The impact of hubs on the adoption of products among a South African Bottom of the Pyramid (BOP) network

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ABSTRACT

The original study on which this study was based on was conducted by Jacob Goldenberg, Sangman Han, Donald R.Lehmann, and Jae Weon Hong and published in 2009. In a slight contrast to Goldenberg *et al* (2009), this study was conducted among a bottom of the pyramid (BOP) network in South Africa using one non discretionary product whilst the original study was conducted on multiple high tech products in Korea

This study explores the role of hubs (people with an outstanding number of social ties) in diffusion and adoption of products. The study was conducted using data on a large network and its adoption of a product (electricity) to identify two types of hubs – innovative and follower hubs and their role in influencing adoption ala Goldenberg et al (2009). Even though hubs are not necessarily opinion leaders nor are they necessarily innovators (as described by Rogers, (1962)) they tend to adopt earlier in the diffusion process. Innovator hubs have a greater impact on speed of adoption whilst Follower hubs have greater impact on the size of the market or total number of adoptions. Interestingly and crucially this early adoption behaviour of hubs can be a useful predictor of future product success.

Among BOP network nodes, relationships and trust are important in determining the amount or degree of influence one can exert on a fellow network member. Homogeneity increases trust which in turn impacts the role of a hub as a force of influence. The centrality of hubs to networks is also a factor behind their role as information to the rest of the network passes through them, to a degree giving them control over the dissemination of information.

Keywords: social network, social hubs, influentials, diffusion of innovation, Bottom of the Pyramid, adoption

DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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1 CHAPTER 1: INTRODUCTION

1.1 Introduction

The objective of growing the business is one that is central to many companies. For organisations that do not necessarily want to grow, then maintaining and retaining of customers become the objective (Thomas, 2004). Kim and Lee (2010) assert that innovation of products by businesses happens globally, but not all innovation takes the same amount of time to diffuse into markets. Choi, Kim and Lee (2010) argue that sometimes diffusion of an innovation propagates throughout the whole population and other times it stops in its interim process.

This research conducted in Gauteng, South Africa, aims to establish and explore the role of network hubs in the adoption of products within the Bottom of the Pyramid (BOP) sector of the population. The academics referenced in this study (and more) have been critiqued for failing to distinguish between diffusion and adoption and, in some instances, using the two terms interchangeably (Antonelli, 2006 and Watts and Dodds, 2007). Due to this application of terminology, this study does not attempt to differentiate these terms. Even though the study makes reference to these studies, it focuses on the impact of these phenomena on adoption.

In a study that aims to understand diffusion in the business sector the concept is defined as “the process of delayed adoptions and imitations of a given innovation with fixed economic characteristics, including the performances and the price, which takes place because of the dynamics on the demand side in a population of heterogeneous markets” Antonelli (2006, p. 212).

Network marketing, diffusion and adoption are at the core of the problem or challenge of this study. According to Goldenberg et al. (2009), hubs play an integral role in the dissemination of information as they are at the heart of networks. The positioning of individuals in the network also has a bearing on their effectiveness as influencers and the centrality as described and defined by Kiss and Bichler (2008). Hubs are defined as individuals with many social ties and connections (Goldenberg et al, 2009). They are central to a network and function as a means of adoption, and have recently been the focus of academic attention for the role they play in their networks (Goldenberg et al, 2009). In this field of growing interest, the current study explores the possible role of hubs in the BOP context.

1.2 Research Motivation and Relevance to South Africa

Marketers are concerned with, among other things, the growth of markets and therefore the growth of their own brands. Goldenberg et al. (2009) argue that growth processes are important to marketing in general and new product adoption in particular, in which diffusion of innovation is governed by other things. It would then be prudent for marketers to attempt to understand as many of those 'other things' that control adoption. Knowing the way in which the diffusion of products takes place within a social system helps marketers to better understand the behaviour of the members who make up that system (Martinez, Polo and Flavian, 1998). In agreement with Goldenberg et al. (2009), Martinez (1998) further assert that diffusion happens at different speeds in different consumer markets, and the speed depends on not only the characteristics of the product itself but also on the peculiarities of the market at whom they are targeted. This assertion raises interest for South Africa as the country is renowned for its diverse population.

The diversity of South Africa introduces unique challenges and opportunities for marketers. It is therefore essential for any new adoption process, as proposed by the hub theory, to be validated across markets and circumstances; hence the need for the current study which seeks to test hubs in a particular market and with a certain segment – the BOP

It is therefore worth considering that present day South African society was previously deliberately engineered to be different by a governing system that forced people to live with, and among, people that shared cultural identity. Financial disparities between sectors of the South African society were also exaggerated by the socio-economic and political systems and those disparities still exist to date. The implication was that even within the same culture, people have different sub-cultural behaviours and nuances. For instance, a Zulu teenager growing up in Umlazi, KwaZulu Natal, will have different social preferences and behaviours (taste culture) to a Zulu speaking person of the same age and gender from Soweto in Gauteng BMR (2009). The challenge for the South African marketer in 2010 is that although income may be regarded as the determinant of class, markets differ on more dimensions than just that of income. Chipp and Corder (in review) argue that the same is true for the BOP population.

Globally, Prahalad (2010) states that there are 4 billion people in the BOP and, based on the size of that market; these people cannot be a monolith. He purports that they represent extreme variety in their levels of literacy, rural–urban mix, income, and cultural and religious differences, as well as on other levels of segmentation. Based on Prahalad's (2010) insight, the BOP profile is representative of the global picture. There will be differences in these people based on location, culture, society and other socio-economic factors (BMR, 2009). These theories highlight the impact of geographic location on the profiles and behaviour of people in BOP markets.

This study is rooted in three areas: Hubs, networks and product adoption, and how recent conceptualisations of these operate with BOP consumers. The observation by Truong, Kitchen & McColl (2009) that what was traditionally accepted as superior goods in the top-end markets is filtering into lower-end markets becomes important as it highlights a shift in the acceptance and adoption of products across markets. The question is then: How do these people or markets view these goods? As stated before, the way in which they view the goods impacts the way in which they behave with respect to the adoption of these goods. This democratisation of luxury is indicative of the changing landscape in which marketers need to operate globally. It is an indication not only of shifts in markets but it also forces a change in the way in which marketers should view their roles in the introduction of products into markets. The question that arises is*: Is it possible that this is purely a marketing-driven phenomenon*? Some academics argue that this cannot be the case as information is important to the diffusion and adoption process (Antonelli, 2006). The role of information becomes a prominent feature of this study as hubs are recognised and defined as strong channels of information because of their wide and large social networks; they are consequently exposed to new information quicker than other members of the network (Goldenberg et al, 2009*).*

1.3 Research Problem, Objectives and Scope

The objectives of the study are to investigate the role of hubs in a network in the adoption or lack thereof of products among BOP consumers. The research problem is centred on growing the understanding of the role of hubs across different contexts. In doing so, it should shed greater light on consumers at the bottom of the economic pyramid. It has been argued by Prahalad (2010) that business does not really understand this sector and there is a general belief that it is not a profitable market to pursue.

This research is limited in scope to only include and address aspects of product adoption of the BOP market and the possible role played by hubs in influencing this adoption.

1.4 Assumptions of the Study

The assumptions of this study are similar but not the same to those made by Iyengar (2010) and Van den Bulte and Valente (2010). The assumptions are:

1. These hubs will be identifiable for the study to be complete.
2. The influence of hubs is at work among customers and that influence will be recognisable/identifiable and/or measurable.

Other assumptions of the study are that (not related to Van den Bulte and Valente, 2010):

3. The definition of BOP as will be applied in this study coincides with the markets identified. This is because there could be some overlaps between socio-economic groupings and it could be a challenge to have a clear-cut definition of this market.
4. Secondary data that can be interpreted already exist on the relevant sector for this study and that are related or relevant to product adoption. Unit of Study Based Assumptions

- There are other factors that may influence the adoption of a product and, although this study does not aim to investigate these, it is assumed that the respondents will be able to exclude factors such as elasticity, price and the importance of the product when giving their perspective on the influence exerted on others.

2 CHAPTER 2: THEORY AND LITERATURE REVIEW

2.1 Introduction

The base of the research is hubs and influencers, product acceptance and adoption and BOP consumer behaviour. Society and consumer behaviour also play an important role in this study. The theory will clarify some of the factors that influence and impact brand or product acceptance and adoption. To clearly understand the construct, the different components that comprise it will be defined and explored. The theory will therefore explore product adoption and hubs and their role in society. The population is BOP consumers and, using existing literature, this population will be defined and explored to understand the relationship or lack thereof between these components of the construct.

2.2 Consumer Behaviour

It has been contended that “marketers should consider the nature of consumer environments when designing product names, packages, and advertising campaigns” (Berger & Fitzsimons, 2008, p.12).This is because environmental cues influence consumption behaviour, they argue. Social influence on consumer behaviour is also said to be effective even when it is non-interactive (Argo, Dahl and Manchanda (2005). Argo, Dahl and Manchanda (2005) argue that the mere presence of a social force around a consumer influences consumer behaviour. Argo et al. (2005) highlight that social impact theory, which attempts to define and understand the role of social forces in a network, is based on three principles that define its functionality and these are:

1. Size, proximity and source of strength of the force. That is to determine, whether it is a high or low source of strength.

2. The relationship between the social forces "influence of a social presence is a multiplicative function of the forces with the greatest impact occurring when there are several people in close proximity and in high source strength" (Argo et al, 2005, p.207–208).
3. "A social presence influence is an inverse function of the number of targets, proximity and source strength: the impact of the social forces will be divided between the targets" (Argo et al, 2005, p.207–208).

These three pillars of social impact as highlighted by Argo et al. (2005) are reflective of many variables that characterise network environments as discussed later in the study. Many townships, rural dwellings and most recently informal settlements where BOP individuals are likely to be found in numbers are often characterised by being large with strong social variables that have a significant impact on their community. Consumer behaviour cannot, however, be attributed only to influential leaders, individuals or groups that people come into contact with. Berger and Fitzsimons (2008) argue that the prevalence of perceptually and conceptually related stimuli can shape real-world judgment and decision-making.

This finding asserts the argument that people are not solely responsible for the decisions made by others. Part of the conclusion of their study is that environmental cues influence consumer behaviour and that "marketers will be more effective to the extent that they link their product to prevalent environmental cues" (Berger and Fitzsimons (2008, p.12).

This argument confirms the assertion that consumer behaviour is influenced by other factors. The question this argument brings to the fore, however, is: *To what extent do other human beings that one interacts with regularly (like networks and hubs) form part of one's environment and could therefore be considered environmental cues?*

2.3 Ubuntu: Implications and effects on relevance of study

Other aspects of human behaviour are around cultural nuances and practices. African cultures are communal in their behaviour and there tends to be more interdependence among community members than there is in Western and European cultures (Chipp and Corder (in review)). This interdependency becomes a strong ingredient and adhesive in the formation of communities. The behaviour of looking out for each other became the fabric of African culture. In South Africa it is known as Ubuntu or Botho, which mean humaneness. This culture, by and large, involves putting others before oneself. Venter (2004) argues that Ubuntu/Botho is a social ethic and unifying vision.

Table 1: Societing and Ubuntu

Model	***Transaction Based***	***Relationship Based***	***Societing***	***African? Ubuntu?***
Circa	1950 on	1975 on	2000	
Origin	US	Scandinavia	Mediterranean	Emerging markets
Focus	Structural	Process	Group/Cultural	Social responsibility
Strengths	Marketer's toolkit (4P etc)	B2B 121 marketing	Consumer group Connection driven	Multiple stakeholder Sustainable development/sustainable consumption
Role of Brands	Brand Management	Total Brand Experience	Brand Cults	Brands as part of community

Source: Chipp (2003)

From the table Chipp (2003) the characteristics/models of Ubuntu and its emerging markets origins (of which SA is one) as well as brands as part of community are two variables that are likely to be prominent in the SA BOP. What is interesting is the fact that Societing (with Mediterranean/Italian roots) is the one credited with being more connection driven. This, however, does not imply that the behaviour only exists in that culture. Those cultures although different to those of South Africa, would also have BOP consumers.

2.4 Adoption and Acceptance

Some academic writers on adoption appear to use the terms “adoption of product innovation” and “adoption of brands” interchangeably (Dunphy and Herbig, 1995; Szmigin and Foxall, 1998; and Antonelli, 2006) and others. Furthermore, some studies fail or neglect to draw the differences between customer acceptance and adoption (Dunphy and Herbig, 1995 and Martinez, Polo and Favian, 1998). This study will not be any different from an adoption point of view. The studies used in this section were used based on their relevance to the theory on adoption not on what was being adopted. This distinction therefore does not make a difference to this study as it focuses on the influence behind the decision and not necessarily the decision on whether to adopt or accept. The question is centred on the influencers of that decision. As already discussed, a number of writers do not distinguish between the different items to be adopted.

Dunphy and Herbig (1995) argue that for a product to succeed it must be relevant and have demonstrated value. Value in its nature is very subjective and there are a lot of factors that can influence one regarding something as of value to them. Based on the argument on value, products will not succeed, specifically; they will not get adopted and/or accepted if they do not promise some value to that consumer.

The question would then be: *What constitutes value?* Guzman and Paswan's (2009) quote purports that brands are socially constructed, thus making them a cultural phenomenon. They go on to cite McCracken (1986) arguing that a brand obtains its meanings (where value can be determined) through a three-step transfer process: from *cultural elements* in the *social world*, to *consumer goods*, to the *individual consumer* (Guzman and Paswan, 2009 p.73). The direct and immediate implication of Guzman and Paswan's (2009) theory for this study is that the products used in this research either have a cultural or social relationship with the selected BOP markets. At the very least the products should have some relevance or value to the individuals in a BOP network or be driven by a well-known brand. In that way these products and their adoption and acceptance may be considered of significance to the audience, making their adoption, acceptance or rejection a more conscious and weighted decision than if they were not. This, in turn, implies that the role played by hubs will be of more significance in this regard.

The implication of this to marketers could be that the social relevance of a product is considered and, where possible, engaged before it (the product) is applied to social networks as a product that is considered socially inept and invaluable may not succeed despite the social network forces behind it. The perceived value of the product, however, appears to be the basic core requirement (Dunphy and Herbig, 1995) and this does not seem to have changed over time. The argument was raised again years later that the value proposition of a product is based on the perceived benefits over the perception of cost. The authors assert that the widespread understanding in marketing that this value is based on the selection of the alternative that maximises value, that is; relationship between real benefit and costs is not as strong as the perception (Barki and Parente, 2010).

They further argue that what differs among low-income and upper-income consumers is the way they perceive the value proposition, that is, the relation between how benefits and costs are perceived. For example, in a study done in Brazil the reinforcement of dignity and personalised relationships is said to be more important among lower-income than upper-income consumers.

The implication of this theory is that the drivers of perception will be more powerful and influential than the reality. It is therefore important that marketers are aware of these influencers and influential factors and use them to their advantages where applicable. Relationships are a core feature of a network or community especially in the low-income sector (Barki and Parente, 2010), and it would then be to the marketer's advantage to identify the strong relationship contacts (groups or individuals) in the network or community. Huh and Kim (2008) argue that the theory of adoption is crucial to academics and marketers alike, and that buyers can be categorised into the following categories based on how quickly adoption takes place:

- Innovators
- Early adopters
- Early majority
- Late majority
- Laggards.

These categories are said to be useful as they can help marketers to target prospects for new products, develop penetration strategies for various adopter segments and predict the continued acceptance of a new product.

This theory by Huh and Kim (2008) stems from a study and a book written by Rogers (1962) on the adoption of innovation. Rogers (1962) argued that when trying to convince people to adopt a new idea, there is a chasm that divides the people one must concentrate on trying to convince and the rest. See appendix 2. These people or groups he argued make up the smallest percentage of the market and they are known as innovators and early adopters. These innovators and early adopters are of particular interest to this study as they represent the population from which the unit of analysis for this study resides.

Hubs (also known as people with multiple connections in a network) are likely to fall under the innovator and early adopter segments as they have many more ties and exposure in a network Goldenberg et al (2009). They are likely to be exposed to products before and more frequently than other nodes of the network. They are also most likely to have links or be accessible to other networks, which increases the probability of early exposure to products and innovations Goldenberg et al (2009*),* Goldenberg et al (2007), Van den Bulte and Wuyts (2007), and Kiss and Bichler (2008).

The strength of hubs lies in the networks and connections they posses. Their existence (by definition) depends on networks and how they function. Network marketing therefore becomes a factor when considering how products are accepted and diffused into a network. Relationship marketing or network marketing principles are at play in the manner in which hubs interact with their networks.

Ndubisi, Malhotra and Kok Wah (2009) argue that the relationship marketing concept is built on three unique but interrelated theoretical approaches, two of which are related to individuals and a third to organisations. The two theoretical approaches that impact individuals are:

- The behavioural approach which encompasses models related to relationship marketing, including constructs such as trust, commitment, satisfaction and customer retention (Ndubisi et al, 2009). A combination of these could influence adoption. If the source of the information is trusted then it follows that their opinion is likely to be held in higher than normal regard. Hubs could represent a level of trust in the network especially in instances where there are personal relationships.
- The network theory in contrast is reported to focus on the interactive character of relationships within a network (Ndubisi et al, 2009). Based on this theory, the influence of hubs within a network comes into effect. The nature of interaction within the network can therefore influence adoption.

The authors argue that the key constructs in the relationship marketing theory are trust, commitment of parties involved, competence and communication. In the context of this study, trust and communication will be key components of the role played by hubs in influencing product adoption or lack thereof.

Competence, they argue, is important in that people will nurture relationships with competent individuals. Information fits in with the theory on competence in that individuals with some level of competence will disseminate useful information. It is argued that competence gives the knowledgeable party the power to influence, (Ndubisi et al, 2009).

From the theory it is evident that network marketing is a dependent variable depending on variables such as trust, connections, relationships and product knowledge and information. Iyengar, Van den Bulte and Valente (2010) argue that network marketing is based on a number of assumptions, one of which is that some customers' adoptions and opinions have a disproportionate influence on others' adoptions. They further argue that this is likely to hold true when some customers have a much more central position in the network. Goldenberg et al. (2009) describe these individuals as hubs or when potential adopters look for advice from experts usually defined as opinion leaders (Iyengar et al, 2010).

These theories imply that being knowledgeable or occupying a central position in a network automatically gives one a disproportionate influencing power compared to other members of the network. Therefore based on the theory, hubs and opinion leaders will have an influence on adoption in a network. It is then evident why marketers need to understand the role of hubs in their markets and environments. Whilst understanding the role of hubs in influencing adoption, marketers would also want to understand what constitutes a successfully adopted product versus one that was not successful. The rate of adoption serves as a useful predictor of eventual product success according to (Goldenberg et al, 2009, p.1–4).

