficial users (HOP Associates, 2002). Many Internet users are cautious to do transactions online and only monitor their account status; this suggests that the use of additional services, such e-shopping, will not advance quickly. All the banks are diligently exploring the cellular network since it provides one of the most effective and efficient paths to the mass market in SA. Mobile solutions are already being created as a result, and they are doing useful tasks like validating a customer's check information and sending the message to a cell phone in a matter of seconds. Craftsmen and contractors on the go will particularly benefit from this service. It is crucial to keep in mind that many residents of rural areas are still "unbanked" or find it challenging to access banking services because they frequently have to travel to cities and centres where the nearest bank(s) are situated. This also introduces a different risk, notably the high possibility of being targeted since cash is typically used to carry money. Although mobile and ICT solutions (Internet banking) and debit cards should solve this issue, low-income and rural populations still do not use them. In some rural areas, the tradition of cash is still prevalent. Therefore, for the time being, these people still rely on a car drive to fulfil their banking demands rather than ICT technologies. Only 67 000 people in

South Africa were using mobile banking as of the World Wide Worx study from 2003, although most banks anticipated a significant uptake in 2004. Even if mobile banking is still not extremely convenient or affordable, as mobile phone capabilities and user interfaces advance, opinions will change and it may eventually overtake Internet banking in popularity, as is the case in other countries. Mobile banking has quickly taken up in other emerging nations, especially when using cell phones, which ultimately eliminates the need for travel.

3.1.3 E-Commerce (Specifically Online Shopping)

Travel behaviour will change as there are more online shoppers and as online shopping becomes more appealing and accessible due to impending IT advancements and as Internet users become accustomed to it. Internationally, there could be a significant impact; however, it is unlikely that the same impact will be felt in South Africa given that a significant portion of our society lacks access. Few e-commerce analysts sincerely think that in the near future, time spent shopping at physical and mortar stores will be largely replaced by online purchasing. Shopping is frequently associated with other pursuits, and there are other motives beyond from the eventual purchase of a collection of items that drive people to go shopping (Gould, 1998). The type of retail online purchasing that is most popular is doing your groceries. Gemini Consulting recently calculated that 70 000 South Africans make more than one purchase online each month. That amounts to less than one in 10 people who bank online, one in 40 people out of an estimated three million people who use the internet, and a mere drop in the bucket when compared to South Africa's approximate 45 million population. Less than 0.15 percent of all retail sales are made online, with an estimated spending of well under R300 million (eBusiness, 2003). However, websites like Kalahari.net contend that online banking drives online retail sales. Therefore, the first step is to encourage people to use Internet banking. When consumers feel comfortable doing their banking activities online, Sales will come next. They anticipate significant increase in online retail shopping in the medium future, even though it may take a few months for this conversion given that nearly a million individuals are reportedly currently utilising Internet banking. It's crucial to keep in mind that consumers that shop online tend to be the most affluent and sophisticated consumers overall. Despite its limitations, online grocery buying is a reality in South Africa. However, only a small portion of the total population has access to such infrastructure because of the degree of population differences. At the moment, e-services are available at all of the large grocery chains. The rise of suburban supermarkets has been accelerating in South African cities. Residential areas' low-density sprawl is largely to blame for this. Due to the proximity of these facilities and the requirement to get goods home, a sizable portion of grocery excursions are made in cars. Home delivery is the foundation of e-commerce as it currently exists, which may result in less centralised deliveries and increased freight traffic. Additionally, it can lead to higher-than-expected transportation demand, particularly for urban road transportation, which might not be sustainable. The transport and distribution system will be under more strain if order frequency rises. Additionally, the number of automobiles driving throughout the city increases in direct proportion to the number of businesses offering home delivery. The paradox that "as customer desire for home shopping increases, the likelihood of their being at home to collect their purchases decreases" makes it difficult and perhaps very expensive logistically to extend the end of the supply chain to people's front doors. decreases" (Retail Logistics Task Force, 2001). (Retail Logistics Task Force, 2001). However, supermarkets are willing to charge lower delivery fees in an effort to capture more of the market. These costs include order processing, storage, picking, packing, and transport.

3.2 ICT Technology Market and Trends in SA:

As was already established, it is challenging to determine how much ICT is influencing transportation in South Africa. To "get a sense" for potential transportation effects, we might look at the predicted expansion in the ICT sector.

