Sustainable impact in developing rural areas through business creation

Designing and implementing an ICT-enabled logistics brokering system to have a long term impact in Kgautswane, South Africa

Graduation committee

**University of Technology Delft:**
- Professor: Prof.dr.ir. A. Verbraeck
- First supervisor: Dr.ir. G. Kolfschoten
- Second supervisor: Drs. J.H.R. van Duin
- Third supervisor: Dr. J. Barjis

**Council for Scientific and Industrial Research:**
- First supervisor: Dr. S. Muniafu
- Second supervisor: Ir. J. Maritz

Martin Marijnissen
Stud.nr.: 1044923
April 2009
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Preface

Within this report the results of my Master Thesis project are presented. From July to December 2008 I have been working for the Council for Scientific and Industrial Research (CSIR) in South Africa. The CSIR is one of the leading science and technology research, development and implementation organizations in Africa. The South African parliament is shareholder of the CSIR and funds CSIR research through parliamentary grants (PG). Within the Built Environment (BE) research area the Rural Infrastructure and Services (RIS) competency area addresses rural and second economy challenges. My master thesis is part of a PG research that is being carried out within the Rural Infrastructure and Services competency area. As a part of my Master Thesis project I spent six months working on the design and the implementation of a logistics brokering system in Kgautswane, one of the many developing rural areas in South Africa.

While transport is essential for development in rural areas, it is often just not available. Within his PhD, Sam Muniafu states that the use of ICT-enabled logistics brokering services in rural areas is expected to reduce the problems related to transport in developing rural areas. Muniafu’s findings and conclusions formed the starting point for my research. Together with Sam we were planning to take his research further and to gain new knowledge on the actual design of a sustainable logistics brokering system. One week after my arrival in South Africa however, we were all shocked by the news Sam passed away while being treated for an auto-immune disease. His death came totally unexpected and everyone was stunned by this tragic loss. Within the CSIR everyone was very clear about the obligation we had to Sam to continue with this research. I also want to extend a special word of thanks to Johan Maritz who took up the task of supervising me in South Africa after Sam’s death.

I would furthermore like to thank Gwendolyn for her excellent supervision, Joseph Barjis for his unrelenting enthusiasm, Alexander Verbraeck for his sharp insights, Goodhope Maponya for always laughing, Brian Marrian for his hospitality, Juanita, Jason and Rico for giving me a home away from home, Clara Masingha for her kindness, Ishmael and Simon for all their hard work and commitment, Mishack, Sharon and Thelma for their help with the questionnaire and the test, Doctor, Jack and Piet for promoting our project within the taxi association, Deon van der Merwe for his help with the USSD system, Johan du Toit for dedicating near to one hundred hours to this project in one week, my family and friends and of course Rianne for sharing me with all the kind people I met in South Africa for six months and lastly Bart for sharing a great experience with me.

And thanks to everyone else who supported this research

Martin Marijnissen

Delft, June 2009
Sustainable impact in developing rural areas through business creation
Executive summary

For most people in the Western world transport fortunately is something that is simply there and something we can benefit from daily. It enables us to drink foreign coffee and to travel half way around the world for a vacation or a business meeting. Looking at how transport affects our lives it becomes clear how valuable and important it actually is. Transport enables us to source the production of goods to places where it is most convenient, to use our expertise within a certain field and to focus on what we do best. Without transport the Western world would probably not have been able to develop in the way it did.

Throughout the world there are many developing rural areas which are characterized by an underdeveloped service delivery and minimal economic development. This means that people living in these areas often have to travel long distances to reach work, a clinic, a hospital or a supermarket. For these regions to develop, the accessibility of these services is of a big importance. Unfortunately it is not rare for people within these rural areas having to walk for several hours to get around or for them to even stay at home, because transport is simply too expensive or not even available. Obviously this has a detrimental effect on a variety of activities essential for development. Jacobs & Greeves (2003) state that logistics services are essential components of economic development in all countries, but particularly in those still in the process of development. (Jacobs and Greeves 2003)

Local inhabitants of these developing rural areas mentioned their main challenge in order to lower the cost of transport and to increase the availability of transport to be improving the coordination of logistics service processes and to consolidate and synchronize freight and passengers. Sam Muniafu states that the use of ICT-enabled logistics brokering services in rural areas is expected to reduce the economic and service access barriers associated with small enterprise sizes, long distances from amenities, and low-volume supply chains. (Muniafu 2007) Such a logistics brokering system is focused on overcoming these coordination and communication constraints as to increase the availability of transport.

The South African Council for Scientific and Industrial Research (CSIR) has decided to research how they can design a logistics brokering system to have a sustainable impact on the transport problems in developing rural areas. To gain a better understanding of the problems people in these areas face the CSIR has set up long-term relationships with the inhabitants of the real world context in a way that will ensure active participation by the latter in the research and development (R&D) process. (Maritz, Veldsman et al.) One of these areas is Kgautswane, a rural area in the south of the Limpopo Province. This specific area has been selected by the CSIR to function as the initial context for this research. The specific objective of this research therefore is:

“To design an ICT-enabled logistics brokering system that sustainably improves the transport service delivery in Kgautswane, South Africa”

Because an initial scan of literature on using ICT-systems in rural areas showed a large portion of failed and unsustainable projects this research objective should lead to a better insight into the design of ICT systems in developing rural areas in general and more specifically into the design of ICT-enabled logistics brokering systems to have a sustainable impact in developing rural areas. The outcome of this design effort should therefore answer the following research question:
“What design guidelines can we derive and test for ICT-systems to create a sustainable impact in the context of developing rural areas, with a specific focus on an ICT-enabled logistics brokering system?”

We decided to adopt a design science perspective in order to gather new knowledge on this topic. This perspective guides any research regarding learning from innovative designs. Since a vast amount of ICT-system implementations proved to be unsustainable, clearly there still was a lot to learn and the ICT-enabled logistics brokering system could not be routinely designed, but required an innovative design.

We first developed four guidelines that were used to guide the research and design process. The first guideline argues the important role of a structured design approach, the second guideline elaborates on the essential role of user participation within this design approach, within the third guideline creating business opportunities for a local intermediary is introduced as an effective way of sustaining a system’s added value and the last guideline suggests some criteria to select the technology best suited for a developing rural area. By adopting a structured design approach, we focused on the actual problem instead of thinking of a technical solution and looking for a problem. This helped us to become aware of all kinds of different problems. Within the practical design of the logistics brokering system we for instance decided to use timeslots and not allow people to request transport for a specific time, in order to make sure we would be able to group enough transport requests to ensure profitable trips for the local taxi association. Having the local taxi association participate in the design process proved to be particularly useful in order to become aware of these difficulties. We also waited with the choice for a specific technology until the end of the analysis phase in accordance with the fourth guideline. This proved valuable, since it turned out that we did not need an advanced technology. Using a less advanced technology actually was more useful since this could be used on more types of mobile phones.

Within this evaluation it was noted that every respondent considered the designed service a valuable and easy to use service. Some respondents also encouraged us to make this system known to the whole of Kgautswane because it would help to ease their transport problems. The test results and the interactions with local intermediaries showed that the designed logistics brokering system has a clear potential to sustainably improve the transport service delivery in Kgautswane.

Based on this evaluation the set of guidelines that was derived within the first section of part A of this research has been discussed in order to verify their use in creating a sustainable impact in the context of developing rural areas by shaping the design of ICT-systems. As an answer to the main research question each of these guidelines was noted to have proved to be useful in the design of an ICT-system in the context of developing rural areas.
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1 Introduction

“In today, after more than a century of electric technology, we have extended our central nervous system in a global embrace, abolishing both space and time as far as our planet is concerned” (McLuhan 1965)

In 1964 Marshall McLuhan first referred to the world as a global village. The quote placed here is from his book “Understanding Media”. In this book he argues that through the use of information and communication technologies space has vanished. When writing his book, McLuhan was mainly referring to being aware of everything that is going on in the world. Since 1964 a lot has changed and today we are not only aware of what is going on in the world, we are also producing and consuming on a global scale. We use computers that are being produced in Taiwan, we drink coffee made from Bolivian coffee beans and at night we drink a Dutch Heineken. Not only are we producing and consuming on a global scale, people also tend to travel more and more, to get to work, to go on a holiday or just to visit friends.

1.1 Research motivation

For most people in the Western world transport fortunately is something that is simply there and something we can benefit from daily. It enables us to drink foreign coffee and to travel half way around the world for a vacation or a business meeting. Looking at how transport affects our lives it becomes clear how valuable and important it actually is. Transport enables us to source the production of goods to places where it is most convenient, to use our expertise within a certain field and to focus on what we do best. Without transport the Western world would probably not have been able to develop in the way it did.

Although the global village is a suitable metaphor for our world being more and more interconnected, we should not forget that there are some areas within this village that are highly isolated. Throughout the world there are many developing rural areas, mainly located within the developing world countries. These rural areas are characterized by an underdeveloped service delivery and minimal economic development. This means that people living in these areas often have to travel long distances to reach work, a clinic, a hospital or a supermarket. For these regions to develop, the accessibility of these services is of a big importance. Unfortunately it is not rare for people within these rural areas having to walk for several hours to get around or for them to even stay at home, because transport is simply too expensive or not even available. Obviously this has a detrimental effect on a variety of activities essential for development. Jacobs & Greeves state that logistics services are essential components of economic development in all countries, but particularly in those still in the process of development. (Jacobs and Greeves 2003) Box 1 on page 16 gives some examples of problems related to transport in a real world situation.
1.2 Research background

The impact of transport problems in developing rural areas is significant. A lot of research has been done to alleviate these problems. One of the focus areas is the use of information and communication technologies to accelerate development and to bridge the gaps in mainstream service delivery. (Muniafu 2007) Within his PhD research Muniafu researched how ICT could facilitate logistics service delivery in developing rural areas. Based on interviews with several logistics service practitioners he states the following:

"Through the interviews with the logistics service practitioners, we found that the main challenge they faced in developing logistics services was how to improve the coordination of logistics service processes in the rural areas. They identified the main problems as being the lack of consolidation and synchronization of small freight volumes, passenger transport, and the presence of complex many-to-many movements." (Muniafu 2007)

Muniafu researched the possibilities of using a logistics brokering system focused on overcoming communication constraints as to increase the availability of transport. He developed a software suite that enables a logistics broker to register vehicles with unused capacity and capture possible transport demand. Using this tool such a broker can facilitate communication between people who request transport and possible transport suppliers. With specific reference to rural areas, he states that the use of ICT-enabled logistics brokering services in rural areas is expected to reduce the economic and service access barriers associated with small enterprise sizes, long distances from amenities, and low-volume supply chains. (Muniafu 2007)

The Council for Scientific and Industrial research is one of the leading science and technology research, development and implementation organizations in Africa. Within the Built Environment (BE) research area the Rural Infrastructure and Services (RIS) competency area addresses rural and second economy challenges, as is described within their mission statement:

"RIS strives to provide innovative and sustainable technological solutions to the constraints faced by rural communities and Small, Medium and Micro Enterprises (SMMEs)." (CSIR 2008)
In following of this mission the RIS competency area has decided to research how they can design a logistics brokering system to have a sustainable impact on the transport problems in rural areas. To gain a better understanding of the problems people in these areas face the CSIR has set up long-term relationships with the inhabitants of the real world context in a way that will ensure active participation by the latter in the research and development (R&D) process. (Maritz, Veldsman et al.) One of these areas is Kgautswane, a rural area in the south of the Limpopo Province. This specific area has been selected by the CSIR to function as the initial context for this research.

1.3 Research problem

The use of information and communication technologies to accelerate development is researched by a vast array of researchers. (Walsham and Krishna 2005; Muniafu 2007; Naude and Maritz 2007; Pade 2007) Naude and Maritz (2007) state that there is a strong case for investing in the research, development and implementation of Information and Communication Technologies. Pade (2007) even has a stronger opinion and argues that the use of ICTs in development activities can considerably enhance rural development. These sources therefore strengthen the case for the use of an ICT-enabled logistics brokering system to enhance the transport delivery in developing rural areas. However these same sources also frequently report on failures of ICT systems in these areas. Muniafu (2007) mentions a high proportion of failed or unsustainable developmental projects and Pade (2007) discusses barriers and constraints specific for rural communities, which can result in projects to completely fail or to be unsustainable. Walsham and Krishna (2005) even go as far as stating that previous experiences have not been encouraging. These researchers frequently criticize the way ICT’s have been used and implemented for development before, but the way in which ICT’s have been used for development in the

Extracted from “ICTs and the MDGs: On the wrong track?”

We are left with an agenda that prioritizes the use of ICTs in those domains in which they are often least able to be implemented, least able to succeed, least able to sustain and, hence, least able to make a contribution to development. One can just envisage the meetings in development institutions:

- **Boss:** “OK chaps, we need to apply ICTs in development. Where shall we put the computers?”

- **Underling no.1:** “Well, sir, how about in some high-tech firms in the city that could use them to create jobs and improve exports?”

- **Boss:** “You idiot, that’s not what poverty alleviation and social development are all about. Get out of my sight.”

- **Underling no.2:** “I know, sir, how about putting them in a small village where there’s no electricity, most people are illiterate, and everyone is really poor.”

- **Boss:** “Brilliant suggestion; here’s $100,000; go and do it.”

Most of the projects applying ICT to the MDGs* never properly work, and for those that might just get off the ground, go back two years later, and it’s all crumbled to dust. Our evidence base on this does need strengthening but a recent survey suggests at least one-third of such projects are total failures and one-half are partial failures, leaving little room for success.

A classic example is Gyandoot; an initiative of computer kiosks in rural India. In 2000, amid much fanfare, this won awards from the Stockholm Challenge and the Computer Society of India. Later studies of Gyandoot in 2002 did not hit the headlines, but they found kiosks abandoned or closed; absurdly low usage rates of once every two-three days; and few signs of developmental benefits. (Heeks 2005)

*MDG: Millennium Development Goals
last few years is maybe most clearly illustrated by Heeks. Heeks (2005) wrote an article to point out that ICT’s in itself are no solution, but they should be used as a means to an end. The main lesson that can be drawn from his experiences and views is that if we forget to think about how we should use ICT’s to help the developing areas of the world to develop, these projects are bound to fail. (Heeks 2005) In box 2 on page 17 an extract of his article on ICT’s and the Millennium Development Goals is placed. This extract shows Heeks’ perspective on simply putting computers in developing rural areas. When taking the views found in literature into account one can only conclude that there still is a lot to learn about the design of an ICT system to have a sustainable impact in a developing rural area.

1.4 Research objective and question

In the previous sections it has been made clear that there is a need to improve the transport delivery in the developing rural areas of the world and that an ICT-enabled logistics brokering tool could help to alleviate this problem. When designing and implementing an ICT-system one should keep in mind that such an implementation has not always proved to be sustainable.

As the CSIR wants to explore logistics brokering in rural areas, this research should provide them with information on how a logistics brokering system can have a sustainable impact on the transport problems in rural areas. As mentioned before, the area of Kgautswane in the South of Limpopo, South Africa will form the initial context of this research. The specific objective of this research therefore should lead to a sustainable improvement of the transport service delivery in Kgautswane, hence the objective is formulated as follows:

“To design an ICT-enabled logistics brokering system that sustainably improves the transport service delivery in Kgautswane, South Africa”

This research objective should lead to a better insight into the design of ICT systems in developing rural areas in general and more specifically into the design of ICT-enabled logistics brokering systems to have a sustainable impact in developing rural areas. The outcome of this design effort should therefore answer the following research question:

“What design guidelines can we derive and test for ICT-systems to create a sustainable impact in the context of developing rural areas, with a specific focus on an ICT-enabled logistics brokering system?”

1.5 Research approach

To ensure that the defined objective of actually designing a logistics brokering system leads to an answer to the defined research question it is essential to choose an appropriate research approach to guide the research. Within this research the design-science paradigm has been followed. Hevner states that in the design-science paradigm knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact. (Hevner, March et al. 2004). Design-science thus enables researchers to understand the problem addressed by the
designed system and the feasibility of their approach to its solution. (Nunamaker, Chen et al. 1991) It is important to note that design-science research addresses important unsolved problems in unique or innovative ways. (Hevner, March et al. 2004) Hevner provides a clear distinction between routine design and design research as to argue that design science is only applicable in situations where problems are unsolved and that need innovative solutions. He states that the key differentiator between routine design and design research is the clear identification of a contribution to the archival knowledge base of foundations and methodologies. As design-science research results are codified in the knowledge base, they become “best practice”. System building is then the routine application of the knowledge base to known problems. (Hevner, March et al. 2004) This distinction has been visualized in Figure 1-1: From "Design research" to "Routine design". This figure shows two main axes, one indicating the innovativeness of design and the other indicating the knowledge base in which the so called “best practices” are stored. As is mentioned in the previous section, implementation of ICT systems in rural areas is not without difficulties and should be researched further. You could state that the knowledge base for the design of ICT-systems in rural areas does not yet allow for routine design, but needs creativity and innovativeness. Hopefully we can contribute significantly to the knowledge base by the design that will be made for Kgautswane.

To make sure the design of a system will actually return knowledge and understanding of the problem domain and its solution, Hevner defined seven guidelines. Not all guidelines are relevant within this research, because of the focus that has already been chosen. For instance two guidelines discuss the necessity of creating an actual design and making sure this design is relevant for the stakeholders of the researched problem domain. Because we chose to create a design for a specific rural area in South Africa, these guidelines are already adhered to. For this specific research and the focus we already chose, the following three guidelines are relevant to keep in mind – adopted from (Hevner, March et al. 2004):

1. **Research rigor**: Rigor addresses the way in which research is conducted. Design-science research requires the application of rigorous methods in both the construction and evaluation of the designed system. Rigor is derived from the effective use of the knowledge base – theoretical foundations and research methodologies.
2. **Design evaluation**: The utility, quality and efficacy of a designed system must be rigorously demonstrated via well-executed evaluation methods. Evaluation is a crucial component of the research process. Evaluation of a designed ICT-system requires the definition of appropriate metrics and possibly the gathering and analysis of appropriate data. Because design is inherently an iterative and incremental activity, the evaluation phase provides essential feedback to the construction phase as to the quality of the design process and the design product under development. A designed system is complete and effective when it satisfies the requirements and constraints of the problem it was meant to solve.

3. **Design as a search process**: Design is essentially a search process to discover an effective solution to a problem. Problem solving can be viewed as utilizing available means to reach desired ends while satisfying laws existing in the environment (Simon 1996). Abstraction and representation of appropriate means, ends, and laws are crucial components of design-science research. These factors are problem and environment dependent and invariably involve creativity and innovation. Means are the set of actions and resources available to construct a solution. Ends represent goals and constraints on the solution. Laws are uncontrollable forces in the environment. Effective design requires knowledge of both the application domain (e.g., requirements and constraints) and the solution domain (e.g., technical and organizational). Given the wicked nature of many information system design problems, however, it may not be possible to determine, let alone explicitly describe the relevant means, ends or laws. (Vessey and Glass 1998) In such situations, the search is for satisfactory solutions, i.e., satisficing (Simon 1996), without explicitly specifying all possible solutions. While it is important why an artifact works, the critical nature of design in information systems makes it important to first establish that it does work and to characterize the environment in which it works, even if we cannot completely explain why it works.

These three guidelines will be applied in this research to ensure the system design will actually return knowledge and understanding of the problem domain and its solution.

The general process of design-science research is discussed by Vaishnavi and Kuechler. (Vaishnavi and Kuechler 2007) They adopt Owen’s general model for generating and accumulating knowledge as a helpful model to understand the design research process. A visualization of this model is shown in Figure 1-2: Generating and accumulating knowledge. “Knowledge is generated and accumulated through action. Doing something and judging the results is the general model … the process is shown as a cycle in which knowledge is used to create works, and works are evaluated to build knowledge.” (Owen 1997) As is indicated by Hevner (2004) building these so called works requires not only a theoretical knowledge base however but also requires relevant business needs from the environment within
which these works will be applied. These business needs have to be gathered through an analysis of this environment. Hevner (2004) refers to this contextual body of knowledge as the experience base. Because both this experience base and the knowledge referred to by Owen are required to be able to create works they have been placed alongside each other in the visualization of Owen’s general model for generating and accumulating knowledge. The general process of this research has been based on this model and has been split up into three parts. The first step (part A) within this research consists of an analysis of relevant notions that can be found in literature and an analysis of the local context. This will result in both the knowledge and experience base necessary for the actual system design. Within part B the knowledge and experience base will be used and translated into design requirements. This part of the research will also discuss the final system that has been designed to enhance the transport service delivery in Kgautswane. Part C of the report will evaluate the system that has been designed in part B. Each part of this research will answer several sub research questions; Apart from the two sub questions in Part C, all sub research questions will be addressed within a separate chapter of the report. For the different parts of the research the corresponding research questions are shown below:

A. **Analysis; Knowledge and Experience base**
   A.1. **Chapter 2 –** Which design guidelines can we derive from literature to create a sustainable impact in the context of developing rural areas for ICT-systems?
   A.2. **Chapter 3 –** What is the state of the transport service delivery in Kgautswane and how can this be improved by an ICT-enabled logistics brokering system?

B. **System design; Logistics Brokering in Kgautswane**
   B.1. **Chapter 4 –** Which requirements should be set for a logistics brokering system to be sustainable and effective in improving the transport service delivery in Kgautswane?
   B.2. **Chapter 5 –** How should an ICT-enabled logistics brokering system be set up to be expected to sustainably improve the transport service delivery in Kgautswane, South Africa?

C. **Evaluation; Success in Kgautswane?**
   C.1. **Chapter 6 –** How effective is the designed ICT-enabled logistics brokering system in improving the transport service delivery in Kgautswane?
   C.2. **Chapter 6 –** What is the expected sustainability of the designed ICT-enabled logistics brokering system?

**1.6 Design approach**
As has been mentioned before in this introduction, the ICT-enabled logistics brokering system will be designed to enhance the transport delivery in Kgautswane, South Africa. This area has been chosen by the CSIR as the context for this research, because they have built up a long-term relationship with the inhabitants of this area in a way that will ensure active participation in the research and development process. To make sure this process makes use of this resource rigorously it is important to structure this process as much as possible. To guide the design and the actual design process a concrete design approach thus has been selected. Within this research the approach on designing mobile service systems from van de Kar and Verbraeck (2007) is applied to structure our design efforts and our interactions with the local stakeholders in Kgautswane.
The purpose of the designing mobile service systems approach is to produce a service for end-users. (Kar and Verbraeck 2007) In accordance with the research objective the final design should provide a real service to the end-users in Kgautswane. One of the most important perspectives presented by van de Kar and Verbraeck is to design a service system according to three areas of interest. Firstly a service concept should be defined to express the value for its users. Secondly, an appropriate organizational network should be in place that supports the service production from an (inter)organizational point of view. Thirdly a technical architecture should be provided to structure software, hardware and netware that enable the delivery of a service. (Kar and Verbraeck 2007) In Figure 1-3: Distinguished aspects of a service system these three different aspects have been visualized. The three arrows indicate the interdependencies that exist between the different aspects. Within this research the design has been broken down into different deliverables according to a detailed approach that has been described within the book of van de Kar and Verbraeck. These deliverables all form a part of either the service concept, the technical architecture or the organizational network as described above. Within part B of this report the design therefore will be discussed according to this break-down structure. Before discussing the design, the first chapter of part B of the report will discuss the different design requirement that have been formulated based on the findings presented in part A of this report. Besides breaking down the design of the service system, van de Kar and Verbraeck also give some guidance on how the actual design process should be arranged. (Kar and Verbraeck 2007) To a large extent this has shaped the interactions with the local stakeholders in Kgautswane. The main focus of the design approach derived from their book is that the design process needs to be incremental and iterative. The actual interactions with both the local suppliers and the users of the system therefore where designed in order to guide the refinement and verification of previously defined design requirements. The requirements with regard to the business processes and the service concept for instance have successively been derived from interactions with local stakeholders, interpreted, incorporated in a preliminary design or several preliminary design options, presented to the local stakeholders and adjusted according to their newly triggered needs.

1.7 Outline
Within the first part of this report chapter two will provide an overview of relevant notions found in literature. Based on these sources several guidelines will be introduced as to establish the knowledge base necessary for the design of the actual service system. This chapter will be concluded with an general evaluation of these guidelines and an assessment of the fit between the chosen design approach and these guidelines. The following chapter will establish the experience base; within this chapter the different interactions with the local stakeholders will be elaborated on. These interactions will be discussed according to the actual design process that has been adopted in order
to provide a complete overview of the experiences within Kgautswane. This chapter will therefore start with a discussion of the followed design process and will give more insight into the envisioned service concept. Chapter four is the first chapter of part B and will give an interpretation of both the knowledge and experience base by presenting the requirements that have been set for the design of the service system. The next chapter presents the service system design and will discuss several design options and defend the choices that have been made. Part C consists of only one chapter within which the designed system will be evaluated. This chapter essentially will focus on whether the logistics brokering system can be expected to be successful and to sustainably enhance the transport service delivery in Kgautswane. This evaluation can be seen as an assessment of the extent to which the objective of this research project has been reached, it basically describes the practical contribution this research has made to the community of Kgautswane. Following these three parts of the research, the last chapter of this report will provide an answer to the main research question by concluding with an overview of the scientific contribution this research makes to the knowledge base on the sustainable design of ICT-systems and more specifically ICT-enabled logistics brokering systems, in rural areas. Apart from describing the scientific contribution, this conclusion will also discuss the project’s limitations, suggest further research and reflect upon the entire research project.
Part A:

Analysis;
"Knowledge and Experience base"

A.1. Chapter 2 – Which design guidelines can we derive from literature to create a sustainable impact in the context of developing rural areas for ICT-systems?
A.2. Chapter 3 – What is the state of the transport service delivery in Kgautswane and how can this be improved by an ICT-enabled logistics brokering system?
2 Developing rural areas, what’s the difference? – Knowledge base

“As we make progress in the third millennium, we are experiencing an important change in our daily lives, the move to an Internet-based society (Turban, King et al. 2006). The growth of Internet infrastructures and the World Wide Web has created new opportunities, such as sourcing strategies that enable access to skills and expertise, and the provision of critical services (Qureshi 2003). The United Nations Conference on Trade and Development (UNCTAD) annual report for 2004 pointed out that enterprises and society at large widely accept that information and communication technology (ICT) is at the centre of an economic and social transformation that is affecting all countries.” (Muniafu 2007)

The quote placed above is a section from the first paragraph of Muniafu’s dissertation on developing ICT-enabled services in transition countries. This quote highlights the reason for using ICT for development frequently found in literature. The role ICT currently plays in our society is often being translated into a role of accelerator in developmental activities. As has already been mentioned in the introduction Muniafu (2007) mentions a high proportion of failed or unsustainable developmental projects however. According to Heeks (2005) one-third of ICT projects are total failures and one-half are partial failures, leaving little room for success. Apparently ICT’s are not easily adapted to fulfill the role of developmental accelerator. ICT projects either are abandoned, stay dependent on donor funding or simply do not deliver on their developmental goals. We should therefore ask one another why these ICT projects are failing and why ICT’s apparently cannot easily be made to accelerate development. We should wonder what the difference between the western and the developing world is. There is a need to learn how to design an ICT system to have a sustainable impact in a developing rural area. It therefore is essential to learn from previous experiences and to gather knowledge on best practices with regard to the design and implementation of ICT-systems in developing rural areas. This section of the report will give an overview of relevant notions found in literature in order to guide the design effort in the next part of this research. These findings have been structured into a set of four guidelines as to answer the following research question as presented in the introduction:

A.1. Which design guidelines can we derive from literature to create a sustainable impact in the context of developing rural areas for ICT-systems?

The general perception that can be found in literature is that an ICT-system can only have a sustainable impact in a developing rural area if the main focus of the design effort is the value a system holds for its users. The first guideline argues the important role of a structured design approach, the second guideline elaborates on the essential role of user participation within this design approach, within the third guideline creating local business opportunities is introduced as an effective way of sustaining a system’s added value and the last guideline suggests some criteria to select the technology best suited for a developing rural area. This chapter will conclude with a general evaluation of these guidelines will discuss the design approach for this research.
2.1 Guideline 1: Stop thinking about ICT-systems

Multiple ICT-projects have failed because their focus was limited to using ICT-systems for development. Very often the goals and objectives for using these ICT-systems were unclear or they were based on the general perception that ICT technology would simply trigger development without having even thought about why it should be used. It is important to keep in mind that ICT in general will never be a solution but at best can form a powerful facilitator in solving a problem. According to Fourie (2007) poverty cannot be cured by simply linking a rural poor person to a computer network, the focus should be on the information and the communication services rather than the ICT itself.

"Technology is not the real challenge. The human factor remains the greatest barrier to development and the major reason for project failures." (Fourie 2007)

Gigler (2004) questions the ability of ICT’s to empower poor communities within his paper titled: “Including the excluded”. Within the conclusion he writes that there does not exist a direct causal relationship between ICTs and empowerment, but that in fact this relationship is being shaped by a dynamic, multi-dimensional interrelationship between technology and the social context. He even states that the technical issues involved in the provision of ICTs frequently do not play a key role. (Gigler 2004)

Caroline Pade (2007) has researched project management techniques for sustainable ICT projects in rural development. She stresses the importance of simple and clear project objectives, approaching a project in a holistic way and using ICT’s to enhance existing rural development activities. According to Pade the introduction of ICT’s in the developing world has resulted in ICT initiatives that are characterized by goals that are too lofty. As she mentions, ICT acts as an enabler and ICT projects therefore cannot be implemented in isolation of the activities that make up a community. A holistic systematic approach thus should be adopted. Pade mentions building human capacity, creating a favourable environment for business creation and infrastructure development as possible aspects of a rural ICT project that should also be addressed in order to ensure a sustainable impact. ICT projects simply need to be integrated and anchored into local organisational activities and processes. (Pade 2007)

From the statements above one can conclude that previously ICT-systems too often have been implemented with an overly strong focus on technology. As put by Heeks, the general idea to often was: “Where shall we put the computers?” (Heeks 2005) This first guideline therefore says to stop thinking about ICT-systems. The first step should not be focused on how or where or when you should use ICT’s, it needs to be focused on which problem you actually want to solve. When adopting this focus the final solution can always be evaluated based on the extent to which the initial problem is solved. This will ensure that if an ICT-system turns out to be a part of the designed solution, it is embedded in the necessary organisational activities and processes.

Basic development models for information systems, like Boehm’s (1988) spiral model, adopt a similar focus. Boehm (1988) identified four activities that should be carried out subsequently in multiple rounds. The first activity in this approach consists of determining objectives, alternatives and constraints. Clearly it does not focus on any specific solution initially; by starting the development process with this step, insight is gained into what specific problem should be solved and which possibilities for solving this problem should be evaluated. Herder and Stikkelman (2004) promote...
their view that designing is “Selecting an instance in the design space that meets the objectives and constraints.” (Herder and Stikkelman 2004) They adopt the general framework that also starts with determining objectives, constraints and alternatives, referred to as the design space. When taking the focus of these basic design models into account it becomes apparent that what is generally accepted within basic design theory, should also be applied to the design of ICT systems in developing rural areas. Because ICT systems play such a central role and are so widely accepted in our society, it was to easily regarded as a quick fix to accelerate development; to some extent local communities were expected to independently find utility for the ICT systems that they were provided with. The list of failures of such projects show that this approach has failed; a more structured approach, that focuses on the utility of ICT systems upfront, should guide any developmental effort incorporating ICT’s.
2.2 Guideline 2: Ensure added value through user participation

Corresponding with the technology driven approach, described within the first guideline, previously ICT programs were frequently not responding to a concrete need expressed within the communities. (Gigler 2004) As is mentioned before the first step should be to get a clear project focus and to define the problem you want to solve. Gigler (2004) stresses the capacity of poor people to define their own development priorities and goals, whereby outside agents should only ‘begin’ to work with the community, once it has developed its own ‘development plan’ and identified its specific needs for outside support. (Gigler 2004) Clearly the people within the community need to be involved when defining a problem and designing a possible solution. According to Pade (2007), ICT projects imposed on a community that has not independently determined a need for it through project participation are more likely to fail or not be sustainable. (Pade 2007) She states that like a business, a project is required to understand the market it aims to target and it thus should serve the community’s requirements for ICT services. The participation of the community in the planning, analysis, design, implementation, and evaluation of an ICT project therefore is essential for the sustainability of the project. Basically every ICT-system should be guided by the context it is designed for, as described by Fourie: “The beneficiary needs to be at the core of the design and implementation process of any poverty reduction effort.” (Fourie 2007) Similarly Fortier states the following: “The outcome of the design process needs to be based on participation by the communities themselves, who are best placed to define the specific design and use of an ICT system most appropriate to their own needs.” (Fortier 2003)

Participatory design is a well described and widely researched approach in Western society. According to Kensing and Blomberg for systems to be well integrated into current work practices it is of central importance that meaningful and productive relations between those charged with technology design and those who must live with its consequences are developed. (Kensing and Blomberg 1998) They consider user participation central to the value and therefore the success of any project.

Puri, Byrne et al. (2004) argue that participation in information systems development should be a social process of bringing people together to understand different views and share decision-making so a sustainable information system is designed that is culturally and locally specific. They furthermore state that, while involvement of all stakeholders in the Western participatory traditions has been emphasised, particularly in the socio-technical tradition, the challenges to doing so in community settings of developing countries are clearly different. “Cultural practices are deeply embedded in the ethos of the community and the participatory paradigm in these settings is bounded by the cultural traditions and practices. For user participation to be successful the designers should try to share practice with users. User participation means not only users participating in design but also designers participating in use. They state that participatory design is a learning process in which designers and users learn from each other and the users, in particular, must have a guarantee that their design efforts are taken seriously.” (Puri, Byrne et al. 2004)

The Council for Scientific and Industrial Research (CSIR) is participating in an international research consortium, titled Collaboration at Rural (C@R), aimed at enabling people in rural areas to participate fully in the research and technology development activities that potentially affect their lives. This consortium is funded by the European Union’s Framework Programme 6 and comprises thirty partners from fifteen countries. Research that is being carried out within this consortium is
centred around so called Rural Living Labs. These rural living labs are user-centric, real-life research and development contexts, involving people, businesses and public players in the co-creation of services enhancing rural development. Within this concept research institutions set up long-term relationships with the inhabitants of the real world context in a way that will ensure active participation in the research and development process. The user-oriented methodology of the Rural Living Labs will ensure that the highly specific requirements of rural users are met, and will provide mechanisms to gather technical requirements for the project as well as develop and test possible solutions. (Maritz, Veldsman et al.) By setting up long-term relationships with rural communities mutual learning can be realised and the users stay involved and therefore can verify themselves that their design efforts are taken seriously. Within personal communication with Johan Maritz, a research group leader from the CSIR, he pointed out that for these long-term relationships to be maintained mutual benefits need to be ensured. It therefore is essential to not only design and test possible ICT-systems, but to make sure these systems are actually realised and implemented.