Innovators and marketers would be interested in such a study as they can then focus (in product development) their attention on getting high adoption in order to increase their products' chances of success. To illustrate the potential power of social influences, in his book, The Tipping Point, Malcolm Gladwell tells a story of a group of small town misfits that are credited with the revival of an old shoe brand that was on its way to 'extinction' (Gladwell, 2000).

When this behaviour replicates through a society, it can (as is the case in South Africa) become either a marketers 'gold mine or nightmare' depending on whether the marketer's goods and services are considered by the consumer. The replication of behaviour through society is recognised as a characteristic of Mediterranean/Italian societing, a theory that argues that these communities are group driven; a characteristic similar to Ubuntu (Chipp, 2003).

For behaviour to replicate through a society, information is required for that behaviour to spread. Antonelli (2006) insists that as soon as information on the advantages of the innovation is available, innovation will take place. Coulter, Feick and Price (2002) emphasise the importance of the flow of information in a network and that it is information that makes a network. It is, however, argued by Dunphy and Herbig (1995) that potential customers can be very late adopters, non-adopters or rejecters for a variety of reasons, one of which is isolation from information. It is further asserted that adopters do not necessarily seek information more actively than non-adopters (Dunphy and Herbig, 1995). The degree to which information is looked for seems to be the variable, whilst the search and dependence on information are the constants based on this observation. Networks are connected by an information thread. If hubs are at the centre of the networks, then dissemination of information becomes a major function of these individuals (Coulter, Feick and Price, 2002).

Huh and Kim (2008) in their analysis of the results of their study (which was based on high-tech products), found that adoption duration was positively related to the usage of the basic function of the product.

They also found that early adopters are not necessarily heavy users of the innovative functions of high-tech products, meaning that even early adopters still purchase products for basic use (Huh and Kim, 2008). This coincides with the definitions by Goldenberg et al (2009) about the characteristics of hubs. They argue that hubs do not necessarily have to be mavens or product experts, but are simply people with a number of ties. The logical implication then is: If hubs do not have to necessarily give expert advice and the product meets the basic usage needs of the consumer, the hub may simply have to pass information about the product on to effect adoption.

In a study to understand the adoption and acceptance of personal computers in American households, Venkatesh and Brown (2001) found that there were important differences between adopters and non-adopters. Adopters ware said to be influenced by different outcomes (utilitarian, hedonic and social) and non-adopters were reported to be influenced strongly by the fear of obsolescence (specifically in the technology sector). The study revealed (based on a longitudinal analysis) that non-intenders' behaviour was in line with their original decision, whereas some of the intenders followed up their original decision. The implication for this study is to understand what the decision was (if any) before hubs played a role. According to the study by Venkatesh and Brown (2001), initial intention is one of the variables at play when adoption or non-adoption decisions are made. The adoption of products should logically also be related to the relevance of the product to the target market.

This argument on relevance relates to the comments on social viability of the product and value of the product (Dunphy and Herbig, 1995 and Huh and Kim, 2008). Dunphy and Herbig (1995) argue that along with relevance, the product or service must have demonstrated value and meet specific needs in order to prosper. This is in agreement with Antonelli (2006) and Barki and Parente (2010) that the advantage (perceived value) to the potential adopter should be clear and adoption will happen. An important aspect of the theory to note is that this is perceived value and that perception can be generated and perpetuated through deliberate design and engineering by marketers. If this is left to the consumer, they will create their own perceptions that may not suit the desired positioning.

Just as buyers or potential buyers can be categorised into behavioural categories (Huh and Kim, 2008), adoption or rejection also follows a process. A deduction can be made from the two statements that the role of hubs as influencers is weakened if members of the network do not perceive or cannot be influenced to see the value of a product. The adoption process goes through awareness, interest, evaluation, trial and adoption (or rejection). This process, however, has limitations and Dunphy and Herbig (1995) argue that to overcome these limitations an innovation decision process was proposed: knowledge, persuasion, decision, implementation, confirmation. It has been argued in the theory that information is the common thread that holds networks together.

The innovation decision process does not counteract the role of hubs. Hubs can still play a role in espousing and/or popularising the value of the product to the network. Hubs may also assist in spreading other uses and value of the product. With respect to Dunphy and Herbig (1995), hubs would play the role of knowledge dissemination and persuasion in their respective networks.

In both the adoption and innovation decision processes, the role of hubs cannot be discounted in aiding the adoption of products.

The study also states that “poor dissemination of information is the major reason many marketers assume for non-adoption of the product” (Dunphy and Herbig, 1995, p.198). The importance of the information highlighted is in agreement with Coulter, Feick and Price (2002) who argue that this assumption usually makes marketers double their communication efforts without assessing the real cause of non-adoption. Adoption is also said to be affected by the rate of innovation and rate and variety of products at the consumer’s disposal (Cui, Bao and Chan, 2009). For some new products, consumers may delay the adoption, skip the new product or reject it after a trial. Due to the increased number of products, it is a logical conclusion that consumers would devise coping mechanisms to deal with the ‘onslaught’ of products and some of these coping strategies may include refusal, delay, extended decision-making and pre-test (Cui, Bao and Chan, 2009).

As argued by LeBoeuf and Simmons (2010), people’s attitudes towards a product influence the decision on adoption or rejection. Brands, however, can change attitudes towards the product. This argument further reinforces the importance of brands in the adoption process. From their study on the impact of environments on consumer behaviour, Dijksterhuis, Smith, Van Baaren and Wigboldus (2005) assert that attitudes were seen as conscious evaluations based on a considerable amount of weighting pros and cons of attitude objects. They further argue that the mere perception of an object, its associated attitude is automatically activated and “ready” to guide further behaviour (Dijksterhuis al, 2005).

The role of perception as argued by Dijksterhuis et al. (2005) is in accord with the arguments by Dunphy and Herbig (1995) and Huh and Kim (2008) that the perceived value and relevance of the product will impact adoption as they influence the decision made. It could then be argued that marketers should ensure that information about the product is effectively, efficiently and accurately disseminated in order to influence or inform the perception of consumers. Berg and Fitzsimons (2008) argue that when concepts are activated through direct exposure, they are known to affect judgement and decision-making.

Antonelli (2006) asserts that adoption like other consumption cannot be regarded as a passive attitude as it requires a number of preliminary activities such as search and selection before actual adoption takes place (Antonelli 2006, p.211). This notion of steps navigated before adoption takes place consents with (Dunphy and Herbig, 1995). Antonelli's (2006) definition of diffusion also, to some extent, explains and justifies why academics have not looked at the two concepts, diffusion and adoption, separately. Therefore, for the purpose of this study the theory of 'delayed adoptions and imitations of products' will be used as a guide to understanding the relationship between diffusion and adoption.

The study does not, however, seek to define the differences but acknowledges that literature on the two phenomena is related and some of the studies referred to use the terms interchangeably. Antonelli (2006) further asserts that contagion as a phenomenon supplied the first frame of understanding of diffusion.

He argues that as soon as the information about the advantages provided by the innovation becomes available to the potential adopter, the adoption will take place (Antonelli, 2006). It, however, raises a question on whether the propensity to adopt happens before exposure and availability of information or whether those factors influence the propensity to adopt.

2.5 Hubs

Goldenberg, Han, Lehmann and Hong (2009) define hubs as people with large social networks or large ties to other people who could be convincing or perhaps even charismatic and, on occasion, know a lot about the subject matter. The authors further argue that influential people broadly exhibit the following three main traits:

1. They are convincing (may be even charismatic).
2. They know a lot (i.e., are experts).
3. They have a large number of social ties (they know a lot of people).

The study further defines two types of hubs, *innovator* and *follower* hubs. It is contended that innovator hubs influence the speed of adoption in a network whilst follower hubs influence the number of people who eventually adopt an innovation. The authors also observe that social hubs appear to adopt earlier because of their larger number of connections rather than innate innovativeness (Goldenberg et al*,* 2009, p.1–4*).*

The purpose of this study is not, however, to establish the rate of adoption of the hubs themselves. The underlying assumptions in this regard, are that hubs would have adopted the product themselves or understand it before they can influence others in the network. This does not suggest that the hub is an expert or opinion leader on the product.

The impact of centrality in the network and usage volume associated with early adoption is confirmed in other studies (Coulter, Feick and Price, 2002). The strength of the hub's influence is argued to be underpinned by the trust in the individual, which leads to a level of credibility being attached to the recommendation made (Thomas, 2004). The argument by Goldenberg et al. (2009) on the different types of hubs and their roles can be used as the basis of defining the differences between adoption and diffusion. If innovator hubs have an effect on the speed at which adoption takes place then, based on that assertion, they (influencer hubs) can be said to influence the adoption decision-making process directly.

Based on the characteristics of influential people as argued by (Goldenberg et al, 2009) these people (innovator hubs) are likely to have a combination of charisma or ability to convince and maybe even some expert insights to substantiate their arguments when informing others about products. Derived from the definition, innovator hubs are the key types of hubs because their role is that of converting others from non-adopters to adopters.

Follower hubs would then be the complementary partners of innovator hubs as they are said to diffuse (spread) the product into the network (Goldenberg et al, 2009). They (follower hubs) exemplify hubs as defined by Goldenberg et al. (2009) closer because if they are responsible for the number of adopters then they are likely to boast more ties or connections than innovator hubs.

Thomas (2004) argues that credibility and trust play a part in the strength of the hub's influence. Both these aspects, credibility and trust, one could argue, are related to not only past experiences but also to the command of the subject matter the hub displays. A relationship outside the issues being discussed could also impact on the credibility and trust of the hub. The behaviours of hubs could also determine their adoption decision impact. The social network itself has an impact on the behaviour of its members. O'Cass and McEwen (2004) argue that a consumer's desire for goods is largely determined by his or her social networks. They contend that many consumers are not acting autonomously but as representatives of a larger group (O'Cass and McEwen, 2004). A desire for goods is also fuelled by hedonic instincts or behaviour that ties in with the recognition of value or a perceived value to the adopter as argued by Antonelli (2006) and thus reinforces the importance of value to the consumer.

The role of hubs involves influencing, communicating and information, social and consumer behaviour, diffusion and adoption and centrality as earlier addressed (Goldenberg et al, 2009). A hub is such because it belongs to a network in one form or another and therefore theory on networks must be considered (Goldenberg et al, 2009). The definition of hubs used in this study confirms this claim by highlighting the connections hubs are said to have. The many connections that define hubs constitute a network. In a study measuring influence in customer networks, Kiss and Bichler (2008) not only identify two types of networks (Random and Scale-free networks), but also identify different types of centrality and their measurement based on the network topology. Centrality they argue is related to the importance or prominence of members of a network (Kiss and Bichler, 2008).

Hubs may not necessarily be prominent but are important to a network as they are the ones with the most ties (by definition) and therefore the most exposure to other members and activity within the network. Their knowledge of the subject matter may, however, render them important (Goldenberg et al, 2009). It is argued that competence does not only give the knowledgeable person in a relationship the power to influence others, but it also causes the other party to nurture the relationship as it allows them to leverage that valued knowledge possessed by the other party (in the context of this study, these are hubs) and therefore willingly stay in the relationship. (Ndubisi et al, 2009).

The implication of this analysis by Ndubisi et al. (2009) is that knowledgeable nodes in a network keep the network intact as members stay in the network because of the mutuality of the relationship. A study on measuring influence in networks argues that scale-free networks which follow a power law distribution tend to contain centrally located and extensively high degree hubs (Kiss and Bichler, 2008, p.235). They argue that these hubs attach new members that prefer existing members that are already well connected. This behaviour, they assert, is fundamentally different to that of random networks (Kiss and Bichler, 2008, p.235). The strength of that influence will be determined by, among other factors, the topology of the network, the type of product (high or low risk) and factors such as advertising and experience. The type of news being passed on, that is, negative or positive word of mouth, would also determine the type of advice a node will accept and who the news is coming from, that is, a weak or strong tie (Goldenberg et al, 2007). Other factors such as centrality and ties are said to have an impact on the strength of influence between members of a network (Kiss and Bichler, 2008 and Goldenberg, Libai Maldovan and Muller, 2007).

One of the characterising features of any network is the length between the members (nodes) of that network. Kiss and Bichler (2008) define this path as the **geodesic distance**. Another characteristic is centrality, which is also the main characteristic of a hub (Goldenberg et al, 2009).

The following are some of the most well-known centrality measures:

(1) ***Closeness centrality***. Measures how close nodes are to all other nodes in a network. It argues that members occupying central locations with respect to closeness can be very productive in passing on information. This measure (based on theory) on African communities and culture (Chipp, 2003 and Venter, 2004) would be higher for the population of this study (BOP). The effects and traditions of Ubuntu are likely to strengthen closeness centrality.

(2) ***Betweenness centrality.*** Measures the interactions between two or more non-adjacent nodes (people in different networks). The node is central if it lies between other nodes on their geodesics. The interdependency of the community in the South African BOP market fosters interactions between people in that community as they have to communicate not only for social reasons but also to know what is happening in the network so that they all understand their roles or the roles they could play.

(3) ***Eigenvector centrality.*** Measures the importance of a node in a network. Each individual's status is considered proportional (not necessarily equal) to the weighted sum of the individuals to whom they are connected (Kiss and Bichler, 2008, p.235). It could be argued that in societies in which individuals are interdependent, the ones that inform the society may be regarded as part of the group with a heavier weighting. According to the Eigenvector measurement definition, these would be regarded as the important members of the network. The method of measurement appears to have the ability to inform the outcome.

The arguments poised against the different centrality variables imply that centrality is likely to be higher in all its forms in South Africa but particularly in the BOP sector due to the social and cultural behaviour of the society. By implication, hubs can be expected to be more impactful in such a society. Iyengar et al. (2010) use an argument raised by Van den Bulte and Wuyts (2007) that a decentralised network simply spreads information about the product's existence rather than information that mitigates perceived risk, then there is not much variation among customers' relative influence (Iyengar et al, 2010, p.4). This argument suggests that decentralised networks simply pass on information around without the alleviation of some of the concerns that the nodes might have. In those networks nodes have no reason to believe one person over the next because the information received is similar in terms of assisting them understand the drawbacks of making that decision. Centralised networks would be the opposite. With regard to hubs and social networks, a connection to a member of the network with high centrality may prove to be more valuable than a node with no or low centrality, considering the definition by (Goldenberg et al, 2009).

Goldenberg, Libai Maldovan and Muller (2007) support this point of view by further arguing that the impact of influence is further dependent on the types of ties they have with other people. They identify two types of ties:

(1) ***Weak ties.*** Defined as influence by contacts with whom one has tenuous or random relationships (Goldenberg et al, 2007). Random tenuous relationships as suggested do not foster relationships that build trust and credibility between a hub and other members of the network. As per Thomas' (2004) argument, these variables (trust and credibility) have a direct impact on the strength to influence. The relationship between the strength of ties and the type of relationship appears therefore to be a direct one based on Goldernberg et al (2007) and Thomas (2004).

(2) ***Strong ties.*** Defined as more stable, frequent and intimate interactions that characterise individual's personal networks (Goldenberg et al, 2007). Stability and frequent interaction are highlighted as the variables required. This gives an impression of not only a personal relationship but a long-standing one (stability). It is therefore clear that the better the relationship between the hub and other nodes of the network, the better the influencing capability of the hub on the node.

Logically a higher number of ties would then increase the probability of both *weak and strong* ties. This raises the importance of the role played by hubs in the adoption of a product because hubs will have both strong and weak ties simply due to their exposure to large numbers of people (Goldenberg et al, 2007). Both weak and strong ties are argued to have certain strength with regard to influencing (Goldenberg et al, 2007). They contend that it is not inconceivable that nodes with relatively weak ties can influence each other either positively or negatively about adoption of a product (Goldenberg et al, 2007). This assertion takes the theory of ties and its implications on hubs to yet another dimension.

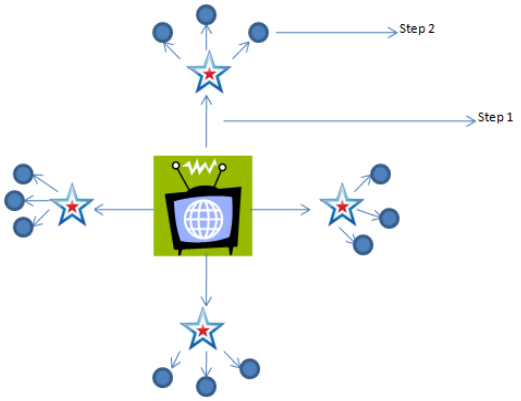
The suggestion at this stage is that strong ties are important as they are more meaningful and are likely to yield stronger influencing environments. A more pertinent point raised is that ties (first and foremost) matter and then the strength of the tie can be considered. The theory on ties (Goldenberg et al, 2007) suggests that a close community, that is, one where people know each other and frequently interact is likely to produce strong influence behaviour than one that does not exhibit close relationships. This assertion becomes important as it implies assessing the characteristics of the population of the study (BOP) in order to understand the outcome of the study better.

Groves, Obenour and Lengfelder (2003) argue that the there is a correlation, in part, between the adoption of a product into a culture and how that product is presented in relation to the understanding nature of that culture. The culture and cultural nuances of a target market will influence the perception of how that network or community views a particular product and the value it places on that product. The importance and role of value or perceived value have been discussed (LeBoeuf and Simmons, 2010). There are, however, products that may span different cultures and communities. Basic need products such as electricity, water, shelter (housing) and clothing may differ in design and aesthetic appearance but the basic requirements for them may need to be satisfied before aesthetics are considered.

For marketers to whom the socio-cultural nuances, trends, beliefs, values and practices of their target or intended target markets, hubs offer a potentially relevant channel of communication that may induce trial of products. Subrahmanyan and Gomez-Arias (2008) cite an example where Hindustan Liver Limited (HHL) the Indian unit of the Anglo–Dutch consumer company, Unilever, uses networks of rural women to sell some of its products. By doing this the company has not only created distribution channels but is creating hubs as they could form multiple ties with tens or even hundreds of people within their communities and networks. Watts and Dodds (2007) make reference to a study by Katz and Lazarsfeld (1955) on public opinion and the role of individuals versus the media on decision-making scenarios ranging from political to personal. They argue that the flow of information followed what the researchers called a “two-step flow” of communication which at the time contrasted with the accepted one-step or hypodermic model that treated individuals as atomised objects of media influence.