The overall South African economy depends more and more on the telecommunications industry. The sector's income increased from R7 billion to R56 billion over the ten years from 1992 to 2001. (Gill Wald and Kane, 2003). It increased during this time, going from 1,9% to 5,8% of South Africa's GDP. It is evident that a sizable portion of the population lacks even basic access to telephones when one considers the numbers and level of access (fixed line or cellular). Only 42% of people have access to a phone in their home. The mobile cellular market has risen above aall forecasts, holding over 30% of the overall market share by 2001 and having more customers than the fixed network (see Figure 3). The pre-paid market in the United States, according to market research firm BMI-Tec knowledge.
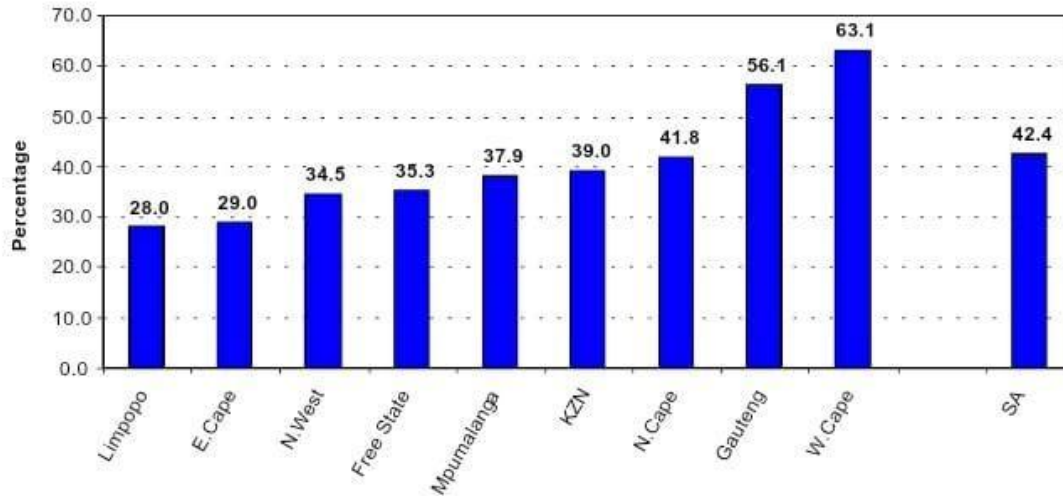
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Figure 2. Percentage of households in each province with one or more telephones in the dwelling (Statistics SA, 2001).

More than 90% of newly established connections are pre-paid, and 75% of cellular subscribers are from South Africa. the Internet began in 1993 and the first time it had fallen below 20% (World Wide Worx).
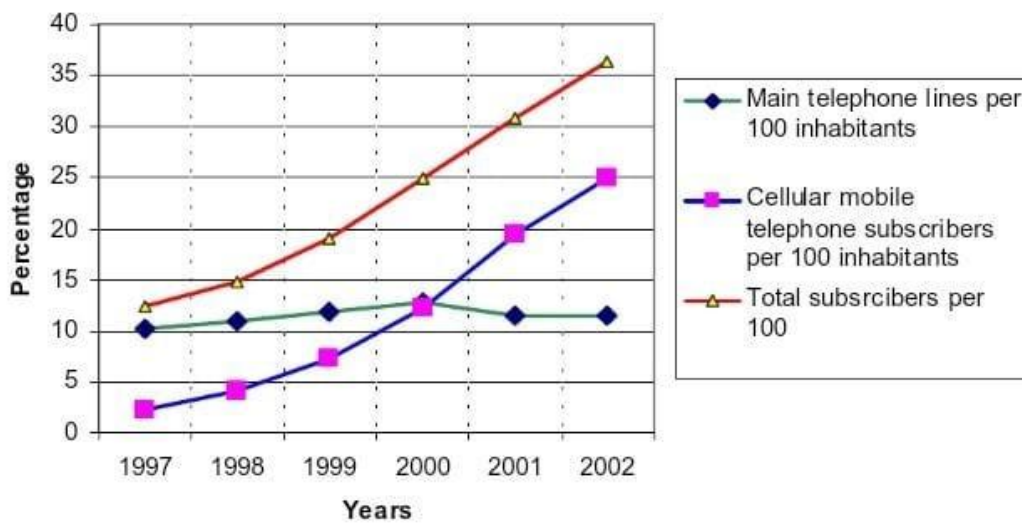

Figure 3. Growth of fixed line vs. cellular phones, 1997 – 2002.

3,28 million South Africans were projected to have Internet connectivity by the end of 2003, representing only a 6% growth in 2003. Just 1 in every 13 South Africans fall into this category, a little increase from the 1 in 15 at the end of 2001. Still a large portion of South Africans lack access to telephones, and an even larger portion lack access to the Internet. The Second Network Operator's introduction of competitive access services for businesses and Sentech's introduction of high-speed or broadband wireless access present opportunities for the Internet market to expand in 2004. The providers of these services want to expand their market share in South Africa, particularly in the less-served areas. infrastructure. The remote communities that are not currently served by fixed-line communication could profit from this.