Besides extracting user requirements, the participative design and implementation process in practice should focus on the evaluation of options presented to the users, rather than involving them with the actual design of a system. (Heukelman 2006) Because the users in a rural environment lack an understanding of what ICT’s can do for their community, it is difficult for them to articulate their technology needs in relation to their rural development goals. Pade (2007) suggests to firstly introduce a project to the community in a simple manner and expanding the ICT services provided according to the stimulated demands of the people. (Pade 2007) Although participatory design challenges are clearly different in community settings of developing countries as articulated by Puri, Byrne et al. (2004), some challenges are also clearly similar. (Puri, Byrne et al. 2004) In line with the remarks made by Heukelman (2006) and Pade (2007) with regard to the process of participatory design in the developing world, van de Kar and Verbraeck state the following:

“It is difficult for users to list requirements for information systems in which they are involved. Different users will have different requirements and requirements will change over time. This problem can be mitigated through the inclusion of users in the design phases as in an evolutionary development model. An evolutionary approach is suitable in situations where the requirements are not well formed or understood by the users, where it is difficult to specify the requirements, or where it is difficult to determine how a proposed solution will perform in practice.” (Kar and Verbraeck 2007)

Clearly the difficulty of extracting system requirements from a participatory design process is not unique to the developing world, but better can be seen as a challenge for developing ICT systems in general. As mentioned before the Western participatory tradition has been widely researched and documented and herewith forms a valuable source of knowledge on how to address this challenge.

One valuable approach that was already mentioned in the above placed quote from van de Kar and Verbraeck (2007) is to use an evolutionary development model in the design process. According to Boehm (1988) an evolutionary design approach consists of expanding increments of an operational product with the directions of evolution being determined by operational experience. Within Boehm’s spiral model he therefore suggests to develop an information system by iteratively checking requirements, refining designed prototypes and verifying and testing their functionality within
multiple rounds until the system designers are satisfied with the results. (Boehm 1988) This approach clearly supports the remarks made by Pade (2007) on starting simple and expanding the system further based on stimulated needs. Similar to van de Kar and Verbraeck (2007) and Puri, Byrne et al. (2004), Kensing and Blomberg (1998) state that in order for users to take an active part in technology design it is essential for designers to learn about the everyday work practices of potential users and for users to learn about possible technology futures. Similar to the Rural Living Labs approach adopted within the Collaboration @ Rural research consortium, Kensing and Blomberg (1998) also promote establishing long-term working relationships with the users of an ICT system. They furthermore indicate that workshops, questionnaires, open ended interviews and user observations are among the primary techniques to gain insight into unarticulated design requirements. To allow users and designers to more easily interact Kensing and Blomberg (1998) suggest to make use of visualisations, scenarios and simulations. (Kensing and Blomberg 1998)
2.3 Guideline 3: Create local business opportunities to sustain added value

For any system intervention the goal is to have a sustainable impact. For a system to be sustainable the design of such a system should be relevant to its local context and needs to be managed and maintained in order to remain relevant. The previous guidelines should help to design a system that is relevant for and of real value to a rural community and highlighted the importance of the participation of the people within the community during the design phase. The participation of the people that are involved in the use of the system should not stop after the implementation phase however; this is where it becomes most important for them to stay involved. As mentioned before, Fortier states that the communities themselves are best placed to define the specific design and use of an ICT system most appropriate to their own needs. (Fortier 2003) Continued participation of the community in the operation of an ICT-system is one aspect of what is commonly referred to as ownership. Siochru and Girard define the concept of ownership as a process of internalisation of responsibility, legal ownership and degree of decision-making for the ICT development process and its outcomes. (Siochru and Girard 2005) The sustainability of a project depends on the ability of the community to take ownership of the ICT project process. Ownership plays a significant role in setting the foundation for local buy-in, and is crucial for relevance, effectiveness, efficiency, impact and hence the sustainability of rural development activities. Ownership also plays a role in increasing sustainability because it limits interference of and overdependence on external actors. (Ballantyne 2003; Pade 2007) Ownership is not only an issue in the context of developing rural areas, but also plays a role in participatory design projects in general. As stated by Kensing and Blomberg (1998); users must increasingly gain in their ability and willingness to take on the roles played by the researchers initially. “A wide range of actors must care about the survival of the project” (Kensing and Blomberg 1998)

Opinions on how continued participation and the more engaging concept of ownership should be realised vary. Pade suggests to cultivate an influential local project champion that can take up the role of intermediary. These champions can essentially inspire, drive and encourage the targeted community to use ICT, thereby facilitating the introduction of ICT’s as smoothly as possible. Subsequently, they can effectively communicate the project objectives toward supporting rural development to the rural community and make an effort to keep the project on track in terms of achieving its goals. (Pade 2007) Such a local project champion herewith can form the embodiment of ownership and makes this somewhat vague concept more tangible. Fourie does not clearly identify the need for a single local project champion but emphasises the need to have ICT projects to be self-managed and appropriated by the local communities they are designed for. (Fourie 2007) This would mean that the external actors should also relinquish control of the project. As stated by Michiels and van Crowder; “In order to enable communities to locally appropriate the used technologies, the control over these technologies should be decentralized.” (Michiels and Crowder 2001) ICT-systems and services for rural communities therefore should always be designed in such a way that it is possible for these systems to be managed by the local communities themselves. Rensburg and Veldsman took ownership and the ideas of self-management and local project champions and have introduced the concept of the social entrepreneur, a so called Infopreneur. They argue that it is necessary to change the mindset that currently drives ICT-system implementation in developing rural areas and state that it has become quite clear that the relatively simplistic views of the ‘enabling powers’ of ICT’s in the development arena have failed to deliver on the promised development goals. Similar to multiple researchers quoted previously Rensburg and Veldsman share Fourie’s opinion that
the focus should be on the information and the communication services rather than the ICT itself. The concept of the Infopreneur takes the idea of an influential local project champion one step further and places this local entrepreneur at the heart of the actual service delivery. Rensburg and Veldsman have defined the Infopreneur as a self-employed social entrepreneur utilising ICT's. Accordingly they state that the role of the government, the big NGO’s and any other party should adopt a new mindset required to move from “technology diffusers” to ICT intensive “business developers”. (Rensburg and Veldsman 2006) This new role of “business developers” would come down to cultivating a local project champion as suggested by Pade and to design a service utilising ICT, focused on offering financially profitable business opportunities to this “Infopreneur”. The idea of rural development through business creation is supported by several researchers in the field. Kendall and Singh state that in essence the principle of sustainability states that development efforts should be economically or commercially self-sustaining eventually, and that preferably they should be made sustainable through some kind of market mechanism. (Kendall and Singh 2006) In their opinion any system intervention therefore should be limited to overcoming the barrier that was keeping the market from developing on its own. (Kendall and Singh 2006)

The different strategies for realising ownership range from local capacity building and simply encouraging local stakeholders to take ownership to business development for local entrepreneurs. Basically most references in literature point in the same direction with regard to ownership. Ownership is essential to make sure a project remains relevant to its local context. To ensure ownership an individual or group of people should see value in taking up the role of manager and decision-maker. By designing an ICT-system from the perspective of a financially profitable service offering, this value might be realised. If possible it therefore is desirable to design a service system using the concept of the Infopreneur as proposed by Rensburg and Veldsman. (Rensburg and Veldsman 2006) Besides creating enthusiastic project owners that benefit from staying involved, an ICT project will also be more sustainable when designed according to this concept, because the progression of the project will become independent from donor funding. Bridges highlights that a business plan should be developed even if the ICT service in the community is not financially profitable. (Pade 2007; Bridges 2009) So regardless of whether a project can be made independent from donor funding it is essential to design the associated service from a business perspective in order to introduce an incentive for a local intermediary to manage the service successfully. General models that try to explain changes-of-practice also promote providing an incentive for sustaining the impact of any system intervention. (Briggs 2006) The Value Frequency Model (VFM) posited by Briggs (2006) explains changes-of-practice by discussing a rational line of thought that clarifies how an individual chooses a goal from a specific set of goals to pursue. He argues that an individuals’ choice on which goal to pursue is dependent on the value he or she associates with each goal and the likelihood that he or she will be able to reach this goal. Creating an incentive for a local intermediary to sustain the developed service will clearly add value to the associated goal of this local intermediary. In line with the previous two guidelines, this guideline thus is also supported by generally accepted concepts not specifically designed for the development of ICT systems in rural areas.
2.4 Guideline 4: Start thinking about ICT-systems again

This last guideline picks up where we left off at the first guideline. Once the problem that should be solved by a project is made clear through user participation and the design of the system has been centered around the service that should be provided by a business driven by a local intermediary, the necessary technology that is appropriate within the context of a developing rural area should be selected. Although the previously discussed guidelines where supported by general development models or notions found in literature not specifically focusing on developing rural areas, obviously these areas do considerably differ from the Western context. As stated by Pade (2007): “Not all ICT applications are appropriate to every rural environment, and it is important to choose the right applications to implement in a rural project.” (Pade 2007)

Basically two aspects should be considered in order to be able to choose the technology most appropriate. First of all ICTs need to be simpler, more robust and flexible, rather than being on the cutting-edge but likely fragile. It is important to avoid creating projects that are highly dependent on the used technology and its maintenance. (Fortier 2003) Pade (2007) suggests to analyze the rural environment in terms of its potential to accommodate particular ICTs. Aspects that should be evaluated are infrastructure availability, its accessibility, affordability, security, local electricity supply, cellular/mobile phone coverage, telecommunication network, internet service, etc. (Pade 2007) Paying attention to the requirements these possible constraints hold for the choice for a certain technology produces more sustainable results. (Pade 2007)

A second aspect that is important for choosing the appropriate technology is a certain sensitivity to the needs and requirements of the rural community. (Pade 2007) In order to use the technology to its fullest potential, the technology utilized must match the skills of the poor, or the poor need to be instructed on how to use the technology. The technology applied must be appropriate for the needs of the specific community. In order to make the technology easier to use for the people, all support instructions for instance must be in the local language. (Fourie 2007)
2.5 Conclusion; it’s all about stakeholder value

At the beginning of this chapter the question was raised on what the difference is between developing rural areas and the Western world. After the discussion on the abovementioned guidelines one can only conclude that it’s all about the value a system holds for its stakeholders, both for rural areas and the Western world; in other words, there is no difference.

As mentioned within the first and second guideline, the spiral model, Boehm’s (1988) basic development model for information systems will also help creating a sustainable impact in developing rural areas. Similarly the discussion on participatory design showed that associated problems and approaches are not unique to either the developing or the Western world. Within the third guideline Briggs Value Frequency Model (VFM) was mentioned as a theoretical foundation that supports the creation of local business opportunities from the perspective of basic general human behavior, again a theory that is applicable to both the developing and the Western world. So if we can approach the developing world using existing theories and models from the Western world what explains the high proportion of failed or unsustainable developmental projects mentioned by Muniafu (2007) and Heeks (2005)?

We should look at how we adopted technology in general and what triggered the rapid expansion of computer usage from the nineteen eighties onwards in the Western world. Professor of the Economics of Technical Change Steinmueller (1995) argues that software development explains the revolution in information systems:

“Every application of information technology has required complementary software – computer instructions that transform the tabula rasa of the computer hardware into machines that perform useful functions.” (Steinmueller 1995)

The key insight here is the necessity of transforming computer hardware into machines that perform useful functions. Within the Western society we went through an extensive and costly process before we arrived at the current stage where information and communication technology can perform useful functions and is at the centre of our economic and social activities, as described by Muniafu (2007). In 1973 Boehm already pointed out that expenditures on software were three times higher than those on hardware. Companies initially spent billions of dollars on in-house software development to be able to transform computer hardware into machines that perform useful functions. (Boehm 1973) Currently the position companies like Microsoft and Google hold within our society shows us the value we assign to software that enables us to utilise information and communication technology. Applications like WordPerfect that enabled us to use computers for activities we already carried out before, but now could carry out more efficiently, really were the drivers of the adoption process in the Western world. In our current society software is being developed by a numerous amount of suppliers geared to all sorts of applications in the Western world. We therefore have adopted a mindset that assigns value to having a computer, because in the current Western world it actually has this value. Too often we therefore thought to create an impact in the developing rural areas of the world by providing them with what we currently assign value to, a computer. We forgot about the extensive and costly process we went through and still continue to go through into the future to transform computers into machines that perform useful functions. This does not mean however that the developing areas of the world have to follow the same extensive
and costly development trajectory as the Western world has done. Clearly we should try to make use of the lessons we learned throughout our process of adopting new technologies and try to cut short the development trajectory for the developing areas of the world. Obviously using newer technologies and advanced applications in order to accelerate development can have clear benefits and there are several examples of successfully skipping stages in the development trajectory. The most well known example is the rapid expansion of cell phone usage in the developing areas of the world, herewith skipping the use of landlines, a technology that has been used for decades in the Western world. Accelerating development by skipping stages in the development trajectory is called leapfrogging and holds big opportunities for developing rural areas. (Steinmueller 2001) Although accelerating development by leapfrogging should be pursued, it is not always an easy process and it is definitely not as easy as simply putting computers in place. Obviously our developmental trajectory has been shaped by our needs and the position of the Western society in general. We could ask ourselves whether some of the most common and newly adopted uses of technologies in the current Western world also hold value for the people in the developing world? Are applications like Google, Facebook and EBay also of value to the people in developing rural areas, or, from a different perspective would they have been valuable to the people in the Western world fifty years ago? Probably not. It therefore might be possible to use new technologies but it remains essential to keep thinking about its possible use to the people in these developing rural areas. So although leapfrogging is possible, we cannot simply skip stages in a development trajectory, while being insensitive to contextual differences.

Basically we could state the developing world is not that different from the Western world with regard to the process of adopting technologies, we only approached both of these worlds differently. We deliberately tried to skip stages in the development trajectory and on occasion have been to insensitive to contextual differences. For ICT systems to have a sustainable impact in developing rural areas we therefore should not simply put computers in place (Heeks 2005), but adopt a structured approach and try to find what type of use is perceived as useful and what type of use adds value to the involved stakeholders. Apart from adopting a structured approach to assess local needs and to design an appropriate system that adds real value, the guidelines described in the previous sections also mentioned some points of interests that might help in extracting design requirements and that might help to realise a sustainable impact, specifically in the context of developing rural areas. Based on the previously discussed guidelines the following recommendations can be made:

- Adopt a structured research and design approach that starts with determining objectives, alternatives and constraints in order to ensure the relevance of any system intervention. (Boehm 1988; Gigler 2004; Herder and Stikkelman 2004; Fourie 2007; Pade 2007)
- Set up and maintain long-term relationships with the inhabitants of the real world context in a way that will ensure active participation in the research and development process. Make sure to safeguard mutual benefits and therefore thus attempt to actually realize and implement designed systems. (Maritz, Veldsman et al.; Kensing and Blomberg 1998; Puri, Byrne et al. 2004)
- Adopt an evolutionary approach consisting of expanding increments of an operational product with the directions of evolution being determined by operational experience. Basically start simple and expand the system further based on stimulated community needs. (Boehm 1988; Heukelman 2006; Pade 2007)
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- Learn about the current work practices of the future users of the system in order to create a good fit between the designed system and the local context. (Kensing and Blomberg 1998; Puri, Byrne et al. 2004; Kar and Verbraeck 2007)
- Organize workshops, administer questionnaires, hold open ended interviews and observe users in order to extract user requirements. (Kensing and Blomberg 1998)
- Have users learn about possible technology futures and have them participate in the design process by letting them evaluate different alternatives, rather than involving them with the actual design of a system. (Boehm 1988; Kensing and Blomberg 1998; Heukelman 2006)
- Use visualizations, scenarios and simulations to communicate designs and design tradeoffs. (Kensing and Blomberg 1998)
- Establish a local intermediary to manage the system. (Michiels and Crowder 2001; Rensburg and Veldsman 2006; Fourie 2007; Pade 2007)
- Share in your enthusiasm and try to get a wide range of actors to care about the survival of the project. (Kensing and Blomberg 1998)
- Match project management responsibilities to a financial incentive structure in order to safeguard project sustainability. (Briggs 2006; Kendall and Singh 2006; Pade 2007; Bridges 2009)
- Use technologies that are more robust, simpler and more flexible, instead of being cutting edge and fragile when used in a developing rural environment. (Fortier 2003; Fourie 2007; Pade 2007)

The approach we chose for the design of the logistics brokering system in Kgautswane should also focus on how to add value to the involved stakeholders in order to ensure a sustainable impact. We should therefore make sure our approach follows the guidelines mentioned within this chapter. The first choice in our approach was to develop a real service system for the community in Kgautswane, because the CSIR has set up long-term relationships with the inhabitants in this area. This area actually is one of the Rural Living Labs discussed in the second guideline. Within this area two Infopreneurs, as have been discussed within the third guideline have already been trained. All of our interactions with the inhabitants of Kgautswane will be guided through these local intermediaries. Furthermore the approach on designing mobile service systems fits the presented guidelines. First of all, as has already been mentioned in the introduction, the purpose of this approach is to produce a service for end-users according to three areas of interest, the service concept, an organizational network and a technical architecture. This approach clearly is holistic and focuses on the value for the different stakeholders. Secondly it adopts Boehm’s spiral model and also promotes an iterative approach. Using this design approach the actual logistics brokering system will be designed from the perspective of creating business for these two Infopreneurs. The different choices with regard to the design approach clearly are in line with the guidelines discussed in this chapter. Within the next chapter the results of the interactions with the inhabitants of Kgautswane will be presented. For each step in the design process the guidelines and recommendations of this chapter have formed the basis of our interaction.
3 Transport service delivery in Kgautswane – Experience base

As has been mentioned within the introduction, Part A of this research consists of two main elements, a so called knowledge and experience base. Within the previous chapter the knowledge base has been established using relevant notions found in literature, within this chapter the experience base will be established. Because the local context of Kgautswane is significantly different from the Western world, approaching a project in a holistic way, as mentioned in the previous chapter, has much more implications. Some of the effects this has on the actual design process are not easily or necessarily captured in design requirements but are valuable to take notion of. In order to give a complete overview of the context the logistics brokering system needs to be designed for, this chapter will therefore discuss the different interactions that have taken place within Kgautswane according to the design process we used. This chapter will not yet draw clear conclusions from these experiences, but will merely contextualize this research project. The actual requirements that have been set for the service system have evolved throughout the design process and hence are not easily allocated to a single experience. The discussion on the defined design requirements therefore will be discussed separately within the next chapter, the experience base established within this chapter will be referred back to frequently in order to support each of these requirements. This chapter hence will provide two distinct outputs, firstly an overview of our experiences in Kgautswane, necessary to support the requirements in the next chapter and secondly a general overview of the transport service delivery in Kgautswane and the possibilities for a logistics brokering system to improve upon this. This chapter herewith will answer the following research question:

A.2. What is the state of the transport service delivery in Kgautswane and how can this be improved by an ICT-enabled logistics brokering system?

Within the next section the design process that has been followed will be discussed. Since this chapter will discuss our experiences in Kgautswane according to this design process, this first section will further stipulate the contents of the following section.
3.1 Research and design process

Although the research and design process has been iterative and continuously adapted based on newly discovered insights, adhering to one of the guidelines mentioned by Hevner (2004), a rigorous method has been defined upfront. The goal of this process design was to transform the concept of a logistics brokering system into a working system that improves the transport service delivery in Kgautswane. This process design has been based on the book of van de Kar and Verbraeck (2007). As mentioned before, the main focus of the design approach derived from their book is that the design process needs to be incremental and iterative. This has also been highlighted within the knowledge base. The actual interactions with both the local suppliers and the users of the system therefore where designed in order to guide the refinement and verification of previously defined design requirements. Another main influence has been to structure the process in order to gather requirements for both the suppliers and the users of the system. At the start of the research project the role of the logistics brokering system has not been specified any further than being a system that should improve the transport service delivery by enhancing coordination and communication between transport demand and supply. The specific group of users and transport suppliers that would make use of this system and the specific role this system would play has grown throughout the design process. We will make choices with regard to the role of the system and its uses and suppliers explicit while discussing our experiences in Kgautswane.

Within Figure 3-1: Process design, the different interactions with the local stakeholders have been visualized. The choice for each of these interactions has also been guided by the recommendations from the previous chapter. We held open-ended interviews, administered a questionnaire and organized two workshops. The first step in the actual research process was to get a first impression of the situation by talking to local transport users and suppliers. Within this step we kept an open mind in an attempt to find the real problems these people are facing. These first interviews gave an initial focus and insight we sought to further investigate using interviews and workshops with transport suppliers and users. Based on what we learned from the first experience we held a workshop with several transport suppliers in Kgautswane to learn their current work practices, to try to verify the problems we found previously and to identify the barriers for improving the transport service delivery in Kgautswane. The next step was a more focused research into the problems, needs and

![Figure 3-1: Process design](image-url)
position of transport users, by firstly administering several structured interviews followed by a more widely administered questionnaire guided by local research assistants. Within the last step we presented a preliminary design to the taxi association and discussed some last issues that needed to be specified. Within this interaction we also provided them with feedback on the results of the interviews and questionnaires we administered to their transport users. This process was purposefully designed to verify gathered information. As can be seen within Figure 3-1: Process design, both the transport suppliers as the transport users have been consulted on three different occasions each and transport suppliers were confronted with and asked to verify information given by the transport users and vice versa. These five different interactions will be discussed subsequently. For each of these interactions the goal of that particular step in the design process, the approach that has been chosen in order to safeguard the quality of the results, the realized results and its main conclusions will be discussed. Within the next section firstly a general description of the area and our local contacts based on our observations and our continuous interactions with the Infopreneurs will be given.
3.2 The context of Kgautswane

The research project was carried out in Kgautswane, South Africa. As has been mentioned within the introduction this area has been chosen for this project since the CSIR has developed long-term relationships with the inhabitants of this region. Throughout this chapter a discussion regarding the experiences we have had in this area will provide insight into the current transport issues and the requirements for the logistics brokering system set by the various stakeholders. This section will firstly provide an overview of Kgautswane and herewith will provide a starting point for our further analysis.

Kgautswane is located in between the three reasonably sized towns of Burgersfort, Leboeng and Ohrigstad. Kgautswane consists of nineteen villages shown on the map to the right. Both maps can also be found in a bigger format in appendix E. Kgautswane has a high population density and houses a total of around 100,000 inhabitants. Most of these villages lie along one main road, that is situated in between two mountain ridges and that is about sixty kilometers long. The red lines on the map showing the overview of Kgautswane indicate tarred roads connecting the towns near to the Kgautswane area. The orange road is the...
main road running through Kgautswane. This road is unpaved, herewith resulting in quite a lot of wear and tear of the vehicles that make use of this road. The pictures on the next page give some insight into the quality of this dirt road. This road basically consists of a rock bed covered in sand and dust with a considerable amount of loose rocks scattered over its surface. The first picture shows people travelling on a donkey kart over the main road, the second picture shows our car after thirty kilometers on this road.

3.2.2 The people
Kgautswane residents have modest expectations of life. The local economy is limited to the exploitation of some small scale shops called Spazas, that serve the community with a very basic assortment of goods. Most local residents therefore are forced to find work elsewhere. The large portion of people that is not able to find a job is dependent on social grants, which results in an income of about R300,- per month on average, one euro buys R11,42 (value on June 5th 2009). Because the area is very dry the number of subsistence farmers is also very limited. While life is harsh in Kgautswane, people are able to sustain their livelihood. Their livelihood is very dependent on the availability of transport however. Currently they often have to walk for hours to receive treatment at the clinic, to get to work, to visit friends and family or to simply buy groceries. Frequently walking is not an option because of old age or bad health, this sometimes even results in people staying at home. This clearly affects their livelihood and the ability for Kgautswane to develop any further.
3.2.3 The Chief
Local communities like the one found in Kgautswane are very closed and have a tight social structure. Local cultural sensitivities exist and Kgautswane is a so called Traditional Authority area. This means that while formally the local councilor has the local authority, effectively this authority lies with the Chief of the area. The Chief is a traditional leader that is still playing an active role within the community. He divides the land and has to give permission before any activity that might affect the community can be undertaken. Since everyone within the community sees, accepts and follows the Chiefs guidance it was essential to obtain permission from this local Chief. The picture below was taken after the meeting within which a councilor of the Chief gave us permission to continue with our project.

Figure 3-7: Driving through Kgautswane

3.2.4 The Multi Purpose Community Centre
Started as a community initiative, the Kgautswane Multi Purpose Community center currently plays a central role in any developmental activity undertaken in Kgautswane. It is managed by the local community itself, which are left on their own when it comes to development. Local governments tend to focus on developing urban areas, pursuing economic interests; the role of the community centre therefore is absolutely essential. The community center started with providing care for the elderly, the disabled and the orphans of the community. Through several developmental projects this community center has grown and comprises several rooms and offices, that have been constructed by welding a dozen 20-foot steel transport containers together. The center has realized the clinic located nearby, provides accommodation to

Figure 3-8: Meeting with chief Lekgala
tourists/visitors and researchers and houses an ICT center consisting of several computers, a printer and a scanner. Since several years the South African government is also funding this centre and provides several services there. The center has been created and is currently led by Clara Masingha. Clara truly is the driving force within the community. Throughout our project Clara provided us with a place to sleep and dinner during our visits to Kgautswane. Her involvement was essential to the project in more than one way. Besides accommodating us, she actually enabled us to do our research. Her role within the community opened up the people of Kgautswane and resulted in a general willingness to accept possible new initiatives. The picture to the right shows one of the transport containers in the community centre being used as a library.

3.2.5 The Infopreneurs
Simon Motumi and Ishmael Adams are the two Infopreneurs we have worked with during the project. These two Infopreneurs already run several businesses under the name of SMITE (IT) Infopreneurs. Their business is run from the ICT center at the community center and consists of, among others, typing and printing, photocopying, writing business plans and making DVD’s at parties and funerals. The picture below shows an overview of their services and products on offer. As mentioned before we decided to adopt a focus within which we try to develop the logistics brokering system as a business that can be run by a local intermediary, in this case we try to develop this service as a business for SMITE (IT) Infopreneurs. In order to create ownership it therefore is important to involve them from the beginning of the project. We therefore stimulated them to take the lead throughout the project and limited our role to that of an external advisor. For every meeting they set up the facilities, informed involved stakeholders and made important decisions with regard to the local research and design process.

3.2.6 The cell phone boom
Since August 2005 the people of Kgautswane have access to mobile telecommunication. The
two paragraphs placed below are extracted from an article titled “Cell phone boom in rural Africa”. These paragraphs illustrate how rapidly the use of mobile phones has been adopted throughout rural areas like Kgautswane.

“KGAUTSWANE, South Africa 2006 - Lucy Mhlapo had noticed people in the nearby town chattering into tiny metal boxes pressed to their ears, but she never dreamed she’d use one of the devices herself. Then, in August last year, a 148-foot tower of red and white steel appeared on the hill behind Mhlapo’s dusty village in South Africa’s north-east. The neighbors said it would make cell phones work here in Kgautswane. Mhlapo’s daughter scraped together enough cash for a second-hand cell phone and some airtime, and in January this year, at the age of 60, Mhlapo made her first call. “I was so happy, I called my brother in Johannesburg and asked him to bring some mealie pap,” she laughed, referring to the staple starch food popular in southern Africa.

South African operators Vodacom – jointly owned by Telkom and Vodafone – and rival MTN make serious money in areas like this in South Africa. As demand rages among rural folk, Vodacom, which erected the Kgautswane mast, now has to kit out rural base stations with the same level of equipment as base stations in the city. Still, it made back the $164,800 outlay for the Kgautswane mast in less than six months. People living in the area around the base station – which covers a roughly 19-mile radius – make between 20,000 and 30,000 calls a day, just over a year after coverage went live, according to Vodacom.” (Hutchings 2006)

In the last three years the cell phone usage has grown even further and a second mast has been erected. When asking one of the local people whether he had a mobile phone, he replied with: “Yes... I have three”. Within sections not shown above, the article further mentions handset makers launching low-cost phones and operators adapting their services to this rural market by selling airtime in tiny denominations, by offering free “please call me” text message services, by building shared pay phones and by enabling richer customers in the city to transfer airtime to poorer relatives. Since a logistics brokering system should enhance coordination and more important communication, this development is an interesting opportunity for this system to tap into.
3.3 Unstructured interviews with transport suppliers and users

3.3.1 Goal
This was our first interaction with the community of Kgautswane. When we went on this trip the precise project goal was unclear and we wanted to make sure that the focus we initially had chosen to adopt would lead to a system that solves a real problem. The first goal of this trip was to establish contact with our local intermediaries, the two Infopreneurs. We furthermore wanted to get a shared project focus, a project focus that is accepted and shared by both the CSIR and the local community.

3.3.2 Approach
Because the initial project definition was developed without having had contact with the local community we were unsure about the actual problem. A first difficulty in this stage was the inability of the Infopreneurs to have insight into what problems could possibly be solved and therefore for them to define a clear project focus. A second problem was that the local community of Kgautswane faces a multitude of problems. We therefore decided to visit the area without any project focus or research process in mind. Our intention was to just enter in several conversations and to let the local people speak while we listened. Afterwards we jointly decided which project focus would be most suitable to the context of Kgautswane. We had set up several interviews with possibly relevant stakeholders upfront and had defined some questions with regard to transport, but mainly visited the area to gain an understanding of life in Kgautswane.

3.3.3 Results
During our trip we held interviews with a local farmer and a supermarket owner, we made a trip with a local taxi bus and we had a group discussion with the Infopreneurs, the manager of the community centre and a representative of the taxi association. The reports of these different interactions can be found in appendix A. Based on these interactions we uncovered several basic problems that helped to place our research within context. This list of problems is by no means exhaustive, but does provide a basic starting point for further analysis.

- **The main road through Kgautswane is unpaved;** This seems to be one of the main problems Kgautswane is facing. This has already been mentioned within the previous section, within this trip however, this problem was again highlighted within almost every conversation. Everyone in Kgautswane sees the current state of their main road as one of the biggest barriers to their development. The quality of roads is the responsibility of the South African government, which has prioritized economic development and therefore mainly addresses roads leading to mines. One of the challenges within this research therefore is to try and enhance the situation in Kgautswane while seeing this unpaved main road as a given.

- **The inhabitants of Kgautswane struggle to make a living;** Most people in Kgautswane are dependent on public forms of transport, because they are not able to buy their own car. Within several meetings it became clear that a significant proportion of people in Kgautswane also do not have money to pay for public forms of transport and therefore prefer walking over having to pay for transport. It therefore is essential to establish a better picture on what the demand for public forms of transport is. If we want to remain at our initial project focus we need to make sure whether there is a significant group of people that is willing to pay for transport, but which is not being serviced properly currently.
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- **Transport is not always available:** There are three main parties providing public forms of transport in Kgautswane: the Great North bus company (commercial bus), the Ohrigstad Long and Local Distance Taxi Association (taxi busses, 15 p.) and private pickup trucks. In the morning and the evening there usually is sufficient transport supply and demand. There is a significant drop in transport supply during the day however. The bus services the area once in the early morning and once in the late afternoon. Taxi busses also only service the area during the early morning and late afternoon. The public transport service provided by pickup trucks is very irregular and usually also only available during the morning and afternoon. The uncertainty of transport demand has been mentioned as the main reason for this drop in transport supply during the day. Transport demand during the day appears to be too scattered and distributed throughout the day for a transport supplier to have some security about its possible earnings. High competition between the different transport suppliers hampers coordination between them and the transport users. They have tried to devise a schedule for transport supply during the day, but some taxis and pickup trucks tended to arrive early and stole business and herewith lowered the reliability of transport demand again. Although this is a clear problem, it at the same time is an indication that there actually is a significant group of people that is willing to pay for transport, but which is not being serviced properly currently.

- **Local farmers cannot compete with the big farmers located nearby:** During the conversation with a local farmer it became clear he also faced several transport problems. He has a need to transport his produce for over 200 kilometers, because he is not able to sell his produce at a profitable price at the local towns. He simply is not able to compete with the bigger farms that operate near Kgautswane. He tried to cooperate with his fellow farmers in the area in order to achieve economies of scale, but failed because there was a lack of trust. He was of the opinion that the main solution to his problem would be a tomato processing plant. This would help to create a consistent market for his produce. It would also enable individuals within the community to create some business for themselves.