The argument behind the introduction of the two step was that information flowed from the media to influencers (like opinion leaders) and then to their followers or connections. Watts and Dodds (2007) make a case that this was the birth of the theory on influentials as is understood today. Although it acknowledges the role played by influentials in the two-step process, their study proceeds to argue that it is not exactly known how, if indeed at all, influentials (of the two-step process) are responsible for the diffusion or adoption or products (Watts and Dodds, 2007). This study is related to Watts and Dodds (2007) in that it seeks to confirm whether influentials, this time in the form of hubs, have an impact on the decision made on product adoption and whether hubs facilitate access to the products they influence the network to adopt.

Figure 1: Schematic of the Two-Step flow of influence



Source: Adopted from Watts and Dodds (2007)

From the two-step process illustration it is evident that the influentials (at step 2) are at the beginning of the involvement of a network as the number of connections begins to grow. Hubs are likely to be the first to get this information due to their connection or ties to other nodes of the network (Kiss and Bichler, 2008). It is the influence that hubs are likely to exert, if any, that this study aims to reveal.

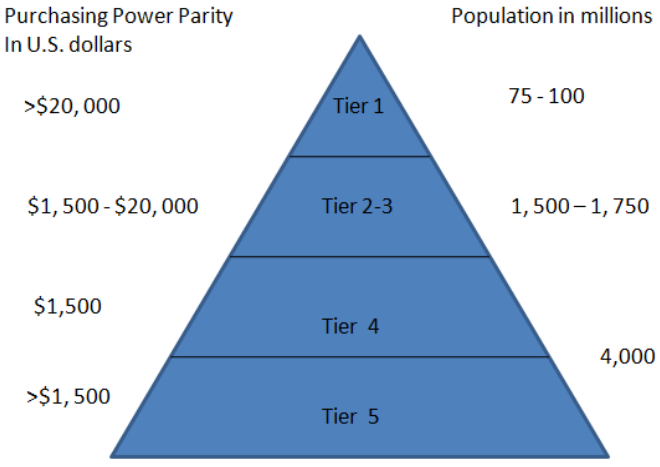
2.6 Why Hubs?

Hubs have not been studied in as much detail as the other social influencers, that is, mavens, opinion leaders and influentials. Hubs are also interesting and different from the others in that their strengths lie in the fact that they have multiple connections and not necessarily that they are better or well-informed than others. They become better informed because they are exposed to many people (relative to everyone in the network) and the probability of information getting to them or passing through them is higher than an average network member's (Kiss and Bichler, 2008 and O'Cass and McEwen, 2004).

2.7 Bottom of the Pyramid

In 2008 the United Nations Millennium Project estimated that there were four billion people living in poverty (Subrahmanyan and Gomez-Arias, 2008). These people have been classified and defined as being economically at the bottom of the pyramid (BOP). These individuals as defined by the World Resources Institute (WRI) and the International Finance Corporation (IFC) are said to have incomes below US$3,000 per annum in local purchasing power parity (Subrahmanyan and Gomez-Arias, 2008 and Prahalad, 2010).

Figure 2: The Economic Pyramid.



Source: Prahalad (2010, p28)

The WRI-IFC definition suggests that these individuals live on US$8.22 or less a day which in the South African context equates to about R61.60 a day (at the current average R7.50 to 1 US$). Chipp and Corder (in review) assert this definition and state that previous theory estimates range between US$2 and US$16. Chipp and Corder (in review) advocate the use of living standard measures (LSM) as a supporting tool to defining the BOP for exactly such reasons. Looking only at income and financial measures may be misleading.

Both definitions (Prahalad and WRI-IFC) were done on the purchasing power parity (PPP) (Subrahmanyan and Gomez-Arias, 2008 and Prahalad, 2010). An observation to be made here is that both definitions are based on the same variable, PPP, but they differ. PPP is the hypothesis that currencies in different markets "move towards equality in a common currency" (Mehrara, 2007, p.251). PPP is affected by exchange rates and inflation, hence it is possible to have more than one standard definition depending on the currencies involved (Louw, 2008). Another reason LSMs could be useful in the definition of BOP (Chipp and Corder (in review)).

These definitions (Prahalad and WRI-IFC) are but one example of the differing views of who or what the BOP really is. The two definitions seem to differ based on monetary valuations between small and very small. Chipp and Corder (in review) argue that a better discriminator than a single demographic variable is required. They assert that this measurement would be more comprehensive as a socio-economic status measurement without the use of currency. Removing currency allows measurements that take into account the daily reality (situation) facing the individual.

LSMs will highlight some of the characteristics of the population and assist in defining the BOP sector. Some of the characteristics of the BOP market raised by Martinez and Carbonell (2007) are that there is often rapid change and that although the purchasing power of the individuals is low, the purchasing power of households is stronger. This argument does not only support the view by Chipp and Corder (in review) but it justifies the use of LSM as a means of differentiation. Chipp and Corder (in review) affirm LSMs to measures household living standards. They further propose that household income is not perfectly correlated with personal income. Through an exercise of individual and household cross tabulation, Chipp and Corder (in review) argue that low-income earners are found across a greater spread of household income groups with a large number of individuals who earn below US$2 per working day come from a large number of households with incomes between R25 00 and R4 999. This evidence is in agreement with Martinez and Carbonell (2007) that in the BOP market, household income is more important than individual income when assessing value or purchasing power.

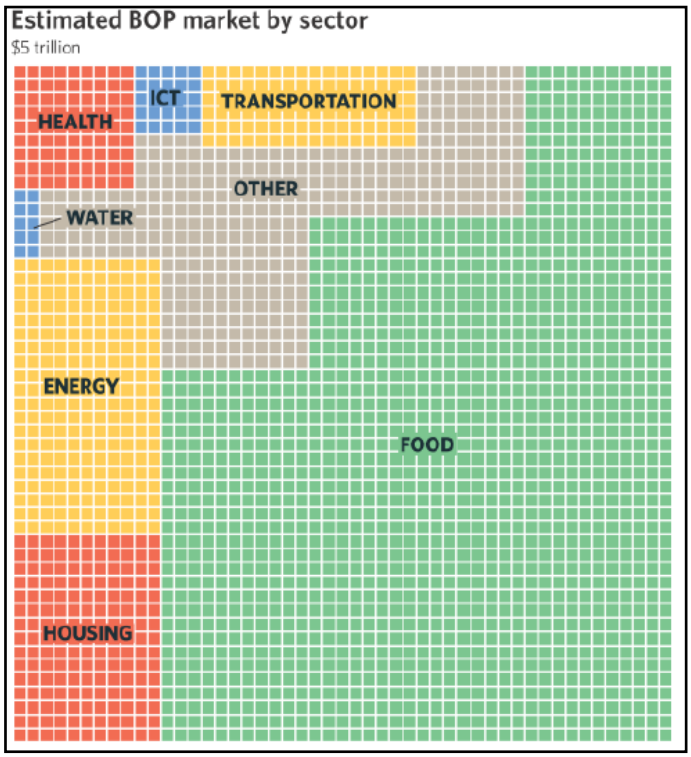
Income is but one of the diversity variables of the BOP market. The differences and diversity of the BOP consumer are confirmed by Prahalad (2010) who is considered one of the pioneers of this sector of society in terms of understanding who they are and how they function and operate. He argues that the BOP is like a kaleidoscope that cannot be clarified by a single view (Prahalad, 2010). Another of the major debates around BOP consumers is about their consumption habits, preferences and mannerisms (Chipp and Corder (in review)) who argue for instance that the effect of culture comes into play.

In the South African context the network, community and household have a more prominent role to play in communities especially at the bottom of the economic pyramid because people depend on each other for survival (Chipp and Corder, (in review)). This point raised by Chipp and Corder affirms the relevance of hubs in market adoption. AMPS (2010) defines LSMs as a stable and dependable multi-attribute segmentation tool in which no personal attributes are used that is based on access to services and durables, and geographic indicators as determinants of the standard of living.

It is argued that consumer behaviour towards brands differs by consumer category (i.e., regular, premium or BOP). Push factors such as brand equity, brand personality and brand endorsements are alleged to be the brand drivers for the regular and premium markets, whilst pull factors such as price advantage, social status and perceived value are considered drivers in the BOP market segments (Rajagopal, 2009). The social status element of the argument by Rajagopal (2009) further affirms the relevance of hubs. Due to their position in the network, they have a certain social status.

Barki and Parente (2010) advance the argument that BOP are consumers with lower self-esteem for whom relationships determine the selection of consumption alternatives. They build on the access, affordability and availability (Prahalad, 2005), and include relevance as an additional ingredient of success when marketing to the BOP. The argument behind this theory is that these low self-esteem consumers expect companies to offer them dignity and be embedded in their communities (Barki and Parente, 2010). Hubs offer a great opportunity for companies to embed themselves into these communities as they are already at the heart of the community's network and, due to their high connection levels, would have a generally better understanding of that network than an ordinary node.

Figure 3: Market Sector of BOP.



Source: Louw (2008)

Figure 3 provides a visual representation of the category of products the BOP sector spends its money on (Louw, 2008). It is important then for the purposes of this study for these sectors to be considered when researching the adoption drivers and influences of this market. The year following the publication of this diagram Subrahmanyan and Gomez-Arias (2008) stated that findings from their study on understanding consumer behaviour at the BOP indicated that after food the need for communication and improvement of social bonds was next.

Figure 3 does not specifically highlight communication but the spending on energy, 'ICT' and 'Other' could cover the areas on this need for communication and social bonding. As pointed out in the literature, value or perceived value will have an impact, but the need and basics may also contribute.

Food is the core requirement which is in line with Maslow's needs structure but, in slight contrast, energy and other needs surpass the need for shelter or housing. The products used for the findings of this study will fall under one of the categories represented in Figure 3. Table 2 below gives a classification of the different LSM groups and the variables of their definition. The BOP cluster is made up of the LSM 1 to LSM 4 groups. It also provides evidence of the differences between the different groups and one can see the gaps between the different LSMs within the BOP structure. These differences further confirm the varying characteristics of the BOP clusters as raised by Martinez and Carbonell (2007), Prahalad (2010) and Chipp and Corder (in review).

The research seeks to understand the market at the base of the economic pyramid's adoption or propensity to adopt and whether hubs have a role to play in the BOP market's adoption of products. In doing so, the research will reveal the important sources of influence that this market considers when making adoption decisions. What is known and accepted is that many of the purchases in this sector are essential and carefully executed due to the scarcity of funds.

Table 2: Living Standards Measure (LSM's) by contributing variables

LSM Variables	LSM									
	LSM 1	LSM 2	LSM 3	LSM 4	LSM 5	LSM 6	LSM 7	LSM 8	LSM 9	LSM 10
	%	%	%	%	%	%	%	%	%	%
No domestic	100%	100%	100%	100%	99%	98%	91%	78%	56%	20%
0 or 1 radio set in household	100%	100%	93%	93%	86%	81%	69%	56%	41%	17%
Rural - Not in Gauteng or W. Cape	100%	91%	81%	63%	38%	15%	7%	6%	3%	5%
Hi-Fi/music centre	0%	31%	41%	47%	58%	63%	69%	75%	81%	90%
House / town house/cluster	0%	25%	35%	51%	65%	73%	79%	84%	92%	97%
TV set	0%	24%	55%	79%	94%	98%	99%	100%	100%	100%
2 cellphones in household	0%	15%	19%	26%	27%	34%	37%	35%	39%	36%
Water in house/plot	0%	12%	38%	63%	86%	98%	100%	100%	100%	100%
Fridge/freezer (not deep freezer)	0%	7%	36%	65%	89%	96%	97%	98%	99%	100%
Flush toilet in/out	0%	1%	7%	34%	58%	89%	99%	100%	100%	100%
DVD	0%	5%	11%	27%	46%	63%	70%	76%	80%	88%
Electric stove	0%	1%	4%	22%	60%	89%	98%	98%	99%	99%
3 or more cellphones in Household	0%	3%	6%	16%	23%	29%	37%	46%	47%	59%
Metro dweller	0%	2%	7%	14%	27%	50%	59%	58%	60%	65%
Microwave	0%	0%	3%	11%	32%	75%	94%	97%	98%	99%
Home theatre system	0%	1%	6%	8%	19%	32%	45%	53%	57%	71%
Built in kitchen sink	0%	0%	0%	7%	20%	68%	95%	99%	99%	99%
Hot running water	0%	0%	0%	2%	8%	42%	84%	96%	99%	100%
Washing machine	0%	0%	0%	1%	6%	36%	76%	87%	95%	99%
Motor vehicle in household	0%	1%	3%	7%	11%	25%	59%	83%	94%	99%
Deep freezer	0%	5%	6%	8%	8%	14%	30%	45%	59%	78%
Home telephone	0%	1%	2%	4%	6%	15%	28%	37%	46%	64%
VCR	0%	0%	1%	3%	7%	14%	25%	36%	47%	60%
Vacuum cleaner/polisher	0%	0%	0%	0%	0%	5%	24%	45%	70%	90%
Mnet/Dstv subscription (equivalent to 'cable')	0%	0%	0%	0%	2%	6%	20%	37%	53%	80%
Home security service	0%	0%	0%	1%	1%	6%	16%	24%	41%	69%
PC Desktop / Laptop	0%	0%	0%	0%	1%	5%	15%	35%	67%	95%
Tumble drier	0%	0%	0%	0%	0%	1%	7%	14%	31%	63%
Dishwasher	0%	0%	0%	0%	0%	1%	2%	3%	9%	35%

Source: Chipp and Corder (in review)

3 CHAPTER 3: PROPOSITIONS AND HYPOTHESES

3.1 Propositions

Zikmund (2003) defines propositions as the statements concerned with relationships among concepts and concepts, in turn, being the basic units of theory. Therefore, a proposition aims to explain a link among concepts. This chapter provides propositions that the research will investigate. These propositions have been developed based on the definitions of hubs provided by Goldenberg et al. (2009) and BOP provided by Prahalad (2010), taking into account the unique South African dynamics provided by Chipp and Corder (in review). Adoption theory will be guided by a definition by (Antonelli, 2006).

Proposition 1

Adoption of products is a community-wide phenomenon and households are likely to be influenced by a few hubs and pass it on to the rest of the community.

The literature highlights various theories that support this proposition. The theory on collectivism in the BOP (Chipp and Corder (in review)) argues that the lower one goes to the bottom of the South African pyramid, the greater the likelihood of following collectivist rather than individualistic principles. The definition of hubs as per Goldenberg et al. (2009) suggests that due to their central position, hubs are likely to be at the centre of network and community activity. Such a proposition is further supported by Iyengar, Van den Bulte and Valente (2010) when they argue that some customers' adoptions and opinions have a disproportionate influence on others' adoptions.

Proposition 2

The influence of a social presence is "a multiplicative function of the forces with the greatest impact occurring when there are several people in close proximity and in high source strength" (Argo et al, 2005, p.207–208). A social presence influence is an inverse function of the number of targets, proximity and source strength. The literature argues that the distance between nodes in the network is a key proponent of that network, and distance impacts and defines the strength between the ties within that network. Goldenberg, Libai Maldovan and Muller (2007) argue that the more interactions there are within the network, the more influence on members the network or certain nodes in the network have on the rest of the network

Proposition 3

Hubs are not mavens or product experts but are simply people with a number of ties. Their strength lies in the number of ties and connections and the reputation they have within their communities or networks. Huh and Kim (2008) provide a theory on hubs that supports this proposition. Their theory is crucial to the understanding and definition of what hubs are. Extensive work has been done on opinion leadership, mavens and influencers, and these are not to be substituted for hubs.

Proposition 4

If information is a key factor in networks and hubs are central to the hub as suggested by the literature (Goldenberg et al, 2009), then the amount of information a hub has and disseminates is related to the performance of that hub as an influencer, that is, the extent and quality of information available from/through the hub. Subrahmanyan and Gomez-Arias (2008) argue that after food the need for communication and improvement in social bonds is the next most important for BOP networks.

Proposition 5

The product used in the study must be of importance to the end-user. The hub will either be a facilitator of access to the product or be the point of information dissemination. It is through this dissemination of information on access to products that hubs will be influential in their networks.

Proposition 6

The initially recruited or volunteer hubs (innovative hubs) were responsible for the speed of adoption, whilst the follower hubs (those recruited by the innovative hubs) would be responsible for market size, that is, broad adoption and diffusion of the innovation into the networks. There are also more follower hubs than innovator hubs and they are more similar to the network in terms of innovativeness. For this reason, they are likely to be more trusted by the network (Goldenberg et al, 2009).

Goldenberg et al (2009) provide the basis of this study and this study aims to empirically test the findings and theories of their 'Role of Hubs in the Adoption of Products' paper. This study, however, will focus on a different product type and a different market segment as identified in the preceding chapter (Chapter 2). For this reason, over and above the propositions made by the author of this study based on broad theories gathered from the literature, there are hypotheses that must be included as part of this study and are later statistically tested in the context of this study.

3.2 Hypotheses of original study by Goldenberg et al

Goldenberg et al. (2009) bring forward the following hypotheses and justifications thereof. The results in this study attempted to disprove or confirm these hypotheses using the data of electricity purchases through hubs. **Social hubs are more likely to adopt at the early stages of a process.** P = 1 – (1 – p) (1 – q) α (t), where P is the probability that the person adopts, p is the effect of exposure to external forces (e.g., marketing efforts), q is the impact of word of mouth (network effects), and α (t) is the number of links to current adopters. The number of the adopters at time t would then be E (P) xM – (t)].

For Goldenberg et al. (2009) this meant that a person with a large number of links (e.g., 500) contributes much more to the adoption through interactions (word of mouth) than a person with a moderate number of links (e.g., 25). They argue that even if a more conservative view were to be taken, social hubs are not more persuasive than other people or that they contact everyone to whom they are linked; more connections will be activated after these hubs have adopted, resulting in a significant increase in the adoption rate. In addition, because innovator hubs adopt earlier than follower hubs, they have more time to influence the network (Goldenberg et al, 2009). Thus:

H2a: Hub adoption speeds up the overall adoption process.

The theory also emphasises the speed of adoption as one of the traits examined in the classification of hubs as either innovator or follower hubs. From this classification the impact of each type of hub was explored and the theory identifies two distinct roles played by the two types of hubs: Speed of adoption and market size respectively.

H2b: Innovator hub adoption has a larger correlation with speed of adoption than follower hub adoption.

This hypothesis proposes that innovator hubs will be more responsible for the rate of spread of the product (width) whilst follower hubs will be responsible for penetration of the product into the network. This could also be viewed as the depth of the product adoption as it addresses issues of usage and repeat usage, which complete adoption.