IV. THE BUILT ENVIRONMENT

The horse-drawn city was transformed into the modern metropolis during the century of motorised transportation. ICT, on the other hand, has been adopted in a city that is heavily dependent on cars. ICT is not a perfect substitute for the automobile; hence it cannot be anticipated that its effects on cities will be similar to those brought about by the

automobile. Urban regions have traditionally developed into hubs of activity that were initially based on their physical locational benefits, including closeness to natural resources or transportation hubs. Cities and their internal structures were largely shaped by distance. As a result, geographers and planners have given technology that influences how much it costs to travel long distances a lot of attention. The price externalities like noise and air pollution as well as energy, time, and money are examples of distance. Since both may lower the costs of distance, transportation and telecommunications are the primary "friction-reducing technologies." The research is sparse on evidence connecting ICT to urban sprawl or to people taking longer commutes as a result. Many presumptions are formed without any supporting empirical evidence. People are residing in remote or distant locations as a result of technology that connects them to workplaces or employers, for example Planners and decision-makers in the built environment must be aware of the possible effects of e-commerce on the vibrancy of commercial areas (Batty, 1997). The viability of local businesses may be partially dependent on their ability to compete with major chains in terms of internet accessibility and delivery options. Providing the appropriate infrastructure and limiting parking at the workplace are two ways that businesses may in the future encourage staff to work from home (Stead and Banister, 2001). The freedom and variety of options that technology offers users may have the opposite effect of what is intended—an increase in engagement and travel. Planners and policymakers must be mindful of the potential implications of e-commerce on the built environment. regards to the dynamism of commercial regions (Batty, 1997). The viability of local businesses may be partially dependent on their ability to compete with major chains in terms of internet accessibility and delivery options. Providing the appropriate infrastructure and limiting parking at the workplace are two ways that businesses may in the future encourage staff to work from home (Stead and Banister, 2001). The freedom and variety of options that technology offers users may have the opposite effect of what is intended—an increase in engagement and travel. ICT policy-making is still in its infancy because the field is new. Our grasp of the effects that ICT and transportation have on urban areas is said to have a knowledge gap at the moment.

V. POLICY

General Issues It is unlikely that the local metropolitan government (and provincial governments) will make significant expenditures in road infrastructure to solve the growing traffic and congestion issues experienced in the main cities. There are conversations about fostering more dense urban development, which will increase the viability of public transportation, as well as sustainable transportation and minimising the usage of private vehicles. "More and more people are converting to private automobiles for their daily transportation needs," claims Moving South Africa (1999). Urban regions are experiencing an increase in congestion as the car fleet is expected to grow by 64% by 2020. Over the same time period, the size of the stubborn1 customer sector is anticipated to rise by 88%. Planners and legislators are drawn to telecommuting because it suggests a decrease in commuting travel at no expense to the infrastructure and transportation services. Early predictions regarding the adoption of telecommuting were obviously unduly optimistic because the potential role of new ICT in aiding telecommuting also implies a technical solution to the congestion problem. ICT-based transportation policies currently look hazy and ambiguous. These difficulties are not properly addressed; neither have the potential effects been examined nor are there any clearly developed transit plans to address issues like telework, the use of ICT, etc. The following are quotes from a variety of ICT-related policy, strategy, and framework publications. The National Land Transport Transition Act (NLTTA) of 2000 outlines general principles that include ICT-related measures. Aiming to "provide higher priority to public transport than private transport by assuring the provision of adequate public transport services and adopting travel demand management methods to discourage private transport" (Article 18.3.(b)), public transportation plans must be created. Road Infrastructure Strategic Framework for South Africa, a document created by the National Department of Transport (NDoT) in 2002, offers a strategic-level plan of action for better infrastructure delivery. The topic of information systems and decision support is once more highlighted in this document. It specifically discusses ITS (Intelligent Transportation Systems) under the heading Future Developments, which is relevant to the topic of this study. Here, it is suggested that the national government's job is to support ITS by taking the following actions, among others: demonstrating the advantages of ITS Developing financial incentives 1 "Stubborn" refers to people who only use their personal vehicles, according to Moving South Africa in 1999. the creation of regional technical ITS standards! developing expert understanding of ITS challenges! encouraging ITS research Moving SA identified the following as one of the key transportation trends: "The