**Five research proposals**

When visiting a developing rural area like Kgautswane for the first time it is very difficult to see social and economical structures that can possibly be improved by enhancing the communication and coordination of activities. It proved to be difficult to look past all kinds of basic problems like high unemployment and generally low income levels, a very limited amount of locally supplied products and services and basic healthcare facilities that are in no way comparable to those in the Western world. We became doubtful on whether our initial project was focused on the true problems this community faces. During our first trip we encountered such a multitude of problems, we defined five different research proposals, some staying very close to our initial project focus and others completely veering away from the transport issue. One research proposal for instance focused on enabling local people to create competitive businesses. As was mentioned by a local farmer, it is very difficult for local farmers to compete with their bigger counterparts. Exploring options like realizing a tomato processing plant or facilitating cooperation between local businesses in order to create a bigger business scale and a more reliable consuming market, might add real value to the region and contribute to local peoples possibilities for employment. Eventually we decided to stay close to our initial project focus because after some time it became more and more clear there do already exist working social and economic structures, although being very informal. Besides, transport issues were also seen as having a direct impact in the opportunities for a local community to develop. We furthermore saw a clear opportunity to enhance transport service delivery in Kgautswane. Although we had some struggles getting a clear project focus, keeping an open mind in the beginning of the project raised our and, even more important, our local contact’s confidence in the value and feasibility of researching how a logistics brokering system could improve the transport service delivery in Kgautswane.
3.3.4 Conclusion
With regard to the possibilities for logistics brokering to improve the transport service delivery in Kgautswane this experience resulted into several insights that helped to focus the further research. After this trip we did not directly decide to further pursue the initially chosen research focus however. In box 4 on page 46 the difficulty of choosing a research focus that really adds value in a rural area like Kgautswane is highlighted. Eventually we chose to continue to pursue this research, because some insights from this first interaction with the local community pointed directly to a clear communication and coordination problem, which could possibly be solved by a logistics brokering system. We furthermore narrowed our focus by choosing to research how to enhance the coordination and communication between transport demand and supply for transport possibly supplied by pickup trucks and taxi busses during the “off peak” hours of the day. Because the load capacity of both the pickup trucks and the taxi busses is far less than of a large bus, they are far better suited to accommodate the scattered transport demand during the day. We furthermore chose to focus on the “off peak” hours, since the problem in the early morning and late afternoon seems limited and we do not want to interfere with the work processes of the local transport suppliers that are already profitable. This interaction furthermore made clear that it is essential to establish a better understanding of the actual demand for transport in Kgautswane.
3.4 Workshop with transport suppliers

3.4.1 Goal
Since the logistics brokering system obviously only adds value if the selected transport providers are willing to cooperate within this next step we needed to involve them first. We therefore arranged a workshop to discuss the goals of the project, build commitment and gather information. With this workshop we pursued the five following goals:

- Gaining insight into the current transport processes and business strategies
- Creating a shared understanding of the transport problems in Kgautswane
- Introducing the preliminary service concept to the transport suppliers
- Identifying possible barriers to implementation
- Building commitment from the transport suppliers

3.4.2 Approach
There were two important aspects involved in ensuring this workshop would enable us to reach the goals mentioned above. First of all we let the Infopreneurs guide the workshop in order to raise the transport suppliers’ willingness to cooperate and share information. This also helped to overcome the language barrier since most local people lack a good understanding of English. One day before we held the workshop, I therefore spent a whole day with one of the Infopreneurs to grow a relationship of trust and mutual understanding. I purposefully did not have a clear agenda for the bigger part of this day, but we just talked about several problems he and the local community are facing. At the end of this day we discussed the agenda for the workshop and starting from here we clearly entered into a phase within which the Infopreneurs took up the role of project leader, while I operated as an external advisor. Within this discussion his local knowledge already proved to be valuable, he for instance directly pointed out that we should not yet mention the possible benefits of the system for the Infopreneurs, since this could diminish the willingness of the transport suppliers to cooperate. He furthermore suggested to limit their insight into the complete design process and to simply indicate that we would want to interact with them somewhat more in the future. He was of the opinion that they might begin to see such an elaborate process as an obligation without seeing the possible benefits it might hold for them. A second aspect that we paid additional attention to was to create a professional impression. In order to create commitment we wanted to create a focus group that the involved stakeholders experienced as a privilege to be involved in. We therefore prepared an agenda, let the attendees sign a register, had the centre manager introduce us, handed out name tags and introduced a logo to symbolize the cooperative alliance between the Infopreneurs and the transport suppliers. After the workshop we asked all attendees to indicate on the register whether they were willing to be part of this alliance called the Kgautswane Transport Logistics – focus group. We ended the day with a barbeque as an informal kick off of the project.
3.4.3 Results

At the meeting two taxi drivers, two taxi owners, two queue marshals and one representative of the Ohrigstad Long and Local Taxi Association were present. Besides people from the taxi association we were planning to also have a significant group of private pickup truck owners present. From the start of the meeting it became clear that the relationship between the pickup truck owners and the taxi association is a very sensitive issue however. The taxi association sees these private pickup truck owners as stealing their business. It is important to note that transporting people using pickup trucks is illegal by law, but because this legislation is not being actively enforced, pickup trucks flourish in the area due to the bad road. There has been an attempt to make these private pickup truck owners part of the taxi association, there were defensive in this attempt however, probably because they would not be allowed to transport people anymore. At this point we chose to demarcate the project to realizing a service that focuses on people transport provided by the Ohrigstad Long and Local Distance Taxi Association. The results of this workshop will be discussed per goal, as they were defined above.

Gaining insight into the current transport processes and business strategies

The taxi association

The area of Kgautswane is located in between Burgersfort and Ohrigstad. The taxi association that is located in Burgersfort is called Istenleolo. The taxi association located in Ohrigstad is called Ohrigstad Long and Local Distance Taxi Association (OLLDTA). These two taxi associations are not allowed to pick up people from each other’s locations and are in a fierce competition. OLLDTA is the taxi association that is licensed to service Kgautswane. Besides servicing Kgautswane OLLDTA also services Ohrigstad, Leboeng, Burgersfort, Deox, Gauteng, Lydenburg, Phiring and Manoutsa. A taxi association takes care of the taxes that need to be paid to the government, they herewith actually form the link between the taxis owners and drivers and the government. They furthermore are the body that gives out letters to indicate that taxi drivers are actually licensed and they keep order at the taxi rank.
The taxi rank

The taxi rank is a designated area in a town or village where taxis wait for customers. The taxis that are a member of the OLLDTA usually queue at the taxi rank in Ohrigstad. From this taxi rank someone can travel to a whole range of destinations. For the taxi rank in Ohrigstad these destinations are Leboeng, Burgersfort, Deox, Gauteng, Lydenburg, Phiring, Manoutsa and Kgautswane. From most of these destinations someone can travel back to Ohrigstad with a taxi from the same association and from there one can travel to a different destination. Ohrigstad therefore can be seen as the transport hub of the OLLDTA. Only for Burgersfort, as mentioned before, this does not hold; taxis from OLLDTA are not allowed to transport people coming from Burgersfort, because of the fierce competition with Ixhelenolo. At a taxi rank people will have to wait until the taxi going to their destination gets filled up. During normal working hours a taxi will not leave before it is completely filled up.

The queue marshal

A queue marshal works for a taxi association at one specific taxi rank, so each taxi rank that is being serviced by a certain taxi association has a queue marshal working there. The main function of a queue marshal is enforcing a fair distribution of trips among the different taxis that are a member of the same association. The way in which a queue marshal decides which taxi is entitled to which trip is illustrated within the diagram that is shown on the left. The queue marshal only awards a trip to a taxi if there are enough people waiting to go to the same destination to fill up at least one taxi. When there is enough transport demand the queue marshal will use a list to determine who is entitled to
transport these people. For each destination that is being serviced from a certain taxi rank the queue marshal lists all taxis that are a member of the same taxi association. The first taxi on this list is awarded the trip to the destination that list refers to. If the taxi that is next on the list is not present, the queue marshal will put this taxi on hold and award the trip to the next taxi on the list that is present. This is called: “leaving a taxi hanging”. For the next trips taxis that have been left hanging will be first to be awarded a trip. Once a taxi is actually awarded a trip it gets moved to the bottom of the list.

The taxi driver
Not all taxis of one taxi association will always be queuing. If a taxi is near to last on the list for every destination at a taxi rank, he could be queuing for the whole day without being awarded a trip. Taxi drivers have a clear incentive to maximize their turnover since their income equals their turnover minus fuel costs and a fixed price they have to pay to their taxi owner. When a taxi expects to not get a trip quickly he usually queues for floating. Getting a trip after having queued for a certain destination means leaving the taxi rank heading towards a specific destination with a fully loaded taxi. Floating around means leaving the taxi rank empty and driving around in a certain area in search of people to transport. For floating there also is a queue, not managed by a queue marshal however. The taxis that are waiting to queue decide who goes where and when, among themselves. The decision process for floating is shown in the figure on page 51. One essential element of this decision process is the taxi driver’s expectation of the possible amount of people he will be able to transport while floating in a certain area. Since floating around holds a risk of incurring costs without having any business, taxi drivers divide the business amongst themselves and sometimes simply wait at the taxi rank, although they do not expect to get a trip awarded by the queue marshal. For Kgautswane this results in a clear lack of transport supply; taxis queuing for this destination almost always get filled up only at the end of the day and taxis queuing for floating almost never chose to go to Kgautswane. Because the road in Kgautswane is unpaved, resulting in a significant amount of wear and tear taxi drivers see floating around in Kgautswane as unattractive. This insight into the decision structures of the taxi association and taxi drivers does show a willingness to take risks however. It furthermore shows that there is unused transport capacity available.

Peak and off-peak hours
Within the previous trip it became clear that there exist peak and off-peak hours in the transport supply in Kgautswane. The remarks made above with regard to taxis standing in a queue for quite some time during the day, waiting to get filled up, also support this finding. Within this part of the discussion we tried to pin down the exact peak and off-peak hours. The specific times at which the peak hours start and end could not be pinned down precisely however. When one of the taxi drivers spoke about his typical workday he mentioned leaving Makgwareng (Kgautswane) at around 06:00 am, from there he always drives to Ohrigstad, picking up passengers along his route. Usually one taxi
floats around in Kgautswane after the first trip from Kgautswane to Ohrigstad, basically making a second round of pickups. When this taxi gets back to Ohrigstad for the second time that morning he usually starts queuing and waits from around 10:00 to 18:00 to get a full load. Based on this story, the off peak hours, during which Kgautswane is poorly serviced, can be estimated to lie between 10:00 and 18:00.

Scheduled transport
To get an idea of the extent to which taxi drivers might be willing to cooperate with a system that realizes planned transport, they were asked whether planned transport does already occur. The taxi drivers mentioned occasionally being contacted personally to organize transport for attending church, a funeral or a wedding. Typically transport then is arranged for groups of people, herewith ensuring enough business for a taxi driver to be profitable. The choice for a certain taxi usually is dependent on their relationship with the driver, the quality of his driving and his taxi.

Flexibility of transport pricing
Changing the fares of a taxi might be a good way to make their service more attractive or give benefits to transport users that for instance group themselves or which are more flexible in their planned travel time and date. We therefore asked whether the taxi fares are negotiable. Again the taxi drivers were the first to reply to this question. They gave an example of charging less for patients without money travelling to the clinic. Although this is socially related behavior, instead of business related, it does indicate that fares do not need to be static.

Who calls the shots?
When talking about the abovementioned issues like scheduled transport, the business strategy of the taxi driver and the flexibility of transport pricing it has become clear that the taxi driver can be seen as an individual entrepreneur taking his own business decisions. Obviously they need to adhere to the rules set by the association and there is a strong urge to discuss everything among themselves or through the association, but within this framework of rules and social control they are the decision makers. They are for instance free to chose whether they want to queue, float around or transport a group of people on their own. It therefore is essential to keep them involved in the further design process, to ensure the system adds value to their business. We also need to make sure the formal structures of the taxi association are followed, since they still control the opinions of their taxi drivers and provide the largest portion of their income through the taxi rank.

Creating a shared understanding of the transport problems in Kgautswane
After discussing the current work processes of the taxi driver, the queue marshal and the taxi association in general, we focused on the transport problems in Kgautswane. The previous discussion clarified that there is almost no transport supply in Kgautswane during the off peak hours of the day. We started this discussion by agreeing that floating around in Kgautswane is unattractive during the day since there is less transport demand and the area is fairly remote and only accessible by the dirt road running through Kgautswane. Within the previous trip the problems with regard to the demand for transport were already made more specific. It then was mentioned that the main reason for the drop in transport supply during the day was the uncertainty of transport demand. Transport demand during the day appeared to be too scattered and distributed throughout the day for a transport supplier to have some security about its possible earnings. After some deliberation everyone present agreed that this was the case and that there actually is no real knowledge on the amount of
transport demand during the day. They again highlighted the role the pickup truck owners play. Their presence makes transport demand even more uncertain, since there is no communication between them and the taxi association. Since transport demand is uncertain and herewith transport supply as well, we agreed that there might be transport demand that currently is not being met and there should be an opportunity for the taxi drivers to expand their business. It was essential to point out the opportunity for them to expand their business. Initially the different attendees of the workshop thought we were simply trying to prove they were not doing their job properly. Typically with regard to these kind of misunderstandings, having the Infopreneurs taking up their role as project managers is especially important. In this case they instantly picked up that we needed to emphasize the business opportunities for the taxi association more. Once we agreed that there might be underserviced transport demand in Kgautswane, we shared the opinion that for this potential transport demand to become valuable business the challenge essentially is to make this demand more reliable, less scattered and better visible. Basically there is a communication barrier between transport demand and supply that hampers effective service delivery.

Introducing the preliminary service concept to the transport suppliers

Once we established a shared understanding of the transport problems in Kgautswane we introduced the preliminary service concept in order to agree on how we can possibly bridge the communication barrier to make Kgautswane attractive to service. The basic concept was introduced as the Infopreneurs forming an intermediary between the taxi association and the local transport demand in Kgautswane. Their role would be to bridge the communication barrier by collecting and grouping transport demand in order to make this more visible and less scattered. Following this process of collecting and grouping they would communicate the details of these “bundles” of transport demand to the taxi association. In order to try to get the commitment of the association the Infopreneurs did not yet mention their personal benefits, as discussed upfront, but for now focused on the potential benefits of the taxi association. Since the local transport users would be more flexible in when they want transport and because transport would simply be more available, this firstly might result in servicing currently latent transport demand and herewith expanding the business of the taxi association. Secondly having the Infopreneurs take up the role of intermediary could result in a more efficient business operation, since transport demand would be less scattered. At this stage the taxi people became more and more enthusiastic and completely opened up, thinking along with this concept and confirming their need for such a system.

Identifying possible barriers to implementation

The last part of the workshop was focused on what should be done to make this currently still conceptual system reality. Together we brainstormed on possible barriers and requirements the system needs to account for. The following issues were raised:

- The representative from the taxi association mentioned that Simon and Ishmael should not be allowed to have the individual telephone numbers of the different taxi drivers. They should always call the queue marshal to match transport demand with transport supply. The requirement that can be deducted from this remark is that the system should make sure that the distribution of trips among different taxi drivers needs to remain fair.
- Another issue is the question of how to identify who requested transport. The concern of the taxi driver that raised this issue specifically was that he wants to make sure that the people that requested transport actually receive transport, even if other people have gathered at
the same spot. This is actually an issue of reliability; this issue fits within the broader requirement that the system is reliable in that sense that it should make sure that people transport has been arranged, actually get transport.

- Different taxi drivers/owners and even the representative of the taxi association showed their concern on how to brand the system. The requirement that can be detracted from these concerns is that the system should be well known among the residents of Kgautswane. Within this discussion already some possibilities for branding were mentioned. The system could be introduced by word of mouth during a funeral or at a paypoint. A Spaza shop also has been mentioned as a good point of distributing information, the same holds for information distribution within taxis, the taxi people mentioned that especially this form of branding might give good results; people are always curious on what is mentioned in a taxi.

- Another issue is the authenticity of a transport request. This issue also relates to reliability. The reliability we discussed before was the reliability of transport supply, this issue indicates that reliability of transport demand is also really important.

- Another implementation barrier is agreeing on how Simon and Ishmael are going to get paid for their services. It is encouraging to see however that the taxi people are aware of the fact that nothing is for free, but still remained enthusiastic.

- An initial indication of a requirement of the amount of people that needs to be grouped was given by one taxi driver. He mentioned five might be enough, because the rest of the taxi might fill up while travelling to the pickup point.

- It was also mentioned that pickup trucks will continue to form a problem. The taxi drivers were of the opinion that when these pickup truck owners see a taxi driving around they will again try to steal their business.

- Finally a comment was placed on the fact that this system might also add to their amount of leverage at the municipality to try and convince them to adjust the road and to enforce legislation with regard to the illegal pickup truck operations.

- They also mentioned that this system might also enable them to transport people back from Burgersfort, through an arranged pickup point away from the taxi rank

Building commitment of the transport suppliers

Now we agreed on the problem, the possible solution and the barriers we needed to overcome, we finalized the workshop by establishing a focus group. We presented a logo for the Kgautswane Transport Logistics Focus Group, which was received by a big applause. This logo is shown above. As mentioned before at the end of the workshop we asked everyone present to sign the register to indicate whether they were willing to be part of this focus group. The scan of the signed register is shown to the right, as can be seen, everyone was interested to further cooperate. After the workshop we surprised all attendees with a barbeque to build a longer lasting relationship.

Figure 3-16: Workshop register - willingness to cooperate
3.4.4 Conclusion
Within this interaction the Infopreneurs took up the role of project leader for the first time. This proved to be essential, because they simply were better placed to pick up on sensitive issues, like the payment of the Infopreneurs and the discussion on the problems in Kgautswane. A first important result of the meeting itself was the insight that the taxi association is of the opinion that pickup trucks are stealing their business. It also became clear that it is illegal for pickup trucks to transport people. We therefore decided to pursue realizing the logistics brokering service in conjunction with the Ohrigstad Long and Local Taxi Association (OLLDTA), the taxi association servicing Kgautswane. When discussing the current work processes of the OLLDTA it became clear that such a logistics brokering system could actually add value. During the day, the so called off peak hours, taxis are mostly standing idle at the taxi rank. They wait there in order to either fill up and drive back to Kgautswane (usually at the end of the day) or in order to eventually leave empty in the hope of picking up people along the way. Since transport demand in Kgautswane is really scattered and distributed throughout the day and the road running through Kgautswane could easily result in a taxi breaking down, Kgautswane currently is a risk not worth taking. A better communication and coordination through a logistics brokering system therefore could indeed help with overcoming these problems. Another aspect that is important to note for future reference is the fact that taxi drivers act as individual entrepreneurs and are responsible for their own earnings and are therefore the relevant stakeholders within the brokering system. The taxi association furthermore expressed possible barriers for implementation like ensuring a fair distribution of trips among taxi drivers and realizing reliable transport demand. At the end of this workshop, all people present signed the register, herewith indicating to be willing to cooperate within the KTL focus group.

A main limitation of this workshop was that we did not learn about the perspective of the pickup truck owners. Basically pickup trucks are better suited to transport people with regard to the bad road running through Kgautswane and therefore might form an interesting transport supplier. Without hearing their opinion we already decided to continue with the taxi association and to not incorporate pickup trucks in this stage. Maybe this decision could have been researched further. Due to time constraints of the project and the political issues involved in having pickup truck owners transporting people, this quick decision is defendable however.
3.5 Structured interviews with transport users

3.5.1 Goal
In the previous trip several things were mentioned that needed verification from the actual transport users. We furthermore wanted to explore the possibilities for realizing the logistics brokering system. More specifically we pursued the following four goals within this interaction:

- Gain insight into the transport users’ current travel behavior
- Explore possibilities for grouping transport demand
- Test ways to increase the reliability of transport demand
- Verify the use of a mobile phone as a generally accepted way of communicating

One of the most important issues was to verify whether there actually are people that are in need of transport but currently are not able to get transport. We furthermore wanted to get a better understanding of the transport supplied by pickup trucks from the perspective of the transport users. Basically we therefore needed to get a better understanding of the transport users’ travel behavior. Secondly there was a need to know to which extent transport users would be able and willing to use the logistics brokering system to arrange transport. In order to be able to group transport demand it might be necessary for transport users to be flexible and would probably require them to plan ahead to some extent. We therefore needed to gather some insight into the flexibility of these transport users and the extent to which they are able to plan ahead. Since there is a tight social structure within the community, we also wanted to find out to what extent the transport users were able to group themselves. The third goal refers to the concern of the reliability of transport demand, expressed by the taxi association in the previous workshop. In order to possibly increase this reliability we thought of some financial incentives, which we wanted to test with the transport users. As was mentioned within the second section of this chapter, mobile phone usage has increased over the last few years in Kgautswane. The fourth goal therefore was to verify this information and more specifically, to find out whether people would be willing to use their mobile phone to arrange transport.

3.5.2 Approach
The different goals mentioned above have been captured in a structured list of questions that can be found in appendix B: Structured interviews with transport users - questions. Since this would be our first interaction with the transport users with a clear focus on the logistics brokering system we did not precisely know upfront where these interviews would take us. So besides having formulated several questions deliberately open ended, we also only used these questions as a guideline instead of trying to get an answer to all of them. We visited several locations in the Kgautswane area, ranging from very remote to located near to the main road. Each interview was carried out by one of the Infopreneurs since they are well known within the community and since they speak the local language.

3.5.3 Results
In total we held three interviews in three different locations. We first spoke with a group of five people walking from their home in Kgotlopong to the MPCC. During the second interview we spoke with three women sitting by their home in Mufarafara. The last interview was held at the bus stop, where we spoke with a large group of people that was just getting off the bus. The complete reports...
of these interviews can be found in appendix C: Structured interviews with transport users – reports. With regard to the information goals we defined above we verified and learned the following interesting aspects about the transport service delivery in Kgautswane:

- **Gain insight into the transport users’ current travel behavior:** Within Kgautswane the most important travel destinations appear to be parties, the Chief, funerals and the MPCC. Although the distance between people’s homes and these destinations can be more than ten kilometers, many people walk to get around in Kgautswane. Sometimes they are able to use a pickup truck for these trips, but this means of transport is not cheap, not reliable and generally not preferred. Most people prefer to use a taxi, which is not available most of the time, unfortunately. When travelling outside Kgautswane, people usually go to Burgersfort for shopping groceries and buying building materials. Again they would prefer to travel to Burgersfort by taxi, which is only available some of the time. The most important conclusion however is, that there are people willing to spend more money on transport if they would have this option. Secondly it appears that pickup trucks are not stealing business, but picking up the transport demand left behind by the taxi drivers, since multiple people indicated preferring a taxi over both the bus and the pickup trucks. Thirdly it appears that transport demand is very unreliable simply because the same holds for transport supply; people make use of the first available means of transport that comes along, since waiting for a better alternative might result in not getting transport at all.

- **Explore possibilities to grouping transport demand:** After having introduced the service we were planning to realize, everyone indicated to be flexible and willing to arrange transport some time in advance. They furthermore indicated that there were multiple people with similar transport needs and that they were able to group themselves.

- **Test ways to increase the reliability of transport demand:** Having people paying upfront for arranged transport was not generally accepted as a good approach to increase the reliability of transport demand. With regard to money, most people appear to have a lack of trust towards other people. Besides, most people indicated to prefer taxis and, as mentioned above, would be more than willing to wait for a taxi, if they were certain that it would actually come to pick them up.

- **Verify the use of a mobile phone as a generally accepted way of communicating:** Everyone we spoke to had a mobile phone, used it fairly frequently and was willing to use it to arrange transport. Although network coverage is a problem in some locations, the local people there appear to be able to cope with this problem. They usually know where to find network coverage in their vicinity.

### 3.5.4 Conclusion

From this interaction several main conclusions can be drawn. First of all people in Kgautswane currently frequently walk and only sometimes use public forms of transport to get around. Although they occasionally jump in the back of a pickup truck, they would prefer to travel by taxi, because this is safer, more comfortable and cheaper. Unfortunately this mode of transport usually is not available. It seems as if pickup trucks are not stealing business, but are just picking up the demand left behind by the taxi association. The interviews furthermore showed that there is a significant number of people that has money to pay for transport, but has to walk because there is no transport available. There clearly is a lot of business and matching the currently unserviced transport demand with the
unused taxis standing idle at the taxi rank, is likely to be very successful. Transport demand currently is unreliable, simply because supply also is unreliable. The three groups of people furthermore indicated to be flexible in when they want transport, to be able to plan trips ahead, and they also indicated knowing more people with similar transport needs. Lastly, using mobile phones is likely to be the most viable way for people to communicate their transport needs.

Some limitations of this interaction relate to the role of the Infopreneur during the interviews. Within the way we approached the different respondents it might have been better to let the Infopreneurs do the interviews on their own. Our presence might have changed their responses. This approach also clearly resulted in the Infopreneur to take up sort of a strange role floating between interviewer and translator. Since I was making notes, it was essential that all information was passed on to me, but on several occasions the Infopreneur had an entire conversation with the respondents, while he answered my question with a simple yes or no. If we would have let the Infopreneur do the interviews on his own, including taking notes in English, we possibly would have got a richer picture on the travel behavior and transport problems of the people in Kgautswane.
3.6 Guided questionnaires with transport users

3.6.1 Goal
Within the previous interaction we uncovered some interesting insights with regard to the transport service delivery in Kgautswane. We now felt the need to further specify these insights by administering questionnaires on more locations with a more closed set of questions. The goal of this questionnaire was still explorative. With this questionnaire we simply wanted to search for additional evidence in order to support earlier made statements regarding transport demand, reliability of transport supply and certain system requirements. The specific information goals for this questionnaire therefore were the same as within the previous interviews.

3.6.2 Approach
Questionnaire
The list of questions that was used to structure the interviews described within the previous section provided the first main input for the final questionnaire. During some interactions with experts on doing research in rural areas we refined this list of questions. One alteration for instance was rephrasing questions as to not ask people how often they for instance travel on average, but to ask them how often they have travelled somewhere within the last month. Another aspect we incorporated within the questionnaire was a consistency check. We added some questions that allowed us to verify information that was provided as an answer to other questions. We also asked both Infopreneurs to read through the questionnaire and mark difficult words we should change or clarify. The final questionnaire that has been used within this interaction can be found in appendix D.

Segmentation
Because we did not have the time or capacity to administer our questionnaire to a complete and representative group of respondents we at least wanted to make sure we would gather information from a wide variety of people. We therefore grouped villages into clusters of villages with similar characteristics. Together with the Infopreneurs we decided to group these villages based on spatial proximity and similar transport service levels. The different clusters have been highlighted within the detailed map of Kgautswane shown to the right. Cluster A, B and D are serviced by both bus and taxi. Group C is only serviced by taxi, while group E is only serviced by bus. Group F is not serviced at all. We arranged a taxi driver from the KTL focus group to drive us from cluster to cluster as to also further build commitment from the taxi association. We furthermore segmented respondents by visual inspection. We made sure we would administer questionnaires to a wide variety of people, like people with a car or a pickup truck, Spaza shop owners, households and people waiting for transport. We also decided to visit the Clinic, the MPCC and the Tribal office as specific destinations in order to segment our respondents based on their destination.

Figure 3-17: Detailed overview Kgautswane - Village clusters
Local research assistants
In order to overcome language and cultural barriers together with the Infopreneurs we decided to recruit local research assistants to administer the questionnaires. It was important to make sure that the group of research assistants represented each of the clusters of villages and consisted of both men and women in order to make sure the respondents would be open and honest. The Infopreneurs took up the task of recruiting these assistants. They made sure these assistants were able to speak read and write English but also would be able to understand the bigger picture and were aware of why we are doing this research. In order to get comparable results it is important to make sure the respondent precisely understands the different questions, this requires the research assistants to paraphrase questions and to interpret responses. To help them administering the questionnaires we wrote a guide to the questionnaire explaining what kind of information we were looking for specifically within each question. We furthermore discussed the questionnaire and the process of selecting respondents, introducing themselves, administering the questionnaire and the reporting of responses within a training. Again the Infopreneurs played an important role in this training. They were actively participating in doing test questionnaires and also administering questionnaires to real transport users. They furthermore made sure the research assistants understood that we were very happy that they could speak English and that they should not be embarrassed about their experience with speaking English. Without the Infopreneurs we might never even have been able to communicate with these research assistants since they would have been too afraid to even speak English.
3.6.3 Results

As mentioned above, we were planning to have one research assistant from each of the six defined clusters involved, unfortunately the Infopreneurs only managed to recruit three assistants. This did not affect the community’s willingness to cooperate however. The effort the Infopreneurs made in an attempt to recruit an assistant from each of the clusters already raised a lot of positive awareness of our research project.

In the process of administering the questionnaires the role of the Infopreneurs clearly was the one of project manager. Upon arriving at each one of the locations they pointed out who should be targeted in order to make sure we would get a complete picture of the transport problems and needs of the people in the community. When assistants returned from administering an interview we directly discussed their findings as to make sure the questionnaire was filled in correctly. At the start of the next day we discussed the questionnaires of the day before. The main aspect that needed attention was their ability to check and verify information while administering a questionnaire. On some questionnaires they for instance had indicated people had no income while they did spend money on transport. We therefore emphasized for them to draw conclusions and verify these conclusions while administering a questionnaire.

We visited all but one of the clusters of villages. Cluster F, consisting of only Mufarafara, was not visited, since the taxi driver indicated this actually is Istenleolo territory and therefore does not allow OLLDTA to service this area. The number of respondents we contacted in each cluster is indicated in the map of Kgautswane to the right. In total we administered the questionnaire to 68 respondents. A first improvement resulting from this questionnaire was exposing our taxi driver to the underserviced transport demand in Kgotlopong, one of the poorly serviced areas in Kgautswane. Upon arriving there we found several people that had already been waiting for some hours. We decided to transport them, while we were waiting for the research assistants to finish their questionnaires. The taxi driver mentioned going to Kgotlopong again next week now he had discovered there is business waiting for him there.

The next section will first discuss some general characteristics of the focus group and the general transport availability in Kgautswane. Following this overview, the issues regarding travel behavior, the logistics brokering service and communication will be discussed subsequently.
**General characteristics**

Within the group of people we interviewed, 72 percent was female. This is in line with what the Infopreneurs expected since a large portion of men is working outside the area or even outside of the province. The average age was near to 40. The distribution of people among different age categories is shown in the diagram placed to the right.

For most of the respondents their main form of income is a child, pension or disability grant. 53 percent of all respondents is dependent on social grants, 20 percent is self-employed and another 20 percent has a job, the remaining 7 percent is being supported by relatives. We furthermore asked the respondents to indicate to which income category they belong. Together with the Infopreneurs we set these categories to R0-R350, R350-R600, R600-R800, R800-R1200 and more than R1200. The figure below shows the distribution of the respondents among these categories. Within these different income categories the monthly spending on transport also differs quite considerably. For the lowest income group the monthly expenditures on transport are near to R70,- on average, constituting up to 40 percent of their monthly income. The monthly expenditures are consistently higher for higher income categories, but take up an increasingly smaller portion of their monthly income. For the highest demarcated income group the monthly spending on transport is around R170, constituting less than 20 percent of their monthly income. On average all respondents spend a bit over R160 on transport in one month.

Before we asked the respondents about their travel behavior we wanted to gain some general insight into the availability of different transport types. We asked the respondents to indicate whether in their opinion a pickup truck, the bus, the taxi and a private car is either never, sometimes or always available. We furthermore asked them to indicate whether they were able to arrange transportation upfront with these different types of transport. Unfortunately these questions were not completely clear to the research assistants and herewith the respondents. Within the first question always, never and sometimes, can be seen as referring to reliability, but can also be seen as referring to availability, or both. A response that illustrated these possible interpretations for instance was: “The bus is always available when I expect to be available.” This respondent thus also answered that in her opinion the bus is always available, while the bus actually is only available some of the time, in the morning and the afternoon. Another possible misinterpretation was the spatial reach of
availability. We for instance know by visual inspection that the bus passes through Paeng, one of the settlements in Kgautswane, while some respondents from Paeng indicated that the bus is never available. Probably they are of the opinion that they live too far from the main road to see the bus as an available mode of transport. The second question also was difficult to interpret apparently, since this question has only been answered in about half of the questionnaires. Although these questions have not always been interpreted from the same perspective, we still can draw some conclusions from the answers that were given. Especially the respondents that indicated that some modes of transport are never or sometimes available are interesting, since never is an unambiguous response and with regard to transport by pickup truck, taxi and private car, the response sometimes expresses unreliability since we know these modes of transport do not operate according to a schedule.

Out of 66 responses, the bus was indicated to be never available on 7 occasions. These 7 responses were not unique to a specific area however; for each area that had respondents that were of the opinion that the bus was never available, there were also respondents that indicated that the bus was either sometimes or always available. Clearly these responses were different as a result of a difference in opinion whether the bus stop is within reasonable walking distance or not. The figure to the left shows the availability of pickup trucks, taxis and private cars. The bus is not shown in this overview, since this would result in a distorted overview, because the bus operates using a schedule and the difference between being always and sometimes available is less transparent, as was mentioned above. A first remark has to be made about the private car. The graph clearly shows, this specific question has not been answered by a large number of respondents, probably because it was not relevant to those people that do not own a car. This question was also referring to people getting transport by someone else’s privately owned car, apparently this was not completely clear unfortunately. The figure does clearly show however that most of the respondents that did answer this question indicated a private car to be never available. It can therefore be assumed that a private car in any form is least available to this group of respondents and that they are highly dependent on public modes of transport. For both taxis and pickup trucks this figure shows that most respondents indicated that these modes of transport are sometimes available. As was mentioned above this can be seen as an indication of these modes of transport to be unreliable, since they do not operate according to a schedule. The figure furthermore shows a large amount of respondents that are of the opinion that a taxi is never available. When looking at this figure more specifically, it turned out that more than three quarters of these responses were coming from respondents living in either cluster C or E, consisting of Kgotlopong, Mahlashi and Mokutung. Almost 90 percent of the respondents from these areas indicated the taxi never being available. As mentioned above we also asked respondents to indicate whether they were able to arrange transportation for the different types of transport. The most interesting results were that near to 80 percent indicated to be able to arrange a pickup truck, while only 30 percent indicated to be able to arrange a taxi upfront.
**Travel behavior**

Within this section of the questionnaire we wanted to learn three things. Firstly we wanted to grow a better understanding of the transport demand of the people in Kgautswane. Secondly we wanted to know which different types of transport supply are used most, why they are used and whether people actually use the mode of transport they prefer to use. Our final goal was to identify to what extent they currently change their travel behavior in order to match their demand to the available transport supply and to what extent they could change their travel behavior if this would enable them to use a mode of transport that better suits their needs. Since travelling within Kgautswane might have different characteristics than travelling outside Kgautswane, on some occasions we asked for specific information with regard to both type of travels.

**Transport demand**

Within the group of respondents 70 percent indicated to travel to Burgersfort when travelling outside Kgautswane, Ohrigstad was noted to be too small for some type of groceries. 72 percent of the respondents travels outside Kgautswane to buy groceries or stock for their business, another 11 percent travels outside Kgautswane to pay accounts, the remaining 17 percent varies from visiting the police station to playing the lotto. Within Kgautswane this group of respondents travels to multiple destinations, indicated in the figure placed above. The two figures placed below show the frequency with which the respondents travel outside and inside Kgautswane.
and the number of people they know with similar transport needs. The first figure shows that most respondents travel 2 to 5 times outside and inside Kgautswane a month. The second figure shows that more than half of all respondents know at least 1 person with similar transport needs. It also shows that a significant amount of respondents even know 10 or more people with similar transport needs.

Transport supply

For trips, both outside and inside Kgautswane, we asked the respondents to indicate which type of transport they normally use. The figure to the right shows these usage statistics. Obviously none of the respondents indicated to walk when going outside Kgautswane. Within Kgautswane this currently is the most used form of transport. The most commonly used forms of motorized transport within Kgautswane are the bus and the taxi, the role of the pickup trucks is fairly limited. When going outside Kgautswane most people use the bus. The role of the pickup trucks then becomes more important than within Kgautswane however, they have a market share that is almost equal to the market share of the taxis in Kgautswane.