H3: All else being equal, the higher the relative out-degree of a hub, the greater is his or her impact on adoption.

Goldenberg et al. (2009) further argue that social connections provide indirect information; thus, the larger the number of connections, the greater the amount of information possessed. They propose that from a network point of view, access to diverse resources typically requires a person to be connected to diverse actors and sub-networks. This status, they argue, can be obtained when both degree (number of ties) and betweenness (links to different groups) centralities are high. “These centralities are typically correlated, partially because people with an extremely high degree have a higher probability of being connected to people in different social circles. In general, the extent to which someone has an information advantage depends on crossing structural holes, which means linking separate parts of the network” (Goldenberg et al, 2009, p.4–5).” This means being connected to many interconnected people creates an information advantage from collecting different bits of information sooner than the average network member (Goldenberg et al, 2009).

Even with the conservative assumption that social hubs are not more persuasive than the rest of the members in the network, hubs still have a large number of ties and, therefore, potentially more influence than others on people who are not necessarily connected to adopters. If a sufficiently large number of hubs adopt a product, it is more likely that the new product will be exposed to people who otherwise may not have been exposed to it. Thus, Goldenberg et al. (2009) argue that adoption by hubs increases not only the speed of adoption but also market size. **Hub adoption increases the eventual size of a market.**

H4b: Follower hubs have a stronger relationship to market size than innovative hubs.

H2 and H4 would be in contradiction if adoption speed and market size were highly correlated. It is argued thus by Goldenberg et al. (2009) that if hubs do not adopt a product soon after its introduction, this may impede adoption by those who are connected to the hubs. As a result, a higher adoption rate of hubs at the early stage of the diffusion process increases the probability of success of the product (Goldenberg et al, 2009).

Thus:

H5: Hub adoption at an early stage can be used to predict product success

3.3 Hypothesis and Propositions Summary

The priority of the research tests will be on the hypotheses as presented by (Goldenberg et al, 2009). Each proposition will, in turn, be addressed through this process as the propositions were made in relation to the hypotheses.

CHAPTER 4: RESEARCH METHODOLOGY

3.4 Introduction

The purpose of this chapter was to discuss and articulate the research methodology that was followed in gathering and analysing the data. The data were analysed using quantitative methods based on the nature of the research. Zikmund (2003) indicates that if the objective of the research is to get conclusive analysis, that is, to establish whether this phenomenon exists or not within the BOP context, then the suitable method of research would be a descriptive quantitative method.

3.5 Research Method and Design

The quantitative research method was employed because there was some work done in the areas of adoption and BOP. Chipp (2007) argues that this method of research is used when the area is well defined. All three facets of this study (hubs, product adoption and BOP) had traditions of varying degree research. This research thus sought to discover if a certain phenomenon exists within a particular sector of the market. The researcher sought to determine the degree to which it is present or the impact of the phenomenon on the identified sector of society – an attempt to interpret variables within the field of study. A consequence of the study being quantitative is that it will have breadth instead of depth and there is a risk of generalisation (Chipp, 2007). The research did not seek to understand why the phenomenon exists.

From a research perspective this study aimed to discover the effect or lack thereof of an independent variable (people recognised as hubs) on a dependent variable (adoption of product) in a particular sector or segment of society (BOP). It was important to recognise and acknowledge that there are other influential dependent variables on the decision to adopt. As the theory had shown there were other variables at play such as affordability, perceived value, brand and culture (Dunphy and Herbig, 1995; Szmigin and Foxall, 1998; Antonelli, 2006; and Guzman and Paswan, 2009).

3.6 Unit of Analysis

Zikmund (2003) argues that for the researcher to define the research problem the unit of analysis for the study must be determined. Mouton (2009) describes the unit of analysis as the 'what' or object or phenomenon that is to be studied. The unit of the analysis for this study was the identified hubs that interacted with the BOP communities. If the study sought to identify a relationship between the adoption decisions of BOP consumers and the influence of hubs, then the BOP consumer data are the best area to get information on whether hubs have influenced their purchase decisions or not. It is submitted that in order for adoption and diffusion to take place it is necessary that the innovation or product is adopted by a series of individuals or adoption units (Martinez et al, 1998). In the context of this study, the BOP consumer represents these adoption units but the hub is considered the influencer of the decision.

In the context of this study, the hubs were the mobile merchants of electricity to the BOP market. The BOP market is therefore also the adopter and purchaser of the product.

3.7 Population of Relevance

Defining the population helps in defining the sample. The population is a group of entities that share common characteristics (Zikmund, 2003). According to the definition there is some homogeneity that binds these entities and forms a population out of them. The theory suggests that the BOP is one such entity where individuals and households have similar characteristics. This, however, does not retract from the fact that different BOP groups are heterogeneous and that cultural, social, geographical and other factors determine the disparities between the different BOP groups as discussed in the literature. The BOP groups, although heterogeneous when compared to others, are very homogeneous within, that is, BOP communities and networks in South Africa will not be identical to those in India for example. Prahalad (2010) argues that the BOP market is a kaleidoscope and should not be viewed as monolithic.

AMPS (2009) splits the South African LSM universe into clusters based on the variables the households possess or do not possess. From this analysis, AMPS asserts that the BOP forms a cluster called 'Foundation' which comprises LSM 1–4 (Chipp and Corder (in review)).

Table 3: The South African Pyramid

	TOTAL	
The South African Pyramid	'000	%
Population ('000)	31,305	100
The Apex of the Pyramid (Group A – LSM®s 9 &10.)	4,463	14.3
The Buttress of the Pyramid (Group B – LSM®s 7 & 8)	5,105	16.3
The Core of the Pyramid (Group C – LSM®s 5 & 6)	10.534	33.6
The Foundation of the Pyramid (Group F LSM 1–4)	11,194	35.8

Source: Chipp and Corder (in review)

Based on the classification of the Foundation, this study will focus on LSM 2–3 as LSM 1 is said to be totally rural and LSM 4, although classified in the same group as LSM 1–3, does not really meet the financial criteria of US$2–16 a day (Subrahmanyan and Gomez-Arias, 2008; Prahalad, 2010) and Chipp and Corder (in review)). The behaviours and demographics of LSM 4 will also be very different from those of LSM 2 and 3. This could introduce noise into the results of the study (Zikmund, 2003). However, it was acknowledged and accepted by the researcher that LSM 4 comprises part of the BOP cluster even though there is a considerable socio-economic gap between it and LSM 2 and 3 (Chipp and Corder (in review)) (LSM by contributing variables table).

3.8 Sampling

A judgemental sampling method was utilised in which a company that had used hubs to enter the BOP market was identified and the consumer data used to analyse the impact of the hub. Zikmund (2003) defines a judgement (purposive) sample as a sampling technique an experienced individual selects based on some appropriate characteristic or the sample members. In this study, those experienced individuals represented a company to which the data belonged. The primary respondents analysed were selected by non-probability (census), resulting in a non-probability technique (Zikmund, 2003). The sample was made up of a select number of prepaid electricity meter owners in Gauteng, Pretoria. These were electricity meters specifically registered with the Tshwane Metro Council. It is possible that some of the electricity purchasers did not own the meters and could have simply been tenants of the property to which the meter was linked.

The possibility that a different BOP community could have produced different results could not be ruled out as this sample was drawn from a particular area that may have unique variables that influence the behaviour of people. This possible uniqueness of the sample is reaffirmed by the theories by Dunphy and Herbig (1995); Szmigin and Foxall (1998), Antonelli (2006); and Guzman and Paswan (2009) on the role of culture, value perception, affordability and brand aside from the role performed by hubs on the adoption of products within a particular network and/or community.

3.9 Research Approach

Figure 4: Research Approach

3.9.1 Stage 2- Secondary Data Collection

Secondary data in the form of consumer and merchant databases were used to gather information about the hubs and their role in product adoption. Variables on which the data would be analysed were defined and proxies of key constructs were extracted from the data. The data for the study were extracted from the company's sales and trade records, and arranged in a format that permitted statistical analysis.

The method of collecting data was also pre-empted by the definition and discussion of the BOP in the literature. Prior to the research commencing it was anticipated that the researcher may encounter some illiteracy within this sector if primary data collection techniques were adopted.

Therefore, a tool or method that could assist the researcher to gather the information whilst they remained in control of the process was pertinent. Secondary data analysis takes the human factor out of the picture and allows for interpretation of real numbers, that is, those based on fact and not how consumers respond.

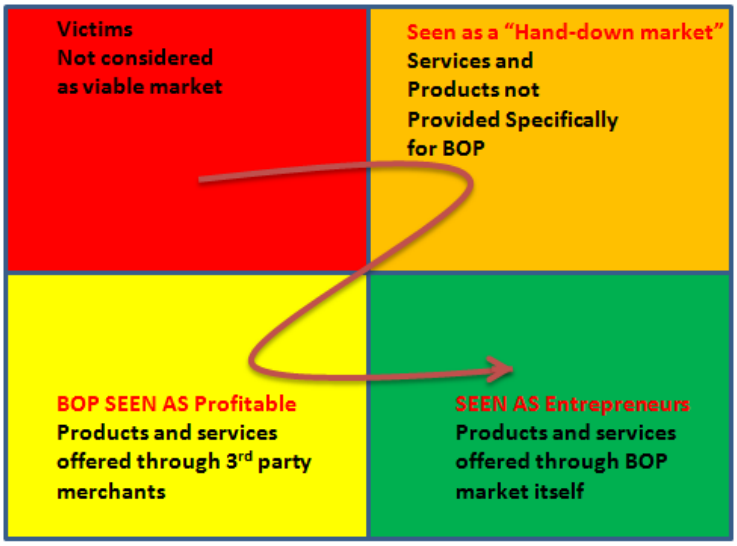
The use of sales data is also in line with how Goldenberg et al. (2009) identified and defined hubs within the network they were investigating. It is stated that hubs should be selected based on connectedness and this connectedness is, in turn, defined by activity and not pointers such as individuals with the highest number of people in their diaries for example (Goldenberg et al, 2009*)*. Sales data (secondary data) give empirical evidence of the activity surrounding a hub. The data were therefore an important filter tool for the sample as they could have been used to qualify and disqualify the units of analysis had the need arose. This filtering was, however, done beforehand and was not required for this study.

3.9.2 The Data

3.9.2.1 Origins of the Data

The data used were sourced from a company (Company Q) that has been doing work in the BOP sector using people classified as connectors or hubs in the company's definition. The hubs used in the study were identified by both the community members and Company Q. In the context of this study, the hubs were using their connections to become small business entrepreneurs using cell phone technology to sell prepaid electricity. Each hub established a customer base and services that base on a monthly, weekly and daily basis.

Figure 5: BOP Development Vision



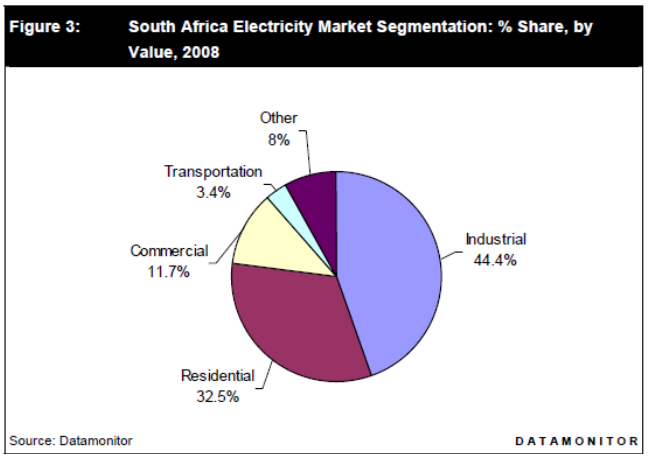
Source: Managing Director of Company Q

Company Q has a business based on the ideal of turning the BOP cluster into an entrepreneurial hub in which people that come from that sector are used to making a living for themselves through small business ventures. The premise of this ideology is that no one understands the BOP customer like people in the BOP themselves. In a sector of the population where relationships and trust are important (Barki and Parente, 2010), Company Q attempts to turn community members who are likely to have relationships already (hubs) into entrepreneurs. The literature asserts that if members of the community or network find the relationship beneficial to them through the services, knowledge and expertise of the hub, then they tend to stay in the network (Ndubisi et al, 2009). It is therefore important to note that these mutually beneficial relationships keep the network strong and could result in loyalty towards the hub.

3.9.2.2 Data and the Study

The data for this study were used not only for the analysis of whether hubs have an impact on product adoption but were also used to identify the relevant population elements. Zikmund (2003) defines population elements as individual members of a specific population. The product under review in the case of the data is electricity. Electricity is an ideal product because it is an essential form of energy for households. LSM 2 and 3 in urban households depend on the availability of electricity even though in South Africa there are still millions of people at the bottom of the pyramid without electricity, running water and sanitation. Electricity is an essential commodity in the South African economy. The South African electricity market generated total revenues of US$6.5 billion in 2008, representing a compound annual growth rate of 13.8% for the period spanning 2004–2008. Industrial use accounted for 44% of the value, with the balance shared between residential, transport, commercial and other uses (Datamonitor, 2009).

Figure 6: South African Electricity Market Segmentation



Source: South Africa – Electricity Datamonitor (Published October 2009)

Residential electricity consumption is the second highest in South Africa. This indicates the importance of electricity to the country and its citizens.

This is in turn an indication of the value or perceived value of the product which, according to the literature, has an impact on the adoption and diffusion of a product (Dunphy and Herbig, 1995 and Guzman and Paswan, 2009). It is for this reason that electricity was selected as the product to be investigated in this study. It is a commodity that all need but not all have and can afford. This therefore makes electricity adoption of interest. Chipp and Corder (in review) determine that only 2% and 7% of the LSM 2 and LSM 3 population respectively are metro dwellers in South Africa.

The data were based on people either purchasing electricity through a hub's cell phone or through their own cell phones, a product they are introduced to by a hub and therefore every time a transaction is made, that particular hub is registered as the seller. According to Chipp and Corder (in review) households categorised under this group (LSM 2 and 3) do not possess a lot of electrical appliances and a collective 5% of them own an electric stove, 0% have hot running water, 43% have a refrigerator (with no freezer), whilst TVs and radios and home theatre systems have a much higher penetration. Cell-phone penetration is also relatively high in the BOP market, with a collective 9% (3% of LSM 2 and 6% of LSM 3) of households having more than three cell phones.

The data used were in a point in time. The point in time selected for this study was September and October 2009. The complete file took into account transactions made before and after 01 September 2009 and those made after 31 October 2009. This period was used because it was indicative of two important factors, the first being that Company Q views this period as a period from which its reporting systems were most stable and the second being that it was a warm period that may exclude the anomalies and impact of the sometimes harsh South African Highveld winter on the consumption of electricity.

3.9.2.3 Data Analysis

The analysis was done based mainly on the propositions related to adoption made in the literature. The analysis of the study on the impact of hubs on adoption by Goldenberg et al. (2009) was also taken into account and, where possible, replicated. The population sectors of the two sectors were not the same and the type of products in the two studies was not the same. The connectedness of the hubs in the study was identified through the degree (number of links or connections to other nodes in the network) of that hub. These links were defined using the argument advanced by (Goldenberg et al, 2009). The definition was based on activity (e.g., transactions) and not on pointers such as the number of nodes identified as the particular hub's customer database. The out-degree (number of people to whom the hub conveys a message) of the hub was considered while defining the hub because these hubs were sellers; therefore, customers visited the hubs for their purchases.

3.10 Limitations of the Research

Some people were eliminated from the data based on the selected period of research. Although this is a limitation of the study, it was agreed with Company Q that, in the context of this study, any individual that is not active for a period of two months may not necessarily be the type of hub we are looking. It was also proposed by Company Q that these hubs depend on the funds gained from the business model and that anyone who was not active in that period (after tracking and data systems were implemented) would have not made any profit for two months and that hubs in their nature are in constant contact with their communities.

Goldenberg et al. (2009) advance the argument that there is a close correlation between the in- and out-degree and this study assumes only the out-degree (number of visits to the hub) and not the number of visits by the hub to other nodes in the network. It is argued that hubs with high out-degrees have high in-degrees degrees and, therefore, have an overall high connectedness and closeness to their network. This trait has in the literature been advanced as the catalyst for high diffusion (market growth) (Goldenberg et al, 2009).

The data do not elaborate on and explore the core reasons for the purchase of electricity at a particular point in time, especially at uncommon business hours after 12.00 midnight for example. Thus, it becomes difficult to understand the importance of that purchase to that individual at that point, but the combination of time of purchase and repeat purchases allows for an assumption to be made about the crucial role the hubs play in their communities.

4 CHAPTER 5: COMPOSITION OF THE DATA

4.1 Introduction

This Chapter will focus on the results of the study. The results show the hubs, their connected nodes and the frequency over February, March and July and August 2009 that the hubs serviced or met with a specific member of the network. As stated in chapter 4, the study focuses on electricity as the product of adoption. Due to the importance of hubs to this study factors of in-degree (the number of people who convey information to the hub) and out-degrees (number of people to whom they convey information) could not be ignored, Goldenberg et al (2009). The results provide the out-degrees of each hub therefore giving the researcher some insight into the impact hubs have on their network. The impact of the hub is crucial in understanding the importance of hubs on product adoption.

The literature defines the Eigenvector Centrality as the importance of the node (member of a network) to that network measured on a weighting proportional (not necessarily equal) to the number of connections that node (in this case the hub) has in the network (Kiss and Bichler, 2008). This measure or interpretation of importance is paramount to this study in that the nodes of a network may have many connections in the network but have no importance or add little or no value to the network through those connections. This definition suggests that knowing many people on its own does not make them important to the network but it does make them a hub. Therefore this definition in turn suggests that hubs could be of no importance to their network thus validating the need for this study which attempts to establish the importance of hubs as influencers of adoption of products.

The number of connections a hub has also influenced the tests and the interpretation analysis of these results. The frequency of purchases and new client acquisitions not only give important insight into the pattern of behaviour of this market but in the context of this chapter, it also gives invaluable information on the rate of influence and the spread of influence exerted by hubs.

For example the nodes in this network would not be able to purchase electricity over the counter after office hours. Based on the results, the fact that they can and appear to be doing so in increasing numbers, provides some indication of the importance of the hub to their network reference. In many cases the lack of electricity could mean the difference between a meal and going to bed hungry or impede a child from doing homework due to lack of light. There are other substitutes like paraffin stoves, coal stoves and candles but they are not as effective and pose known risks of both health and fire. As stated in chapter 4, electricity is therefore an important commodity in these communities.