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rise of information technology: - with increasingly sophisticated IT, global high-value-added manufacturers have increasingly been able to move towards just-in-time manufacturing processes, reducing inventory costs but increasing the demand for high-precision transport and logistics." The same is true for the transportation industry, where IT enables operators to provide shippers and customers with more exact information, improving service levels. Here, just dealing with the logistics of freight has been the focus. According to the Rural Transport Framework for South Africa, there has been a strong focus on linking remote communities to infrastructure and services in order to promote development. Rural logistics are thought to be improved through ICT-based services that are closely associated with Multi-purpose Community Centres (MPCC). In addition, the document aims to demonstrate "greater alignment and development synergies can be achieved, especially with those sectors that must serve a dispersed population from centrally located nodes, facilities, and markets and those sectors involved in the provision of linkages, infrastructure, and services (especially telecommunications and other ICT-based services)" (Mashiri et al., 2002)It's also crucial to remember that ICT applications have just recently been partially explored in areas related to transportation, such as smartcard efforts, the taxi recapitalization programme, and vehicle identification.

VI. CONCLUSION

Final thoughts Because it binds together activities done by both individuals and businesses, transportation is a special industry. This indicates that it shouldn't be handled separately, but rather as a component of any composite evaluation. Each sector's decisions have an impact on transportation, including those related to housing, company location, recreation, retail, education, health care, and a host of other variables (Stead and Banister, 2001). Nearly every element of our life is just now starting to be impacted by telecommunications. We will rely on IT more and more as we get busier to cut down on needless travel. We will also increasingly rely on IT as population grows, especially inside metropolitan regions, to reduce congestion on transportation networks and at activity sites.(For instance, utilising a cell phone to check the intensity of traffic on routes before leaving). A very large number of people's small effects can add up to a system's overall huge effects. People with poor degrees of traditional accessibility may benefit the most from the Internet's virtual accessibility. Currently, countries with long, dark winters (such Iceland, Finland, Norway, Sweden, and Canada) or remote rural areas have the highest per-capita Internet usage. Isolated regions in developing countries are likely to have increased demand for connectivity. This is crucial in South Africa since a significant portion of the population lives there in inaccessible rural areas. This in turn makes offering services very expensive and complicated. It follows that many individuals will stay in this circumstance until the issues can be overcome with the use of technology. ICT is only now beginning to get traction. offering communities that would typically have difficulties (and high expense) receiving such services with virtual access into rural locations. The traditional process of setting up land-based lines has been replaced by the exponential growth of mobile cellular phone use. Previously unavailable educational services are now accessible to remote centres via satellite television. We are still in the early stages of these technologies' application, in terms of scope. For more communities to have access to such "virtual" services, ongoing commitment is necessary. However, training the (possible) consumers is necessary for the acceptance of new technology. This must be done in conjunction with the creation or improvement of virtual accessibility. The relationship between actual travel, virtual mobility, and social engagement will become more and more important. Though understudied and poorly understood, these relationships are constantly changing. Previous hopes for the beneficial effects that ICT might have on travel and transportation have frequently ended in disappointment. Communications are likely to be used by people to avoid some unpleasant travel or to reschedule and reroute journeys to less crowded times and locations. We have very little measurable evidence of this influence, but the prevalence of contingent, part-time, and self-employment, which has been somewhat augmented by IT innovations, must be reducing peak commuting traffic. Only telecommuting has been considered as a way to cut down on travel, frequently with inflated hopes. Planners and decision-makers in the built environment must be aware of the possible effects of e-commerce on the vibrancy of commercial areas (Batty, 1996, 1997). Whether or not neighbourhood retail centres can compete with large chains in terms of online availability may very well be a factor in their viability as well as delivery services. People are modifying their routine behaviours as a result of increased exposure to and familiarity with the information age. We must keep in mind that the Web and other Internet-related advancements are still in their infancy. The "digital gap," which emphasises that a sizable segment of the population lacks access to even basic services, let alone ICT

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infrastructure, is another issue we confront in South Africa. Additionally, this group lacks the financial resources needed to quickly "connect."

Needs for Research ICT and transportation-related research hasn't been studied much in South Africa. The research team working on this project also discovered a data-poor environment. Current government surveys don't ask enough questions to adequately reflect ICT-transport concerns. Standard data-capturing procedures need to be examined, possibly revised, and expanded to account for the use and nature of ICT in the home, home office, and mobile environments. The behavioural reaction to all tele-activities has not been thoroughly studied or understood (locally). Responses are likely to vary greatly, with small behavioural adjustments more likely than significant ones.

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