Within the previous interaction with the transport users we learned that the availability of the different modes of transport is a problem which forces them to change their travel behavior. We therefore asked the respondents to also indicate whether the mode of transport they currently use is their preferred type of transport or whether this is merely the best available option. Less than thirty percent of the respondents indicated that they are currently using the type of transport they actually would prefer to use. We furthermore asked them what type of transport they would prefer to use, while asking this question we emphasized that within their preference they should also incorporate the possible additional cost of using an alternative mode of transport. This was essential in order to ensure that the difference between current and indicated preferred use is attributable to the limited availability and reliability of transport supply. The figure to the right shows the indicated preferred use of the different transport modes for both travelling

![Use of different modes of transport](image1.png)

**Figure 3-27: Use of different transport types**

![Preferred use of different modes of transport](image2.png)

**Figure 3-28: Preferred use of different transport modes**
inside and outside Kgautswane. The striking difference between this and the previous figure clearly is the preferred use of the taxi. When going outside Kgautswane 85 percent of the respondents currently using the bus indicated to actually prefer using the taxi. The respondents that preferred to use the bus indicated price as the mean reason for choosing this option. 70 percent of the respondents currently using a pickup truck would also prefer to use a taxi, the remaining 30 percent preferred to use a pickup truck because of its ability to transport goods. When travelling inside Kgautswane no one who used the bus or a pickup truck was actually using their preferred mode of transport, again the vast majority would travel by taxi if it would be reliable and available. Probably there is a far less need to transport goods inside Kgautswane, rendering pickup trucks less attractive. Even some of the private car owners indicated to prefer to use a taxi, because of its price and comfort.

In order to get some more insight into the attractiveness of the taxi we asked the respondents why they prefer a certain type of transport. The figure to the right shows the number of times different reasons have been marked as contributing to the attractiveness of the taxi. Safety and comfort were marked most frequently. An interesting result is the number of times the ability to transport goods has been marked. More than 20 percent of the people that preferred using a taxi indicated this as one of the reasons for choosing this option. Apparently quite a lot of people experience the transport capacity of the taxi as sufficient and herewith see the taxi as a good alternative to the pickup truck with regard to transport capacity. Another interesting result is the number of times reliability has been marked. Reliability clearly is not associated with transport supplied by taxis. This supports our findings during the structured interviews that transport supply in general is unreliable and people simply make use of the first type of transport that comes along.

Apart from first of all availability, reliability, safety and comfort, price has also been mentioned on several occasions to drive the choice for a certain type of transport. Some people preferred using the bus over using a taxi, and some private car owners preferred using a taxi over their own car, all because of price. Price thus...
is an important aspect of the transport service delivery in Kgautswane. We therefore asked the respondents to indicate the costs of the type of transport they were currently using. The figure on page 66 shows the average cost of the different types of transport for both travelling outside and inside Kgautswane. The costs have not been segregated based on length of travel and therefore do not form a reliable source of information with regard to exact pricing of transport. Because there is clear consistency between earlier made individual statements and these figures and because the pricing differences are consistent for travelling outside and inside Kgautswane, this figure does however help to get some insight into how the different types of transport compare to each other with regard to cost. The most important insight from this figure is the large difference in cost between professional transport supply by the bus company and the taxi association and the uncoordinated transport supply by pickup trucks and private cars.

Matching demand and supply
As mentioned above, the last section within this discussion on the travel behavior of the people in Kgautswane will focus on the extent to which transport users currently change their travel behavior in order to match their demand to the available transport supply and to what extent they could change their travel behavior if this would enable them to use a mode of transport that better suits their needs.

In order to get a better insight into the actual mismatch between transport supply and demand we asked every respondent how often they changed their travel behavior in the last month as a result of unavailability of transport supply. Every respondent had changed his or her behavior at least once and more than three times on average. We furthermore asked them to indicate how they changed their behavior more specifically. The figure placed above shows that by far on most occasions people change their type of transport. To further pin down the problem of availability we asked two questions specifically focused on two cases. Firstly we asked whether respondents
regularly had to walk somewhere, because there was no transport available, while they were willing to pay and secondly we asked whether they sometimes chose to use a pickup truck, because a taxi was not available, while they actually preferred to use a taxi. As can be seen in the figures on the previous page, both described situations happened to almost all respondents. Apparently availability of transport supply poses a big problem.

The next questions focused on the extent to which the respondents could change their travel behavior if this would enable them to use a mode of transport that better suits their needs. We asked whether they were flexible enough to change their time or day of travel and whether they were able to plan their trip in advance. This is valuable information since more flexible transport demands are more easily grouped and when people can plan a trip some time in advance it is more probable that enough transport requests can be gathered for a trip to be financially viable. With regard to the flexibility of the transport users, we first of all asked them whether they make certain trips on specific times. Most respondents indicated that they do not travel at specific times, for travelling within Kgautswane they more frequently indicated to be less flexible however. This also appears to be in line with their destinations inside and outside Kgautswane. Most respondents travel outside Kgautswane to shop for groceries, which is something that does not have to be done at a specific time or day. Inside Kgautswane one important destination for instance is the clinic, which is more critical since they commonly need to be visited at a specific day in the week for treatment or medicines. Going to church obviously also is fixed on a specific day of the week. We also asked the respondents to further specify their flexibility by indicating whether they could change their time/day of travel within one day, one week, one week or whether they could not change their time or day of travel at all. The figure shown above visualizes the answers to this question. A total of 86 percent of the respondents can be called flexible to some extent and up to 72 percent stated to be able to change their time/day of travel at least within one week.

Based on the reasons for travelling outside Kgautswane and the destinations within Kgautswane we can also get an idea of the extent to which transport users can plan ahead. Most of the trips are recurring trips and therefore probably can be planned ahead. With regard to planning ahead we also asked the respondents to indicate fairly specific the amount of time they are able to plan their trips in advance. Only three percent stated not to be able to plan their trips some time ahead. Another three percent indicated to be able to plan trips one day in advance. The remaining 94 percent could plan their trip at least one week in advance.
Logistics brokering

Once we got an understanding of the travel behavior of the respondents we introduced the general service concept and pointed out that this service might provide them with transport, but they also might need to change their travel time and data and that they might need to plan their trip in advance. Once we introduced the system we asked the respondent whether they would make more use of the taxi if it would be made more available through this service. We also asked them whether they would be willing to pay more for transport that would be arranged through such a service.

The figure to the right shows the results of both of these questions. Both at a normal price and a somewhat higher price more than 90 percent of the respondents indicated to make more use of the taxi. The three respondents that indicated not to make more use of the taxi supplied through the introduced service at the normal price, were either private car owners or simply did not prefer to use the taxi. With regard to charging somewhat higher prices for arranged transport some respondents indicated that they simply do not have a lot of money available for transport. Although most respondents reacted positive to this initiative, it is possible that not all of them actually realized the effect additional transport expenditures would have on their budget. It furthermore is commonly known that people in developing areas tend to be overly positive in order to elevate chances of having things realized. These results therefore should be evaluated with a wide margin for error. We furthermore asked the respondents how much they would have probably spent on transport in the last month if it would have always been available. The main goal of this question was to verify whether the respondents actually have the money they state to be willing to spend available. Unfortunately usually the research assistants calculated this number based on previously provided numbers therewith lowering its use as a means to verify consistency among different answers. Having the research assistants discussing the answer to this question with the respondents did reemphasize that more use of the taxi would result in additional costs however. It therefore still has
value as a means to strengthen the confidence in the fact that people would actually make more use of the taxi. The first figure at the bottom of the previous page shows the results of this question. This figure shows that on average for each income group respondents at least agreed that they would have spent more according to the calculation of the research assistant. The final question within this section was to check whether people would be willing to pay upfront as a means to improve the reliability of transport demand. We asked them to indicate their willingness to pay upfront in two cases, the first being paying the taxi association upfront directly and the second being paying the taxi association through the Infopreneur as a middleman. The figure on page 69 shows the results of this question. In both cases the majority of the respondents proved willing to pay upfront. The respondents that stated to be unwilling to pay upfront, mentioned a lack of trust as the main barrier. It is possible that this concern also plays a role for the people that indicated to be willing to pay upfront. Obviously actually paying upfront is quite different from stating you would be willing to pay upfront, especially for those people for whom money or the lack thereof plays such a big role in their daily life. Again these results therefore should be evaluated with a wide margin for error.

Communication

The last section of the questionnaire focused on the means of communication between the transport users and the Infopreneurs. We evaluated mobile phone ownership and usage and possible other means of communication. 88 percent of the respondents owned a mobile phone, another 6 percent can use the mobile phone of a friend or relative, the remaining 6 percent indicated to use a public phone. Out of the respondents that owned a cell phone or could use the cell phone of a friend or relative 14 percent indicated to not have cell phone coverage at their home. These respondents were all living in either Paeng or Mokutung. The respondents from Paeng indicated that they usually could find coverage somewhere in the vicinity of their house, the respondents from Mokutung had more troubles finding network coverage and mentioned to have to walk for more than twenty minutes or even more than five kilometers. On average each respondent spends around R75,- a month on airtime. For individual respondents this figure differs quite a lot however. The first 50 percent of the respondents spends less than R30,- a month, while respondents in the top 10 percent spend up to 10 times as much. 30 percent of the respondents that owned a cell phone or could use the cell phone of a friend or relative did not use SMS, because most of them did not know how to use SMS. Within the last question we asked the respondents whether they could think of other means of communicating with the Infopreneurs. 78 percent could not think of an alternative for using their mobile phone, 19 percent suggested walking to the MPCC and the last 3 percent mentioned using the public phone. Clearly using the mobile phone is the best alternative. From this point onwards we decided to develop a service which would allow the people of Kgautswane to use their mobile phone to arrange transport.
3.6.4 Conclusions
This questionnaire resulted in a lot of valuable insights. The respondents indicated to mostly travel to Burgersfort to shop for groceries, when travelling outside Kgautswane. When travelling inside Kgautswane 65% of the respondents indicated to travel to either the Clinic, the Church or the MPCC. This is valuable information since these typically are destinations where groups of people travel to at specific times. This is confirmed by another question that showed that near to 40% of all respondents knows five or more people with similar transport needs. Within Kgautswane people mostly travel by foot and outside Kgautswane people mostly travel by bus. When asking what type of transport the respondent would prefer to use, both for travelling within and outside Kgautswane the taxi was preferred by the vast majority of respondents. 70% of the respondents that indicated to currently use a pickup truck noted that they would actually prefer to use a taxi. 91% of all respondents indicated to have used a pickup truck on occasion, while they would have preferred to use a taxi if it would have been available. Because of limited availability of transport supply 92% percent of respondents indicated to change the type of transport they use; people walk, take the bus or jump in the back of a pickup truck while they would prefer to use a taxi. If transport would be made more available through a logistics brokering system most of the respondents stated to be able to plan their trip more than a week in advance and to change their day of travel within a week from their originally planned travel date. Although these results need to be interpreted incorporating a wide margin for error, the first impression seems very positive. It appears that a logistics brokering system could solve a real problem. A last important conclusion that was drawn based on this questionnaire is to develop a service which would allow the people of Kgautswane to use their mobile phone to arrange transport, since this proved the most viable option; 94% of all respondents had direct access to a mobile phone and up to 78% of all respondents saw no alternative to using the mobile phone to communicate with the Infopreneurs.

Making use of research assistants helped to overcome some of the constraints of doing research in a developing rural area. It also introduced a lot of difficulties. It was essential to keep training these research assistants, also throughout the process of administering the questionnaires. Especially training them to check whether answers were consistent with previously given answers. We for instance could have trained this skill somewhat more, by having them administer a questionnaire to one of the Infopreneurs, which in turn tries to be as inconsistent as possible. An important limitation of this questionnaire is that, especially for people in this context, saying is different from doing. People tend to give answers in order to try to influence the course of the project. They might over exaggerate their problems or behavior, hoping we will be able to solve these problems. Apart from doing a questionnaire it therefore also might be valuable to simply try to simulate certain situations in order to uncover their actual behavior. In retrospect we for instance could have already tried to let them make a transport request and test to what extent they would be willing to plan ahead and to test to what extent they actually are flexible.
3.7 Workshop with taxi association

3.7.1 Goal
The structured interviews and the guided questionnaire provided us with some valuable insights we wanted to share with the taxi association. We wanted them to learn how their unreliability results in unreliable demand. Both interactions with the transport users showed how pickup trucks are not really stealing business, but are simply transporting the people that are left behind by the taxis. Apparently people simply use the first available type of transport, because waiting for a taxi might mean not getting transport at all. This proved to be a big opportunity for the taxi association to increase their business, since most respondents indicated to actually prefer travelling by taxi. Within this last interaction with the taxi association before we finalized and tested the design we therefore wanted to reiterate our findings of the previous workshop, verify the requirements we identified and to share our findings of the interviews and the questionnaire. Another important aspect of this workshop was to prioritize the different requirements in order to be able to take important design decisions. We furthermore wanted to gather some more practical information with regard to travel times and the pricing scheme of the taxi association. Essentially our goals were to further build commitment from the taxi association and to agree on our design.

3.7.2 Approach
The approach we adopted within this workshop was focused on clearly communicating results and providing insight into design trade-offs. As suggested within the guidelines that were discussed in the previous chapter we made use of visualizations and prepared some preliminary design alternatives in order to let the taxi association easily participate in the design process. For instance the map of Kgautswane we created was presented. We furthermore presented somewhat more schematic maps of the area, a first one with all roads straightened out and a second one in the style of a metro line. This helped us to discuss servicing the different settlements and illustrate possible routing issues more clearly. We furthermore split up the workshop into two days in order to make sure that the different attendees could rethink certain issues and could regain their enthusiasm for the project before we would discuss sensitive issues like finances and decision structures. We subsequently discussed the following issues:

- Day 1
  - Analysis
  - Issues
- Day 2
  - Service proposal
  - Information gathering
  - Decisions

Within the discussion on the analysis we carried out, we first simply went through the main conclusions of the previous workshop and, more importantly, the results of the interviews and questionnaire with the transport users. The analysis resulted into several issues that were new to the taxi association and which had not been discussed before. Discussing these issues formed the end of day one in order to send them back home with the assignment to think about these issues. The next day we started with presenting our service proposal and identifying the implications this would have for the taxi association. We then again allowed them to think about whether they could agree with
our proposal or whether they were of the opinion things should be done differently. In the meantime we gathered some additional information on travel times between certain settlements and the current pricing scheme of the taxi association. The last issue on the agenda then was to decide how we wanted to tackle the issues introduced on the previous day and whether our proposal fitted their demands or whether we should adjust the preliminary service system. The pictures to the right show some of the visualizations we used within the workshop.

3.7.3 Results
As mentioned above, we had two clear goals we pursued with this workshop. Firstly to further build commitment and secondly to agree on our findings and the final design of the service system. We had to agree on four distinct items:

- Reliability of demand and supply
- The customer proposition
- Risk taking
- Routing

These different issues will be discussed subsequently in detail below.

Reliability of demand and supply
The main issue that should be handled by the logistics brokering system is the lack of communication and coordination between the taxi association and the transport users. The reliability of demand was mentioned to be a problem from the beginning of the project. The issue of pickup trucks stealing business was also mentioned as lowering the reliability of demand. As mentioned within the results of the guided questionnaire, most people would prefer to travel by taxi, but simply choose to use the first available type of transport, almost regardless of their actual preference. In our opinion the problem with regard to the reliability of demand therefore was clearly linked to the unreliability of transport supply. The first step therefore was
to point out that there exists a vicious circle that maintains a situation within which both transport supply and demand remain to be unreliable. Although this implied that increasing the reliability of demand would entail the taxi association having to start with providing more reliable transport to the people of Kgautswane, it also made clear that there is a lot of additional business for the taxi association to tap into. Using the results from the questionnaire and especially focusing on the possible additional business helped us to agree that the taxi association should be the first to break the vicious circle of unreliable transport demand and supply. Since this was a sensitive issue, where the taxi drivers could interpret our findings as offensive, it turned out to be really important to have done the questionnaire in cooperation with several taxi drivers. Since they had seen the situation first hand they supported our findings and helped to gain acceptance with the rest of the taxi association.

**The customer proposition**

We identified two options with regard to the customer proposition. Within the first option transport users would be allowed to request a trip and the taxi association would simply provide them with this trip. A second option was to gather transport requests and to choose a trip and its route and departure time in order to service as much transport requests within one trip. This option would either entail people not getting a trip or at least not getting a transport offering in line with their initial request. The first option clearly is a far more transparent customer proposition, but the second option would allow for more profitable trips. It is important to note however that the second option would be less attractive to the transport users, obviously resulting in less business for the taxi association. We emphasized that especially in a situation where trust and reliability appears to be such an issue it is important to have a clear customer proposition. We therefore chose the first option and decided to commit ourselves to providing everyone that requested transport with a trip serving their expressed transport need.

**Risk taking**

Clearly linked to the previous issue was the level of risk the taxi drivers were willing to take. As mentioned within the results of the first workshop, the taxi drivers are responsible for the risks they take and also reap the benefits of taking these risks. Since we decided to provide a trip to everyone that requested transport, there is no certainty on the number of transport requests that can served by a single trip. We therefore discussed whether individuals should be allowed to request transport, since this would introduce the risk of having to make an unprofitable trip. Although the queue marshal would enforce a fair trip distribution and taxi drivers thus would equally share trips, the profits or possible losses are not shared and pose a risk to each individual taxi driver. We therefore decided to only allow groups of five or more people to request transport. Apparently the individual character of the risk of financial losses forces the system to make sure each individual trip is profitable. This requirements thus turned out to be more important than the total amount of possible business.

**Routing**

A slightly less sensitive issue, was the issue of routing. The main choices we needed to make here were which settlements we were going to service and whether it was acceptable to service these settlements with a single line. In order to clearly communicate the implications of these choices we created several maps of the area. As mentioned before, initially there were no maps of the area available. Within this workshop we therefore introduced a map of the area to the taxi association,
this was the first time they actually saw a complete overview of Kgautswane. We furthermore
created two more maps of the area, a first one showing the settlements as points and the roads as
straight lines and a second one that was even more schematic and had the appearance of the map of
a metro line. Although this was their first experience with the use of such a map, it turned out to be
the one that was most insightful to them. While discussing these maps it became clear that there
were several settlements that were simply too inaccessible to be able to service and there were some
settlements OLLDTA was not even allowed to service. We therefore decided to not incorporate
Mufarafara, Mokutung, Kgotlopong, Mahlashi, and Makgopa. Once we crossed out these settlements
it became clear that there were three settlements located some distance from the main road and all
other settlements were located on the main road. With the schematic map we now could clearly
visualize the implications of servicing all settlements in a single trip. This would mean having to take
two detours of leaving and returning to the main road. Some transport users travelling from a
location on the main road to another location on the main road would possibly face a maximum
delay of around thirty minutes. Choosing to service all settlements in a single trip would also have a
clear benefit to the taxi association however, it would enable the Infopreneurs to group all transport
requests with the same departure time, regardless of their origin and destination. We therefore
chose to service all settlements with a single service line.

3.7.4 Conclusions
This last workshop helped to prioritize the different requirements. The first most important
conclusion is that it is essential to provide a transparent customer proposition in order to break the
vicious cycle of unreliable transport supply and demand. The second most important conclusion is to
limit the risk of unprofitable trips, regardless of the influence this has on the attractiveness of the
service. This means servicing all transport requests with a single service line and only allowing groups
to request transport.

Within this interaction we had to discuss quite sensitive issues and we needed to make clear how
certain design choices influence the outcome of the system and how these choices always are a trade
off. We used visualizations to help communicating these issues. Although this helped a fair amount, it
still took quite some effort clarifying every possible implication of a certain design choice. Within the
guidelines that were discussed in chapter two, simulation was already mentioned as a good way of
helping local people to participate in the design of such a system. Unfortunately because of time
constraints we were not able to realize such a simulation. All of the issues discussed above could
have been captured in a business game to show the taxi association that for instance taking more risk
would possibly provide them with more business.
Part B:

**System design;**

“Logistics Brokering in Kgautswane”

B.1. **Chapter 4** — Which requirements should be set for a logistics brokering system to be sustainable and effective in improving the transport service delivery in Kgautswane?

B.2. **Chapter 5** — How should an ICT-enabled logistics brokering system be set up to be expected to sustainably improve the transport service delivery in Kgautswane, South Africa?
4 Logistics brokering in Kgautswane – Requirements

Within this part B of the report the design that has been made for the logistics brokering system in Kgautswane will be discussed. This chapter will firstly give an interpretation of both the knowledge and experience base. The requirements that have been set for the design of the service system will be presented. This chapter herewith will answer the following research question:

B.1. *Which requirements should be set for a logistics brokering system to be sustainable and effective in improving the transport service delivery in Kgautswane?*

Not all of the findings from both the knowledge and experience base can be captured in requirements. Some of the findings simply verified certain possible solutions like the possible use of mobile phones and the flexibility of transport demand. Where relevant these issues will be highlighted in the next chapter while discussing the different design choices. The requirements that are presented here will be discussed according to the associated stakeholders. The requirements that have been set for the intermediary, the transport users and the transport suppliers will be discussed successively. The figure below shows the eleven requirements that have been defined categorized per stakeholder. This overview will be used in the remainder of this report in order to link design choices to requirements.

<table>
<thead>
<tr>
<th>Logistics brokering in Kgautswane - Requirements -</th>
<th>Intermediary</th>
<th>Transport User</th>
<th>Transport Supplier</th>
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</thead>
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<tr>
<td>Managing the logistics brokering system needs to be profitable</td>
<td>I.1</td>
<td>[U.1]</td>
<td>[S.1]</td>
</tr>
<tr>
<td>The process of interaction needs to be automated</td>
<td>I.2</td>
<td>[U.2]</td>
<td>[S.2]</td>
</tr>
<tr>
<td>The service needs to allow use with basic mobile phones</td>
<td>[U.1]</td>
<td>U.3</td>
<td>[S.3]</td>
</tr>
<tr>
<td>Service costs need to be minimized</td>
<td>[U.2]</td>
<td>[U.3]</td>
<td>S.4</td>
</tr>
<tr>
<td>Transport supply needs to be reliable</td>
<td>[S.1]</td>
<td>S.2</td>
<td>S.5</td>
</tr>
<tr>
<td>Transport demand needs to be reliable</td>
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<tr>
<td>Single trips need to be profitable</td>
<td>S.1</td>
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<td>Taxi occupation degree needs to be maximized</td>
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<tr>
<td>Business needs to be maximized</td>
<td>S.4</td>
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<tr>
<td>Trips need to be fairly distributed among the different taxis</td>
<td>S.4</td>
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</tr>
<tr>
<td>Taxi drivers need to be able to fill up their taxi along the route</td>
<td>S.4</td>
<td>S.5</td>
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Figure 4-1: Design requirements
4.1 [I] Intermediary

I.1 Managing the logistics brokering system needs to be profitable
Within the knowledge base ownership was mentioned to be essential in order to make sure a project remains relevant to its local context (See section 2.3 Guideline 3: Create local business opportunities to sustain added value). To ensure ownership an individual or group of people should see value in taking up the role of manager and decision-maker. We therefore decided to design the logistics brokering system from the perspective of creating business for the two Infopreneurs of Kgaustwane. Obviously this requires that managing the logistics brokering system needs to be profitable.

I.2 The process of interaction needs to be automated
The concept of an Infopreneur is defined as a self-employed social entrepreneur offering an array of services to the community. Working as a local entrepreneur in a developing rural area like Kgaustwane is very difficult. Since people struggle to make a living, demand for services usually is low and profit margins are very limited. Rensburg and Veldsman (2006) also describe how an Infopreneur is forced to adopt a strategy based on economies of scope instead of scale. Within the description of Kgaustwane in chapter three a picture showing the service offering of Smite (IT) Infopreneurs confirms this strategy (See section 3.2.5 The Infopreneurs). They offer a multitude of services, ranging from designing and printing business cards to shooting DVD’s for weddings and funerals. In order for them to be able to manage the logistics brokering system it is essential that they are still able to spend time on managing their other services. With regard to the process of gathering and grouping transport demand it therefore is essential to automate this process as much as possible. (Rensburg and Veldsman 2006)

4.2 [U] Transport User

U.1 The service needs to allow use with basic mobile phones
Within the previous chapter the section that described the context of Kgaustwane first mentioned the rapid expansion of mobile phone usage in this area (See section 3.2.6 The cell phone boom). During the interactions with the Infopreneur and both the structured interviews and the guided questionnaire this common use of mobile phones has become clear (See sections 3.5.4 and 3.6.3). The questionnaire showed that 94 percent of all respondents had access to a mobile phone and that more than three quarters of all respondents saw no alternative means of communication suitable for contacting the Infopreneurs. Based on these findings we therefore decided to develop a service which would allow the people of Kgaustwane to use their mobile phone to arrange transport. The article by Hutchings (2006) that first mentioned the extensive use of mobile phones already indicated that the mobile phones that are being used sometimes are bought second-hand and special low-cost phones are being produced for use in areas like Kgaustwane. Personal observations confirmed that the phones that are being used are not advanced and usually only support SMS and basic calls. Obviously the service has to be designed to at least be accessible by people using these basic mobile phones.

U.2 Service costs need to be minimized
Obviously this requirement is relevant within any business activity, but within the context of a developing rural area it has a much higher priority. Throughout the analysis we paid attention to the livelihood of the people in Kgaustwane. Within the first interaction the barriers of these people
struggling to make a living became apparent on several occasions. The shop owner mentioned some people preferring to walk for hours because of the cost of transport (See section 3.3.3). The questionnaire gave some more insight into their average monthly income. More than half of all the respondents were dependent on social grants. These people have a monthly income of less than R400,- on average. For these people their spending on transportation constitutes up to half of their monthly income (See section 3.6.3). Clearly minimizing service costs is essential in this context.

U.3 Transport supply needs to be reliable

The reliability of both demand and supply has been mentioned continuously as one of the main issues with regard to transportation in Kgautswane. For the logistics brokering system to add value to the transport users, it therefore is essential for the transport supply to be reliable. The lack of reliability of both transport supply and demand has resulted in an array of problems. Almost all respondents to the questionnaire indicated to prefer to use the taxi, but sometimes use a pickup truck since a taxi is not available. Even less than thirty percent indicated to use the type of transport they actually would prefer to use and people simply make use of the first type of transport that comes along, while the vast majority would travel by taxi if it would be reliable and available. On several occasions respondents even mentioned to not trust taxis showing up (See section 3.6.4). Apart from being reliable in supplying transport, reliability of transport supply thus should also refer to living up to all possible expectations that might be raised by a logistics brokering system.

4.3 [S] Transport supplier

S.1 Transport demand needs to be reliable

As mentioned above, both transport supply and demand are unreliable. Where transport users require more reliable supply of transport, the transport suppliers require more reliable demand for transport. Within the last workshop with the taxi association the vicious circle that exists between these two has been discussed and the taxi association proved willing to try to break this cycle (See section 3.7.3). Although they recognized that it might take some time for transport users to start trusting the system and therefore for transport demand to become more reliable, we should still try to ensure the reliability of transport supply from the start.

S.2 Single trips need to be profitable

The value of this requirement became clear within the last workshop with the taxi association. During this workshop we discussed whether we should allow individuals to request transport or whether we should only allow groups to request transport. The risk of unprofitable trips turned out to be a risk the individual taxi drivers were not willing to take and it therefore was decided to only allow groups to request transport, despite herewith limiting the service of requesting a trip to a limited amount of transport users. Because the taxi drivers themselves have to take the responsibilities for their decision to make a trip and thus either incur the loss of a trip or the possible profits, single trip profitability turned out to be more valuable than the total amount of business (See section 3.7.3).

S.3 Taxi occupation degree needs to be maximized

This is a basic requirement that needs to be kept in mind while designing the service. Although it is not essential to take measures to maximize the occupation degree, since single trip profitability is already ensured through only allowing groups to request transport, obviously a higher occupation degree is more profitable and thus preferred. Since the occupation degree influences the profitability
of a single trip, this requirement is also more important than the total amount of business of the taxi association (See section 3.7.3).

S.4 Business needs to be maximized
Throughout the research and design process the increase in possible business for the taxi association was the taxi association’s main reason to cooperate. We also continuously emphasized this aspect in order to keep them committed. The results of the questionnaire showed that if taxis would become more reliable and available it should be possible to significantly increase the total amount of business for the taxi association (See section 3.6.3). The logistics brokering system therefore should try to capture as much of the transport demand as possible.

S.5 Trips need to be fairly distributed among the different taxis
During the first workshop with the taxi association, distributing business fairly among the different taxis turned out to be one of the association’s main activities. At the taxi rank the queue marshal is solely busy with keeping order and deciding who gets a next trip. A fair trip distribution therefore was directly mentioned as an important requirement for the logistics brokering system and the attendees of the workshop stated that the Infopreneurs should always arrange transport through the queue marshal (See section 3.4.4).

S.6 Taxi drivers need to be able to fill up their taxi along the route
If a trip is not fully booked taxi drivers need to be allowed and enabled to pick up people along the route. It is important to specify this requirement since it raises the issue on how to arrange for a taxi driver to have insight into the amount of seats he needs to keep empty for people that booked a seat through the system and thus still needs to pick up (See section 3.4.4).
5 Logistics brokering in Kgautswane – Design

The logistics brokering service as mentioned throughout this report has been kept fairly conceptual. The logistics brokering system has been introduced as a system that should improve the transport service delivery in Kgautswane by enhancing the coordination and communication between transport demand and supply. At the end of chapter two we mentioned to have decided to develop the logistics brokering system as a self sustaining business for the two Infopreneurs of Kgautswane. They should operate the system and herewith form an intermediary that is positioned in between the transport users and the transport suppliers. The experiences described in chapter three further helped to narrow down some specific details during the analysis phase. After we held the first interviews we chose to develop a system that would enhance the transport service delivery during the day, since the transport problem in the early morning and late afternoon seems limited and we do not want to interfere with the work processes of the local transport suppliers that are already profitable. After the first workshop we further narrowed our focus to using the unused capacity of taxis standing idle at the taxi rank during the day and we decided to not incorporate pickup truck owners and the bus company as transport suppliers. Since 94 percent of the respondents of the questionnaire indicated to have access to a mobile phone and near to 80 percent of the respondents saw no alternative to using a mobile phone, we furthermore chose to develop a service which would allow the people of Kgautswane to use their mobile phone to arrange transport. Based on the requirements that were defined in the previous chapter we can now further specify the actual design of the logistics brokering system and herewith answer the following sub research question:

B.2. How should an ICT-enabled logistics brokering system be set up to be expected to sustainably improve the transport service delivery in Kgautswane, South Africa?

The set up of the final design of the logistics brokering system will be discussed in three sections. As indicated by van de Kar and Verbraeck (2007) a service system design should consist of a service concept, a technical architecture and an organizational network. These three different aspects will be discussed subsequently.
The specific requirements that guided the choices for each of the different aspects will be highlighted to clearly link the service system design to the requirements discussed in the previous chapter. The figure shown above visualizes which requirements guided the choices for the different aspects of the service system design. For each of these aspects this figure will be reiterated showing the link between the requirements and the different design choices more specifically. Within the design of the logistics brokering system we evaluated several options and possible choices but on occasion we made a choice without having had explicitly specified all possible solutions. As mentioned by Hevner (2004) in one of the guidelines referred to in the introduction, it is important to first establish that a design does work, even if we cannot completely explain why it works. Due to the critical nature of design in information systems Hevner (2004) referred to design as a search process, which does not always require a full assessment of all possible options.
5.1 Service concept

The service concept expresses how the service creates value for its users. As mentioned above, the basic service concept of the logistics brokering system is an Infopreneur operating as an intermediary by arranging transport for the people in Kgautswane. The main design challenge therefore was to design a service that was both profitable for the transport suppliers and attractive to the transport users. The figure shown below indicates the requirements that guided this aspect of the service system and herewith ensured an attractive and profitable service system.

In order to match these different requirements we made several design choices that are discussed in three different sections. The first section is called “What You Request Is What You Get” (WYRIWG) and is focused on the customer proposition, within the second section several design choices that were made in order to ensure single trip profitability and to increase the occupation degree of each taxi will be discussed, the last section focused on how the service has been differentiated to allow for a better fit between service profitability and customer value.

5.1.1 WYRIWG; What You Request Is What You Get

This section discusses the customer proposition. We chose to define the customer proposition as transparent as possible, What You Request Is What You Get! As can be seen in figure 5.2, the following requirements guided this choice:

- **U.1** Service costs need to be minimized
- **U.2** Transport supply needs to be reliable
- **S.1** Transport demand needs to be reliable
The first requirement is really important to adhere to, since this determines whether the service system holds value for the transport user. If service costs become too high, people that are already struggling to make a living will not make use of this service. The cost of communication obviously is the main component of the total cost of the logistics brokering service, it therefore is essential to limit the amount of communication necessary to arrange transport. In order to align different transport needs it therefore is not possible to for instance renegotiate the departure time of different transport requests. Since the results from the questionnaire showed that up to 72 percent of the respondents stated to be able to change their day of travelling at least within one week however, we did want to make use of this characteristic of transport demand. We therefore considered to let people indicate the extent to which they are flexible. Based on this information we would then try to identify the departure time that would have the highest chance of satisfying people’s transport needs. An insurmountable drawback of this option is the high probability of people that will not be satisfied with the chosen departure time and thus will be disappointed. As has already been made clear throughout this report, reliability of both transport supply and demand is an important issue. The questionnaire clearly showed that the people in Kgautswane choose their mode of transport based on availability, they simply make use of the first available type of transport. The reliability of transport demand herewith is a valid concern of the taxi association. On the same hand however, their currently uncoordinated supply of transport also inherently is unreliable and herewith maintains a situation in which taxis are not worth waiting for and a situation in which Kgautswane is unattractive to service. In order to break this vicious circle the transport services provided by the taxi association need to become more reliable. When reliability and trust is an issue, it is important to have a transparent customer proposition that clearly specifies what the user can expect to gain from using a service as to make sure no false expectations are raised. A service that will probably disappoint at least some transport users therefore is not realistic. We therefore decided that a transport request made through the logistics brokering system should always be matched with a trip correctly serving the expressed transport need. Obviously this is the best option from the perspective of the transport user, it both satisfies the requirement regarding minimizing costs, because there is no need for a lot of communication and it satisfies the requirement regarding reliable transport supply, since a transport user can be sure he or she will always get a trip precisely matching his or her transport request. This is also important for the taxi association since this will also make transport demand more reliable, there is a major risk associated with this option however. If the taxi association always precisely has to match a transport request, it is possible a taxi has to be sent out to fulfill only one transport request. In order to adhere to the requirements of ensuring single trip profitability and maximizing the taxi occupation degree a transport request is subject to certain terms and conditions which are discussed in the following section.