4.2 Data Provider, the Service and the Data

4.2.1 Data Provider and Service

The data was sourced from Company Q. The organisation specialises in moving BOP communities into the formal or first economy by offering them products that allow them to transact in the formal economy with very little money exchanging hands. Innovations from Company Q allow poor BOP consumers access to goods and services that the current formal economy would not due to lack of collateral, no permanent employment and no credit history.

These factors all exist in the BOP market and as a result, these consumers are kept out of the formal economy and yet in some instances their expenditure on certain goods and services compares favourably with that of people in the formal economy (it is still lower but significant). The spending patterns and behaviours differ but there is an insignificant difference in amounts spent on certain commodities. Company Q argues that electricity is one such product.

The customer purchase analysis over one month (graph appendix 1) profiled three types of consumers (represented by the different shapes) and the frequencies and values of their purchases.

- High end LSM* 8-10 (Living Standard Measure as defined in chapter 3) consumer/household in formal economy (red square) spends approximately R650 on electricity a month
- Middle class consumer/household in the formal economy (diamond) spends approximately R1200 on electricity a month
- BOP consumer (green pyramid) spends approximately R300 on electricity, a significant amount given SA's electricity tariffs. Some middle class households spend less than R300 on electricity, argues Company Q.

The usage patterns also depend on size of household and type of dwelling as well as municipality. The graph does not only attempt to justify the use of Company Q's information as expert information but also highlights two important variables that also appear in the data in this chapter. Those are time of purchase and frequency of purchase.

4.2.2 The Data

The data recorded a total of two thousand one hundred and fifty nine (2159) hubs or sellers over the periods of the study. A number of variables were used in organising the data. These variables were selected based on their ability to explain the phenomenon of adoption influencing. These variables included the following:

- **New customer acquisitions** as these denote the influence of hubs within the network and whether it is increasing or decreasing over time. The variables were also selected aligned to (Goldenberg et al, 2009) in order to replicate as much as possible their original study. New acquisitions also help in identifying the difference between two types of hubs, innovator and follower hubs which based on the literature, have different roles with varying effects or impact on network adoption (Goldenberg et al, 2009).

- **Repeat purchases per hub** (out-degree), were also used in organising the data. These also help to determine the difference between adoption and a one-off influence exerted by the hub. Repeat purchases were used to segment the hubs based on their ability to either acquire new clients, or influence true adoption, measured through these repeat purchases.

- The data was further organised on a **time basis** where the weeks of selected months were examined. The reason for organising the data this way is because adoption has a time factor attached to it. A single purchase does not validate or describe adoption. The analysis and tests of the data also depend, in some instances, on time based or time series data.

4.3 Hypotheses of original study by Goldenberg et al

There were several hypotheses in this study. These hypotheses were modelled on the study by Goldenberg et al. (2009) from which the model of hubs for this study was drawn.

The following hypotheses were adapted and tested in the current study.

- H1: Social hubs are more likely to adopt at the early stages of a process.

Thus:

- H2a: Hub adoption speeds up the overall adoption process. Innovator hub adoption has a larger correlation with speed of adoption than follower hub adoption.
- H3: All else being equal, the higher the relative out-degree of a hub, the greater is his or her impact on adoption.
- H4: Hub adoption increases the eventual size of a market.
- H4b: Follower hubs have a stronger relationship to market size than innovative hubs.
- H5: Hub adoption at an early stage can be used to predict product success – here you could potentially use frequency, timing and amount of spend.

4.4 Abstract: Current Study Tests

The test and results to follow were conducted in line with (Goldenberg et al. 2009). A null hypothesis (H0) was derived for each hypothesis test. The rejection or the choice not to reject (H0) based on the outcome of the hypothesis test (Regression and Correlation in this case) will determine whether the hypotheses (H1 to H5) will be rejected or not. (H0) proposes the opposite of the research hypothesis.

4.5 Hypotheses of Current Study

4.5.1 H1: Social hubs are more likely to adopt at the early stages of a process.

Goldenberg et al. (2009), argue that social influence is proportional to the number of people a person knows who adopt rather than the percentage who adopt. It is further argued that because hubs adopt early due to their large number of links, their adoption should increase the speed of adoption in the period after they adopt assuming as satisfactory, the performance of the product Goldenberg et al. (2009). The social hub is also known as the less innovative hub but has a larger number of connections (driven by social relations) compared to the more innovative hub. Goldenberg et al. (2009) also argue that social hubs or follower hubs need more product exposure than innovator hubs to make a decision to adopt. It is assumed in this study that all hubs are adopters as they would have to use the product in order to sell it. Social hubs are then differentiated from other hubs using a combination of Goldenberg et al. (2009)'s formula of the probability of a person's adoption, P= 1- (1- P) (1-q) ^α (t) where P = probability of adoption, (p) = effect of exposure to external forces such as marketing, (q) = the impact of word of mouth (network effects) and Rogers' (1962) innovation adoption curve.

Rogers (1962 & 1976) grouped innovators and early adopters as the leaders of adoption, (appendix 2). This study did the same and considered the first 20% (slightly higher than Rogers) of hubs to adopt the services in the very first quarter (week 38 to 50, 2008) of the data ever being available as innovator hubs and the rest as social or follower hubs. Their behaviour will then be tested with respect to the P = 1 – (1 – p) (1 – q) ^α (t) equation in order to test hypothesis (H1).

4.5.1.1 Descriptive Statistics

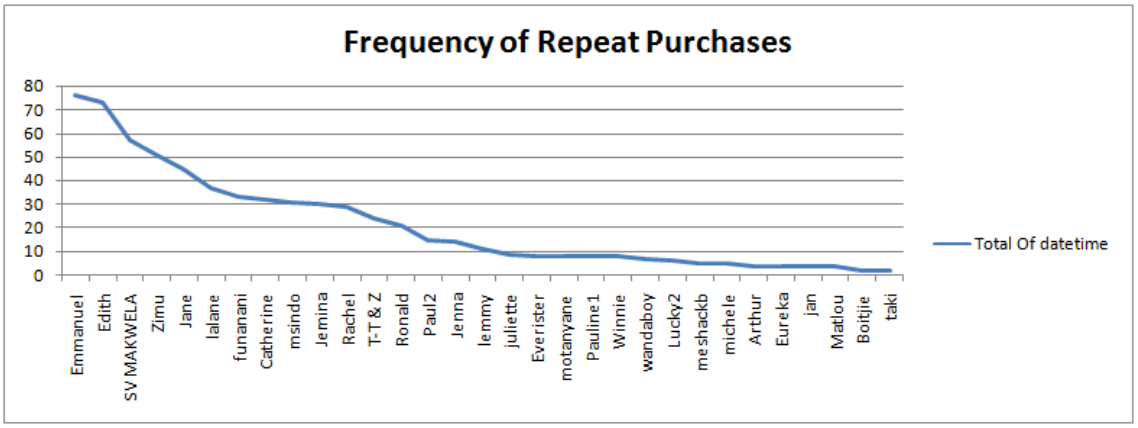
In the context of this study, early adopters are defined in terms of time of adoption. The selected period (February, March and July, August 2009) does not represent the early period of the data and the first hubs to adopt the product. To identify the early adopters and the hubs that adopted at the beginning of the data ala Rogers (1962) was interrogated. The results reflect the following:

- The data show that in the first quarter there were 40 early adopter hubs that adopted the product. There were a further 20% from this list that were the Innovators as defined by Rogers, (1962) not innovator hubs as defined by (Goldenberg et al, 2009). The 2.5% was reflective of a population of which hubs belong hence its use as a guide to identifying the innovator hubs. Goldenberg et al. (2009) do not justify a hubs innovativeness based on which percentage they fall under. The reasons behind their innovativeness may not be the same. Hubs are said to become innovative through some interest but mainly through their connections whilst innovators are driven by interest and knowledge in the product. Hence if there are 40 innovative or early adopter hubs, the top 2.5% are people with a particular interests and first hand information about the product. These innovators were made up of 8 hubs that joined within two weeks of each other.

- From the 40 early adopter hubs, 31 of them effected repeat purchases within the first quarter of their adoption. This repeat purchase information is important to this study and this hypothesis because based on the theory advanced by Goldenberg et al. (2009), social hubs are determined by their closeness to the market (more than innovator hubs who are more specialist and knowledge based) and therefore their ability to grow the market is greater than those of innovator hubs.

Repeat purchases are a variable or contributor to market growth. Therefore based on the theory and parameters of this study, 77.5% of hubs who were the first to adopt the product, that is in the first quarter (2008), exhibited traits of social hubs in that they were able to grow the market through repeat purchases very early after their own adoption; therefore using that aspect of the theory by Goldenberg et al. (2009), they were social hubs and they had adopted early.

Figure 7: Frequency of Repeat Purchases



The frequency of repeat purchases achieved in the early stages of the process also indicates that even amongst the 31 social hubs, there were some hubs that were stronger than the rest in terms of ability to achieve repeat purchases or their sociability within their networks.

4.5.1.2 Adoption probability formula

The examination of early adopter data gave some indication of the early adoption of social hubs as defined using one characteristic of social hubs and that is the ability to influence and grow the market more than innovative hubs. When using the probability of adoption formula ($P = 1 – (1 – p) (1 – q)^{\alpha(t)}$), another characteristic of social hubs as defined by Goldenberg et al. (2009), is applied in identifying social hubs and that is the number of connections.

Goldenberg et al. (2009), argue that social hubs will have more connections or out-degrees (more people to whom they convey information) than innovator hubs in a network due to their closeness to the network relative to innovator hubs (homophily). The data was then ranked in terms of connections at 0.5 standard deviations from the mean in order to identify social hubs.

The results (appendix 3) show the significance of other factors and network factors (p and q) versus the number of connections. The total number of connections of all hubs over the selected period is 60, 327. Within this there are social and innovative hubs. It is important to note that slight adjustment in communication and other effects (p and q) significantly impacts the probability to adopt (highlighted areas and spikes on graph). Adoption in this context is measured by the acquisition of goods through the influence of a hub. This implies that a hub with many connections, but with little or no interaction, will have little or no impact on adoption and people with low numbers of connections but high interaction will have more impact on the probability to adopt. This affirms the theory that innovator hubs will have less impact on adoption than social hubs due to their lower interaction with and closeness to the network, (Goldenberg et al, 2009).

4.5.1.3 Statistical Test (based on Goldenberg et al (2009)

The percentage of hubs adopting product over time was correlated to the market growth (appendix 3b) and it is evident that the number of hubs as a percentage of the market rapidly declines in the early stages of the period. The results of the test carried out for this study the results are similar to those attained by (Goldenberg et al, 2009). The percentage of hub adopters declines gradually over time whilst the market (meter count) increases indicating that there are more people adopting the product whilst social hubs had already adopted.

The decline in hub adoption over time can be expected as hubs will have adopted early and since there are a finite number of hubs in a network, the number of new hubs adopting must decline over time

4.5.1.4 Regression

Figure 8: Regression Summary Output

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.733923021							
R Square	0.538643001							
Adjusted R Square	0.511504354							
Standard Error	0.012161022							
Observations	19							
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.036575276	0.005807702	6.297718988	8.02283E-06	0.024322095	0.048828456	0.024322095	0.048828456
Timeperiod	-0.002269285	0.000509369	-4.455089305	0.000347607	-0.00334396	-0.00119461	-0.00334396	-0.00119461

Dependent Variable: Percentage (%) of hubs

Independent Variable: Time Period (defined in the context of this study as the selected period of the study, from week 6 to week 14 and week 27 to week 36 of 2009).

The regression was calculated over the percentage of hubs over time. The theory had purported a decline in the percentage of hubs over time; therefore a negative coefficient of the percentage of hubs was being sought. The percentage of hubs was the dependent variable whilst the independent variable was the time period. Therefore the movement (adoption) of hubs over time was under investigation in this regard. Although the R Squared is high, a high R squared is not necessary as the behaviour of the coefficient is what is being investigated. The data had a break in it as it jumps from week 14 to 27. Had it been continuous the R squared may have increased even more.

The null hypothesis (HO) of Time-period (for this test) was that the coefficient was insignificant hence the time-period coefficient of -0.22% meaning that in every incremental increase in time the percentage of hubs decreases by 0.2%. This is attributable to the theory that hubs adopt early under investigation in this hypothesis.

4.5.1.5 Summary

The decrease in the number of hubs over time whilst the market increases is an indication that hubs adopt early in the process; the later adoption time, the less the likelihood of those nodes being classified as social hubs.

4.5.1.6 Result

H0: rejected

H1: Chose not to reject

4.5.2 H2a: Hub adoption speeds up the overall adoption process and Innovator hub adoption has a larger correlation with speed of adoption than follower hub adoption.

This hypothesis aims to illustrate the importance of the hub in the adoption process. It is based on the argument that more connections will be activated after hubs adopt; even more so with social hubs, (Goldenberg et al, 2009). A further argument in this regard is that innovator hubs adopt earlier than follower hubs thus they have more time to influence the network. The literature however also describes the different characteristics of both innovator and follower hubs and on that basis it is accepted that although both types of hubs have influencing characteristics, innovator hubs by nature have fewer connections (as they are not as close to the network as follower hubs), (Goldenberg et al, 2009), and therefore would have fewer people to influence hence their speed of adoption influence would be quicker.

Speed or rate of acquisition of new clients is a sound indicator of speed of adoption as it addresses the rate at which hubs acquire non-existing clients. The hypothesis proposes that this rate (speed) is more closely related to the actions of innovator hubs than those of follower hubs. It is important then to distinguish between speed of adoption and extent of product diffusion, which according to the theory is credited to social hubs, (Goldenberg et al, 2009). Although their functions and roles differ, the overall influence of adoption of any type of hub is not in question. Goldenberg et al. (2009) affirm that, “if a sufficiently large number of hubs adopt a product, it is more likely that the new product will be exposed to people who otherwise may have not been exposed to it”, (Goldenberg et al 2009, p 4). Thus, they further argue that adoption by hubs increases not only the speed of adoption, but also market size. Hub adoption increases the eventual size of a market.

Therefore in the context of this study, speed of adoption will be classified in relation to the adoptions and time whilst extent or growth will be referred to in the context of overall influence exerted by hubs in the selected period. Repeat connections (purchases) therefore play an important role in illustrating overall influence of hubs and growth of market as they indicate the value of that hub to members of their network if they keep returning to that hub. Ndubisi et al. (2009), argue that where there is perceived value, people stay in the network and benefit from that value.

4.5.2.1 Descriptive statistics

Of the two thousand one hundred and fifty nine (2159) sellers recorded in the data and in the results of the analysis, one thousand four hundred and forty nine (1449) acquired new clients over the selected periods (February, March, July and August 2009). The acquisition rates (appendix 4A) reflected in the results indicated that different hubs have varying weekly acquisition rates and there was no pattern in these rates across time. In total, seventeen thousand two hundred and thirty three thousand (17,233) new acquisitions were made by 1449 hubs in this period. Therefore 67% of hubs were responsible for 100% of the new acquisitions in this period. The relevance of this data is that innovator hubs would start influencing people early in the process as they tend to adopt early.

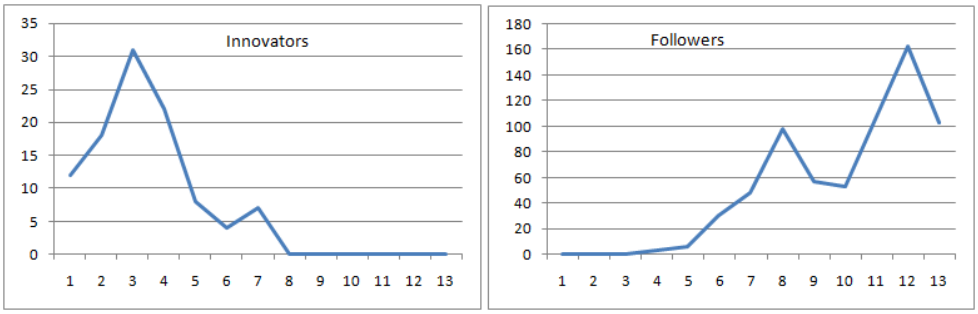
Of interest to this section (hypothesis) however is the rate at which those adoptions happened. Using the classification of adoption speed (time based), the impact of innovator hubs on adoption rate versus that of other hubs can be measured using the rate at which the defined innovator hubs, acquire new products compared to the rate of the total group which will include non-innovator hubs.

Innovator hubs are said to be further removed from their network whilst follower hubs are argued to be closer and are ultimately more similar to the non-hub nodes of the network who for this reason trust the follower hubs more, (Goldenberg et al, 2009).

4.5.2.2 Time Bases Increase Data

Repeat purchase data in the early stages is crucial in understanding the impact of each group of hubs on the market. It is evident from the graphs below that innovators had an earlier impact on adoption (repeat purchases) but followers came later with greater impact on the market. These results support the theory on the impact role of innovators and followers.

Figure 9: H2a Innovators vs. Followers



4.5.2.3 Differences from Original Study

Goldenberg et al. (2009) have provided evidence on the significance of the impact of hubs on adoption. They further found support that innovator hubs had more than twice the impact of follower hubs, affirming theories on the role and impact (they did not define impact) of hubs on adoption.

They however in some instances used multiple products to do so whilst in this study one product of a non-discretionary nature is used. Similar principles were applied in the current study but there were limitations in that in this case, secondary data was used and hubs were not observed in their neighbourhoods and the detail of the data was accurate to the day of adoption rather than the week.

4.5.2.4 Data for Regression

The results (appendix 4B) compared the performance of innovator hubs (the top 20% of adopters in the first quarter 2008 according to date of first sale) and follower hubs on the frequency of repeat purchases (adoption) in the same period. The use of this data is justified by the fact that this hypothesis is about hubs and their influence on speed of adoption but especially innovator hubs. Innovator hubs of this study were identified based on their adoption in that period. The data includes data for regression. The 'Market' represents the total market per week. The Innovator is the number of adopters under the innovator hubs and Followers represents the number of adopters under the non-innovator hubs. It is important to note that the first 20% of adopters (innovators) was made up of only 8 sellers hence fewer observations.

The correlation results indicated that Innovator (innovator hub adopters) correlates less closely to 'Market' (total market per week), that is, follower hubs are more closely related to the weekly performance of the market. The difference between the correlation of innovator hubs and non-innovator hubs is very wide and shows a very strong correlation to market size on the part of follower hubs.

The chart also highlights the speed and rate (amount) at which innovator hubs influence adoption in the given period. Innovator hub driven influence (green bar measured on the primary axis) indicates adoption rates in the first four weeks to be at its highest whilst follower hubs had effected no influence in the first three weeks.