5.1.2 Terms and conditions; Safeguarding profitability
The risk for the taxi association of having to send out a taxi for a single transport requests obviously is dependent on the total amount of transport requests. If, in theory, an unlimited number of transport requests would be made at any time, obviously there would be no more risk, taxis could simply be filled up completely. Unfortunately the total amount of transport demand and transport requests is unknown and is almost impossible to accurately predict on beforehand. By taking certain measures and subjecting transport requests to certain terms and conditions this risk luckily can almost be eliminated. The drawback of these terms and conditions unfortunately is a less attractive service offering. It would therefore also be an option to simply take the risk of having to be sent out
Sustainable impact in developing rural areas through business creation

for a single transport request in order to stimulate transport demand, hoping this will result in enough transport requests for each trip to be profitable. We discussed this design trade off with the taxi association within the last workshop (See section 3.7.3). The outcome of this discussion was that we would start almost eliminating this risk and possibly in later stage, when we would have more insight into the total transport demand, discard some of the terms and conditions. As shown in figure 5.2, the following two guidelines therefore guided the following design choices:

**S.2** Single trips need to be profitable
**S.3** Taxi occupation degree needs to be maximized

We designed four terms and conditions in order to fulfill these requirements; the following four items will be discussed subsequently:

- Trips can only be requested by groups of five or more
- Trips are only scheduled once a week
- Trips can only be requested for a limited number of timeslots
- Trips potentially pass by each stop

**Trips can only be requested by groups of five or more**
In order to maximize business for the taxi association the logistics brokering system ideally would simply gather individual transport requests and would combine similar requests into profitable batches of transport demand. As mentioned above unfortunately the number of similar individual transport requests is uncertain which might introduce a risk for the taxi association having to transport a single individual, which obviously would be unprofitable. Since single trip profitability was expressed as a hard requirement in the last workshop, we can only allow groups of five or more people to request trips, since this was stated to be the minimum number of passengers necessary for a profitable trip.

**Trips are only scheduled once a week**
Although the condition described above ensures a minimum of five people per trip, we should also try to maximize the number of transport requests that can be grouped together in order to fulfill requirement S.3: Taxi occupation degree needs to be maximized. This condition, together with the following two conditions therefore are designed to maximize this number of groupable trip requests. Since the results of the questionnaire pointed out that 94% of the respondents stated to be able to plan their trip more than a week in advance (See section 3.6.4), we decided to only allow people to request transport up to nine days in advance. This should only have a limited effect on the attractiveness of the service, while it does allow the Infopreneur to gather transport requests during a whole week, which increases the possibilities of being able to group transport requests.

**Trips can only be requested for a limited number of timeslots**
A first remark should be made stating for which hours during the day the service can arrange transport. The use of the logistics brokering system is limited to the off peak hours of the day, since, as mentioned before, the transport problem in the early morning and late afternoon seems limited and we do not want to interfere with the work processes of the local transport suppliers that are
already profitable. Then, in order to increase the number of similar transport requests we limited the freedom of the transport users to specify their departure time. As is already mentioned several times above, the people of Kgautswane are regarded as being highly flexible in when they want transport. This obviously is of major value, since it might enable aligning transport needs which in turn would result in a higher occupation degree and more profitable trips. Unfortunately we are not able to capitalize on this characteristic by negotiating departure times because of the cost of communication. We therefore decided to enforce flexibility upfront by not to allow users to request a trip for a specific departure time, but to let them choose a timeslot of four hours within which the intermediary will set the specific departure time. We furthermore limited the number of timeslots to only three timeslots a week for the startup phase in order to align the different transport needs as much as possible. In a later phase it should become more clear to what extent this influences the total demand for transport arranged through this system and to what extent it still is necessary to enforce flexibility. If transport demand grows sufficiently, in time, the number of timeslots could possibly be extended or the length of these timeslots could be brought back to an hour or even less.

**Trips potentially pass by each stop**
The last design choice we made regarding the terms and conditions of making transport requests is potentially servicing every transport request with a single trip. The figure to the right shows the service line we created for Kgautswane. It shows the settlements in Kgautswane we agreed on to service with the taxi association. This figure can also be found in a bigger format in appendix E. Ohrigstad always is the starting point for each trip, according to the transport requests that have been gathered and grouped the trip proceeds along the main line branching off to any of the destinations that lie along branch A, B or C, if necessary. Because the number of branches is limited we agreed it would be acceptable to service all settlements in a single trip. Although this might result in some passengers not being transported as quick as possible, we still decided to service all settlements through one service line because of its effect on the trip profitability. By servicing all settlements in a single trip, the number of transport requests that can be grouped in a single trip increases, herewith again increasing the occupation degree and profitability of a trip. For each trip the precise route will be based on the origins and destinations of the corresponding transport requests, a taxi will only branch of the main line if necessary. When the intermediary schedules a trip he fixes the route and informs the people that requested transport about the departure and arrival times.
5.1.3 Service differentiation: Fully capturing transport demand

As was mentioned before in order to maximize the business for the taxi association the logistics brokering system ideally would simply gather individual transport requests and would combine similar requests into profitable batches of transport demand. In order to adhere to requirements S.2 and S.3 we decided to only allow groups of five or more people to request trips. We furthermore decided to only schedule trips once a week, requiring people to plan ahead to some extent. According to the questionnaire only 40 percent of the respondents indicated to know five or more people with similar transport needs and not every respondent stated to be able to plan their trips in advance. This obviously limits the possible business for the taxi association. By differentiating the service offering we tried to design a service that is able to fully capture the transport demand that exist in Kgautswane. As shown within figure 5.2 we herewith want to adhere to the following requirement:

S.4 Business needs to be maximized

In order to capture the possibly remaining 60 percent of people that is in need of transport, but does not know five or more people with similar transport needs and the people that are not able to plan more than a week ahead, we designed two more services that were both available to individuals as well as groups of people. The service concept of the logistics brokering system thus is differentiated into the following three services:

- Requesting a trip
- Joining a trip
- Finding a trip

These three services are all interlinked, this dependency is visualized in the schedule of the process of arranging transport to the right. The cycle starts each Friday at 12pm with accepting new trip requests. During one week the intermediary collects these trip requests. The next Friday at 12pm he or she will group requests that are similar and which can be served by a single taxi. For each batch of trip requests the intermediary will schedule a taxi. Once trips have been scheduled, individuals can join a scheduled trip. Up until 12pm the day before a trip has been scheduled, individuals can search for trips and book a seat on a trip that fits their needs. Obviously this service will probably require transport users to be flexible since they cannot request transport to fit their specific needs an have to make use of already scheduled trips. Most probably this will not raise a big barrier since up to 72 percent of the respondents of the questionnaire indicated to be highly flexible in when they need transport. At 12pm the day before a trip has been scheduled, a trip will be finalized. This basically
consists of removing a trip from the list of bookable trips and handing over a document specifying the trip details to the taxi association. The third service is focused towards people that are in an instant need of transport, the previous two services obviously are of no value in such cases, since people need to plan ahead to be able to make use of these services. Information on whether someone can expect a taxi passing by his or her location anytime soon would already be useful however, since there might still be seats available. Based on this information a transport user then can decide whether he or she wants to wait for a taxi that is scheduled to pass by. This last service thus was designed to allow people to find trips that have been scheduled for that specific day and to allow them to make an informed decision.
5.2 **Technical architecture**

Once the service concept was clearly specified we again started thinking about the technology which would be most appropriate to use in this context. The choice for the used technology and the design of the technical architecture was guided by the following set of requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I.2</strong> The process of interaction needs to be automated</td>
</tr>
<tr>
<td><strong>U.1</strong> The service needs to allow use with basic mobile phones</td>
</tr>
<tr>
<td><strong>U.2</strong> Service costs need to be minimized</td>
</tr>
</tbody>
</table>

### 5.2.1 Technology selection

The technical architecture had to overcome barriers typical for a developing rural area and basically had to allow for an automated process compatible with very basic mobile phones, while minimizing costs. Below we will subsequently elaborate on the technology we chose to use and the resulting set up of the necessary technical infrastructure and lastly how the technology is used to support the process of arranging transport as mentioned above. From this point onwards there were no real difficult design trade offs, most requirements could be satisfied without influencing the extent to which other guidelines were satisfied. The requirements therefore mostly functioned as design guidelines.

### 5.2.2 Technical processes

![Figure 5-5: Requirements versus Design – Technical architecture](image)
Unstructured Supplementary Service Data (USSD)

Since the choice for the means of communication had already been demarcated to making use of the fast growing use of mobile phones in developing rural areas, our choice was limited to a number of options. Although we needed to find some sort of technology that allowed for automation of the process of interaction between the intermediary and the transport users (Requirement I.2), the common capabilities of the mobile phones frequently used in developing rural areas and the experience of users in these areas do not allow for more advanced technologies like STK (Sim Tool Kit) or internet based applications. A technology that required no advanced technologies or additional software installation at the user’s side was needed in order to satisfy requirement U.1. From this perspective three different technologies still were applicable:

- **Spoken Dialogue System (SDS):** SDS is a quite well known system which is frequently used by for instance customer service centers. With SDS a user dials a number and gets connected to a speaking computer that guides the user through a menu of options. Usually the user chooses an option by simply pressing the associated number (“for option one, press 1”). On occasion such a system also supports speech recognition, herewith allowing the user to make his or her choice known by voice. (Suhm, Bers et al. 2002)

- **Short Message Service (SMS):** As its name already indicates, SMS usually is used among mobile phone users to send short messages to each other. It can also be used in automated processes however. Some common uses for instance are requesting ringtones, participating in radio contests or subscribing to any sort of service. When using SMS for this kind of application its content needs to be highly structured, usually this structure follows a pattern similar to for instance: “SMS: ON<space>[name]<space>[date of birth] to 1111”. It furthermore is important to note that an SMS is stored on a mobile phone and always entails single-sided communication. Any possible response has to be sent within a new SMS. Obviously associated costs are also calculated per SMS. (Vodacom 2009)

- **Unstructured Supplementary Service Data (USSD):** USSD is a protocol that was initially designed to support supplementary services. USSD was basically created to enable a mobile phone to forward calls or to set up multiparty calls, the user of the mobile phone thus never was intended to actively use USSD. Because USSD has some specific benefits with regard to automated interactions it is now being recognized as a valuable way for third parties to set up services. USSD can be seen as a combination of SMS and SDS, a USSD session realizes the technical equivalent of a dialogue, similar to SDS, but is based on data instead of voice, herewith being similar to SMS. A session is initiated by a user dialing a number that starts with either an asterisk (*) or a hash (#), followed by a series of numbers and asterisks and finally again a hash character. Dialing such a number actually sends this string of data to a USSD server that recognizes this string and sends back the associated response. Usually this response consists of a string of data, showing a series of options for the user to choose from. The session eventually is closed by either the user or the server. Since this system is interactive of nature, you could even view it as a very limited and highly dedicated form of mobile internet, but which is supported by up to 99 percent of all mobile phones. Since the USSD protocol has been designed to support normal telephone operation it has been incorporated in mobile phones even before SMS was introduced. An important difference with SMS however is that messages are not stored on the mobile phone. (Truteq 2009)
SDS, SMS and USSD all allow for and have been previously used to automate processes involving mobile phone users and all kinds of third party service providers. Both requirements I.2 and U.1 thus can be satisfied by these three technologies, we therefore made our choice based on cost (requirement U.2). We quickly decided to not further pursue an SMS based system because of high costs and the accuracy of input data. We decided not to negotiate transport needs with transport users because of the cost of communication, the processes of requesting, joining and finding trips are still quite communication intensive however. If each interaction between the user and the logistics brokering system would require a new SMS to be sent, costs of communication would easily grow beyond the cost of the actual transport. From this perspective SMS clearly is not a realistic alternative. Besides these high costs, SMS does not restrict a user in his or her input and does not give direct guidance on how to structure an SMS to be interpretable by a computer. This might result in inaccurate information being provided which in turn might result in an array of other problems. The choice therefore was between SDS and USSD. We finally chose to use USSD since it is near to twice as cheap as making a call per minute and because a text based service usually is quicker since a user is not forced to listen through all different options. (Truteq 2009; Vodacom 2009) An experienced user can evaluate and choose an option from a menu in text in about two seconds, which is far quicker than listening through a spoken menu. (Suhm, Bers et al. 2002; Truteq 2009)

**System overview**

With the choice for USSD as the technology to facilitate the communication between the transport users and the intermediary, the technical system architecture is fixed. The figure below shows an overview of the different system components and how they relate to each other. The first step is the transport user dialing the number of the USSD service. The transport user’s telecom provider will send the initial string of data through to a USSD router which in turn will send this message through to the menu server that interprets this message and responds accordingly. This USSD router and menu server typically are hosted by a so called Wireless Application Service Provider (WASP). Such a WASP is a third party developing and offering services using the network of the telecommunication providers. The clients of such a WASP independently host a database. Through http requests the menu server interacts with this database to dynamically determine the correct response to any given input and stores all received messages in this database. The WASP herewith basically uses the network services of the telecom provider and provides its clients with a USSD enabled

![Figure 5-6: Overview system components](image-url)
communication line with their users. For the logistics brokering system we selected Truteq wireless as our WASP. Softwave built and currently hosts the database. A design choice we made with regard to the setup of the system is to have an application running on the computer of the Intermediary instead of on a website, in order to minimize the required data transfer and associated costs. This application would store a copy of the database and would synchronize any changes at startup and shutdown. The Infopreneur would use this application from his personal computer to schedule and finalize trips. Unfortunately time constraints forced us to make use of a temporary webpage instead of this application to access the database. Although using a webpage requires more data transfer and thus is more costly, its functionality was designed similar to that of the final application. The last step in this overview is the Infopreneur contacting the taxi association to notify them of the trips that have been scheduled.

5.2.2 Technical processes

Within the discussion on the service concept the six processes involved in arranging transport have already briefly been discussed. Once the system has been set up three stakeholders remain active in the daily operation of the system, the transport user, the intermediary and the transport supplier. For each of these stakeholders the corresponding processes will be discussed below in more detail. For each process a use case has been created that accurately shows the interaction between both the different system components and the involved stakeholders. Since these use cases are too detailed to discuss here, only the most relevant activities of these processes will be highlighted and discussed; the detailed use cases can be found in appendix F: Use cases. Although most aspects of these processes are quite straightforward and, as mentioned before, no clear design trade offs had to be made, there are some requirements we took into account while designing these processes:

- **I.2** The process of interaction needs to be automated
- **U.3** Transport supply needs to be reliable
- **S.5** Trips need to be fairly distributed among the different taxis
- **S.6** Taxi drivers need to be able to fill up their taxi along the route
Transport user

As presented within the discussion on the service concept, there are three ways of getting transport through the logistics brokering system. A transport user can request, join or find a trip. With regard to these three services and the corresponding processes two aspects are of importance, the USSD interface and the transport booking ticket.

USSD interface

Each of the three services is accessed through the USSD interface that enables transport users to specify their transport needs. The main challenge in designing the USSD menu structure was to adhere to two technical limitations, while keeping the interface as insightful as possible. The first limitation was a maximum of 160 characters per message to be sent back and forth. A maximum duration of three minutes for one USSD session was the second technical limitation. The structure therefore had to allow for quick navigation. The full menu structure is shown in appendix G. The pictures placed above show some examples of this USSD menu. Within the first screen that is displayed when a user dials the service number, three options are indicated, each one referring to one of the three available services. The first picture in the set of pictures shows this welcome message. For each service the menu structure starts with determining the origin and destination of the trip the user is planning to make. When someone initially chose option three and thus wants to find a trip that can service him or her quickly, the system then has enough information and replies automatically with a list of trips that pass by both the indicated origin and destination. If someone wants to join a trip, the database also automatically returns a list of trips that have been scheduled to pass by both the origin and the destination of the trip the user is planning to make. If someone is requesting a trip, he or she also needs to indicate the date and the timeslot for which he or she wants to request a trip. Once a user either has selected a trip to join or has specified the trip he or she wishes to request, the number of seats a user wants to book for this trip needs to be specified. The system then asks the user to confirm his or her booking. Once a booking is confirmed, the user gets notified whether the booking has been received correctly. When someone requests a trip, a SMS with all the trip details will be sent as soon as the Infopreneur has scheduled a trip and the precise departure and arrival times are fixed. If someone joins a trip and thus books one or more seats on an already scheduled trip, without
any intervention of the Infopreneur, the system instantly sends a SMS with all the trip details automatically. We chose to use SMS for this last interaction since an USSD message is not stored on a mobile phone and we wanted to make sure someone could easily lookup the details of his or her booking.

**Transport booking ticket**

Specifically for transport users that either requested a trip or booked one or more seats on an already scheduled trip, it is important to be recognized as someone that arranged transport through the logistics brokering system (Requirement U.3). This issue has already been brought up by the taxi association within the first workshop. If they do not know who arranged transport, it is not possible for them to guarantee that everybody that booked a seat on a trip will actually get transport. Especially since reliability of transport supply is already an issue it is really important to make sure everybody who booked a seat can rely on this booking. We therefore created transport booking tickets that both act as an entry ticket and as a form of marketing. This ticket is shown to the right, besides explaining how to make a transport booking it also provides a space to write down an ID code. This identification code is uniquely generated for each booking and is sent by SMS together with the details of the scheduled trip. The taxi driver that makes this trip will have a passenger list, with each passenger indicated by this unique identification code. Before getting on the taxi each passenger will have to give his or her ticket to the taxi driver, once he has verified the identification code, the passenger is allowed to get on the taxi. We chose to use a paper based ticket instead of the SMS that is stored on the mobile phone that was used to make the booking, because some people might use someone else’s mobile phone. These tickets furthermore can be distributed in the area to act as a marketing tool.

**Intermediary**

The intermediary is responsible for the two processes of scheduling and finalizing trips. As has been made clear within the discussion on the service concept, the Infopreneur has to group trip requests and schedule corresponding trips each Friday at 12pm and the Infopreneur has to finalize each trip a day before the trip takes place. In order to carry out these tasks the Infopreneur makes use of the website that gives access to the database which stores all trip requests and transport bookings. The specific interactions between the website, the database, the USSD server and the transport user again can be found in appendix F: Use cases, but will not be elaborated on within this section. This section will focus on how the design of the website supports the processes of grouping, scheduling and finalizing trips.

The pictures on the following pages are screenshots of the website that gives access to the database and which supports the Infopreneur in the scheduling and finalizing process. The first screenshot shows the starting point for the scheduling process. The top of the page shows that the trip requests on this page refer to the week starting on Sunday June 28. Below the selected week, one can see the
number of unhandled trip requests for the different timeslots in this week. In this case, there are still two unhandled trip requests for the timeslot of Tuesday morning and three unhandled trip requests for Thursday morning. The timeslot of Thursday morning is displayed in bold, indicating that the trip requests shown on this page are for this timeslot. Below this overview one can verify that there are in fact three unhandled trip requests, two inbound trip requests and one outbound trip request. As can be seen, one transport user has requested a trip for five people from Paeng to Maribaneng, another transport user has requested a trip for seven passengers from Masakeng to Makwareng, the last transport user has requested a trip for eight people from Makgongwane to Burgersfort. In order to schedule a trip for these requests the Infopreneur needs to click on “Book Trip”, shown below each request. This opens up the window shown to the right. The dialogue box provides two options, either to create a new trip or to add this trip request to an existing trip. When creating a new trip the starting time and the number of available seats need to be specified, in order to accommodate for any changes in taxi capacity or availability. If a trip request is being added to an existing trip, the webpage will automatically determine with which trips this specific trip request is compatible and will only allow this trip request to be added to these trips.
If all trip requests have been linked to a trip, the main page of the website will look similar to the screenshot shown above. The overview of unhandled trip requests now shows there are no more unhandled trip requests for this timeslot. A new element is the overview of the trips that have been created. In this case all three trip requests could be serviced by a single trip. The website has automatically calculated the arrival times for each of the stops. For Ga-Molai and Makgongwane no times have been calculated since both these settlements do not lie on the main service line and none of the passengers
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needed to be picked up or dropped off at these locations. In order to adjust, schedule, finalize or cancel a trip, the Infopreneur can click on "Manage trip" to open the trip management dialogue box shown on the previous page. Firstly this dialogue box allows the Infopreneur to make changes to a trip, like changing the departure time or removing trip requests in order to for instance create space for another better fitting trip request. Once the Infopreneur is satisfied with the trip details he can change its status from open to scheduled. As mentioned before, this fixes the route of the trip, sends the final trip details including departure and arrival times to the different transport users and allows people that want to join this trip to book a seat through the USSD interface. One day before a trip takes place, the Infopreneur has to finalize a trip and simply has to open this dialogue box and change the status into finalized. As mentioned before, this removes this trip from the list of trips that can be booked by individuals that want to join a trip. Once a trip has been finalized the list of passengers therefore is final and can be communicated to the taxi association. The last functionality is a precautionary measure that allows the Infopreneur to cancel a trip if anything unexpected happens like for instance a taxi breaking down. Changing a trips status to cancelled will send an apology SMS to all passengers that either requested this trip or joined this trip by booking a seat. Clearly the presented functionality of the website satisfies requirement I.2: The process of interaction needs to be automated.

Transport supplier
The transport supplier obviously is responsible for the actual transport of the passengers of each scheduled trip. Once a trip has been finalized a trip document is printed and handed over to the

![Figure 5-13: Trip document](image-url)
queue marshal who assigns a taxi to each trip in order to ensure a fair trip distribution (Requirement S.5). This trip document is shown on the previous page. This document was specifically designed to enable the taxi driver to easily interpret who needs to be picked up and dropped off where and for the taxi driver to have insight into his excess capacity, herewith satisfying requirement S.6. This document basically is the same as the trip overview shown on the website. The document shows the total number of seats for both the inbound and the outbound trip. When a seat is booked it is marked red, otherwise it is left empty. Each trip request or booked seat is pushed to the top to fill up empty seats, basically all requests are neatly stacked in order to allow the taxi driver to easily see the number of seats he still has available throughout the trip. This is really important since it is essential to allow the taxi drivers to fill up their taxi during the trip in order to raise profitability, while still ensuring the taxi driver leaves enough seats available for the people that actually requested transport. When the color of a seat changes from white to red, obviously this indicates someone has to be picked up. Similarly when the color changes from red to white, someone has to be dropped off. The numbers that are shown at these changeovers, indicate who needs to be picked up or dropped off. These numbers are the identification numbers that have been sent to the transport users and which they note down on their transport booking ticket. The taxi driver therefore also has to use this document to check whether someone actually has requested transport.
5.3 Organizational network

The choices that were made with regard to the service concept and the technical architecture have some implications for the different stakeholders in the organizational network. There furthermore were two specific requirements that guided some clear design choices with regard to the relations between the different stakeholders:

The literature analysis already made clear that designing the logistics brokering service as a business for the Infopreneurs of Kgautswane is expected to make sure the service has a sustainable impact and remains relevant. Now the service concept and the technical architecture are known, the business case can be defined. Firstly the different stakeholders that are involved in realizing this service will be discussed and secondly the business and user service proposition will be elaborated on. As shown in figure in 5.14, there is one more design aspect that was guided by the following two requirements, this aspect will be discussed in section 5.3.2:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.1</td>
<td>Managing the logistics brokering system needs to be profitable</td>
</tr>
<tr>
<td>S.1</td>
<td>Transport demand needs to be reliable</td>
</tr>
</tbody>
</table>

Figure 5-14: Requirement versus Design - Organizational network

The literature analysis already made clear that designing the logistics brokering service as a business for the Infopreneurs of Kgautswane is expected to make sure the service has a sustainable impact and remains relevant. Now the service concept and the technical architecture are known, the business case can be defined. Firstly the different stakeholders that are involved in realizing this service will be discussed and secondly the business and user service proposition will be elaborated on. As shown in figure in 5.14, there is one more design aspect that was guided by the following two requirements, this aspect will be discussed in section 5.3.2:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.1</td>
<td>Managing the logistics brokering system needs to be profitable</td>
</tr>
<tr>
<td>S.1</td>
<td>Transport demand needs to be reliable</td>
</tr>
</tbody>
</table>
5.3.1 Involved stakeholders
The different stakeholders all have their interests and to a large extent have common interests, but with regard to the business model it is essential to precisely specify how each stakeholder adds value to the organizational network and what each stakeholder is expected to gain from cooperation. This section will discuss the added value of each involved stakeholder, the next section will introduce the business and service proposition that was designed to have all stakeholders gain from cooperating. Throughout this chapter five different stakeholders have been mentioned:

- **Telecommunication provider**: Within South Africa there are three telecommunication providers: MTN, Cell C and Vodacom. They provide the telecommunication network that is used by the WASP to provide the USSD service.

- **Wireless Application Service Provider (WASP)**: The WASP is the provider of the USSD service and is a so called third party that uses the telecommunication network of MTN, Cell C and Vodacom. They therefore take care of all relations with the telecommunication providers. Within this research Truteq Wireless has been selected as our service provider.

- **Transport users**: The transport users can be divided into three groups, users that request trips, users that join trips and users that are picked up along the route. It is important to note that people can easily switch between these three groups and that it is essential to maintain a group of users that actually request trips, since without trip requests, no trips will be scheduled and the system will fail. The transport users therefore basically also need to be seen as an indispensable valuable source of information.

- **Intermediary**: Within Kgautswane Smite (IT) Infopreneurs has been selected as the local intermediary assigned to operate the system. They are placed in between the transport users and the transport suppliers as a means of bridging the communication gap that exists between both.

- **Transport suppliers**: The Ohrigstad Long and Local Taxi Association (OLLDTA) has been selected as the transport suppliers for the logistics brokering system. The most important issue with regard to this stakeholder is their willingness to cooperate.
5.3.2 Business and user service proposition

The telecommunication provider and the Wireless Application Service Provider will not be involved in the daily operation of the logistics brokering system. The relation with the telecommunication provider will be maintained by the WASP. The WASP is the actual service provider in this setting and the Infopreneur therefore only needs to maintain a relationship with this WASP. Their service costs are fully variable and dependent on usage and therefore are directly charged to the account of the transport user dialing the USSD number. Apart from resolving connectivity issues the WASP therefore does not play a big role within the daily operation of the system. The transport user, the Infopreneur and the taxi association do have to interact on a regular basis however. Their mutual relations therefore are more complex and important to clearly identify. Within the figure shown to the left the costs and benefits for each of these stakeholders has been visualized. Each of the relationships is essential for the success of the system, if the relationship between two of the stakeholders gets disrupted, the complete organizational network will fail. These different relationships will be discussed below.

**Taxi association vs. Transport user**

As was mentioned above it is essential to maintain a group of transport users that request trips. In the current situation this group has a clear benefit from requesting trips, since this enables them to get transport, while currently the transport supply is very unreliable and frequently not even available. Requesting a trip also has some drawbacks however, a transport user needs to plan ahead and faces additional communication costs. If the logistics brokering system will prove to be able to draw transport supply back into the area during the day and thus make transport supply more available and reliable, the benefits of requesting trips will still be present, but simply waiting for transport passing by might also become an attractive alternative again. We therefore agreed that requesting trips should have an added financial benefit that ensures transport users will continue to request trips. The taxi association therefore was prepared to provide transport users that booked a seat through the logistics brokering system with reliable transport at a discount of 1 Rand for both local trips and trips to Ohrigstad, and to provide reliable transport to users that make a trip to Burgersfort at a discount of 3 Rand.

**Transport user vs. Infopreneur**

The Infopreneur provides transport users with three different services, a user is enabled to request, join or find a trip. As has already been mentioned on several occasions providing these services needs to be a profitable business for the local intermediary in order to increase local ownership and raise chances for sustainability (Requirement I.1). Transport users therefore have to pay a service fee for requesting or joining a trip. Finding a trip has been designed as a basic free service that was simply intended to align transport demand and which at the same time could function as a marketing tool introducing the service to transport users. Obviously the service fee for requesting a trip had to
be lower than the discount that would be given by the taxi association to maintain the intended
effect of giving a financial incentive to continue using the system. At first hand it might appear to be
somewhat strange to have the taxi association giving a discount while at the same time charging a
service fee when someone requests a trip. This however was a deliberate choice that was made to
raise the reliability of transport demand. By having people paying a service fee and at the same time
giving them a discount, transport demand was expected to be more reliable, since someone is likely
to only be willing to pay such a service fee if he or she is really planning to show up (Requirement
S.1).

**Infopreneur vs. Taxi association**
If the Infopreneurs prove successful in marketing and using the logistics brokering system to
efficiently schedule profitable trips, they will provide the taxi association with additional profitable
business. As was mentioned above, in order for the system to become and remain successful and
generate profitable business for the taxi association, the taxi association has to give a discount on the
trips that they provide to people that request and join trips through the system. Besides from giving
this discount it is also essential for the taxi association to trust the Infopreneurs. Since we decided
that a transport request made through the logistics brokering system should always be matched with
a trip correctly serving the expressed transport need, the taxi association has to upfront commit to
making each trip that might be scheduled during the timeslots that are open for trip requests. The
taxi association thus has to trust that the Infopreneurs will provide them with profitable and reliable
business.
Part C:

Evaluation; “Success in Kgautswane?”

C.1. **Chapter 6** – How effective is the designed ICT-enabled logistics brokering system in improving the transport service delivery in Kgautswane?

C.2. **Chapter 6** – What is the expected sustainability of the designed ICT-enabled logistics brokering system?
6  Success in Kgautswane?

This chapter will discuss whether the designed logistics brokering system can be expected to be successful and to sustainably enhance the transport service delivery in Kgautswane. This evaluation can be seen as an assessment of the extent to which the objective of this research project has been reached:

“To design an ICT-enabled logistics brokering system that sustainably improves the transport service delivery in Kgautswane, South Africa”

This chapter therefore basically describes the practical contribution this research has made to the community of Kgautswane. This chapter herewith will answer the following two research questions:

C.1. How effective is the designed ICT-enabled logistics brokering system in improving the transport service delivery in Kgautswane?

C.2. What is the expected sustainability of the designed ICT-enabled logistics brokering system?

The following section will first discuss the results of a test of the system in order to provide an answer to the first research question. The effectiveness of the designed ICT-enabled logistics brokering system will be referred to as the system’s current impact. Subsequently the second research question will be discussed. The future impact refers to the expected sustainability of the designed logistics brokering system. This section will discuss the role of the Infopreneurs and their expectations in order to make an assessment of this expected sustainability.
6.1 Testing current impact

In order to get more insight into the impact of the designed logistics brokering system on the transport service delivery in Kgautswane we tested this system in practice. We already gathered quite a significant amount of data on the transport needs of the people of Kgautswane through several interviews and questionnaires that has guided the design process. Since saying clearly is something different from doing, these interviews and questionnaires are no guarantee for success. It therefore is essential to test this system in practice in order to capture the real behavior of the transport users when being offered the possibility of arranging transport through the designed system.

6.1.1 Goal

In order to correctly answer the research question on how effective the designed system is in improving the transport service delivery in Kgautswane, we should try to test all aspects of the service system, as described in the previous chapter. Unfortunately we had to test the system in December. The people in Kgautswane save up for a whole year to be able to afford some luxuries during the holiday season. In December they therefore travel far more than they do throughout the rest of the year. The initial problem analysis pointed out that transport supply is limited and unreliable during the day, because of a low transport demand, which is scattered and distributed throughout the day and herewith poses the risk of not picking up any business while floating around. In December however, the increase in demand eliminates this risk. This results in most people not having a problem with getting transport and the taxi association not having an immediate incentive to use this system to get more business. For both transport users and transport suppliers the logistics brokering system therefore is far less useful in December. Obviously the results of testing this system in practice therefore will be different from the results we would get in any other month. Probably demand will be less reliable and we will probably need to approach more people before finding someone who wants to use the system. We furthermore ideally would have tested one full cycle within which we would offer people to request, join or find a trip and within which the Infopreneur would schedule and finalize trips. The amount of time that was available for the test prevented us from testing a full cycle of two weeks however. We decided to only do a test with regard to the service of joining a trip, since that could provide us with the most information. There were lots more limitations with regard to this test that prevented us from testing all aspects of the complete service system. Below an overview is given of the most important design aspects of the service system as discussed in chapter five and whether we were able to test this in practice considering the time of the year and the time available for testing.

- Service concept
  - **WYRIWYG:** Whether this was a good design choice or not, can only be tested by doing a comparison between this service and a possible alternative, like negotiation or working with people’s flexibility (See section 5.1.1.) Time constraints prevented us from making this comparison.
  - **Terms and conditions:** The four elements that are part of these terms and conditions would have been extremely interesting to test, but unfortunately all relate to requesting trips, a service we have not been able to test because of time constraints.
  - **Service differentiation:** As mentioned above we only tested the service of joining a trip. Since people are only able to make use of this service if they are flexible to some
extent it verifies information found in the questionnaire. If people prove to be flexible, we could also make an estimation to what extent our choice for timeslots influences the attractiveness of the service.

- **Technical architecture**
  - **Technology selection**: Since the USSD system is fully used both when joining a trip and when requesting a trip, whether the system correctly captures and passes on information to the website can be tested.
  - **Technical processes**: Within the technical processes the interface for the intermediary, transport user and transport supplier have been defined. Unfortunately only the transport user interface could be tested. Since because of time constraints we will only be testing the service of joining a trip, a service which runs without interference of the infopreneur, we were not able to test the technical processes involving the infopreneur. The role of the taxi association could not be tested as well, since, as mentioned above, during this time of the year simply floating around already provides the taxi association with lots of profitable business. It therefore proved impossible to find a taxi driver that was involved in the research and design process willing to make the test trips. Through one of the older members of the taxi association that cared about successfully testing the system, we finally came into contact with a taxi owner that was willing to participate. Unfortunately this taxi owner and his driver had not been previously involved and therefore were not fully aware of the project goals and the processes we defined for the taxi driver. So although it is encouraging to see that with this system we were able to convince an “outsider” of its value, we were not able to test the business processes of the taxi association.

- **Organizational network**
  - **Taxi association vs. Transport user**: This is no new relationship and therefore does not need testing.
  - **Transport user vs. Infopreneur**: We also were not able to test the effect of charging a service fee or to give discounts, since we did not want to obstruct the entire test by incorporating sensitive issues in this test in the phase. We furthermore did not yet test in practice whether people were willing to use their airtime for using the service, because we were still in the test phase and therefore yet had to build trust. We therefore provided interested people with airtime to enable them to make a booking.
  - **Infopreneur vs. Taxi association**: This relation has also not been tested because the taxi association could not be enticed to cooperate in the test.