4.5.2.5 Regression

Figure 10: H2a Regression Statistics

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.957266275							
R Square	0.916358722							
Adjusted R Square	0.897771771							
Standard Error	28.24651785							
Observations	12							
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	19.90010403	21.11115157	0.9426347	0.370481199	-27.85663861	67.65684667	-27.85663861	67.65684667
Follower	1.795294682	0.207513068	8.651477691	1.17805E-05	1.325867509	2.264721856	1.325867509	2.264721856
Innovator	3.637074201	1.519925072	2.392929933	0.040363048	0.198764819	7.075383583	0.198764819	7.075383583

The null hypothesis (H0): Innovator hubs have no impact on speed of adoption.

The Multiple R Squared indicates that 96% of the market movement is explained by the variables, innovators and followers. Innovator and follower both have p-stats below 0.05 meaning they are both significant. However the p-stats of follower were much lower than those of innovator, meaning the follower hubs were influencing the market more than innovator hubs at that point in time. This information coupled with the correlation to speed of adoption, indicates that adoption of hubs does increase speed of adoption and that follower hubs have a larger correlation to the size of market. This aligns to the theory on the role of hubs and the proof from the data that innovator hubs effect repeat purchases (adoption) earlier but follower hubs have greater impact on market size.

4.5.2.6 Summary

The results of the speed of adoption influenced by hubs appear to validate the hypothesis that hubs do influence speed of adoption.

4.5.2.7 Results

H0: Reject

H2: Cannot be rejected

4.6 H3: All else being equal, the higher the relative out-degree of a hub, the greater is his or her impact on adoption.

The out-degree (number of people to whom the hub conveys information) of the hub in these results is indicated by the number of adopters who remain or by the repeat purchases. It is therefore a direct correlation between visits by a network node and the hub. Goldenberg et al. (2009) argue that hubs can influence provided the product performs, whilst Dunphy and Herbig (1995), argue that the product must have demonstrated value and Ndubisi et al. (2009) argue that a mutually beneficial relationship between hub and network is important.

In-degrees as defined by Goldenberg et al. (2009), address the question on the number of people and the rate at which the hub fosters adoption. From an out-degree point of view the hub is at the source of information, hence it is a measure of the number of people to whom the hub conveys information, (Goldenberg et al, 2009). This can be signalled by the number of users who continue to use the product through the specific hub, that is repeat purchases by a hub in this regard.

This hypothesis is affiliated to the theory that social hubs influence market size. Goldenberg et al. (2009), argue that social connections provide indirect information, thus the larger the number of connections, the larger the pool of information possessed and the bigger the advantage on influencing adoption as it affords these network nodes the option to collect information sooner than the average network member. This status, they argue, can be obtained when “number of ties (degree) and betweenness centralities (links to different groups) are high”, (Goldenberg et al 2009, p 4). An argument therefore that the adoption of hubs increases not only the speed of adoption but also the market size is advanced by (Goldenberg et al, 2009).

Their similarity of follower hubs to the market was said to give them more trust in the network, (Goldenberg et al, 2009). This argument arose from the theory of homophily, that argues that the degree to which pairs of people are similar in terms of certain attributes is related to the tie strength between the two, (Goldenberg et al, 2009). The trust between networks and follower hubs can therefore be explained this way.

4.6.1 Descriptive Data

Frequency of Repeat Purchase

The tests for this hypothesis should be concentrated on data around the number of connections hubs possess. In this regard the number of individuals connected to the hub alone was deemed insufficient because hubs do not only convey information to new people they meet. The out-degree must take into account the existing number of the hub's clients that the hub conveys information to continuously. In fact, due to their existing connection, hubs have more access to these nodes. This implies that, once again, along with new acquisitions, repeat purchases are an important measure for out-degrees.

The results for this section were obtained from a list of complete repeat customers. Repeat In BOP households, purchases are made when required and rarely does shopping or product acquisition happen in bulk, (Prahalad, 2010). Only seven hundred and sixty seven (767) hubs induced one or more repeat purchases over the selected period. This in itself is an indication (in line with the theory) that there are different types of hubs and they play different roles with regard to influencing adoption, (Goldenberg et al, 2009). The first half of the data (Feb – March) reflects a weekly growth and the second half (Jul – Aug) shows a relatively static growth (appendix 5A). In this study repeat purchase is an indicator of adoption and growth.

It was therefore important to get a picture of the extent of repeat purchases in the results before understanding who, within the hub database, were the drivers of adoption and what their out-degrees were before testing for a relationship between the two. Based on the theory, the type of hub that influences repeat purchases would be classified more as follower hubs as they are credited with penetration and diffusion (market growth) of the product, (Goldenberg et al, 2009). Follower hubs are followers to innovator hubs and would still adopt or come into the system before the average node of the network due to their multiple connections. Unlike innovator hubs, they are not considered experts on the product according to (Goldenberg et al, 2009).

The results showed some correlation between the number of repeat purchases and the value of repeat purchases. A snapshot of the top fifty hubs (ranked on repeat purchases) shows the disparities between the high performers and the rest of the hubs in the data (this is a top 50 of 767 or 6.5% of repeat purchases). The highest performer had over 6000 repeat purchases and the lowest performers had 1. The number of observations in this regard exceeds 30 and therefore based on the central limit theorem, can be considered meaningful.

4.6.2 Testing the Hypothesis

4.6.2.1 Market performance per week data

This test measured the impact of hubs on repeat purchases (adoption). See appendix 5B.

4.6.2.2 Rationale of this test

Adoption is defined as repeat purchases in the contex of this study and the frequency thereof is an indication of impact of whomever or whatever drives that behaviour. In this case hubs are correlated to the increase in repeat purchases to explore the kind of

relationship between the two.There appears to be a direct relationship between market growth and the number of hubs, that is, a relationship between increase in adoption and an increase in the number of hubs (trend). It can therefore be argued that the more hubs join the network, the more the number of connections in that network. Therefore, the more hubs there are to convey information the greater the repeat purchases hence the greater the adoption (assuming repeat purchases are a reflection of real adoption). Due to the question raised in the hypothesis a correlation between the growth of the market and repeat purchases and there is an almost perfect correlation of (0.998). That is market growth is positively correlated to repeat purchases which represent adoption in the context of this study. See (appendix 5C)

4.6.2.3 Regression

H0: Out-degrees of a hub have no impact on their ability to influence adoption (Repeat purchases)

Figure 11: H3 Regression Statistics

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.998063713							
R Square	0.996131175							
Adjusted R Square	0.995903597							
Standard Error	192.364558							
Observations	19							
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	190.4789924	82.43380663	2.31069024	0.033660449	16.55886303	364.3991218	16.55886303	364.3991218
Repeat Purchases	1.122291455	0.016963384	66.15964356	5.9636E-22	1.086501843	1.158081068	1.086501843	1.158081068

4.6.2.4 Rationale for test

From the correlation results it was evident that there is a relationship between repeat purchases and size of the market. These repeat purchases depict out-degrees or the number of people to whom the hub conveys information as in the context of this study every purchase demands an interaction between customer and seller (network node and

hub). With the repeat purchases (out-degrees) being the element of observation, they are independent and the regression is used to determine the relationship between them and their dependent variable

- Independent Variable: Number of repeat purchases
- Dependent Variable: Number of hubs
- The high R Squared indicates that 99% of the market movement can be explained through the behaviour of the variables (repeat purchases). This result of the hypothesis indicates through the p-value that the coefficient of the variable is significant as it is much lower than 0.05.

Repeat purchases in this context is representative of out-degrees due to the fact that e every contact demands interaction and communication between hub and network node. Therefore, the more the number of out-degrees, the larger number of hubs. As per the market correlation data, the more the repeat purchases (out degrees) increased, the bigger the market grew.

4.6.3 Summary

The evidence in from the tests suggests that the more people hubs know the more influence they are able to exert.

4.6.4 Results

H0: is rejected

The evidence is that hubs do impact the number of repeat purchases. Or that out degrees impact significantly, the adoption of products.

H3: Do not reject

4.7 H4: Hub adoption increases the eventual size of a market. Follower hubs have a stronger relationship to market size than innovative hubs.

H2 has already dealt with the impact of innovative hubs on the speed of adoption. The remaining hubs (not innovator hubs) were thus classified as follower hubs. Goldenberg et al, (2009), argue that H2 and H4 would be in contradiction if the adoption speed and the market size were highly correlated. The two concepts are however logically different. The literature also argues that hubs expose people that may otherwise not have been exposed to information. In the context of this study, for these hubs to expose their respective networks to the product, they themselves ought to have initially adopted as they would not be able to use the product without adopting it beforehand. Goldenberg et al. (2009), argue further that if hubs do not adopt a product soon after its introduction, this may impede adoption by those who are connected to the hubs.

This argument by Goldenberg et al. (2009) is herein in that if hubs had not adopted and influenced the network to use the product, it may have taken longer for the network to find out about the availability and benefits of the product or, depending on physical location, some may have never found out. This is because Company Q relied strictly on word of mouth through the initially selected and volunteer hubs. That is, there was no external influence push from the company and the success of the product was solely dependent on network effects and influences. Thus if P = 1 – (1 – p) (1 – q) ^α (t) and both (p) and (q) were zero (0) then P would equal zero (0). Logically if the probability of adoption was zero, then it means that there is no chance of adoption even though the hub may have a large number of (α) or connections over the (t) the time period.

4.7.1 Theoretical Qualification of Hypothesis

The above rationale implies therefore that hub adoption will only increase the eventual size of the market if the hub communicates the product or service to their network. As stated in H2, follower hubs are the opposite of innovator hubs in that they contribute to the extent of adoption or market size. It was also clarified in H3 that these follower hubs have stronger homophilistic relationships with their networks than innovator hubs meaning the ties with the network are stronger, Goldenberg et al. (2009). The literature argued that stronger ties are a function of various factors amongst them connectivity and closeness, that is, there is more communication between these hubs and their network hence (q) network effects (word of mouth) cannot be zero, implying that the adoption of these (follower) hubs will increase the probability of their network nodes adopting soon after the hub. Increased probability of adoption implies increase in possible adoption and eventual adoption.

4.7.2 Descriptive Data (2008 data ala H2)

Hypothesis 2 (H2), dealt with the speed to adoption and the role of innovators with regard to influencing that speed of adoption. For this reason data from the first quarter (early adopters and innovators) was used. It is therefore logical to analyse results from the same period in order to determine the impact of followers so that similar data and circumstances are used when determining the relationship of the follower hubs to the growth on the market (market size).

Hypothesis 2 already highlighted the relationship/correlation between innovator hubs and follower hubs to the market. This time the two have been summed and the correlation is stronger. That is, total hub driven adoption is closely correlated to the market growth. The correlation of **(0.94)** is very significant and is sound evidence of the impact of hubs on the market. Hub to market correlation results were as follows: Innovators: (0.929); Followers: (-0.469); Combined (Total): (0.948)

See appendix 6

4.7.3 Regression 1(hub adoption and market size)

Figure 12: H4 Regression Statistics

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.948652761							
R Square	0.89994206							
Adjusted R Square	0.889936266							
Standard Error	29.3090417							
Observations	12							
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	42.74892886	12.71397188	3.3623583	0.007213622	14.42043416	71.07742356	14.42043416	71.07742356
Total	1.628978663	0.171764694	9.483780568	2.57811E-06	1.246263076	2.01169425	1.246263076	2.01169425

A high R Square indicates that the behaviour of the dependent variable can be explained by the independent variable 90% of the time. A P-value of (0.0044) indicates the significance of the coefficient, that is, one unit movement (increase) in the independent variable (hub adoption) results in a 1.6 unit impact on the dependent variable.

4.7.4 Follower Hubs Relationship with Market Size

Now that it is clear that hubs do have an impact on market size, it is then important to understand the relationship between follower hubs and market size versus the relationship between innovator hubs and market size. Goldenberg et al. (2009) argued that innovator hubs however influence speed and not the size of the market.

4.7.5 Implications

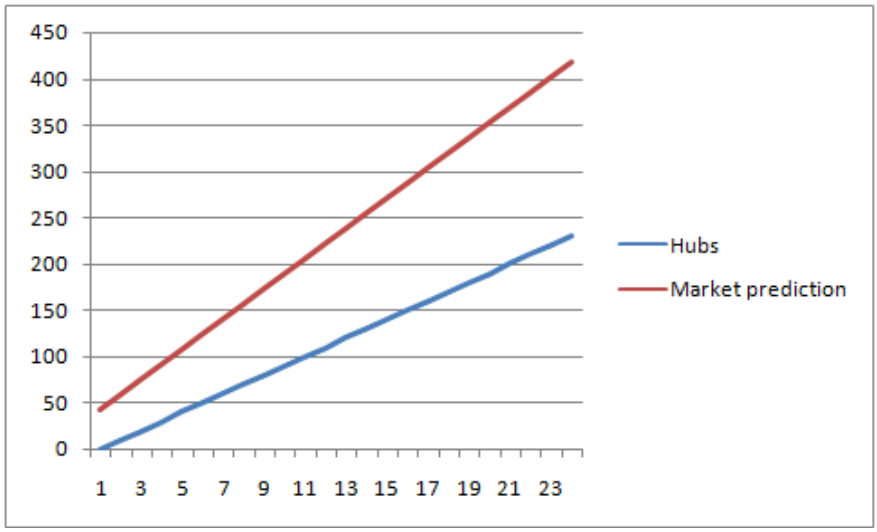
Make estimates about market size and model the impact of the hubs using innovator and follower hubs rates as a comparison using regression.

4.7.6 Market size estimates and assumptions

The data of this study is solely based on the existence of hubs, therefore, estimating the possible volume market size (number of meter numbers) would be impossible as the ones in the data were all cultivated by hubs. Value market size however can be estimated because even though hubs acquired the network nodes, they are also responsible for repeat purchases which had already been classified as a form of market size indicator or determinant. The current regression results were used to estimate the market size and/or performance without the presence or impact of hubs. The regression data was ideal as it represented information on the contribution of both innovator and follower hubs.

The idea then, was to assume the market was what it is and then establish a relationship between the markets (from where it is, including the impact of hubs, to what it would be if numbers of hubs were added). Therefore the current market size of 42.74892886 (intercept) is assumed the base or market at zero (0) hubs. Hubs were then added in increments of ten (10) at a time to see the effects on the market. The 90% R squared permits this kind of assumption and estimate because it stipulates that there is a 10% chance that hub adoption (increase) does not impact on market size (growth) versus a 90% chance that they do. The outcome of the estimate test and effect of adding hubs to the market over time is in the graph.

Figure 13: Market size estimates and assumptions



The principles of this test, match the time effect of more hubs used by Goldenberg et al. (2009) below. Their study used an adjusted R-squared due to them splitting the innovator and follower hub figures. These are combined in the current study hence an R-squared and not adjusted R-squared. The percentage of that R-squared very closely matches the adjusted R-squared of the Goldenberg et al. (2009) study. See appendix 6B.

The results of both studies confirm the impact of hubs on market size. Evidence towards the impact of followers versus innovators in this regard was supplied in hypothesis 2.

4.7.7 Summary

Both regression and descriptive data results support H4. Hub adoption does impact on market size in the future.

4.7.8 Results

H0: reject

H4: Cannot be rejected

4.8 H5: Hub adoption at an early stage can be used to predict product success

Goldenberg et al. (2009), argue that hubs have to adopt a product soon after its introduction or else it impedes adoption by those connected to the hub. The argument is based on the theory that innovator hubs initiate the process, thus if they choose not to adopt, they may block the adoption process. Follower hubs in contrast are said to give the product a second push in the main market, which is necessary for widespread adoption. For these reasons Goldenberg et al. (2009), assert that hub adoption at the early stage of the diffusion process increases the probability of success of the product.

4.8.1 Original Study Method (Goldenberg *et al* 2009)

The method applied by Goldenberg et al. (2009), to test this hypothesis was specific to the type of data their study produced. A logistic regression between 30 modestly successful products and 30 highly successful products was performed. The adoption data were then split between innovator and follower hubs. To further test the relevance of this method they applied it across a small sample of hubs (to make it realistic and closer to managerial applications) and repeated the logistic regression. In both cases (using innovator and follower hubs) their results proved that early forecasting based on hub adoption was potentially useful. In the first test using all hubs the classification table of results indicated a 100% correct prediction and in the second they got a 70% correct predictions rate, (Goldenberg et al, 2009).

The results of these tests provide unquestionable evidence to the usefulness of hubs as predictors of product success. For these tests to be successful however, the following requirements were important:

- Existence of hubs before product so as to define 'early adoption'
- Number of products to compare and determine the difference between successful and unsuccessful product. Thus a classification or definition of success needs to be established.
- A time of hub adoption and subsequent product adoption by the network or other hubs as a result.
- At least two types of hubs in order to compare the prediction accuracy between the two.

4.8.2 The limitations of the current study compared to original study

The current study, although somewhat similar to that of Goldenberg *et al (2009),* is not identical and therefore contains structural differences that may not permit certain tests to be executed precisely the way they were carried out in the original study. The tests carried out in the original study had to be adjusted to fit the data of the current study. The current study has the following limitations with regard to testing H5 ala Goldenberg *et al (2009)*:

- There is no evidence or data of these hubs existing before the product. That is, hubs were defined using the existence of the product and their interaction with the product. It is therefore impossible to define hub adoption at an earlier stage (t-0, note: what does this mean?) than first day of sale as the market starts at the first day of sales.
- In the current study, data was based only on one product therefore a comparison between highly successful and modestly successful products could not be carried out. This implies that success needs to be defined in the context of the current study with one product.

4.8.3 Assumptions and definitions of the current study

The assumptions and definitions of certain terms are important in order to ensure the possibility and feasibility of tests similar to those carried out by (Goldenberg et al, 2009).

- Without an understanding of what success means in the context of this data, it would be impossible to test the hypothesis. Success for this hypothesis is defined as the **weekly growth** in sales of the product through hubs. The assumption in this regard is that sales are not stationary on a daily and therefore weekly basis.

4.8.4 Data Results

If success is defined as weekly increase in sales, then the most relevant result of the current study is the data that show sales performance of the product over a given period. The value spend (monetary spend) data of the current study in the early adoption stage and current stage are shown in the tables. Total Impact represents the sum of all values in the reporting period. It is the total transactions in the period. The Total impact figures appear to be growing over the given period. The mean (an arithmetic calculation of central tendency) appears to follow total impact in growth over time. This means that the average of spend is increasing or growing over time. The most observed number (amount spent) also fluctuates but shows a general growth trend over time. See Appendix 7 A

It is the number of new repeat purchases that determines growth. Therefore in this regard the median of repeat purchases is an irrelevant measure but the total impact which represents the sum of all frequencies in the reporting period represented as the total number of transactions in the raw data and the Median (the most observed value) could be used in interpreting growth or decline of the product over time. Both total impact and mean data show a generic growth over time. See Appendix 7 A

4.8.5 Current Study Execution of the test

The lack of multiple products in this study can be compensated by analysing hub adoption and product performance over two different time periods one of which was the time period classified as early adoption period in Hypothesis 2. This time period was also based on a group of hubs defined for this study as early adopters. The time period and hubs were therefore different from the time (week) prior therefore presenting varying circumstances for the data to behave and get analysed. These circumstances simulate conditions under which different products could have been adopted.

- To test the hypothesis, the early hub adoption period (first twelve weeks) was regressed against the performance of the market in a later period (current period meter number count). A comparison of the current period meter count and the early meter count (at the time of early adoption) was also made.

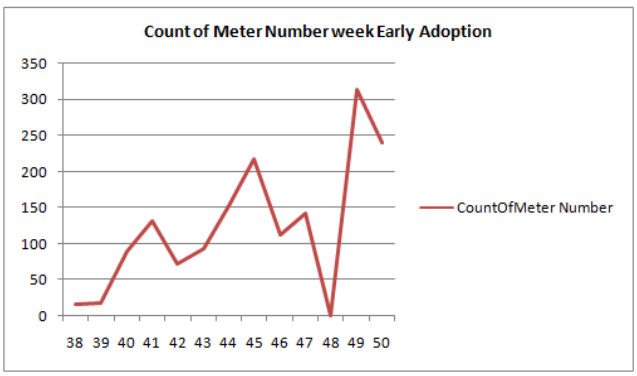
4.8.6 Rationale for test

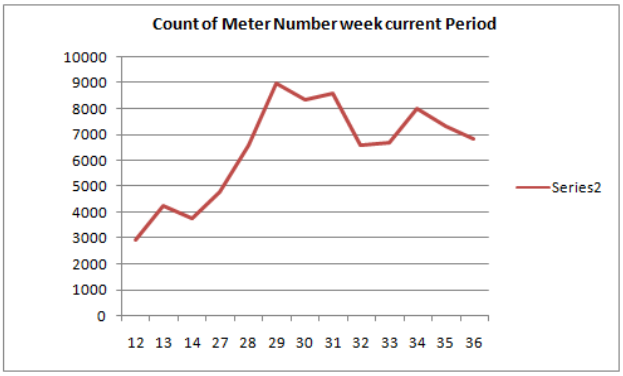
This test required that there be dependent (market performance) and independent variables (hubs) and the significance of their impact on product success (growth as earlier defined) was sought. A regression is the ideal test to examine the relationship between dependent and independent variables. In this case there were two independent variables hence (innovators and followers) hence the Multiple Regression. A correlation could have been used in this case but correlations cannot be used to for forecasting. Correlation would have indicated whether there is a relationship between the variables but would be insufficient in predicting future success.

4.8.7 Descriptive Statistics

The descriptive statistics included market data that will show the performance of the market in the two time periods and the adoption of hubs in relation.

Figure 14: Meter Number Counts





The meter count is directly linked to the weekly growth of the market as per the predetermined definition of success (weekly growth of market). The difference in the market in the first and last 12 weeks also shows a much stronger correlation of followers to market performance than that of innovators in the later 12 weeks.

An interesting observation of the results is that as the early adopter influence decreases, followers take over the market growth.

4.8.8 Regression

H0: Early adoption has no bearing on product success

Figure 15: H5 Regression Statistics

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.742106595
R Square	0.550722198
Adjusted R Square	0.460866638
Standard Error	1400.298804
Observations	13

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	7073.859807	1033.642022	6.843626	4.49E-05	4770.76186	9376.957756	4770.761859	9376.957756
Innovators	-122.2034296	57.90910095	-2.11026	0.061015	-251.23295	6.826088124	-251.2329473	6.826088124
Followers	4.271408553	11.17808056	0.382124	0.710365	-20.634907	29.17772413	-20.63490703	29.17772413

The regression results show a sufficient Multiple R Squared. This means that 74% of the behaviour of dependent variable (market) can be explained by the independent variables. Innovator P-value is more significant than followers meaning that innovators (very early adopters) have much more significance on the future performance of the market than followers.

4.8.9 Summary

The evidence from the results suggests that early adopters can predict future success of the product. However success needs to be defined in order for it to be measured. In this case sales growth (success) was certainly related to early adoption.

4.8.10 Results

H0: is rejected.

H5: Chose not to reject

4.9 Chapter Summary

The hypotheses tests and analysis used in this chapter were conducted to analyse the data but were also used to closely match the original study by (Goldenberg et al 2009). The objective of the study was to investigate the effect of hubs using the methods and tactics used in the original study. The implication of this is that the author also used the observations as they were applied in the original study. The original study results were focused around significance and of and impact of variables on the different scenarios and not much detail was entered into around results variables such as betas and coefficients of the study and their meaning.

5 Chapter 6: Interpretation of Data and Research Results

5.1 Introduction

This chapter analyses the data and the results of the data presented in Chapter Five. The interpretation of the results and data prior to the results is facilitated by insights gained in the literature review and from interactions with Company Q. The purpose and objective of this analysis is to analyse and confirm the validity of some of the theories raised in the literature as well as the hypotheses through an examination of the results. The focus of the study is on the existence of the relationship between the unit of analysis (the hubs) and their respective social networks and the impact the hubs have on the adoption of the product in the network; particularly because the theory suggests that hub influence on adoption is universal and influence on innovation adoption can be applied across different types of networks as it is related to network effect such as strength of ties and centrality, (Goldenberg et al, 2009) and type of network (Goldenberg et al, 2007). An expectation from the study is that it will provide an insight into the sample population (BOP). A level of generalisation may appear in the interpretation and analysis due to the quantitative nature of the study, (Zikmund, 2003).

6.2 Description of the data environment and sample

The data analysed in chapter 5 was gathered from a BOP sector network. The data collected was based on the activities of network nodes known as hubs who are individuals with a high number of connections within the network, (Goldenberg et al, 2009). The data was based on the activities of these hubs over the selected periods in 2008 and 2009. The number of hubs in the study in both instances (2008 and 2009), were sufficient based on the central limit theorem.

The data was not centred only on hubs but also influenced by the nature of the product (electricity). Electricity is a non-discretionary product, that is, it does not depend on the network nodes' preference choice or judgement; nevertheless the channel of consumption is discretionary as nodes can chose not to purchase it through hubs. In this case electricity is a product that the network nodes had to purchase when the need arose.

6.3 Interpretation of Data Prior to Analysis

The data used in this study was empirical and therefore brought to bear factual information that was evident before statistical analyses were carried out. This evidence may not in all instances address a particular proposition or hypothesis but may give guidance and insight that could inform future studies.

It can be deduced from the data and literature that in the BOP electricity is probably primarily used for food (cooking and preservation) and entertainment and information through TV's and radios and home theatre systems. The higher penetration of refrigerators and radio systems affirms the findings by Subrahmanyan and Gomez-Arias (2008) that the need for information is second to food in terms of importance to the BOP consumer. From the data there is evidence of a large number of sales taking place in the late afternoon and early evening. There is evidence of some individuals then returning much later in the evening to top-up on their earlier purchases for lower amounts.

Some deductions based on the theory can be made on the time at which some purchases have been made. The data show purchases made at midnight and well after midnight in some instances.

Considering that these electricity purchases could not be made at the municipal office or Eskom at that hour it can be deduced that the hubs extend the access to the product and in this instance, they (hubs) are emergency providers. A sale willingly made at that hour also indicates that there was a willing buyer willing seller transaction which is evidence of a mutually beneficial interaction, transaction or relationship, Ndubisi et al (2009).

More people in this network are continually discovering this service as the number of connections per hub increases week on week. With this, there is also an increase in repeat purchases over time. This indicates the value or perceived value of the product by the BOP market. The main objective of the results and tests conducted in chapter 5 was to closely match the study by Goldenberg et al. (2009) as much as possible and replicate as where possible. The analysis of the results is also kept in line with Goldenberg et al (2009) for comparison.

Zikmund (2003, p.65) argued that the objectives of the study, the available data sources, the urgency of the decision, and the cost of obtaining the data will determine the method chosen. In the case of this study as stated the research objective was not only to explore the impact of hubs on their networks but to also to as much as possible replicate (Goldenberg et al, 2009). Therefore, the research design determined by (Goldenberg et al, 2009), was followed in this study.

6.4 Hypothesis 1 (The likelihood of social hubs adopting in the early stages)

Goldenberg et al. (2009) argue further that, innovator hubs have a lower threshold of exposures to followers but because of the number of connections, the social hub may influence people that are not innovative to adopt in the early stages. This they argue may cause these contacts to be mistakenly identified as innovators hence social hubs are likely to adopt in the early stages. Hypothesis one is the relationship between the time of adoption of a product by a hub. The null hypothesis states that there is no relationship between hubs and the time of adoption of products and the alternative hypothesis states that there is a relationship. As per the original study, Goldenberg et al. (2009), the execution of the hypothesis testing was conducted on a time basis evaluating the percentage of hubs joining at each stipulated time period. In this regard, weekly data was used. That is, t5%, t16%, t30% and t100% was used as a logic as per (Goldenberg et al, 2009).

The literature review (Chapter Two), highlights different schools of thought on the reasons adoption takes place. Dunphy and Herbig (1995) argue that for a product to succeed it must be relevant and have demonstrated value. Guzman and Paswan (2009), argue that brands are socially constructed, thus making them a cultural phenomenon.

The implication of Guzman and Paswan's (2009), argument for this study is that, the products used in this research either have a cultural or social relationship with the selected BOP markets. In examining the different reasons for adoption, it is clear that the elements of this study (product, market and unit of analysis) satisfy those requirements. The relevance of electricity to communities was further asserted in Chapter 4.

Amidst all the reasons put forward by academics regarding why adoption occurs or not, Goldenberg *et al* (2009), argue that adoption has its early advocates that may influence everyone else to subsequently adopt and these individuals, they refer to as hubs. Hubs are said to be likely to adopt earlier than everyone else because they are exposed to many people and therefore have a stronger social network than average network members.

The implication of this is that they get information quicker than everyone else and due to their large network, disseminate that information to many more people. The results in chapter 5 (hypothesis 1 statistical test), show the behaviour of social hubs compared to the normal network nodes. Most hubs were in the market right at the beginning and the number of hubs joining the market declined over time whilst the rest of the market numbers increased over the same period of time. This piece of evidence validates the theory advanced by (Goldenberg et al, (2009). It also demonstrates that the theory is active in this context and that hubs join and then later that follower hubs are responsible for adoption of product and growth of the market.

It has been argued in the literature that this is so because these follower hubs have stronger ties with and are closer to the rest of the market which according to the literature results in more trust hence follower hubs can influence market size as they influence a lot more people than innovative hubs (Goldenberg Goldenberg et al, 2007) and (Goldenberg et al, 2009). One of the characterising features of any network is the length between the members (nodes) of that network. Kiss and Bichler (2008), define this path as the **geodesic distance.** Follower hubs therefore reduce the geodesic distance making them very accessible and approachable.

The question on hubs adopting early is a time based issue and statistical tests were conducted in the form of a regression of percentage of hubs and time. The percentage of hubs in this case denoted the number of hubs in the market relative to the number of other people. With the percentage of hubs being the dependant variable and time the independent variable, it was evident from the p-statistic of time period (which was <0.05) that time period as an independent variable is statistically significant in explaining the behaviour of the dependent variable (percentage of hubs). The results indicate that for every incremental increase in time, the percentage of hubs decreases by 0.002, or 0.2%. this means that over the innovation of adoption cycle, Rogers (1962), there are unlikely to be any hubs in the later stages of the cycle (late majority and laggards) or simply over time as they tend to adopt in the early stages, innovator or early adopter stages for example.

The results also show an increase in the number of non-hub network members adopting the product at the same time as the number of hubs adopting was declining. By their nature and definition, there are fewer hubs in a network than other members so it could be expected that the number of hubs adopting are smaller and quicker. This argument is countered by the evidence provided by the percentage of hubs adopting as a percentage of other network members joining. If the hypothesis were not valid and true the percentage of hubs joining per number of new adoptions would not decline as drastically. As an example, the biggest weekly adoption number was 9010 people in week 35. The percentage of hubs adopting in week 35 was only 0.39% of the total. In contrast, week 6 saw the smallest number of adoptions in the period with 281 adoptions but yet hubs made up 6.76% (the highest percentage of hub adoptions of the period).

As was the case in the original study by Goldenberg et al, (2009), hub adoption tends to decline slowly, while non-hub adoption increases over time. Thus, the concentration of hubs among early adopters is larger than among later adopters, (Goldenberg et al, 2009). This according to the literature can be attributed not only to the connectedness of hubs but also to the nature of influence theory as described by Watts and Dodds, (2007). Based on this theory (Tow –Step flow of influence), as the influence leaves its original sphere, there are a lot more influencers adopting it and passing it on to many more people.

5.1.1 Conclusion for Hypothesis 1

5.1.1.1 Probability of adoption formula

The probability of adoption formula by Goldenberg et al (2009), in practice indicates that a movement in the (p) and (q) values which denote external influences and internal network influences has a very direct impact on the probability of adoption. A lack of either variable reduces (P) probability of adoption and therefore based on the formula, hub activity can influence adoption and if that activity happens early, due to the direct correlation, it can be assumed that it can influence adoption early. It is important to note that Goldenberg et al. (2009) although they derive and mention the formula, it is not utilised in their analysis. The formula appears to be mentioned to simply make a point as opposed to addressing the hypothesis.

The null hypothesis (H0) of the test (that the coefficient time period is insignificant) can be rejected as the regression p-static indicates high significance with the coefficient of time period on the percentage of hubs being negative as was being sought.

Hypothesis 1 was supported as time period shows significance on determining the behaviour of a number of hubs. The negative (-0.0022) coefficient indicates that over time or as time progresses, the number of hubs joining decreases by (-0.22%). It is therefore evident that on average, hubs adopt sooner than non-hubs on a time basis. Therefore the behaviour of hubs within the BOP market did not differ from that of hubs examined by Goldenberg et al. (2009), on high tech internet based products.

This is an indication of the universality and consistency of hub traits across different environments, markets, products and even time periods. It can therefore be concluded, based on the results of this study that hubs do adopt earlier than the rest of the population in a network. Hubs also influence adoption through the network. Kiss and Bichler, (2008), (O'Cass and McEwen 2004) proposed that hubs become better informed because they are exposed to so many people (relative to everyone in the network) and the probability of information getting to them or passing through them is higher than an average network members. Their centrality in terms of access to information was hereby credited for their quick adoption.

6.5 Hypothesis 2 (Hub adoption speeds up overall adoption and innovator hub adoption is more correlated with speed of adoption)

Goldenberg et al. (2009), argue that there are two different distinct types of hubs with each playing a different role in the adoption process, and they also adopt products differently to each other. Hypothesis two aims to investigate the relationship between hub adoption and the speed at which it can influence others. The focus in this regard, is on innovator hubs as Goldenberg et al (2009) credit them with influencing speed of adoption. A slight deviation from Goldenberg et al. (2009) method was used to determine early adoption due to the data having constraints of products to compare early performers and late performers. This data also also began at the same time as hubs. That is there is no data before the existence of hubs so the speed of adoption before hubs were involved cannot be determined as was the case with the original study.

In the literature, Huh and Kim (2008), argue that the theory of adoption is crucial to academics and marketers alike and that buyers can be categorised into innovator, early adopters, early majority, late majority and laggard groups or individuals. The subsequent literature on hubs gave credence to the theory that hubs are likely to be early adopters of products in a network. Further to that, however, the literature provided definitions of two types of hubs, innovators and followers (Goldenberg et al 2009). These definitions were based on the personal and social factors that according to Weimann (1991) cited by Goldenberg et al (2009), include personality traits (how persuasive the individual is), knowledge (understanding of product) and social capital (type of connectivity).

The data for hypothesis 2 indicates a larger correlation between follower hubs and the market than that between innovator hubs and the market. The results show that in the first 3 weeks follower and innovator hubs did so, but with smaller number and lower effect on the market. The speed of innovator influenced adoption is higher to that of follower influenced adoption based on the results of hypothesis 2 data.

The regression was run on the impact of the two variables, innovator hubs and follower hubs on market performance (adoption). The Multiple R of 96% means that market movement can be explained 96% of the time by changes in the independent variables followers and innovators. P-Stat values of 0.00 (follower) and 0.04 (innovator) are both significant as they are both (< 0.05). However follower hubs have a much stronger significance and therefore correlation with market size. The theory linking follower hubs to the size of the market is extensive and comes from diverse sources. Goldenberg et al (2009), argue that this is due to the homophily or similarities between people and that follower hubs are more similar to the network nodes than other hubs thus they are trusted and therefore can influence more people than innovative hubs. Kiss and Bichler, (2008) argue that the type of network has a role to play in the influence. They propose that scale-free networks which follow a power law distribution tend to contain centrally located and extensively high degree hubs Kiss and Bichler, (2008, p.235).

They (Kiss and Bichler, 2008, p.235) argue that these hubs attach new members that prefer existing members that are already well connected. This in line with Goldenberg et al (2009), in that they also define follower hubs to be well connected in the network but more importantly have some similarities with the network. This implies that new members, joiners or users seek familiarity, perhaps for reassurance that they too belong and have made good choice. This is influence.

Goldenberg et al. (2007), on the other hand argue that the type of news conveyed has an impact on the adoption of product. In the context of this study, the news conveyed by the hub could have been considered good news as it offered the network a solution to purchasing of electricity. As discussed earlier, in some instances these hubs 'came to the rescue in times of no electricity, as they were available to nodes long after what could be considered reasonable business hours. This based on the theory, would accelerate the rate of adoption and influencing capacity of the hub and therefore the speed at which the hub can influence capacity.

The regression results show that single unit movement in the follower hub results in 3.6 unit movement in the dependent variable (the market) whilst innovator hubs only exert a 1.8 unit movement in the market per single unit movement. This phenomenon is further validated by the Time Based data graphs which indicate a steeper gradient on the market from innovator hubs early on. The followers adopt later but have greater impact on their market. The steeper gradient of the innovator hub graph is evidence of the early adoption influence by innovator hubs. The graphs for innovator and follower hub correlation cross at the point where innovator hub influence subsides and follower hub influence which is much higher, increases.