Clearly the test holds an extreme amount of limitations, mainly because of time constraints and the difficulties of testing the impact of the designed system in December. The test still forms a valuable first experience however. If we look back at chapter five, the most important trade offs have been made with regard to the service concept. The system has been designed to minimize the risk of a low occupation degree. It therefore is especially important that we get a feeling for the attractiveness of the service. By testing the system in practice we therefore pursued several practical goals, mainly
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relating to the transport users. Did the transport users perceive the service as valuable and would they want to use this service? Are people flexible enough to join an already scheduled trip? Another important aspect obviously is the reliability of transport demand. A last aspect is the usability of the system, we wanted to know whether the system was intuitive enough for people to independently lookup information or make a booking.

Another aspect that also could be tested and is valuable to gain some insight in, is the USSD system. Although obviously the USSD system has been tested throughout its realization, this test is essential to prove whether it will also work in a context with less reliable network coverage, older mobile phones and more inexperienced users. We therefore monitored and checked the bookings that have been made with the data that is received and stored in the database.

6.1.2 Approach

Research assistants
In order to promote the system and assist interested transport users with booking a seat on one of the scheduled trips we made use of the same research assistants that carried out the questionnaires. These research assistants also kept track of the number of people they spoke to before someone wanted to book a seat on one of the trips. For each person that made a booking they furthermore filled in a small questionnaire in order to capture his or her actual transport need together with the actual booking that was made. The difference between the actual transport need and his or her booking should give some insight into the flexibility of a transport user. By noting down the booking that was made it was also possible to verify whether the system was capable of accurately capturing these bookings. Another section within this questionnaire focused on the usability of the system and for instance referred to the user’s ability to independently make a booking. Within the last section the research assistant asked the user to give his opinion on the system. The complete questionnaire that was used can be found in appendix I: Test questionnaire – Transport users. In order to promote the system, the research assistants were also provided with a document that showed how to use the system and how to book a seat, this document can be found in appendix K: Booking process. Each booking was directly verified using the questionnaire and the data in the database.

Realities of testing in December
Throughout the process of promoting the system and offering people to book a seat it proved fairly difficult to get people to use the system and commit themselves some days in advance to travelling somewhere on a specified day and time. The effects of increased demand and supply in December really influenced our test. We ended up moving our date of travel one day back and we also had to decide to only offer one trip instead of two. Because the number of people that actually wanted to book a seat was fairly limited, we also only gathered a limited amount of data on the behavior of the transport users. We therefore wanted to learn why the system turned out to be quite difficult to promote, was it really due to the higher levels of demand and supply in December or did we make essential mistakes in the design? In order to capture all the impressions the research assistants had gotten while promoting the system, we therefore asked them to rank a number of different statements referring to possible reasons for transport users not to use the system. This list of statements and the answers of the four research assistants can be found in appendix J: Test questionnaire – Research assistants.
Trip observations
During the actual trip we monitored which users actually showed up in order to gain some insight into the reliability of demand. We furthermore called people that did not show to ask them why they did not show. We also counted the number of passengers that was picked up along the way to gain some insight into the necessity of only allowing groups of five or more to request trips.

6.1.3 Results
As was mentioned in the beginning of this chapter, testing the designed logistics brokering system in practice should answer the following research question:

C.1. How effective is the designed ICT-enabled logistics brokering system in improving the transport service delivery in Kgautswane?

In order to answer this research question the bookings that were made and the actual trip experience, the system usability and user perception and possible reasons for people not wanting to use the system will be discussed subsequently.

It always starts with one
As was already mentioned above it proved quite difficult to actually get people to book a seat on the planned trip. We spoke with 58 people in total of which only five people made a booking. Although this is less than we expected upfront, it still amounts to approximately nine percent of all respondents. If we would extrapolate this nine percent to the total population of Kgautswane, a total number of nine thousand people would want to book a seat, which would clearly be an enormous increase in the business for the taxi association and an improvement of the transport service delivery in Kgautswane. Obviously this system still is far from the stage at which each person of Kgautswane is known with the logistics brokering system and considers using it to book a trip. Looking at the size of the test group, a total number of five bookings therefore is fair, especially considering we had to test in December. From the total of five bookings, three people booked a single seat and two people booked two seats. All of these five bookings corresponded with the bookings received by the database, showing the transport users successfully made their booking and the USSD system was successful in capturing these bookings. While the questionnaire pointed out that the reliability and availability of taxis was a problem on both inbound and outbound trips, everyone booked in order to travel to Burgersfort and no one made use of the opportunity to book an inbound trip. A possible explanation is that the system is still new and people do not yet see its ease of use and therefore are only willing to make the effort for longer trips, another explanation is that people are less willing to plan ahead for shorter trips. When we went on the trip unfortunately only one out of five bookings was followed up. The problem of unreliable transport demand clearly also became apparent during the test. After having spoken to some of the people that made a booking but did not show it became clear that these people simply are not used to committing to an agreement with regard to transport. Their previous experiences with transport shaped their way of thinking. One person for instance mentioned to have already caught a trip to Burgersfort, clearly the result of always having to make use of the first form of transport that comes along, because of uncertainty on when to expect the next opportunity to get transport. Another couple simply was too late at the agreed pickup point. So although transport demand clearly proved to be unreliable, the reasons for people not showing up pointed out that growing a new relationship of trust between the transport users and suppliers might
increase this reliability. Despite only one person showed up, we did manage to fill up the taxi during the trip however. We pickup up two people for a local trip, four people for a trip to Ohrigstad and fourteen additional people that wanted to travel to Burgersfort. Clearly these figures cannot be translated into figures for other months, since, as mentioned before, taxis always find enough business in December.

System usability and user perception
Because such a limited amount of people wanted to make a booking, we already brought the number of trips down to one. People that wanted to book a seat therefore never had to choose for either the morning or afternoon trip and could always book the amount of seats they wanted to book. We therefore cannot use the results from the user questionnaire to evaluate to what extent users proved to be flexible in their transport demand. The system usability and the user perception can be evaluated however. These results do have to be seen as only a first indication, since they are based on merely five observations. Out of these five people about half had airtime available to use the system, but, as was indicated by one of the research assistants, people usually buy airtime just before they plan to use it. More important is whether they were willing to use their airtime in order to access the service, out of five people only one mentioned not to be willing to use his airtime. Considering the system still needs to prove its use, this is encouraging. With regard to making the booking, only one person was unable to access the service, luckily this was not due to the USSD system, but due to lack of network coverage. Another person experienced the service timing out and had to dial the USSD number again. Fortunately the USSD system remembers previous sessions and the user could finish her booking. All of the respondents needed some help with making the booking, but the research assistants indicated for each of these respondents that they expected them to be able to use the service on their own the next time. The assistants furthermore noted that every respondent considered this a valuable and easy to use service. Some respondents also encouraged us to make this system known to the whole of Kgautswane because it would help to ease their transport problems.

91 percent of the respondents did not want to book a seat, because ...
As mentioned above, we asked the four research assistants to value different statements as a possible answer to the question placed above. For each statement we asked them to indicate whether they either totally disagreed, disagreed, were neutral, agreed or totally agreed with the shown statement. A complete overview of these statements and the results of this exercise can be found in appendix J: Test questionnaire – Research assistants. Only if statements can provide a distinct insight because most assistants either agreed or disagreed with a statement, it is discussed here. A first essential statement was: “The respondents had no need to book transport, because during this time of the year transport is frequently available”. Only one of the assistants disagreed with this statement, two other assistants totally agreed and commented with something a taxi driver mentioned: “It’s a busy time, the taxi is always full!” After December the system therefore will probably be more valuable, since there will be less supply of transport once demand declines again. Two other statements furthermore indicated that respondents did not want to book a seat, because they were unwilling to plan their trip in advance and because they wanted to transport goods for which a pickup truck is better suited. The remarks that were made with regard to these statements also pointed towards the increase in transport demand and supply during December as the main reason behind this behavior however. It was mentioned that especially during this season people wanted to transport goods and that during this time of the year people do not want to plan ahead,
because they know there is transport available. Some general statements that were largely disagreed with and therefore were encouraging, showed that in the opinion of the research assistants, people needed transport, also could pay for transport, had a mobile phone, trusted the technology and understood what the system would provide them with. Some final remarks that were made by the research assistants furthermore showed that the system is new, but people like it and it will just take time for them to get used to booking trips and planning ahead.

### 6.1.4 Conclusion

This test faced several limitations. First of all, as has already been mentioned throughout the discussion above, December was not the best time to test the system, since the problem it has been designed for is almost nonexistent this time of the year. The results therefore are of less use and we mostly need to base our opinion on other peoples opinion. The actual goal of testing the system in practice therefore was not completely reached. Another limitation was the extent to which the system was actually tested, we only had time to test one service instead of all three nor did we have enough time for testing the grouping and scheduling of trips by the Infopreneur. The service we provided to the transport users in the test was also slightly different from the designed service, because we did not offer them a discount, we did not charge a service fee and we did not ask them to buy airtime to use the system. Although these limitations are the result of defendable choices or the result of unfortunate circumstances, they do affect the result and ask for a more extensive test during a different time of the year. For now this test did provide a valuable and best possible first insight into the effect this system will have on the transport service delivery in Kgautswane. In general the test was successful in the sense that the system was generally seen as valuable and attractive, 9 percent of all respondents made a booking and the technical system was capable of correctly capturing and sending through transport bookings.

### 6.2 Estimating future impact

Essentially the sustainable impact of any service is dependent on two aspects. The service has to remain relevant to a user’s needs and the organizational network supplying the service needs to be willing and able to continue supplying this service. The guidelines defined in chapter two were also focused on these two aspects. The first two guidelines discussed the importance of starting any system design effort with an assessment of the needs of the users of the system and advised to take a participatory design approach as a means of ensuring system relevance. The third guideline elaborated on the importance of designing a service as a business to be run by a local intermediary, since in a rural environment a local intermediary is best placed to ensure a system remains relevant to the local context. The test described in the previous section evaluated whether the designed system currently is successful in realizing an impact in improving the transport service delivery in Kgautswane. In order to estimate the future impact of this system we need to assess whether the organizational network is both willing and capable of ensuring the system remains relevant in the future. Unfortunately we could not meet with the taxi association because of the busy times of December and we therefore were not able to evaluate the system and their role together with them. Although this might be seen as a lack of commitment, we should also view this from their perspective. Throughout the year they struggle to make a living and in December they have an opportunity to earn several times more than what they earn in a normal month. The system furthermore has not yet proven its value to them and therefore not being willing to meet during this time of the year does not show no commitment, it merely shows people behaving opportune in the
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context of a developing rural area. We therefore were limited to evaluating and discussing the future of the system with the Infopreneurs.

6.2.1 Goal
The goal of the evaluation with the Infopreneurs was twofold, first of all we wanted to know their opinion on the system and secondly we wanted to gain some insight into the extent to which they actually own the system and its future. As was mentioned within the third guideline discussed in chapter two, Siocru and Girard (2005) define the concept of ownership as a process of internalisation of responsibility, legal ownership and degree of decision-making. The second goal of this evaluation therefore was to establish whether the Infopreneurs feel responsible for the survival of their system and whether they are willing and able to make business decisions to safeguard the system’s relevance.

6.2.2 Approach
In order to capture the information referred to above we did a basic structured interview within which we discussed several topics with the Infopreneurs, like the final system design, their future expectations and possible improvements of the system. The full list of questions that has been used in these interviews can be found in appendix L: Evaluation Infopreneurs – Structured interview. We furthermore had the Infopreneurs independently evaluate the entire research project. They were given several sheets of paper and a pen and were simply asked to evaluate the project, there was absolutely no other input except their own experiences and initiatives. This writing exercise was done in this fashion without any precisely defined result in mind, we simply wanted to see what they would write, as a means of assessing their insight into the project, their ability to show initiative and the extent to which they owned the project.

6.2.3 Results
As was mentioned in the beginning of this chapter, estimating the future impact of the logistics brokering system on the transport service delivery in Kgautswane will provide an answer to the following research question:

C.1. What is the expected sustainability of the designed ICT-enabled logistics brokering system?

The results of both the writing exercise and the structured interviews will be discussed jointly in three sections. Firstly an assessment of the ownership of the Infopreneurs will be presented, secondly the Infopreneurs’ opinion on the current system design and possible changes to this design will be discussed, lastly the expectations for the future will be highlighted.

Ownership
The evaluation that the Infopreneurs independently carried out showed some clear signs of them having internalized responsibility for the project, the complete evaluations can be found in appendix H: Evaluation KTL research project – Simon Motumi and Ishmael Adams. For this evaluation they set up a structure within which they provided an overview of the complete research project, starting with a short description of the background of Kgautswane and ending with the way forward and suggestions for possible improvements. For them to set up such a structure and providing a clear
overview shows how they have a full understanding of the project and its goals and therefore are capable of taking ownership of the project. Discussing several issues with regard to next steps in order to further improve on this system shows they already take initiative and own the project.

Within the interviews we also discussed whether they view the system as being financially attractive and whether that forms a good and essential incentive for them to continue managing the logistics brokering service. Since within the startup phase financial rewards might not yet be viable it was important they would also still be willing to invest time and effort to promote the use of the system and to keep the taxi association involved and excited. Both Infopreneurs mentioned to be more than willing to continue with this project. One Infopreneur even mentioned to not expect any income from this project for the upcoming months, since the people required at least “two months of proper preaching”, to get known with and used to the system. With regard to the taxi association they mentioned it was essential to keep them connected and organize workshops to talk about new developments. But as they said themselves: “The most important thing to do is to stay committed ourselves and to never stop encouraging, even when the going gets though.”

System design
With regard to the design of the system we wanted to know whether the Infopreneurs were able to independently assess and reflect on its use. We therefore asked them to identify for which people which service would provide the most value and to locate possible barriers and to think of ways to overcome these barriers. Apart from providing insight into the Infopreneurs’ ability to manage the logistics brokering system this discussion also highlighted the expected value of this system to the transport users of Kgautswane.

Both Infopreneurs saw the service of “joining trips” as most valuable, since requesting a trip requires the people of Kgautswane that are not used to planning ahead, to book their trips too much time in advance. They did see an opportunity for the service of “requesting trips” however. They suggested to target people going to church, funerals, weddings or for instance soccer games, since these people frequently travel in groups and the time at which they need to be somewhere is already fixed on beforehand, enabling them to book a trip in advance. They also mentioned that it was important however for these people to request a trip for a specific time and possibly for more diverse locations, because weddings, funerals and soccer games also are at a specific time and are not always located in Kgautswane, Ohrigstad or Burgersfort. Both of the Infopreneurs clearly have adopted a business driven mindset that allows them to possibly adjust the logistics brokering system and promote it with the most relevant target groups. This discussion also makes clear that the Infopreneurs are definitely excited and believe this system holds value for the people of Kgautswane. One Infopreneur even stated to be “ecstatic!”.  

Expectations
A last short discussion we had with the Infopreneurs was focused on their expectations for the future. Firstly they mentioned the taxi association also being exited, according to one of the Infopreneurs the taxi association already suggested to print stickers with the USSD number as a way of promoting “their” service. They furthermore expected more people to start planning ahead, especially once December has passed. One of their last remarks was that it simply was essential for them to continue promoting the system, since as soon as both the transport users and the transport suppliers start seeing the rewards they will become more and more excited.
6.2.4 Conclusion
The most important limitation of this discussion was that the taxi association did not participate. Although there are multiple indications for them to continue to be willing to participate in offering the designed services, it would have been valuable to have discussed this with them directly however. The main conclusion on the expected sustainability should be seen as positive. Both the Infopreneurs are extremely excited and capable to take this project further, the basic elements for a project to be sustainable.

6.3 Discussion
The test results and the interactions with the Infopreneurs showed that the designed logistics brokering system has a clear potential to sustainably improve the transport service delivery in Kgautswane. This evaluation also made clear that there are some aspects of the design that possibly should be adapted in order to better accommodate the needs of the community of Kgautswane. The Infopreneurs for instance mentioned the importance of allowing people to specify their departure time when requesting a trip, instead of having to adhere to a predefined timeslot. If in practice people would not request trips if they were not allowed to specify their departure time themselves, this would have big consequences. Since trip requests actually trigger all other processes it is essential to make sure people are willing to request trips. Especially since the Infopreneurs expect the “joining a trip” service to become most popular, while this service can only be offered if other trips have already been scheduled. The choice for timeslots has been made in conjunction with the taxi association and therefore should only be changed if the taxi association agrees an alternative would be better. The choice for timeslots influences the risk of having to make an unprofitable trip. Allowing the users to request a trip for a specific time therefore would either increase this risk or would require to also change other aspects of the design as a way of keeping this risk on the same level. The figure on the next page shows how three different design aspects relate to this risk and the attractiveness of the service. Within this figure each axis represents a design choice. The choice for timeslots or an unrestricted departure time, the choice for only allowing groups to request trips or to also allow individuals to request trips and the choice with regard to the amount of time people have to plan ahead. Obviously a service that also allows individual requests, that does not restrict departure times and provides people with transport instantly will be highly attractive to transport users. This service would also hold a lot of risk for the taxi association however. Alternatively, a service that requires people to plan ahead, that only allows trips to be booked by groups and which has to be booked within certain timeslots, results in a higher expected occupation degree and therefore holds the lowest risk for the taxi association. The “requesting a trip” service currently is designed similar to this last option and clearly is less attractive than the first suggested service. Unfortunately the taxi
association proved to be extremely risk avoiding, while taking risks, as mentioned by one of the Infopreneurs, simply is "the way business works". In order to make this service more attractive the taxi association has to become more business minded and adopt more of a long term vision. Another aspect that was mentioned frequently in the previous section was the unwillingness or inability of the people of Kgautswane to plan their trips in advance. Although both the Infopreneurs and the research assistants indicated to expect the transport users to plan ahead more once they experience the results of booking a trip or a seat through the logistics brokering system, it would be beneficial if the amount of time people are required to plan ahead can be reduced. Clearly this poses the same problem as mentioned with the use of timeslots. If the amount of time people need to plan ahead would be reduced, the taxi association either has to become more business minded and accept a bigger risk, or this decision needs to be compensated by increasing the size of the groups that are allowed to request trips or by further limiting the number of available timeslots. Since this is not really realistic on the short term it is more important to keep promoting the system in order to make clear to people that planning ahead provides them with a service they otherwise would not have got.
6.4 Suggestions and way forward

Within their evaluation the Infopreneurs already mentioned some suggestions and described the way forward. Since from this point onwards they should take ownership of the project and make the business decisions themselves these unedited suggestions have been listed below:

- “We need to continue with the service implementation with the people who started this project and involve those who share the same vision along the way. When the system proves to be successful we can possibly also involve local towns and villages which are not yet being visited.”
- “We need to organize information sessions for big groups with the transport users at the MPCC in order to explain the USSD interface. We could also think of adding some sort of competition giving away prizes like airtime in a raffle held among everyone that made a booking.”
- “We need to have additional sessions with the transport suppliers to emphasize the necessity of the use of this service.”
- “It would be valuable if the taxi association would expand into trucking.”
- “We should also try to get the taxi association to cooperate with other associations to build a better infrastructure.”
- “The user interface needs to be translated into Spadi.”
- “We need to realize technology supplier affiliation processes in order to ensure the sustainability of the technological aspects of the service.”
- “The department of transport needs to be involved locally, at district level, at a provincial and at National level to have them buy into the system. Local transport management needs to become an issue on the political agenda.”
- “Taxi owners who do not have road worthy vehicles need to be assisted with business plans that will enable them to acquire funds for new vehicles. Alternatively we could make vehicles available to them in order to ensure that they keep to road standards & requirements, while continuing to use the system.”
- “We should retest the system in January and February 2009 when there will be a relative quiet after the Christmas season to gauge the level of response as compared to this time of the year.”
- “In concluding – I (Ishmael Adams) personally would not think of a more better and viable system that would ease the frustrations of the many people, whether in rural Kgautswane arid or semi-arid region, town or city anywhere in SA, be it in transport or ordering that can beat this one. This is going to prove BIG if properly done & maintained. We need to keep encouraging both users and suppliers to look closely into this and make funds available to grow and research even deeper and closer.”
- “Lastly: Let’s keep the existing relation between Smite (IT) Infopreneurs and the CSIR and improve upon it. We would like for Martin Marijnissen to continue (if possible) with us on this in Kgautswane as everyone has grown used to him and he shares the same vision on this and other issues, with us in Kgautswane.”

Because they clearly have enough ideas and enthusiasm to take this project further it is important to enable them to do so as quick as possible. Although not all suggestions directly refer to the logistics brokering system in every case it at least is the link between the Infopreneurs and the taxi
association. We therefore should make the system fail safe and somewhat more flexible and insightful, to allow the Infopreneurs to continue testing and building a relationship of trust between them, the taxi association and the transport users. As was already stated within the introduction and which was highlighted again in the knowledge base, starting simple and building from there is a good approach for realizing an effective and sustainable system implementation. (Boehm 1988; Hevner, March et al. 2004; Heukelman 2006; Pade 2007)
7 Conclusion

This last chapter of the report will provide an answer to the main research question by concluding with an overview of the scientific contribution this research makes to the knowledge base on the sustainable design of ICT-systems and more specifically ICT-enabled logistics brokering systems, in rural areas. Apart from describing this scientific contribution, this conclusion will also discuss the project’s limitations, suggest further research and reflect upon the entire research project.

7.1 Scientific contribution

Within the introduction it has been made clear that there is a need to improve the transport service delivery in the developing rural areas of the world and that an ICT-enabled logistics brokering tool could help to alleviate this problem. Because an initial scan of literature on using ICT-systems in rural areas showed a large portion of failed and unsustainable projects we carried out this project in an attempt to answer the following research question:

“What design guidelines can we derive and test for ICT-systems to create a sustainable impact in the context of developing rural areas, with a specific focus on an ICT-enabled logistics brokering system?”

We decided to adopt a design science perspective in order to gather new knowledge on this topic. This perspective guides any research regarding learning from innovative designs. Since a vast amount of ICT-system implementations proved to be unsustainable, clearly there still was a lot to learn and the ICT-enabled logistics brokering system could not be routinely designed, but required an innovative design. We decided to design an ICT-enabled logistics brokering system for the rural community of Kgautswane. The basic processes leading to knowledge that enables a shift from innovative design to routine design are a knowledge using process and a knowledge building process. The first step is to establish a knowledge base that helps to shape the further design process. The knowledge using process then in essence is creating a design based on this knowledge base. The knowledge building process follows this design process and basically entails evaluating the created design and codifying newly found insights in the knowledge base. This led us to split up the research into three distinct parts, each with their own set of sub research questions. The first step (part A) within this research consists of an analysis of relevant notions found in literature, which were interpreted and translated into a set of guidelines for ICT-systems to create a sustainable impact in the context of developing rural areas. The counterpart of this body of knowledge was a so called experience base resulting from an analysis of the local context of Kgautswane. Within part B the knowledge and experience base has been used and translated into design requirements. This part of the research also discussed the final system that has been designed to enhance the transport service delivery in Kgautswane. Part C of the report presented an evaluation of the system that has been designed in part B. Based on this evaluation the set of guidelines that was derived within the first section of part A of this research can now be discussed in order to verify their use in creating a sustainable impact in the context of developing rural areas by shaping the design of ICT-systems. We will first reiterate the main conclusions with regard to each sub research question and will then discuss whether the set of guidelines has proven to be useful in the design of an ICT-system in the context of developing rural areas.
7.1.1 Conclusions sub research questions

Part A: Analysis; Knowledge and Experience base

A.1. Chapter 2 – Which design guidelines can we derive from literature to create a sustainable impact in the context of developing rural areas for ICT-systems?

Several sources mention ICT projects either being abandoned, staying dependent on donor funding or simply not delivering on their developmental goals. While ICT’s are frequently seen as possible accelerators of development, apparently ICT’s are not easily adapted to fulfill this role. Within this chapter we therefore wondered why these ICT projects are failing and which difference between the western and the developing world is keeping such a large amount of ICT projects from fulfilling their role as developmental accelerator. A literature analysis pointed out that in fact the developing world is not that different from the Western world with regard to the process of adopting technologies, we only approached both of these worlds differently. We deliberately tried to skip stages in the development trajectory and on occasion have been to insensitive to contextual differences. For ICT systems to have a sustainable impact in developing rural areas we therefore should not simply put computers in place (Heeks 2005), but adopt a structured approach and try to find what type of use is perceived as useful and what type of use adds value to the involved stakeholders. The following four guidelines therefore were defined in order to ensure stakeholder value:

I Guideline 1: Stop thinking about ICT-systems
II Guideline 2: Ensure added value through user participation
III Guideline 3: Create local business opportunities to sustain added value
IV Guideline 4: Start thinking about ICT-systems again

The first guideline argues the important role of a structured design approach, the second guideline elaborates on the essential role of user participation within this design approach, within the third guideline creating business opportunities for a local intermediary is introduced as an effective way of sustaining a system’s added value and the last guideline suggests some criteria to select the technology best suited for a developing rural area.

A.2. Chapter 3 – What is the state of the transport service delivery in Kgautswane and how can this be improved by an ICT-enabled logistics brokering system?

Within chapter three we elaborated on the research and design process we adopted in Kgautswane. We also described the results of these interactions and this led to a general description of the area of Kgautswane and demarcated the focus of the logistics brokering system, herewith providing an answer to the second sub research question. The most important insights hereto were that transport demand is low, scattered and distributed throughout the day. For the taxi association Kgautswane therefore is unattractive to service during the day. This confirmed the possible value of a logistics brokering system that would enhance communication and coordination between transport users and transport suppliers. We decided to try to improve the transport service delivery as provided by the taxi association through creating a system that gathers and groups transport demand.
Part B: System design; Logistics Brokering in Kgautswane

B.1. Chapter 4 – Which requirements should be set for a logistics brokering system to be sustainable and effective in improving the transport service delivery in Kgautswane?

Based on Part A of the report we defined eleven requirements that were applicable to either the local intermediary that would manage the system, the transport users or the transport suppliers.

Intermediary
- Managing the logistics brokering system needs to be profitable
- The process of interaction needs to be automated

Transport user
- Service costs need to be minimized
- The service needs to allow use with basic mobile phones
- Transport supply needs to be reliable

Transport supplier
- Transport demand needs to be reliable
- Business needs to be maximized
- Single trips need to be profitable
- Taxi occupation degree needs to be maximized
- Trips need to be fairly distributed among the different taxis
- Taxi drivers need to be able to fill up their taxi along the route

B.2. Chapter 5 – How should an ICT-enabled logistics brokering system be set up to be expected to sustainably improve the transport service delivery in Kgautswane, South Africa?

The logistics brokering system was designed based on the requirements that were set in chapter four. Based on the approach of van de Kar and Verbraeck (2007) on designing mobile service systems the design of the logistics brokering system was structured into three aspects, the service concept, the technical design and the organizational network:

Service concept
With regard to the service concept three important decisions were made in order to provide the transport users with a valuable service and the taxi association with profitable business:

- The system is designed to offer three services, groups of five or more people can request a trip at least 10 days in advance, individuals can join and book a seat on an already scheduled trip until a day before the trip actually takes place and someone in instant need of transport can find trips that are scheduled for the current day.
• In order to facilitate grouping transport requests, people were only allowed to request a trip to take place during a certain timeslot instead of allowing them to specify the departure time themselves.
• Also in order to facilitate grouping, the routing of each trip would pass all settlements in Kgautswane if necessary.

Technical design
The technical design was mainly guided by the requirement to automate the process of gathering transport requests and bookings and the requirement to minimize service costs. This led to the decision to use the Unstructured Supplementary Service Data (USSD) protocol, because this was the option with the lowest cost and also provided a more robust way of gathering transport requests.

Organizational network
With regard to the organizational network we specified the relations between the three stakeholders that would be involved in the daily operation of the logistics brokering system:

• **Taxi association vs. Transport user:** We decided that the taxi association needs to give the people that booked a trip or a seat through the logistics brokering system a discount, in order to make sure that people will continue to use the system once taxis start travelling to Kgautswane more frequently.
• **Transport user vs. Infopreneur:** In the relation between the infopreneur and the transport users, we decided to let the transport users pay a service fee in order to ensure reliability of demand. Together with the discount that will be given by the taxi association, it will still be cheaper to request a trip instead of simply waiting for transport.
• **Infopreneur vs. Taxi association:** In order for the Infopreneur to be able to provide the taxi association with profitable business it is essential that the Infopreneur does not need to negotiate trip details with the taxi association, the taxi association therefore needs to trust the Infopreneur and simply has to agree with the trips that are scheduled.

**Part C: Evaluation; Success in Kgautswane?**

C.1. Chapter 6 – How effective is the designed ICT-enabled logistics brokering system in improving the transport service delivery in Kgautswane?

In order to provide an answer to this question we tested the designed system in practice. Unfortunately we had to carry out the test in December, which is not the best time to test this system. In December people travel far more because they go out more often to shop for groceries, because of the holiday season. This also results in an increase in transport supply and therefore the problem the system was actually designed for is almost nonexistent this time of the year. We did manage to gather some data however. We were able to get five people to book a seat on a trip we scheduled upfront. One person showed up for the trip, the problem of unreliable transport demand clearly also became apparent during the test. This might be a matter of people getting used to planning trips upfront however. Almost all people that made a booking were able to use the USSD system and the research assistants mentioned all respondents would be able to book on their own
the next time. The assistants furthermore noted that every respondent considered this a valuable and easy to use service. Some respondents also encouraged us to make this system known to the whole of Kgautswane because it would help to ease their transport problems. Thus, although further testing needs to be done, the test results clearly showed that the designed logistics brokering system has a clear potential to improve the transport service delivery in Kgautswane throughout the year, excluding December.

C.2. **Chapter 6 – What is the expected sustainability of the designed ICT-enabled logistics brokering system?**

By discussing the designed system with the Infopreneurs and having them independently evaluate the system we tried to estimate the future impact of the system. On several occasions the Infopreneurs mentioned things like: “The most important thing to do is to stay committed ourselves and to never stop encouraging, even when the going gets tough.” and: “The system simply needs two months of proper preaching, in this phase I do not expect any financial benefit”. This clearly showed a high level of ownership and, as mentioned within the guidelines defined in chapter two, ownership is the most important aspect of ensuring sustainability. Based on these discussions we therefore concluded that the designed ICT-enabled logistics brokering system also can be expected to be sustainable.

**7.1.2 Conclusion main research question**

Based on the realized results in Kgautswane we can now evaluate whether the guidelines we defined within chapter two can be expected to help guide the creation of ICT-systems in such a way that these systems will create a sustainable impact in the context of developing rural areas and herewith answer the main research question:

“What design guidelines can we derive and test for ICT-systems to create a sustainable impact in the context of developing rural areas, with a specific focus on an ICT-enabled logistics brokering system?”

The main research question will be answered by subsequently discussing the four guidelines and elaborating on how they shaped this research and how this research would have generated different results if these guidelines would not have been adhered to.

**Guideline 1: Stop thinking about ICT-systems**

At the beginning of this research the scope of the project was defined as follows: “The work confines itself to the realization and testing of a web-enabled logistics brokering services toolkit with incorporated geo-spatial functionality, and a discussion of the results obtained while testing the toolkit in the rural environment. The research project is limited to activities that are related to design, development, demonstration and testing of the toolkit.” (See appendix M: Startup document – First problem description) Although obviously with this scope there was still room for analyzing local needs and requirements, several technological aspects of the research had already been fixed however. This scope clearly is technology driven and would probably have resulted in a different outcome of the project. From the first interaction onwards we decided to adopt a more bottom up
approach that was focused on the needs and requirements of the local community, leaving technological issues to be discussed at a later stage. By adopting this approach we came across a whole range of issues that were relevant to discuss and which we needed to make arrangements for. Ensuring reliability of transport demand and aligning transport demand, while limiting communication costs and differentiating the service offering are all issues that might not have been picked up when we would have had adopted the initial technology driven approach, while especially these issues are essential for the relevance and sustainability of the logistics brokering system. Clearly adopting a structured approach that starts with determining objectives, alternatives and constraints is essential in order to ensure the relevance of any system intervention.

Guideline 2: Ensure added value through user participation
Throughout our research and design process we involved the actual users of the system. During the analysis phase we uncovered essential requirements and insights that helped to guide the design of the service system. Especially adopting an iterative process turned out to be valuable however. It clarified and helped to value different requirements, adopting an iterative process furthermore confronted the taxi association with new insights about the transport users and vice versa and lastly this process helped the taxi association to become aware of design trade-offs, herewith raising their acceptance of certain design choices. The iterative process for instance made clear that single trip profitability was essential for the taxi association to be willing to cooperate, it also helped the taxi association to understand that they were part of a vicious circle influencing the reliability of transport demand. An example of how this iterative process clarified design trade-offs for instance is the choice to service the entire area with one route, despite the detours, in order to maximize the occupation degree of each taxi. Especially in this last case visualizing these design choices and trade-offs proved to be really useful. Although none of the people within the taxi association had ever even seen a detailed map of Kgautswane, we decided to use a more extreme visualization of the area. We discussed the issue of routing using a normal map of the area, a schematic map and one showing a highly schematic service line. These three maps can be found in appendix E: Maps. While one would expect they would prefer to use the normal map, because that map is easier to relate to, we ended up using the schematic visualization of the service line. One of the Infopreneurs even mentioned also using this schematic visualization himself when explaining the layout of the area to other people. With regard to user participation one therefore can state that it provides insights that otherwise might have been missed and it furthermore increases the acceptance of design choices.

Guideline 3: Create local business opportunities to sustain added value
We chose to develop the service as a profitable business supplied by a local intermediary. The influence this choice has had or can be expected to have on the sustainability of the project is difficult to estimate, since currently managing the service does not yet generate an income. Adopting an approach within which we placed the Infopreneurs at the heart of the service delivery from the start of the project did already have some clear benefits however. During the interactions with the community described in chapter three, the Infopreneur was already mentioned to have been essential on several occasions, by simply leading the workshop sessions and picking up on sensitive issues more easily than we did, by taking up the role of translator when necessary, by locating the research assistants, by getting permission from the chief and by building relationships with different stakeholders. By basically stimulating the Infopreneurs to take up the role of project leader from the beginning of the project they clearly got a level of responsibility for the project and showed ownership on several occasions. Appendix N: Documents Smite (IT) Infopreneurs shows several
letters written by the Infopreneurs in their own language in order to request permission from the chief, formally invite representatives from the taxi association and pickup truck owners and a letter written in order to recruit research assistants that were needed to guide the questionnaires. These letters were written on their own initiative and were a way of working we would not have thought of using ourselves. We would definitely have underestimated the importance of asking permission to the chief or formally inviting representatives of a taxi association that came across as being highly informal. Clearly without these local intermediaries the research project could not even have been realized and definitely will not be sustainable in the future. Whether it has been essential to provide a financial incentive is difficult to conclude at this stage, that it has been essential to have a local intermediary as a local project leader clearly can be concluded.

**Guideline 4: Start thinking about ICT-systems again**

This last guideline stated to start thinking about ICT-systems again. As mentioned in the discussion with regard to the first guideline we deliberately left technological issues to be discussed at a later stage. Because we had already defined which type of service we wanted to offer in order to meet the requirements that have been set by the different stakeholders, several technologies could be eliminated instantly. The local context of the research also gave more insight into what the technology was required to do. Again referring back to the initial project scope, within the service offering we defined to be most useful, there was absolutely no need to incorporate geo-spatial functionality. While there was a clear need to frequently interact with the transport users, this then was not defined as an element within the initial project scope. Because we left technological issues to be dealt with at a later stage, we were able to select those technologies that were most useful.

### 7.2 Limitations

While the guidelines discussed above provide some practical guidance when designing an ICT-system in a rural context there are some limitations associated with these guidelines. First of all these guidelines have only been applied in a single project. Secondly we made use of a local intermediary that was an already established contact that had experience in providing services to the local community. These guidelines therefore might be more difficult to follow in a situation where a local intermediary still has to be found and trained to take up the role of a local project leader. Another limitation of the way we approached the project is that we still triggered each next step, within which the local intermediary quickly took up the role of project leader again, but this still entails the Infopreneur having to change his behavior as soon as we would hand over the project, herewith introducing a risk for sustainability. Another, somewhat more practical limitation is our lack of use of simulation as a means of clarifying design tradeoffs. It proved really difficult to get across what influences different design options might have. The taxi association therefore remained quite risk averse, while it might have been more valuable to take somewhat more risk in order to get a more attractive service offering. Using a simulation or a business game might have helped here to make this more clear.

### 7.3 Further research

Further research first of all should focus on continuing to monitor the progress of this project to get insight into actual project sustainability instead of an estimated project sustainability. Secondly this project should be replicated at multiple locations in order to gain more insight into how these guidelines function within different contexts. A third interesting research area is the use of business simulations in a rural context. Serious gaming might be an interesting way of communicating design
trade-offs to involved stakeholders as mentioned above within the limitations of this research. A last interesting area of research would be to test how the relationship between a local intermediary and a researcher can possibly be shaped and what its influence would be on project sustainability. As was mentioned above, in this case we still triggered new developments while both the Infopreneurs showed to have enough initiatives and ideas to take this project further. It might be possible to establish a relationship within which the researcher really only adopts the role of external advisor and coach, while completely leaving all local interactions up to the local intermediary. I believe we underestimate these local people’s capacity to shape their own future and by eliminating ourselves as an essential part of the research and design process we would break down another barrier of interpreting results, herewith making the research and design process, more accurate, quicker and effective. When exploring the possibilities for such a different relation between researcher and local intermediary one should think of how to handle costs of doing research. Clearly the costs made within this research are too high to be covered by the projected earnings of the logistics brokering system. This is no problem, since this research has the focus of replicating this system in other areas. Thinking of how to remunerate costs therefore is essential if a local intermediary would become responsible for the project’s progress. Another aspect that would need attention is the role a researcher plays with gaining commitment. If someone is not a local, he or she will experience some difficulties, but at the same he or she will have some authority towards the local people. This should be mitigated if a local intermediary would take over the role of researcher.

7.4 Reflection
Reflecting on this research project is quite a difficult task. It has been quite a mix between actual project management in a completely new and sometimes overwhelming environment and doing a relatively elaborate desk research in order to ground this research within the existing knowledge base. Matching up theoretical notions with the practical work in an environment that is really impoverished has not always been easy.

Doing research in a developing rural environment like Kgautswane includes overcoming all sorts of problems not associated with doing research in a more professional and developed context. The start of the project clearly was really rough with the tragic loss of Sam Muniafu. But we decided to push through and make sure to get a result he would have been proud of! With Sam missing as the initiator of this research we had to reinvent the wheel to some extent and encountered the first reality of doing research in a developing rural area. We were unsure about the precise problem definition and so were the people for who were planning to solve the problem. We therefore entered into an uncertain phase of uncovering the current situation looking for a problem. Looking for a problem in Kgautswane is not that difficult however, there are multiple problems worth solving. It is difficult to gain some insight into what problem you will be capable of solving however. When walking through Kgautswane for the first time, I only saw poverty and no clear lead for a logistics brokering system to enhance any form of transport service delivery. Were there really people that had money to pay for transport, while they were not able to get any transport. Were all people there not simply really poor and would a project to realize jobs not be of more relevance? At this stage I even defined five different research proposals, which is a witness of our struggle to find a project focus, that was both scientifically interesting and locally relevant. After having spent some time in the area I started to pickup more social structures and informally arranged business structures we could possibly improve upon. We eventually decided to stay fairly close to our initial project focus,
but to adopt a far more demand driven approach to ensure we would design and realize a locally relevant service system.

With fixing our project focus we passed our first hurdle, but doing research in Kgautswane meant having to face far more barriers typical for a developing rural area. The streets in Kgautswane do not have any names, there was not even a map of the area before we arrived there. We needed to meet with the Chief before we were allowed to do our research. On one occasion we had to rush back to the community centre, because we had not yet met with the Chief, while we were driving around in the area without our local contact. Once he heard we were driving around unattended his voice changed and ordered us to quickly get back to the centre, stating that what we did was very, very dangerous. Clearly this also affects your ability to do proper research. Another barrier obviously was language, having to always work through a translator clearly affects speed and quality of communication. Since these barriers also affected the quality of information, all information needs to be verified time and time again. Another problem clearly also is the almost complete inability to communicate through email or phones and therefore having to travel a distance from Delft to Paris for each stakeholder interaction. All of these problems shaped our research and are difficult to capture in a scientific report but are essential to mention.

Although this research has not always been easy, it is extremely rewarding to try and improve the position of the people in such an environment. This research has an impact that goes beyond producing an elaborate report or enhancing the performance of a big company, it might affect real people’s lives and that is the best reward possible.
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9 Appendices

A Unstructured interviews with transport suppliers and users

A.1 Meeting at the MPCC

Date: 11-08-2008

Attendees:
- Jack Molope, Representative taxi association
- Clara Masingha, Centre manager
- Ishmael Adams, Infopreneur
- Goodhope Maponya, CSIR
- Sipho Dube, CSIR
- Mac Mashiri, CSIR
- Johan Maritz, CSIR
- Bart Wouters, CSIR
- Martin Marijnissen, CSIR

Notes:
- Clara mentions that transport is a problem during the day, it is busy in the morning and busy in the evening. Because of the low demand for transport during the day, it is uncertain for taxi’s and busses whether there will be enough transport demand to make the trip worthwhile.
- Clara mentions that some produce from farmers needs to be transported to Ohrigstad.
- Possibly another farm will be initiated by the centre, the department of agriculture is involved in the realization of this project.
- The taxi representative mentions that there are 6 working taxis in Kgautswane, a lot of taxis are broken.
- The healthcare clinic is next to the community centre, a mobile health care clinic comes three times a week.
- The public transport in Kgautswane consists of 2 busses from Burgersfort and 1 bus from Ohrigstad each day. These busses are run by a private company, Great North.
- The state of the road is bad and results in a lot of problems
- A taxi to Ohrigstad costs 10 Rand and a taxi to Burgersfort costs 25 Rand
- Measured from the community centre the distance to Ohrigstad is 17 km and the distance to Burgersfort is 63 km.
- Clara mentioned some businesses in and around Kgautswane: Spaza shops, liquor shops, sewing, forestry and mining
- For some of these businesses the workers need transport to go to Graskop, Sabie, Pelgrims rest, Platinum mines, etc.
- These transports are only once a month, since the workers stay at their work for one month.
- Farm workers do not stay at their work but are collected once in the morning by the farmers that employ them.
- Clara mentions that some Thusong service centers are often white elephants, because they have been initiated by the government and thus are not accepted by community.
She furthermore mentions that the home based carers are the eyes and ears of the centre.

Taxi people discuss problems often and try to find a way to make the issue of the bad road clear to the government.

The Chief and the councilor do not talk. Ishmael and Clara mention that the community has much more respect for the Chief than they have for the councilor. In that same respect both Clara and Ishmael mention that government should not be involved, government involvement always makes the process difficult and often it yields no results.

Than the discussion is again focused on transport. The taxi association representative indicates that taxi drivers charge people two Rand fifty if they are transporting a lot of goods, or even one additional seat if the amount of goods they transport takes up another space.

Sometimes pickup trucks transport people back to Kgautswane, especially if they have a lot of goods to transport. Those pickup trucks are waiting in town. In Ohrigstad around 15 pickup trucks provide transport. Among others a reason for using these pickup trucks is their flexibility, they do cost more however.

With regard to the taxis the representative mentions that transport demand, especially during the day, is to uncertain. For this reason taxis do not work in the community during the day. If a schedule is devised, people will wait for a taxi and demand will be more certain. Such a schedule has been implemented before, but did not work because pickup trucks arrived early to steal customers.

Then Ishmael mentions that a lot of people work in construction and that that might be an option to create a better road, if some assistance is provided.

A problem might be that higher traffic flows will be the result of a better road, specifically if this traffic comes from outside of Kgautswane.

Another thing that was mentioned is SASKO. SASKO delivers bread and might be willing to also use its trucks, when empty, to transport other goods.

Finally it was mentioned that both time, cost and uncertainty play a role with deciding which transport mode to use.
A.2 Meeting at the Business Centre

Date: 11-08-2008

Attendees:
- Shop owner
- Mac Mashiri, CSIR
- Johan Maritz, CSIR
- Martin Marijnissen, CSIR

Notes:
- The shop owner stated to get his goods at Metro and often travels to Nelspruit, Burgersfort, Lydenburg and sometimes even Johannesburg to get his goods. For his transport he uses his own truck, pickup truck or tractor.
- These vehicles often are not being used for quite some time. Especially the truck is sometimes not being used for several months. The pickup truck is only used once a week. He would be willing to rent these vehicles to other people for transport.
- He mentioned that the cost of transport has become more and more important.
- We discussed whether there might be a market for house to house delivery.
- Based on the low volumes of goods people buy at his shop, he thinks the cost of transport will be too high for this service to be attractive.
- The people that buy goods at his shop have no money for transport themselves, they always walk to his shop.
- The people that have money for transport prefer to go to town for their groceries.
- According to the shop owner most of these people do not only go to town for groceries, but also go there for being in the town itself. In a conversation with Goodhope, Goodhope pointed out that these people mainly go to town to get groceries they cannot get locally.
- The shop owner also mentions that this is why he thinks that he will never be able to compete with town for those customers that can afford to go to town for their groceries.
- In fact, he mentions, the only reason he is still in business is the possibility of buying on account at his shop. This is how he keeps his mostly really poor customers.
- He furthermore mentions to supply Spaza shops with cold drinks.
A.3 Meeting at the Farm

Date: 12-08-2008

Attendees:
- Mr. Johnston, Farmer
- Ishmael Adams, Infopreneur
- Goodhope Maponya, CSIR
- Sipho Dube, CSIR
- Mac Mashiri, CSIR
- Johan Maritz, CSIR
- Bart Wouters, CSIR
- Martin Marijnissen, CSIR

Notes:
- Johan starts with an introduction and explains that we are looking for options to improve transport. For instance transport to and/or from Clinics & Hospitals, The MPCC and Towns (Burgersfort, Ohrigstad, etc.).
- Mr. Johnston explains that there is a bus that comes twice a day. If people missed the bus they often try to get a lift from a pickup truck. Transport options therefore are limited, especially for people living in Mufarafara. The bus only comes twice a week in Mufarafara and otherwise people need to walk 7 kilometers to get to the other bus.
- Mr. Johnston mentions that people in this region could possibly save on transport if they were supplied with basic goods.
- Sometimes pickup trucks are used to supply basic goods. They usually charge the same amount for the transport of these goods as they would do for the transport of people buying these goods themselves however.
- Another problem aggravating this difficult situation are the irregularity and low volumes of demand.
- After this Mr. Johnston focused more on his own businesses and mentioned it is difficult for him to make a living and that transport is a big cost factor.
- He is not able to compete with the big farmers and therefore it is difficult for him to find a market for his produce.
- A lot of his produce gets bought by pickup truck owners, they sell his produce within the community.
- They usually offer low prices, but he has no way to negotiate. Other farmers offer produce as well and he has only a limited amount of time to sell his produce.
- He tried to cooperate with the other farmers in order to be able to better negotiate with the pickup truck owners buying their produce.
- This cooperation did not work because of a lack of trust between the different farmers.
- He mentions a tomato processing plant as a possible solution for these problems. Tomatoes are a vegetable that is very suitable to grow in this environment. A processing plant would provide a certain market for the farmers in the region, because processed tomatoes can be kept for a longer period of time. This would also enable other people in the community to start growing small amounts of tomatoes to try and create some business for themselves.
B Structured interviews with transport users – questions

B.1 Questions – basic

Personal details
- Age:
- Sex:
- Address:
- Profession:
- Income category: (0 – R350,-; R350 – R600; R600 – R800; R800 – R1200; > R1200)

Travel behavior
- How many times a week do you travel outside Kgautswane?
- How much do you spend on travelling in one month?
- What do you do in case of an emergency?
- Continue with: “Questions – matrix”

Problem verification
- Do you ever encounter a situation in which you need transport but are not able to get transport?
- Why do these situations occur?
- Is your travel behavior different from what you prefer due to the current level of transport service?
  → Stay at home
  → Change transport mode
  → Change time/day of transport
  → Change destination

Description service system
Explanation of the envisioned logistics brokering system

- Would such a system change your travel behavior?
  → Travel more frequent
  → Change transport mode
  → Change time of transport
  → Change destination

Characteristics of transport demand
- Are you flexible in when you use transport?
- Are there more people that you expect to have similar transport demands?
- If you would be able to arrange transport upfront, how far ahead would you be able to plan your transport?
- Would you wait for transport to be arranged? How long?
- Would you be willing to pay upfront?
- Would you be willing to pay more for transport on demand?
Means of communication

- Do you have a cell phone?
- How often do you use it?
- Would you be willing to use this cell phone, to arrange transport?
## B.2 Questions – matrix

<table>
<thead>
<tr>
<th>Question</th>
<th>Walking</th>
<th>Bus</th>
<th>Pickup truck</th>
<th>Taxi</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you use this type of transport?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What do you use this type of transport for? (School, clinic, work, church, party, funeral)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>During which time of the day do you use this type of transport?</td>
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</tr>
<tr>
<td>Why at this time?</td>
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<td></td>
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</tr>
<tr>
<td>Why do you (not) use this mode of transport for this type of trip?</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you travel for different purposes while using this mode of transport?</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you view this mode of transport in terms of availability?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you view this mode of transport in terms of affordability?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it possible to communicate with a driver about your need for his service in advance? If so, how?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How easy is it to access this mode of transport? (Walking distance, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you view this mode of transport in terms of comfort?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you view this mode of transport in terms of reliability?</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>How long do you have to wait for service on average?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How do you view this mode of transport in terms of operating staff behavior?</td>
<td></td>
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</tr>
<tr>
<td>Do you use the same mode of transport/vehicle for your return trip?</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
C  Structured interviews with transport users – reports

C.1 First interview

Location: Kgotlopong (fairly remote)
Respondents: Two men and three women walking from Kgotlopong to the MPCC
Livelihood: Grants (Pension – R220,- / Child – R220,-)

We held our first interview with a group of two men and three women that were walking on the dirt road with no settlements in sight. Our first questions therefore were where they were coming from, where they were going, why they were walking and how often they make this trip. It turned out they were travelling from their home in Kgotlopong to the MPCC more than ten kilometers away. On average they make this trip about four times a month. They were walking since their area is not being serviced by any taxi and the bus only comes at fixed times in the early morning and the late afternoon. When they have an emergency they wait for a pickup truck passing by, since that is the only available transport during the day. Availability of transport was mentioned to be a problem in general. Besides from travelling to the MPCC, they regularly travel to visit parties, the Chief and funerals. About once a month they travel outside Kgautswane and go to Burgersfort to buy groceries and building material. When they go to Burgersfort they take the bus going out of Kgautswane, when coming back they use a pickup truck, since they need the transport capacity. They mentioned that pickup trucks, similar to taxis, wait until they are completely filled up.

On average they spend around R30,- a month on transport. They would be willing to spend around three times more on transport if it would be more available. When we verified this information they even mentioned that they preferred the taxi over the bus and would not mind having to pay more per trip. In their opinion, the problem is not the cost of transport but its availability.

We continued by introducing the possibility of planned transport, arranged through the Infopreneur as an intermediary and asked some questions on whether they were flexible in when to go somewhere and whether they would able and willing to plan ahead. They simply mentioned to be flexible in when they use transport. They furthermore mentioned that more people have similar transport demands and that they would be able to group themselves, they also would have no problem with planning their trip upfront. When looking back at their previous remarks on their travel behavior this seems realistic. With regard to the reliability of transport demand we asked them whether they would be willing to pay upfront for arranged transport. It turned out that there is a general lack of trust related to money issues. They mentioned definitely not to be willing to pay upfront.

With regard to communication they all had a cell phone and on average used R48,- a month on airtime. They would also be willing to use their cell phones to arrange transport, but preferred calling over using SMS.

Figure 9-1: Respondents walking over ten kilometers to the MPCC
C.2 Second interview

Location: Mufarafara (very remote)
Respondents: Three women sitting at home
Livelihood: Grants (Child – R220,-)

After our first interview we travelled to the remote settlement of Mufarafara where we spoke to three women sitting at home. When we started talking about the transport problems in Kgautswane the first thing they said was that there is no transport supply in Mufarafara at all; the bus does not service the area anymore and taxis do not service it as well. When people need the bus, they need to walk all the way back to the main road, several kilometers away. They therefore are dependent on the use of privately owned pickup trucks as their means of motorized transport. Since usually this is no normal business for these pickup truck owners, this is often very expensive. A single trip to Burgersfort costs R14,-, transporting a fifty or eighty kg bag of mieliemeal costs R25,- or R35,-, transporting a light weight chair costs R5,-. In relation to fees in better serviced areas the fees pickup truck owners in Mufarafara charge are a lot higher. This means that their monthly trip to Burgersfort takes up a large portion of their income and that they usually walk to get around in Kgautswane, despite the distance. They therefore would only make more use of motorized transport if it could be offered at a lower rate than those of the pickup truck owners. Since these fees are a lot higher than the fees in better service areas, this might be possible.

When we mentioned that we were planning to start up a service that might enable them to request transport they mentioned to be flexible in when they need transport demand. They also indicated that there are more people with the same transport needs and that they would be willing to plan transport upfront. With regard to paying upfront, they mentioned this might be an option, if the Infopreneurs would also act as a middleman that safeguards their deposit until they actually got transported.

Similar to the people we interviewed before they all had a cell phone. Network coverage is quite a problem however. There are some places in Mufarafara that have coverage, usually they walk around some time before they find network coverage. Although difficult it therefore is not impossible to use cell phones in Mufarafara. With regard to cost they would be willing to use their cell phones to arrange transport.
C.3 Third interview

Location: Ga Kgwedi (near to the main road)
Respondents: Several (5-10) people just getting of the bus and walking home
Livelihood: Grants (Pension – R220,- / Child – R220,-)

Ga Kgwedi is a settlement that lies on top of a hill near the main road. When we approached the area in the late afternoon we just saw people getting of the bus and had a short discussion with a group of around five to ten passengers. We first discussed the cost of transport by bus, they mentioned that people with work pay around R100,- a week to get to work. From Ga Kgwedi to Ohrigstad the fee is R10,- and to Burgersfort it is R30,-. We continued our discussion talking about their travel behavior during the day, since work related travel usually is quite well covered by the bus servicing the area in the morning and the afternoon. First of all they were of the opinion that local shops are too expensive, so they go out of town to buy goods there. They also buy clothes and building material there. The amount of times they go out to town was ranging from one to four times a month. In case of an emergency they hire a car or look for someone they know. An additional problem for this specific area is getting further into their village, that can take up to one and a half hours. Taxis do not want to go there because of the extremely bad road. Their reason for sometimes using a pickup truck is the unavailability of other means of transport like a taxi. One of the respondents indicated it is not uncommon for him to wait for four hours to get a taxi to transport him, someone else even mentioned having to wait for twice that time on multiple occasions. They also mentioned it has happened that they walked down the hill with money to pay for transport, but that they eventually had to go back home without having seen a single pickup truck, taxi or bus.

The transport problems of the people here maybe are not bigger then for instance Mufarafara, they appear to have more money to spend however. They therefore experience the transport problems therefore as far bigger problems. When we introduced the service we were planning to realize they were enthusiastic and perfectly understood what we were planning to do. They indicated to be flexible and willing to arrange transport upfront. They furthermore mentioned knowing multiple people with which they could group themselves. As mentioned above, the cost is not near as big of a problem as the availability of transport, they therefore clearly indicated to be willing to pay more for arranged transport.

Within the last part of the discussion we focused on their cell phone usage. Everyone in the group we were talking to had a cell phone and network coverage at their homes. They use their phone often and would have no problem with using it to arrange transport.

Figure 9-3: A group of people just getting of the bus in Ga Kgwedi
D  Guided questionnaires with transport users, including guide

Introduction

The Council for Scientific and Industrial Research (CSIR) Pretoria and Smite IT Infopreneurs Kgautswane are jointly exploring the opportunities for an improvement of the transport service level in Kgautswane.

With this questionnaire we would like to capture information that could help us in improving the availability and utilisation of transport.

We would therefore like to ask you some questions about how you travel. Would you be willing to cooperate and to answer our questions? Your assistance is of great help to us.

NOTE: The information you provide is strictly confidential, will not be made available to any third party and will not be used for any other purpose than this research.

For questions please call Martin Marijnissen (telephone nr.: 0765918857)

Researcher

You need to fill in your own name in this section.

1. Personal details (Of the person you are asking questions)

1.1 Personal details

Age: ...  Gender:  □ Male  □ Female

1.2 Location (If the village where the person you are asking questions lives is not on the list, please write that village clearly in the “Other” section.)

□ Paeng  □ Sefateng  □ Lebalelo  □ Ga Kgoedi
□ Ga molai  □ Masakeng  □ Mokutung  □ Makgongwane
□ Matshiretsane  □ Maribaneng  □ Padishanong  □ Moshate
□ Mogoleng  □ Makgwareng  □ Makgopa  □ Kgotlopong
□ Mahlashi  □ Mufarafara  □ Hlapetsa  □ Other: Note down the village where the person you are asking questions lives.

1.3 What is your main form of income?

□ Child grant  □ Pension grant  □ Disability grant  □ Work
□ Other: ...
1.4 Could you indicate to which category your monthly income belongs? *(If people do not want to answer this question please make clear to them, that the answers they give are strictly confidential, will not be shared with any other person and will only be used for the goals of this project. Also make clear to them that this information would be of great help to us in our attempt to make transport more available to the people in Kgautswane.)*

- ☐ R0 – R350
- ☐ R350 – R600
- ☐ R600 – R800
- ☐ R800 – R1200
- ☐ More than R1200

1.5 How much do you on average spend on transport in one month? *(Somewhere near the end of the questionnaire we want the respondent to indicate the amount of money he or she would have spent on transport within the last month if transport would have always been available. Together with this question we want to determine whether someone would have spent more on transport if it would have been available all of the time. If the person you are asking questions thinks it is difficult to answer this question, you could also ask him or her how much money he or she spent on transport within the last month.)*

...  

2. Availability of transport types

2.1 To what extent are the following types of transport available to you? Please indicate the relevant option for each of the different types of transport. Choose either Never, Sometimes or Always AND indicate whether it is possible to arrange a certain form of transport. *(With this question we want to get a clear view of the available types of transport in a certain area, it is important that the respondent does not take the cost of transport into account within this question. For example if a bus comes in an area in the morning and in the evening, you would mark the square that is right from sometimes and under bus, because the bus is sometimes available. Whether the respondent is able to make use of this type of transport because of the cost is not relevant here.)*

<table>
<thead>
<tr>
<th>Pick up truck</th>
<th>Bus</th>
<th>Taxi</th>
<th>Private car</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sometimes*</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Always</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Arranged transport</td>
<td>Yes/No</td>
<td>Yes/No</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

*For instance only during the early morning/late evening*

3. Travel behaviour

To gain an understanding of problems you are facing with regard to transport we would like to ask you some questions about how you travel and how you would like to travel. Within this section we will ask you about your means of travelling outside of Kgautswane as well as your means of travelling within Kgautswane.

Different trips might require different types of transport demand; we therefore divided this section into two consecutive parts. Within the first section we will ask some questions about travelling outside Kgautswane, the second section will focus on travelling within Kgautswane.
3.A Travelling outside Kgautswane

3.A.1 How many times do you normally travel outside Kgautswane within one month? For example to Ohrigstad or Burgersfort. Indicate the number of return trips. (If a respondent finds it difficult to answer this question you could also ask him or her the amount of times he or she has travelled outside Kgautswane within the last month. If someone for instance tells you he or she travels outside Kgautswane five times a month, first make sure that he or she refers to return trips. Five would be indicated on the questionnaire by marking the third square, four would be indicated by marking the second square, 10 would be indicated by marking the fourth square referring to "10 or more").

☐ 1  ☐ 2 to 5  ☐ 5 to 10  ☐ 10 or more

3.A.2 What is your destination when you travel outside Kgautswane?

☐ Ohrigstad  ☐ Burgersfort  ☐ Other ...

3.A.3 What is (are) your reason(s) for travelling outside Kgautswane? (This is a so called “open” question. We want to gather as much information as possible on the reason(s) for people to travel outside Kgautswane. The reason why we want to know this is because this answer might give us information on whether a respondent will be likely to be able to change his or her time of transport. This is important to us, because it determines whether we will be able to easily group different people that need transport. It therefore is important that you try to capture as much information as possible.)


3.A.4 Do you travel outside Kgautswane during a specific time of the day or on a specific day in the week or month? And if so, when and why? (This question asks more specific for the information we were looking for in the previous question. Our reason for asking for this information again, but through a different question is to make sure we get accurate information. Respondents might give a long answer in which they say this is dependent on where they are travelling, if this is the case, please ask further and try to unveil for which destinations their travel time is sort of fixed and for which destinations their travel time is flexible. Together with the answer to the previous question we then can determine to what extent people are flexible with regard to the time they want to travel. Again, this is really valuable to us to be able determine whether we will be able to easily group different people.)
3.A.5 How do you normally travel outside Kgautswane? Please only mark the type of transport you normally use. Indicate the cost of this type of transport at the bottom of this question. (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.) (We are asking for both the type of transport for the trip from Kgautswane to the respondent’s destination as for the type of transport for their trip back home, because these might be different. If someone goes to for instance Ohrigstad to buy building material, he or she might go there by taxi and return with a pickup truck, because he or she needs its transport capacity. Please ask the respondent for the cost of both types of transport that you marked as the types of transport he or she uses. Please not that these costs should be for a one way trip.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Walking</td>
<td>□ Walking</td>
</tr>
<tr>
<td>□ Pickup truck</td>
<td>□ Pickup truck</td>
</tr>
<tr>
<td>□ Bus</td>
<td>□ Bus</td>
</tr>
<tr>
<td>□ Taxi</td>
<td>□ Taxi</td>
</tr>
<tr>
<td>□ Private car</td>
<td>□ Private car</td>
</tr>
<tr>
<td>□ Other: ...</td>
<td>□ Other: ...</td>
</tr>
<tr>
<td>Cost: ...</td>
<td>Cost: ...</td>
</tr>
</tbody>
</table>

3.A.6 Is the type of transport you indicated in the previous question, the type of transport you prefer or is it the best available option? (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.) (With this question we would like to uncover whether people are satisfied with the availability of transport. Within this question and the following questions, preferred type of transport refers to the type of transport someone would prefer to actually use if it would be available. If someone for instance mentions that he or she always needs to walk, while they have money to pay for the fee of a taxi, but this taxi is never available, you need to mark the square that refers to “This is the best available option”. If someone would mention that he or she walks because he or she does not have any money to pay for any other means of transport, you need to mark the square that refers to “This is my preferred type of transport”. The next question asks what type of transport someone would actually use if it would be available. For people that answer this question with “This is my preferred type of transport” there should be no change in behavior if more types of transport became available, because they already use their preferred type of transport, which then obviously is already available. For those people you therefore can skip the next question. For everybody else this question is really important)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ This is the best available option</td>
<td>□ This is the best available option</td>
</tr>
<tr>
<td>□ This is my preferred type of transport*</td>
<td>□ This is my preferred type of transport*</td>
</tr>
</tbody>
</table>

*Continue to question 3.A.8

3.A.7 Which type of transport would you use if it would be available? (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Walking</td>
<td>□ Walking</td>
</tr>
<tr>
<td>□ Pickup truck</td>
<td>□ Pickup truck</td>
</tr>
<tr>
<td>□ Bus</td>
<td>□ Bus</td>
</tr>
<tr>
<td>□ Taxi</td>
<td>□ Taxi</td>
</tr>
<tr>
<td>□ Private car</td>
<td>□ Private car</td>
</tr>
<tr>
<td>□ Other: ...</td>
<td>□ Other: ...</td>
</tr>
</tbody>
</table>
3.A.8 Why do you prefer this type of transportation? You can mark multiple options. (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Comfort</td>
<td>☐ Comfort</td>
</tr>
<tr>
<td>☐ Reliability</td>
<td>☐ Reliability</td>
</tr>
<tr>
<td>☐ Speed</td>
<td>☐ Speed</td>
</tr>
<tr>
<td>☐ Safety</td>
<td>☐ Safety</td>
</tr>
<tr>
<td>☐ Price</td>
<td>☐ Price</td>
</tr>
<tr>
<td>☐ Ability to transport goods</td>
<td>☐ Ability to transport goods</td>
</tr>
<tr>
<td>☐ Other: ...</td>
<td>☐ Other: ...</td>
</tr>
</tbody>
</table>

3.A.9 Would you be willing to change the time or day at which you travel outside Kgautswane, if you would know that transport could be arranged at a time/day different from the time/day at which you originally planned to travel? (Question 3.A.3 and 3.A.4 referred to the same information we would like to gather here, namely information on how flexible a respondent is in changing his or her time/day of travel. Those questions were “open” and gave room for long answers, within this question we want to make these answers more clear by using a closed type of question. Within the first option you should fill in the number indicated at question 3.A.1 for “the previously indicated times a month”.)

☐ Yes, I just need to go outside Kgautswane the previously indicated times a month
☐ Yes, as long as my travel date falls within a week of my original planning
☐ Yes, I can change the time at which I travel, but I do need to travel on the same day
☐ No, I need to travel on my originally planned time and date

3.A.10 Are you able to plan your trip outside Kgautswane some time in advance? (With this question we would like to see, to what extent people can plan their trip ahead, because that will change the time Ishmael and Simon have to group the demand for transport and arrange transport.)

☐ Yes, I know I will need to make this trip already one month ahead
☐ Yes, I know I will need to make this trip already one week ahead
☐ Yes, I know I will need to make this trip at least one day ahead
☐ No, I do not know in advance whether I will need to travel outside of Kgautswane

3.A.11 Do you know of more people that have similar transport needs with regard to preferred type of transport, destination and time and date of transport? (The reason for this question again is the ease with which Ishmael and Simon will be able to group people; if people indicate that a lot of people in their vicinity have similar transport needs, it will be more likely that the service will be able to arrange transport.)

☐ No
☐ Yes, 1 to 5
☐ Yes, 5 to 10
☐ Yes, more than 10
### 3.B Travelling within Kgautswane

(These questions are similar to the questions in section A, the questions in this section focus on transport within Kgautswane however, if questions are unclear, please check the explanation of the questions in section A again)

#### 3.B.1 How many times do you normally travel within Kgautswane within one month? This question refers to trips of a reasonable distance, which would take more than 30 minutes by foot. Indicate the number of return trips.

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<tbody>
<tr>
<td>1</td>
<td>2 to 5</td>
<td>5 to 10</td>
<td>10 or more</td>
</tr>
</tbody>
</table>

#### 3.B.2 What is your destination when you travel within Kgautswane? You can mark multiple options.

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<th></th>
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</thead>
<tbody>
<tr>
<td>MPCC</td>
<td>Clinic</td>
<td>Church</td>
<td>Spazashop</td>
</tr>
<tr>
<td>Other: ...</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3.B.3 Do you travel within Kgautswane during a specific time of the day or on a specific day in the week or month? And if so, when and why? Please specify for different destinations

#### 3.B.4 How do you normally travel within Kgautswane? Please only mark the type of transport you normally use. Indicate the cost of this type of transport at the bottom of this question. (Please answer this question for both the trip TO your destination as for the trip FROM your destination back home.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>Walking</td>
</tr>
<tr>
<td>Pickup truck</td>
<td>Pickup truck</td>
</tr>
<tr>
<td>Bus</td>
<td>Bus</td>
</tr>
<tr>
<td>Taxi</td>
<td>Taxi</td>
</tr>
<tr>
<td>Private car</td>
<td>Private car</td>
</tr>
<tr>
<td>Other: ...</td>
<td>Other: ...</td>
</tr>
<tr>
<td>Cost: ...</td>
<td>Cost: ...</td>
</tr>
</tbody>
</table>

#### 3.B.5 Is the type of transport you indicated in the previous question, the type of transport you prefer or is it the best available option? (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is the best available option</td>
<td>This is the best available option</td>
</tr>
<tr>
<td>This is my preferred type of transport*</td>
<td>This is my preferred type of transport*</td>
</tr>
</tbody>
</table>

*Continue to question 3.B.7
3.B.6 Which type of transport would you use if it would be available? (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>Walking</td>
</tr>
<tr>
<td>Pickup truck</td>
<td>Pickup truck</td>
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<tr>
<td>Bus</td>
<td>Bus</td>
</tr>
<tr>
<td>Taxi</td>
<td>Taxi</td>
</tr>
<tr>
<td>Private car</td>
<td>Private car</td>
</tr>
<tr>
<td>Other: ...</td>
<td>Other: ...</td>
</tr>
</tbody>
</table>

3.B.7 Why do you prefer this type of transportation? You can mark multiple options. (Please answer this question for both the trip TO your destination as for the trip FROM your destination back to Kgautswane.)

<table>
<thead>
<tr>
<th>From Kgautswane to your destination</th>
<th>From your destination back to Kgautswane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfort</td>
<td>Comfort</td>
</tr>
<tr>
<td>Reliability</td>
<td>Reliability</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed</td>
</tr>
<tr>
<td>Safety</td>
<td>Safety</td>
</tr>
<tr>
<td>Price</td>
<td>Price</td>
</tr>
<tr>
<td>Ability to transport goods</td>
<td>Ability to transport goods</td>
</tr>
<tr>
<td>Other: ...</td>
<td>Other: ...</td>
</tr>
</tbody>
</table>

3.B.8 Would you be willing to change the time or day at which you travel within Kgautswane, if you would know that transport could be arranged at a time/day different from the time/day at which you originally planned to travel?

- Yes, I just need to travel within Kgautswane the previously indicated times a month
- Yes, as long as my travel date falls within a week of my original planning
- Yes, I can change the time at which I travel, but I do need to travel on the same day
- No, I need to travel on my originally planned time and date

3.B.9 Are you able to plan your trip within Kgautswane some time in advance?

- Yes, I know I will need to make this trip already one month ahead
- Yes, I know I will need to make this trip already one week ahead
- Yes, I know I will need to make this trip at least one day ahead
- No, I do not know in advance whether I will need to travel within Kgautswane

3.B.10 Do you know of more people that have similar transport needs with regard to preferred type of transport, destination and time and date of transport?

- No
- Yes, 1 to 5
- Yes, 5 to 10
- Yes, more than 10
4. Changing travel behavior

4.1 What do you do if your preferred type of transport is unavailable at the time you planned to travel? (It is important for us to know to what extent transport demand can possibly change if transport would be more available. Within this question we therefore are looking for how people cannot fulfil their actual transport needs and change their travel behavior. The results from this question could indicate whether there is a lot more need for transport than appears to be the case. To guide the respondent towards understanding what we are actually looking for, give examples within which you use the options that are given below; for instance: Does it occur that you urgently need to go to the clinic, but wait for the next day, because there is no taxi available during the day?)

☐ Go somewhere else (closer to home, a destination where I CAN go)
☐ Go at another time
☐ Change type of transport
☐ Stay at home

4.2 Do you sometimes use a pickup truck for transport, because a taxi is not available, while you actually would prefer to travel with a taxi? (This question is actually quite similar to the previous one, but is more specific focussed on one type of change in travel behavior. We specifically ask this question to make precisely clear whether the respondent prefers a taxi or a pickup truck, when both types of transport are available.)

☐ Yes
☐ No

5. Transport on demand

As said previously the Council for Scientific and Industrial Research (CSIR) Pretoria and Smite IT Infopreneurs Kgautswane are jointly exploring the opportunities for an improvement of the transport service level in Kgautswane.

We are currently thinking of an information system that would be used by Smite IT Infopreneurs to register people that need transport. If someone would be in need of transport, they would try and group this person with other people that have similar transport needs. As soon as they have grouped enough people to make the trip financially viable, they will arrange transport for you to go to your destination. In this way, they can either arrange transport for you or a group of people.

5.1 Would you make more use of the taxi, if it would be made available when you want it through such a system? (Within this question it is very important to decide for yourself whether these answers are in line with the previous answer given by the respondent. If that is not the case, he or she might not have understood the service concept. Otherwise we are really interested in the actual reason for this answer. So ask further if someone for instance answered yes to the previous question and no to this question. If the answer remains to be no, please specify why not.)

☐ Yes
☐ No, why not...
5.2 Would you be willing to pay upfront for such a service? (This question has previously raised the issue of how paying upfront should be arranged; if this happens, just answer that it is irrelevant at this stage, but try and figure out what the concerns of the respondent are. Try to pick up whether the respondent might be able to provide us with some suggestions.)

☐ Yes  ☐ No, why not? ...

5.3 Would you be willing to pay upfront for such a service, if Smite IT Infopreneurs would keep hold of the money until you actually travelled to your destination. Then they would pay the transport supplier with your money as soon as they provided you with transport, as to make sure that the transport suppliers will actually transport you. (Some respondents indicated within the first questionnaire that they will only pay on delivery. Because this is probably a trust issue, we thought of using a middleman, as described above. If the question is unclear, you should try and further explain and make more clear that Smite IT Infopreneurs would pay the money back to him or her if no transport would be arranged. They would only pay the taxi driver, if they actually transported him or her.)

☐ Yes  ☐ No, why not? ...

5.4 Would you be willing to pay more for transport on demand as would be provided by the above mentioned service? (The reason for us asking this question is the fact that a taxi driver will only be willing to drive to a certain area if he knows that trip will earn him money. If someone would be willing to pay more than normal, a trip would earn a taxi driver money more easily. That might mean that a taxi does not necessarily have to be filled up before a taxi driver can be convinced to drive somewhere. This will make it easier for Smite IT Infopreneurs to arrange transport and will raise the chance that someone can receive transport within a short amount of time.)

☐ Yes  ☐ No, why not? ...

5.5 Does it regularly occur that you have money to pay for transport, but you have to walk because there is no transport available? (This question is similar to question 4.2; it also refers to a change in travel behavior, but this question focuses specific on whether people that want to use a taxi, walk instead of using a taxi, because a taxi is not available.)

☐ Yes  ☐ No

5.6 Can you give an indication of the amount of money you probably would have spent on transport within the last month if it would always have been available? Opposite to the current situation in which you might have money for transport while it is not available. (This question is the counterpart of question 1.5, for further explanation therefore please read the comments placed at question 1.5)
6. Communication

For you to make a transport request at Smite IT Infopreneurs we are thinking of using a mobile phone. Therefore we have some last questions on your mobile phone usage.

6.1 Do you have a mobile phone? (If someone answers no, continue to the next question; if someone indicates he or she has a mobile phone, you can skip the next question.)

- Yes*
- No

*Continue to question 6.3

6.2 Is there someone close to you who has a mobile phone that you can use? (If someone answers no, he or she cannot communicate through a cell phone. You can therefore skip the following four questions and continue to question 6.7. Question 6.7 is meant as a way of thinking of possible other opportunities to communicate within this environment. The options that are given there are simply to trigger someone’s thoughts on the issue.)

- Yes
- No*

*Continue to question 6.7

6.3 Do you have mobile phone coverage (signal) where you live? (If someone answers no, continue to the next question where he or she needs to answer how far from home he or she can get a good signal: if someone indicates he or she has a good signal where he or she lives, you can obviously skip the next question.)

- Yes*
- No

*Continue to question 6.5

6.4 How far from your home are you able to get good mobile phone coverage (signal)?

6.5 How much do you normally spend on airtime within one month? (Here you could also ask within the last month.)

- 
- 

6.6 Do you use SMS?

- Yes
- No, why not? ...
6.7 What other ways of contacting Smite IT Infopreneurs would you be willing to use to arrange transport? *(This question is meant as a way of thinking of possible other opportunities to communicate within this environment. The different options are simply some suggestions. If people think of their own ways of communicating, please fill this in on the dotted line behind "other").*

- None
- Walking to the MPCC and telling them personally
- Asking someone that is going to the MPCC to tell them personally
- Other: ...

Thanks for your time and cooperation.
E  Maps

E.1  Kgautswane – overview
E.2 Kgautswane – detail
E.3 Kgautswane – schematic
E.4 Kgautswane – service line
F  Use cases
For each of the processes involved in arranging transport for the people of Kgautswane a use case has been placed below. The activity that starts each process is indicated by a blue oval, the activity that does not trigger another activity is marked by a red oval. Out of all processes involved in arranging transport, an intermediary only is involved in the scheduling and finalizing of trips, all other processes have been automated to that extent that there is no direct interaction necessary between the transport users and the intermediary. Users requesting a trip only have to wait for the Infopreneur to determine and communicate their specific trip details, users joining a trip can independently book a seat on any trip that is still available and that suits their needs, without any interference of the intermediary.

F.1  Requesting a trip
### F.2 Joining a trip

![Diagram of joining a trip process]

1. Transport user
   - 3.1 Call *109*<b>><b>1515746</b> (Join a trip)
   - 3.3 Specify transport need
   - 3.7 Make transport booking for selected trip

2. USSD menu server
   - 3.2 Send menu back to transport user
   - 3.4 Receive list of trips filling indicated transport need from database
   - 3.6 Send list of trips filling indicated transport need back to menu server
   - 3.8 Send transport booking to database

3. Database
   - 3.5 Send list of trips filling indicated transport need back to menu server
   - 3.8.1 Send message indicating code or details to menu
   - 3.8.2 Send the trip details via SMS
   - 3.8.3 Send the trip details via SMS

- 3.8.4 Send the trip details via SMS

- 3.8.5 Send the trip details via SMS

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- 3.8.99 Send the trip details via SMS

- 3.8.100 Send the trip details via SMS
F.3 Finding a trip

F.4 Scheduling trips
F.5 Finalizing trips

F.6 Making trips
G    USSD menu structure
An overview of the USSD menu structure is shown below. On the following pages this overview has been split into four views on a bigger scale, TL (Top – Left), TR (Top – Right), BL (Bottom – Left) and BR (Bottom – Right). The text and number marked in red are dynamic and will in reality be based on provided inputs from the user and the database.

G.1 Overview
Sustainable impact in developing rural areas through business creation

G.2 Top – Left
Sustainable impact in developing rural areas through business creation

G.3 Top - Right
Sustainable impact in developing rural areas through business creation

G.5 Bottom – Right
Sustainable impact in developing rural areas through business creation

H Evaluation KTL research project – Simon Motumi & Ishmael Adams

Date: 16-12-2008

Background
Kgautswane is a remote rural area with about 2425 electrified households with six people on average. In total around 100,000 people live in Kgautswane. The area only has one clinic, nine primary schools, 7 secondary schools and many formal and informal retail businesses. Kgautswane is situated 58km from Burgersfort, 17km from Ohrigstad, 65km from Lydenburg, in the South East of the Limpopo province on the R36. The people in Kgautswane depend on manual labor to survive and most of the people with a job work in either Burgersfort, Ohrigstad or Lydenburg, some people even work in Johannesburg.

Forms of available transport

- Walking – for short and long distances
- Taxis – local and town
- Bus (Great North Bus services) – local and town
- Pickup trucks – luggage and people to and from town

Road infrastructure
The roads in Kgautswane are entirely gravel and are not well looked after. The main road is about 54km long and runs from the R36 to the Penge road. The road is bad and it is the reason Kgautswane does not get serviced during the day.

Travel behavior
The people of Kgautswane do a lot of travelling both within and outside Kgautswane. Most frequent travels are to churches, social visits, shopping, funerals, schools, work, doctor/hospital visits, etc. People in Kgautswane mostly walk to their destinations because there is no transport supply available. People sometimes change their trips because of a lack of transport. Some villages in Kgautswane do not get serviced by neither the bus or the taxi and the people in these villages solely depend on pickup trucks when walking is not an option. The transport supply is unreliable and almost non-existent in the off peak hours (between 08:30 and 16:30) This is the period where most people would prefer to have some form of transport.
Sustainable impact in developing rural areas through business creation

Chapter: Appendices

The taxi industry
There are 14 taxis in Kgautswane, which is a small number as compared to the population of the area. Out of these 14 taxis nearly half is not in a good condition and are not well suited to be used to transport people. Taxis sometimes break down resulting in the industry to be unreliable. The taxi industry in Kgautswane has a great potential because there is a huge market to service. Due to the road’s undesirable condition many taxi owners are servicing areas that have better roads. This has left a huge gap in meeting the transport needs of Kgautswane.

The CSIR (Martin) & Smite (IT) Infopreneurs on transport needs vs. supply
The Council for Scientific and Industrial Research and Smite (IT) Infopreneurs of Kgautswane conducted a research through Martin Marijnissen concerning the transport demand and supply. What we found out was disturbing from both the users’ and the suppliers’ point of view. The taxi industry turned out to be unreliable since there is no communication between operators and transport users. The lack of communication results in uncertainty of when users need transport, taxis therefore come into the area on an irregular basis, herewith being unreliable. A meeting was held with the taxi association and a focus group was established in order to identify possible solutions to this problem. The focus group was named Kgautswane Transport Logistics, which is to work hand in glove with Smite (IT) Infopreneurs. From the findings, a system that would best suit both transport suppliers and transport users was designed. An USSD system has been developed in order to support grouping transport requests and to enable the taxi association to make financially viable trips, both within and outside Kgautswane. Many people that were interviewed later proved to be positive that the system will help in solving their transport nightmares. All people interviewed indicated a willingness to use the system in the future and could not wait for the roll-out phase.

The research on transport
The research was conducted house to house through local research assistants. The findings were that, out of 68 questionnaires issued, 65 want to use a taxi and the transport request system and only 3 were not certain what to use.

Current situation of the research
Currently we are about to do the test phase of the USSD system and we are trying to get people willing to test the system and helping them to book a seat on a trip on Friday. The USSD system is working well and we also showed the assistant researchers how it works. Everybody is positive apart from the fact that no one was willing to book a seat for the trip for Thursday and we therefore had to change the data of the trip to Friday.

Finding people willing to use the system is proving to be hard considering the time of the year (December). In December there is a lot of activity and transport business is already making maximum profits. Suddenly the taxis are available because the risks of servicing Kgautswane are low and profits are high. We now are faced with a situation where we have to try really hard to deal with the lack of long term vision by the taxi association and to ensure sustainability and reliability of both service and
demand even during the off-season (mid-January to mid-November excluding end of the months and the Easter weekend). With the system fully functional and properly run – more supply of transport will be realized and more demand will ensure profits.

My hope is that the test phase should prove successful even during this time of plenty as this will totally guarantee what we believe and foresee for the future – a coexistence/win-win situation between the user and the supplier through technology.

Way forward and suggestions

• We need to continue with the service implementation with the people who started this project and involve those who share the same vision along the way. When the system proves to be successful we can possibly also involve local towns and villages which are not yet being visited.
• We need to organize information sessions with the transport users at the MPCC in order to explain the USSD interface.
• We need to have additional sessions with the transport suppliers to emphasize the necessity of the use of this service.
• We need to realize technology supplier affiliation processes in order to ensure the sustainability of the technological aspects of the service.
• The department of transport needs to be involved locally, at district level, at a provincial and at National level to have them buy into the system. Local transport management needs to become an issue on the political agenda.
• Taxi owners who do not have road worthy vehicles need to be assisted with business plans that will enable them to acquire funds for new vehicles. Alternatively we could make vehicles available to them in order to ensure that they keep to road standards & requirements, while maintaining to use the system.
• We should retest the system in January and February 2009 when there will be a relative quiet after the Christmas season to gauge the level of response as compared to this time of the year.
• In concluding – I personally would not think of a more better and viable system that would ease the frustrations of the many people, whether in rural Kgautswane arid or semi-arid region, town or city anywhere in SA, be it in transport or ordering that can beat this one. This is going to prove BIG if properly done & maintained. We need to keep encouraging both users and suppliers to look closely into this and make funds available to grow and research even deeper and closer.
• Lastly: Let’s keep the existing relation between Smite (IT) Infopreneurs and the CSIR and improve upon it. We would like for Martin Marijnissen to continue (if possible) with us on this in Kgautswane as everyone has grown used to him and he shares the same vision on this and other issues, with us in Kgautswane.
I Test questionnaire – Transport users

Introduction

The Council for Scientific and Industrial Research (CSIR) Pretoria and Smite IT Infopreneurs Kgautswane are jointly exploring the opportunities for an improvement of the transport service level in Kgautswane.

Several weeks ago we did a questionnaire in Kgautswane. From the answers to the questions we asked within this questionnaire we could conclude that for a lot of people transport during the day is a problem. Very few people have a private car available, everyone else therefore is either dependent on transport services provided by the public bus company, local pickup truck owners and taxis or they need to walk to their destination, which can take up to several hours.

During the day the bus does not service Kgautswane and taxis and pickup trucks are only very limited available. A lot of people indicated that they would prefer to travel by taxi, but often choose to walk or travel by pickup truck, because the availability of taxis simply is too uncertain.

The Ohrigstad Long and Local Distance Taxi Association (OLLDTA) and Smite IT Infopreneurs Kgautswane formed the Kgautswane Transport Logistics group. Together they want to offer a service that enables people to request transport using their mobile phone. Based on the requests that have been made Smite IT Infopreneurs will than schedule a trip to be carried out by the OLLDTA and would inform the transport users that asked for transport when they will be picked up to be transported to the destination they indicated. This would make taxis more available and more reliable.

This is the system we are currently testing. For upcoming Thursday we arranged for a taxi to drive through Kgautswane in the morning and in the afternoon to transport people locally and to transport people to Burgersfort and Ohrigstad. If you want, you can book a seat on one of these trips using your mobile phone. If you want to make use of this service I will help you to book a seat on this trip.

If we try to book a seat on this trip, we will not be able to guarantee that there is still a seat available. The system will indicate which trips are scheduled to service Kgautswane and how many seats are still available, this might be zero. If we can book a seat on one of the trips you need to be aware that this service will only make sure that you will actually get transport, you will still need to pay for the actual transport.

NOTE: The information you provide is strictly confidential, will not be made available to any third party and will not be used for any other purpose than this research.

For questions please call Martin Marijnissen (telephone nr. : 0765918857)
1. Personal details

1.1 Personal details

| Age: ... | Gender: | □ Male | □ Female |

1.2 Location

- □ Paeng
- □ Sefateng
- □ Lebalelo
- □ Ga Kgoedi
- □ Ga molai
- □ Masakeng
- □ Mokutung
- □ Makgongwane
- □ Matshiresane
- □ Maribaneng
- □ Padishanong
- □ Moshate
- □ Mogoleng
- □ Makgwareng
- □ Makgopa
- □ Kgolopong
- □ Mahlashi
- □ Mufarafara
- □ Hlapetsa
- □ Other: ...

2. Transport need

We will need to use your mobile phone to try to book a seat on one of the trips I mentioned before. Before we will actually try to book one or more seats on one of these trips using your mobile phone, we will first discuss what the process of booking a seat looks like.

2.1 From where do you want transport?

- □ Paeng
- □ Sefateng
- □ Ga Kgoedi
- □ Masakeng
- □ Ga molai
- □ Makgongwane
- □ Maribaneng
- □ Moshate
- □ Makgwareng

2.2 Where do you want to go?

- □ Paeng
- □ Sefateng
- □ Ga Kgoedi
- □ Masakeng
- □ Ga molai
- □ Makgongwane
- □ Maribaneng
- □ Moshate
- □ Makgwareng
- □ Ohrigstad
- □ Burgersfort

2.3.a Which trip did the respondent prefer?

- □ Morning (timeslot 8am – 12pm)
- □ Afternoon (timeslot 12pm – 4pm)

2.3.b Which trips were available?

- □ Both
- □ Morning
- □ Afternoon
- □ None

2.3.c Which trip did the respondent choose?

- □ Morning
- □ Afternoon
- □ None

2.4.a How many seats did the respondent want to book?

...
2.4.b How many seats were available?

... 

2.4.c How many seats did the respondent book?

... 

2.5 What was the ID code that was sent via SMS? (Only answer if the respondent actually made a booking)

☐ ... ☐ No ID code received 

2. System usability

3.1 Did the respondent have enough airtime to use his or her mobile phone?

☐ Yes ☐ No 

3.2 Was the respondent willing to use his or her airtime to access the service?

☐ Yes ☐ No 

3.3 Was the respondent able to access the service with his or her mobile phone?

☐ Yes ☐ No 

3.4 Did the respondent have enough time to use the service? (or did the service time out?)

☐ Yes ☐ No 

3.5 Did the respondent need help while using the service?

☐ Yes, a lot ☐ Yes, a bit ☐ No 

3.6 When do you expect this respondent to be able to use the service on his/her own?

☐ The respondent already did not need my help
☐ Next time
☐ After five times
☐ Never 

4. User perception

4.1 Do you think this is a valuable service?

☐ Yes ☐ No
4.2 Do you think this service is easy to use?

- [ ] Yes
- [x] No

4.3 How do you think we can improve this service further?

[ ]
### Test questionnaire – Research assistants

The four research assistants responded to the different statements presented below. For each cell a number of dots is shown. Each of these dots represents one assistant’s opinion.

<table>
<thead>
<tr>
<th></th>
<th>Totally agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Totally disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The respondents felt uncertain about the background of the research assistants.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. The respondents did not need transport.</td>
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<tr>
<td>3. The respondents could not pay for transport.</td>
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<tr>
<td>4. The respondents were unwilling to plan their trip in advance.</td>
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<tr>
<td>5. The respondents had no need to book transport, because during this time of the year transport is frequently available.</td>
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<tr>
<td>6. The respondents did not expect the service provided through the system to be reliable.</td>
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<tr>
<td>7. The respondents were uncertain about their opportunity to get a return trip.</td>
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<tr>
<td>8. The respondents did not trust or were afraid to use the technology used in the system.</td>
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<tr>
<td>9. The respondents did not have a mobile phone.</td>
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<tr>
<td>10. The respondents wanted to transport goods and a pickup truck is better suited for this type of transport.</td>
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<tr>
<td>11. The respondents expected the trip to cost more than normal.</td>
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<tr>
<td>12. The respondents did not understand what the system would provide them with.</td>
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<tr>
<td>13. The respondents wanted transport at a time different from the time that could be provided through the system.</td>
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<tr>
<td>14. The respondents wanted transport to a different destination than could be provided through the system.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
K Booking process

We will need to use your mobile phone to try to book a seat on one of the trips I mentioned before. Before we will actually try to book one or more seats on one of these trips using your mobile phone, we will first discuss what the process of booking a seat looks like.

Step 0 – Get a transport booking ticket
This transport booking ticket will be made available as soon as the service is available to everyone in Kgautswane. This ticket helps you to make a transport request. This also is a ticket you need to hand over to the taxi driver when you actually get transport. This is not a way of payment, it is merely a way of proving you requested transport. The ID code that you need to write down on this ticket will be sent to you via SMS.

Step 1 – Dial *120*663*2749#
Once you dial this number, the menu shown below will open on your phone. It provides you with three options. With each of these three menu options we try to meet different transport needs in Kgautswane:

1. With the first option someone can request transport that will be arranged specifically for him or her. This can only be done for a minimum of five people however. It can also only be done at least one week in advance.
2. The second option is what we are testing today. It allows you to book a seat on an already scheduled trip; this is available for every amount of people up to 9 in total (per booking). This can be done at least one day in advance.
3. The third option allows you to get insight into when you can expect a taxi to come to your area during the day. As mentioned before, we will choose option 2 within this test.

Step 2 – Specify transport need
Using the menus shown on the next page you can indicate from where you want transport and where you want to go. Based on your transport needs the system will respond with indicating the number of trips that has been scheduled for that week that meets these needs. You can then view each of these trips, decide with which trip you would like to join and book seats for this trip. The last step within specifying your transport need is confirming your booking.
Step 3 – Receive SMS with ID code
Once you confirmed a trip, the system will send you an SMS with your specific trip details, this SMS will also contain you ID code.

Step 4 – Write ID code on transport booking ticket
Once you have received this SMS you will have to write the ID code on your transport booking ticket.

Step 5 – Give booking ticket to the taxi driver
This ticket with the ID code is your proof that you booked a seat on a specific trip. The taxi driver that makes that trip, will know he needs to pick up a person or group of people with a ticket with that specific ID code.
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L Evaluation Infopreneurs – Structured interview

System design
- Which types of transport demand can be serviced by this service?
- Which types of transport cannot be serviced by this service?
- Which type of system usage will probably be the most valuable to the people of Kgautswane?
- To what extent does our choice for timeslots, instead of offering people the option to request transport for specific times, make the system less attractive?
- To what extent do you think it is essential to offer return trips?
- Do you expect this system to be financially attractive to you?
- If not, will that become a problem for you on the long run?
- What is your opinion on the workload involved with operating this system?

Expectations
- Do you think the taxi association will stay/become enthusiastic about using the system?
- This service will need commitment from all stakeholders involved in delivering the service to overcome the period within which we will need to build trust and reliability toward the transport users. Do you expect all stakeholders to remain committed during this period?
- What can we do to make sure all relevant stakeholders will stay committed?
- Do you expect transport demand to become reliable over time?
- Do you expect people to start planning transport more in advance?
- Do you expect people to be willing to use the system?

Ownership
- Do you start other initiatives or develop additional ideas based on this project?
- How do you feel you contributed to this project?
- Could you give some examples that show you took ownership of the project?

Improvements
- Can you think of ways to improve this system or its implementation and marketing further?

A look into the future
- What should be the next step to make this project into a success?
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M Startup document – First problem description

Project: Geo-spatial logistics brokering services

Introduction

In rural contexts characterized by numerous small, spatially isolated actors and high transaction and transportation costs, there is a valid case for investing in the research, development and implementation of Information and Communication Technologies (ICT) and ICT-enabled services and support systems. A key challenge in deep rural environments such as those in South Africa is to overcome constraints such as high transport cost, irregular or unpredictable transport services, transport of low volumes when it comes to demand and supply volumes, limited local skills availability and isolation from or limitations from accessing the information society or knowledge networks. Using ICT and relevant systems holds potential to overcome the constraints mentioned. This could also improve the general accessibility of rural households and enterprises (e.g. to services, peers and markets).

The Council for Scientific and Industrial Research (CSIR) of South Africa has a need for the development and testing (application) of a web-enabled logistics brokering services toolkit with incorporated geo-spatial functionality. When developed, the toolkit can be used by service brokers to coordinate logistics service demand and supply (incorporating GIS maps) to plan service delivery and to determine when and where to send service providers, based on current activity or expressed needs. To assist the service brokers in carrying out their jobs effectively, the toolkit should enable them to establish the locations of customers and logistics service providers. The toolkit should provide functionality that enables the service broker to develop routes, collection points and calculate associated costs for journeys using GIS data.

Important among the requirements of the toolkit are that it should enable the user to:
- Locate transport users and organize services based on expressed needs or activity in a given area
- Provide services through a geo-portal
- Calculate routes, stops, durations, and associated costs using the spatial functionality
- Provide demand mapping and route planning services e.g. the location of collection points, determined through the use of GIS services
- Aggregate demand using spatial intelligence that can be used for transport planning purposes as well.

The toolkit must be web-enabled and provide users with access to GIS- and other supplemental framework data through access to geo-portal services. Furthermore, the toolkit must be well documented (explaining how it works) and be scalable to meet the changing user needs.

Aims and objectives
This work is based on the premise that service oriented computing and web services have emerged as promising technologies for effective assembly of services among heterogeneous applications. The aim is to provide service brokers with a web-enabled toolkit that supports the delivery of logistics brokering services using intelligence from GIS maps.

The specific aims of the project are:

- Perform requirements analysis to assess the applicability and functionality of the geo-spatial toolkits within rural context
- To develop a geo-spatial toolkit for the delivery of rural logistics brokering services
- To demonstrate and test the toolkit in real life settings (linking on to other projects that have already identified areas where such services can be applied)

**Research question**

The main question for this work is: “How can we develop a web-enabled geo-spatial toolkit for use to support the delivery of rural logistics brokering services?”

**Scope**

The work confines itself to the realization and testing of the toolkit, and a discussion of the results obtained while testing the toolkit in the rural environment. It is also important to understand the context and challenges of such areas, therefore the tests will be done in the context of the present service delivery environment in rural South Africa. The research project is limited to activities that are related to design, development, and demonstration and testing of the toolkit.

**Linkage with other initiatives**

There are currently other research projects investigating the use of ICT in rural contexts. These include:

- The Collaboration at Rural Project aims to improve rural collaboration with the focus on creating collaborative working environments. In essence, a large part of the project is investigating ICT related technologies and processes within the deep rural context. It is believed that logistics brokering, as proposed here, can also contribute to this initiative as well.
- The NyendaWeb - a foresight project to establish research platforms that will achieve optimal relevancy in transport and traffic engineering and management in 3 to 5 years’ time. The current research agenda has interim deliverables that will serve as building blocks for various technological platforms or applications.
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N  Documents Smite (IT) Infopreneurs

N.1  A Letter to the Chief

SMITE (IT) INFOPRENEURS

P.O Box 09
Ohrigstad
1122

Matshiresane
Kgautswane (Rieffontein)
Sekhukhune

Contact Persons: Ishmael Adams – 079 432 0491
Simon Motau – 079 108 0936

E-mail: smite01@gmail.com

The Chairperson
Of 1.DTA
Ohrigstad

Thobela Bahlomphegi

Re tsebisha ka la Bone la di 16, 10, 2008 re tlaba le baeng ka mo Centre. Baeng ba ke ba Pretoria (CSIR) lefapeng la Research and Technology.

Tahakgolo ke dinakyishiso go tsinaamelwa (transport) ka Kgautswane. Re leka go hwetsa tselo ya go kaonaatsatsa pharela ye go lola sesiaba sa Banareng.

Re lebeletse go thakgola dinakyishiso tse ka mokgwa o:

15. 10. 2008 – Baeng ba fihla (11H00)
16. 10. 2008 – Dipoledishano le boradikeki le di van (bakkie) bao ba berekelago Burgersfort le Ohrigstad.
17. 10. 2008 – Dipoledishano le maloko a setshaba sa Banareng go kwa dinakywa (needs & expectations) tsa bona ka tselo ya questionnaire.

Re kgopela bocnedi bo be ka tselo e:

✉ 1 x Taxis owner
✉ 2 x Drivers
✉ 1 x Marshal
✉ 1 x Ass. Chairperson

Re ka leboga tswetsoople ya tshomishano ya lena go taba tsı hlabologo Kgautswane bja’e ka ge gobile bjalo go tloja mathomong .

Re a leboga

Walena ka boikokobetso

Ishmael & Simon ba SMITE (IT) INFOPRENEURS.
Sustainable impact in developing rural areas through business creation

N.2  Workshop invitation – taxi association

SMITE (IT) INFOPRENEURS

P.O Box 99  
Ohrigstad  
1122  

Matshiretsane  
Kgautswane (Rietfontein)  
Seklukluune

Contact Persons  
Isimael Adams  079 632 0911  
Simon Motumi  079 108 0936  
E-mail: smiteit01@gmail.com

The Chairperson
OLLDTA
Ohrigstad

Thobela Bahlomphegi

Re tsebisha ka la Bone ia di 16. 10. 2008 re thaba le baeng ka mo Centre. Baeng ba ke ba Pretoria (CSIR) lelapeng la Research and Technology.

Tabakgolo ke dinyakishisho go tsa dinamelwa (transport) ka Kgautswane. Re leka go hwetsa tselo ya go kaonafatsa pharela ye go hola setshaba sa Banareng.

Re lebeletse go thakgola dinyakishisho tse ka mokgwao:

- 15. 10. 2008 – Baeng ba a fihla (14H00)
- 16. 10. 2008 – Dipoledisho le horaditekisi le di van (bakkie) buo ba berekelago Burgersfort le Ohrigstad.
- 17. 10. 2008 – Dipoledisho le maloko a setshaba sa Banareng go kwa dinyakwa (needs & expectations) tsa bona ka tselo ya questionnaire.

Re kgosela boemedi bo be ka tselo e:

- 1 x Taxi owner
- 2 x Drivers
- 1 x Marshal
- 1 x Ass. Chairperson

Re ka leboga tswesopo e ya ishunishane ya lena go taba tsa hlabologo Kgautswane bjale ka ge gobile bjalo go tloa mathomong.

Re a leboga

Walema ka boikokobetsa

Ishmael & Simon ba SMITE (IT) INFOPRENEURS.
Sustainable impact in developing rural areas through business creation

N.3 Workshop invitation – pickup truck drivers and owners

SMITE (IT) INFOPRENEURS

P.O Box 09
Ohrigstad
1122
Matshiresane
Kgaustswane (Rietfontein)
Seklukhuwe

Contact Persons: Ishmael Adams – 079 832 0491
Simon Motumi – 079 108 0936

E-mail: smiteit01@gmail.com

Bakkie Owner

Thobela Mohlomphegi

Re tsebisha ka la Bone la di 16. 10. 2008 re tlaba le baeng ka mo Centre. Baeng ba ke ba Pretoria (CSIR) lefapeng la Research and Technology.

Tahakgolo ke dinyakishisho go tsu dinamelwa (transport) ka Kgaustswane. Re leka go hwetsa tsela ya go kaonafatsa pharela ye: go hola seshaba sa Banareng.

Re lebeletse go thakgola dinyakishisho tse ka mokgwa o:

15. 10. 2008 – Baeng ba a fihla (14H00)
16. 10. 2008 – Dipoledishano le boraditekisi le di van (bakkie) bao ba berekelago Burgersfort le Ohrigstad.
17. 10. 2008 – Dipoledishano le maloko a seshaba sa Banareng go kwa dinyakwa (needs & expectations) tsa bona ka tsela ya questionnaire.

Re kgope ka gore lebe mo Center ka Labone (16. 10. 2008) go thoma ka iri ya bobedi thapama (14H00) go tlo tshuda ka Dipoledishano dinyakishishong (research) tse.

Re ka leboga tswe tsepole ya tshomishano ya lena go taha tsu hlabologo Kgaustswane hja’ie ku ge gobide bjulo go tlopa mahlumong .

Re a leboga

Walena ka boikokobetso

Ishmael & Simon ba SMITE (IT) INFOPRENEURS.
ASSISTANTS NEEDED

SMITE (IT) INFOPRENEURS (KGAUTSWANE) IS LOOKING FOR 6 (SIX) RESEARCH ASSISTANTS TO TRAIN IN CONDUCTING A RESEARCH IN KGAUTSWANE. THIS TRAINING IS PROVIDED BY THE CSIR (COUNCIL FOR SCIENTIFIC & INDUSTRIAL RESEARCH) - PRETORIA.

Research areas are as follows:

A. Mokatung
   Pseeng
   Hlopetsa
   Sefateng
   Lebalelo
   Ga-Kgoedi
   1 Representative

B. Ga Molai
   Masakeng
   Makggoengwane
   Matshiretsane
   Maribuneng
   Phadisanong
   2 Representatives

C. Mosbete
   Mogoleng
   Makgwareng
   Makgopa
   1 Representative

D. Kgaleleng
   Masiasha
   Mafarafara
   2 Representatives

Requirements:

- must be 18 years or older.
- Be able to read, write and speak English well.
- Be available for training when required

Training dates:

2. Tuesday 11/11/2008 - Practicals
3. Wednesday 12/11/2008 - Practicals

Closing date for confirmation is - 9/11/2008 @ 12h00

Enquiries: Simon Motumi @ 079 1080 936 or
            Ishmael Adams @ 079 432 0491

Nourishments will be provided for