In the literature, Martinez (1998) asserts that diffusion happens at different speeds in different consumer markets and that the speed depends on not only the characteristics of the product itself but also the peculiarities of the market at which they are targeted. In the context of this hypothesis, it would appear that innovator hubs introduce these peculiarities into the BOP market.

These results support the theories in the literature that innovator hubs are the key types of hubs as their role is that of converting others from non-adopters to adopters. Follower hubs would then be the complementary partners of innovator hubs as they are said to diffuse (spread) the product into the network (Goldenberg et al, 2009). Follower hubs in the same breath are said to be the ones with homophily (similarity between people on certain attributes) and are therefore closer to the non-hubs in the network. For this reason there is greater trust of follower or social hubs than there is of innovator hubs.

Trust and relationships are important to influence of adoption as they associate with social capital and the type of social connectivity between hub and network, (Goldenberg et al. 2009). Thomas (2004) argues that credibility and trust play a part in the strength of the hubs' influence, and this comes from social hubs due to their relations with the network. Innovator hubs however, it can be concluded, have more impact on the speed of adoption. Theoretically this is justified as some of the influences of innovator hubs would be follower hubs in the early stages.

6.6 Hypothesis 3: All else being equal, the higher the relative out-degree of the hub, the greater is his or her impact on adoption

The out-degree or the number of people to whom the hub conveys information (which is at the heart of this study) is considered as all the connections the hub makes in terms of new client acquisitions, and repeat purchases are assumed to be as a result of out-degrees of that individual. Therefore all the data of this study is assumed solicited by out-degrees and the data does not provide any evidence to the contrary.

New client acquisition and repeat purchases therefore become important contributors to the number of meter numbers (clients) each hub has. Based on the theory and due to the number of connections hubs possess, follower hubs can be expected to have higher out-degrees than innovator hubs. Goldenberg et al. (2009) argue further that, innovator hubs have a lower threshold of exposures to followers but because of the number of connections the social hub may influence people that are not innovative to adopt in the early stages.

Goldenberg et al. (2009) used differentiable products whereas electricity is homogenous meaning that when looking at adoption or sales, it needs to be borne in mind that the reasons for fluctuation in purchases are availability and need and not entirely driven by preference for the product. This study also did not posses information on in-degrees; therefore, unlike Goldenberg et al. (2009), these were not measurable and comparable to the out-degrees. The principles in regressing the independent variable against the dependent variable were maintained. Adoption in this study was defined in terms of repeat purchases. It was also accepted that repeat purchases are a true reflection of adoption. Therefore a bespoke, but academically justifiable, definition of adoption was developed.

The descriptive statistics show a growing trend of repeat purchases over the selected period of the study. Repeat purchases are also credited to the hubs' out-degrees as they are based on connection with the hub at which point interaction and information is conveyed. This frequency of repeat purchases plateaus in the July to August period but retains a slight growth. In the same time period, the value of repeat purchases continued to grow. This is an indication of a market maturing and beginning to understand its use of a product and quantities required per interaction relative to usage patterns. The value of repeat purchases over the same period however continued to grow. This behaviour of the results indicates the market growth implying an increase in hub out-degrees even if it is to the same network nodes.

Kiss and Bichler, (2008, p.235) argue that the Eigenvector Centrality measures the importance of a node in a network. The consistent growth in the number of repeat purchases could be interpreted as a growth in the Eigenvector Centrality of the hubs over time. That is, the network finds the role of the hub more important over time. Groves, Obenour and Lengfelder (2003) argue that the there is a correlation (in part) between the adoption of a product into a culture and how that product is presented in relation to the understanding nature of that culture (Groves et al, 2003*).* Using the rationale presented by Goldenberg et al (2009), that follower hubs are closer to the network than innovator hubs suggests that they may understand the cultural nuances of that particular network better and therefore be able to present products and themselves in a more culturally acceptable manner to the network which may increase the number of people to whom the hub interacts with, with respect to the product or the out-degrees.

The data show signs of a relationship between the number of hubs and the frequency of repeat purchases. If repeat purchases, as suggested in chapter 5, represent true adoption, then these results show a relationship between the number of hubs and product adoption. The relationship between hubs and the network is an interactive one where the hub physically meets with the consumer? to acquire the product. This in turn implies that hub out-degrees (interaction and conveying information or selling) are related to product adoption in the form of repeat purchases. In the literature, O'Cass and McEwen (2004) argue that a consumer's desire for products is largely determined by their social networks. If it is accepted from hypothesis 2 that hubs influence those social networks, then through their out-degrees hubs impact product adoption. All other factors held constant all else being equal, that is, other possible influencers ignored.

The independent variable (number of repeat purchases) was regressed against the dependent variable (number of hubs). The R squared indicates a 99.6% (almost 100%) of the time the behaviour of repeat purchases occurred and can explain the behaviour of the market. The coefficient of the study indicated that a single unit movement in the independent variable effected at least a single unit (1.12) movement in the dependent variable. In this case the relationship between the variables was of a positive nature. This meant that an increase in repeat purchases was linked to a positive increase in number of hubs. These results were similar to those attained in the original study as where the significance of the independent variable was -0.6 implying that hubs with high out-degrees are more effective in speeding the adoption process.

Goldbenberg et al (2009) also registered high Adjusted R2 indicating a high fit of the test to what was being sought. Goldenberg et al (2009) also found that hubs with high out-degrees have ea greater impact on adoption. Their model however (based on their R squared) does not fit as perfectly as the model used in this study.

That is, almost all the movement in the market can be explained by the repeat purchases. If repeat purchases are an indication of adoption (which in this study is driven solely by hub out-degrees) then the higher the hub's out-degree, the higher their impact on adoption. This is further affirmed by the very significant P-statistic of the independent variable (<0.05), in fact it is almost zero at (5.9636E-22). The regression results also show that any single unit increase in the number of repeat purchases results in a 1.1 unit movement in the number of hubs. This means that for adoption (repeat purchases) to take place hubs…this seems incomplete.

The results of the hypothesis 3 tests validate the hypothesis that, ignoring all else, hubs out- degrees have an impact on adoption. Due to the almost perfect correlation of the market with repeat purchases (**0.998),** it is therefore accepted that the higher the connection (out- degrees) a hub possesses, the higher their impact on adoption (repeat purchases).

6.7 Hypothesis 4: Hub adoption increases eventual size of the market. Follower hubs have a stronger relationship to market size than innovator hubs.

Hypothesis 2 dealt with the impact of hubs on speed and hypothesis 4 deals with the impact of hubs on market size which, according to the literature, is the responsibility of follower hubs. Goldenberg et al. (2009) argue that innovator hubs have a lower threshold of exposures to followers. The literature argues that follower hubs are closer to the network nodes (non-hubs) and thus have stronger ties which were defined as more stable, frequent and intimate interactions that characterise an individual's personal networks (Goldenberg et al, 2007). It is therefore clear from the definition why follower hubs would have an impact on market size and the literature argues that this is due to homophily or the degree to which pairs of people are similar, (Goldenberg et al, 2009). This similarity exhibits trust which is integral to the influence impact between two parties. Ndubisi et al. (2009) argue that a mutually beneficial and reciprocal relationship is important in keeping a network intact and growing.

Innovators and followers for this study were defined based on their time of adoption, hence the use of data from a period before the data period. There is a relation between H2 and H4 in that one deals with speed (innovators) and the other deals with market size driven by the different types of hubs. As was the case in hypothesis 2, the descriptive statistics show a growing trend of repeat purchases over the selected period of the study. Repeat purchases are also credited to the hubs out-degrees as they are based on connection with the hub at which point interaction and information is conveyed.

This frequency of repeat purchases plateaus in the July to August period but retains a slight growth. In the same time period, the value of repeat purchases continued to grow. This in an indication of a market maturing and beginning to understand its use of a product and quantities required per interaction relative to usage patterns. The value of repeat purchases over the same period however continued to grow. This behaviour of results indicates the market growth implying an increase in hub out-degrees even if it is to the same network nodes.

The results of the regression provide evidence of the impact of hubs on market size. There is a high correlation between the independent variables (hubs) and the market size. Innovator hubs however start the process through early adoption and follower hubs take it over at a much more impactful rate on market size. The high R-squared provides proof of the statistical significance of the independent variables. Holding all things equal and stripping out the impact of hubs, showed that the market would get stagnant and hubs were critical in the growth of the market.

The R-square of the regression is extremely high at (0.899). This is in line with the even higher R-square attained in the original study (0.99), (Goldenberg et al, 2009, p.9). These high R-Squares indicate that a great part of the behaviour of the dependent variable can be explained by the change in the independent variable. In this case the summed p-value of the innovator and follower hubs was the dependent variable. The reason these were summed is to take into account the influence of innovator hubs. The hypothesis suggests that all hubs influence but follower hubs have a stronger influence on size of market.

It has already been argued by the literature that part of the reason for this is the strength of ties between hubs and other nodes. In this regard, follower hubs are argued to have stronger ties. Goldenberg et al, (2007) argue that booth weak and strong ties are argued to have certain strength with regard to influencing (Goldenberg et al, 2007). They (Goldenberg et al, 2007). Contend that it is not inconceivable that nodes with relatively weak ties can influence each other either positively or negatively about adoption of a product. A pertinent point raised is that ties (first and foremost) matter and then the strength of the tie can be considered. Hence summing of innovator and follower hub p-values.

At this stage the impact of innovator hubs on the speed of adoption is not in doubt as evidence was provided in hypothesis 2. Goldenberg et al, (2009), argued that homophily was the reason for follower hubs having more impact on market size than innovator hubs. If this assertion is true then it implies that follower hubs know and understand the network better. Groves, Obenour and Lengfelder (2003) argue that the there is a correlation, in part, between the adoption of a product into a culture and how that product is presented in relation to the understanding nature of that culture. It can therefore be argued that follower hubs understand these cultural dynamics better and therefore can influence more people over time than innovator hubs.

With respect to hypothesis four however, all hubs influence adoption but follower hubs influence more people over time. From the evidence from the hypotheses (2, 3 and 4) it can be argued that without innovator hubs to ‘kick-off’ or start the process, adoption would not only take longer but information on product itself may take longer to filter through the network. As is the case with BOP networks, there appears to be interdependency (Chip and Corder, (in review)) between hubs.

5.2 Hypothesis 5: Hub adoption at an early stage can be used to predict product success

The main challenge for the hypothesis was the definition of what success is or how success is measured. Without a clear definition of success and the concept of 'early stage', the tests on hypothesis five could therefore not be performed. The same definition of early stages as was applied in hypothesis 1 was applied for hypothesis 5. Success was defined as growth. Growth can be determined both from an increase in repeat purchases (new meter numbers added to repeat purchases over time) and value (an increase in the value of the market). Value was not used however due to inflationary impact and the real value impact would have demanded inflationary adjustments. Goldenberg et al. (2009) also did not refer to value in their analysis. Growth in the number of repeat purchases was used as the proxy for success.

The data for this hypothesis was extracted from early adopter data which was described in hypothesis 1 as the top 20% adopters in the very beginning of the study (2008). Current period data was also used in order to make comparisons between early adoption and current performance. The growth in the impact of repeat purchases from week 38 (2008) depicting early stages to the current data date of week 36 (2009), shows a growth from an impact of 12 to an impact of over 5935. Therefore from this evidence market growth cannot be denied. The difference in market data shows a positive increase in difference between innovator hub induced repeat purchases and follower hub induced purchases.

This is a crucial piece of evidence in that it shows the impact of the innovator hub in the early stages (where it exceeded the follower hubs) and the point at which follower hubs take over as the main drivers of growth (product success). Goldenberg et al. (2009), assert that the innovator hubs are initially the main hubs with follower hubs being the support structures which will drive market size (growth). This evidence from the descriptive data is in line with the theory.

The literature argues that hubs have multiple connections that increase their probability to early exposure, (Goldenberg et al. (2009); Goldenberg et al. (2007); Van den Bulte and Wuyts (2007); Kiss and Bichler, (2008)). This probability of early exposure is then converted into market growth which follower hubs are argued to be the drivers of (Goldenberg et al, 2009). The evidence provided by the descriptive data of hypothesis 5 validates this theory and the impact of early adoption on the future success of products. The theory should however still be tested.

The early adoption (innovator hubs) P-statistic indicates a high significance of this independent variable in explaining the behaviour of the market as it is (<0.05). The follower hubs have no significance in this regard as their p-statistic (>0.05). This means that the first 20% of hubs to adopt the product combined with the rest of the hubs, could explain 74% (Multiple R squared) of the market's behaviour. However within that innovator hubs had more significance. These results show that early adoption can be an indicator of product success as defined in this study.

As suggested in hypothesis 4 analysis there appears to be interdependence between follower and innovator hubs. That is innovator hubs get the process started and follower hubs then take over and grow the market. The regression shows that both innovator and follower hubs have a significant impact (with followers at 0.7) on the dependent variable. The betas (coefficients) indicate however that over time the innovator hub adoption has a negative gradient over time **(-122.2)** whilst followers increase over the same time. In the results there is evidence of follower hubs peaking in adoption exactly at the time when innovator hubs drop in adoption (graph and table on difference in market size during innovator and follower hub adoption periods)

Thomas, (2004), proposes that the strength of the hub's influence is underpinned by the trust in the individual, which leads to a level of credibility being attached to the recommendation made. Due to their stronger ties and closeness to the network, follower hubs are responsible in influencing the members of the network that may not be as innovative and those who require to hear and see information numerous times before they make decisions on whether to adopt or not. These people may be a large majority of the network hence the impact of follower hubs on the size of the market. Goldenberg et al, (2009), argue that innovator hubs have a small threshold of connections in which to convey a message and follower hubs have a much higher threshold and therefore connect to many more people in the network.

6 CHAPTER 7: CONCLUSIONS

This chapter concludes the study by reviewing the findings established as tested against the hypotheses and the preceding literature. A few recommendations to stakeholders and future study suggestions are also made. Future research recommendations will be based on the identified gaps and points of interest and value identified throughout the e process of putting together this research paper. A brief description of the stakeholders and possible stakeholders is also provided along with the limitations of the study and managerial implications.

6.1 Conclusion

This research examined adoption and diffusion in a documented social network. The documentation of this social network is improving and has improved a great deal from the time of the launch of the product in 2008. Technological advancements in recording and the capturing of data from this network is improving with time and the information is becoming more robust. Company Q (the custodians of the product and database) continuously invest in improving its documentation systems.

As was the case in Goldenberg et al. (2009), the findings indicate that hubs can be identified and classified into two types: innovator and follower hubs. Generally hubs appear, based on results, to adopt earlier than normal people in the network. Within this early adoption behaviour, are other traits of hub behaviour that impact adoption speed and market size. Innovator hubs are responsible for speed of adoption whilst follower hubs are credited with market growth, (Goldenberg et al, 2009).

BOP consumers could be profitable if their needs are catered for in product development and marketing. This point is validated by the number of small but frequent purchases of electricity in the network.

This could be taken to indicate that the planning of these consumers happens on a day to day basis and purchases are made to cover just their daily needs.

- The findings listed were not all drawn only from the results of the study but also from the literature examined and the interpretation of the results made in relation to some of the literature. Generally, hubs appear to adopt earlier as a result of their large number of connections and not because of their innate innovativeness (Goldenberg et al 2009).
- Hubs are more effective if they are closer to the network. Goldenberg et al (2009), argue that this homophily is integral in driving trust between network nodes and in turn more influence. This study established the same fact. It also emerged that market growth is the area where hubs are most effective and from a managerial point of view market growth is an important long term success factor.
- Follower hubs influenced more people than innovator hubs in this study. A number of purchases were made late into the night (sometimes after midnight) and in some instances these were repeated by the same customer a number of times. This shows a big reliance on the availability of both the hub and the product. Although no attention was paid to the timing of purchases, some useful information can be extracted from these (see appendix 8). Examining the data one could see a definite pattern in purchase hours; there were purchase peak periods and troughs in the data. The data can also provide insightful information on the behaviour of this BOP network, information that both the regulator (Eskom) and marketers could use. Consumption and spend patterns can be also be deduced.

- Innovator hubs influence the speed of adoption (Goldenberg et al 2009). There are fewer innovator hubs than there are follower hubs and as more followers adopt the product and start influencing the network, fewer innovator hubs adopt. It can be concluded that innovator hubs are effective at the beginning of the process then follower hubs take over the responsibility of conveying information thereby influencing adoption.
- The general financial potential of the BOP market was not referred to much in this study but findings from the data show some interesting value information that could also provide some insight into the financial potential in the BOP market. Company Q data (referred to in Chapter 5) also proposes that the BOP market is a financially viable market. The value growths shown in the data over time validate this proposal (see appendix 9).
- The product diffusion process as defined by Watts and Dodds (2007) and Rogers (1962) is a consistent factor and even with hubs the process does not change but where hubs become a differentiator is in their degree of impact on influence. Access to information proves to be the defining element advantage to the hubs' ability to influence. An informed hub with strong ties is based on the findings and the literature, the ultimate influencer of adoption.

6.2 Future Research Ideas

Ideas for future research are derived from a combination of research limitations of this particular study and the lessons learned and insights gained from the literature review, data analysis and the research findings. The study by Goldenberg et al. (2009), which provided the basis for this study, also provided sound insights for possible future studies.

- This study was conducted in the BOP market from one region of the country using a single product. The same study could be replicated using BOP data from different regions of the country across a number of products which have different values attached. Furthermore this study could be conducted using qualitative analysis based on primary research to explore whether the results will be consistent to those of this study and Goldenberg et al (2009).
- The company (Company Q) from which the data was sourced, bases its business model on the notion that in the long term BOP hubs and members can become viable and profitable entrepreneurs that could give marketers access to that market. A future study can investigate the feasibility of turning BOP candidates into entrepreneurs.
- This study found that innovator hubs are integral to the speed of adoption but follower hubs have the most impact on market size. A study that investigates the proportion of innovator hubs to follower hubs required in a network to ensure sufficiently early adoption to foster successful future market growth could assist stakeholders in understanding the drivers of product success outside marketing and classical sales efforts.
- Goldenberg et al. (2009), argue that because data sets on large networks with multiple processes are difficult to construct, approaches such as tracing hubs and examining their behaviour in a longitudinal study may be a useful avenue for further research.

- A more qualitative understanding of hubs, how they evolve to hub status and how they personally see themselves in light of their roles in society and networks could be pursued for future studies. This study could evolve investigating the in-degrees (the people from whom the hub gets information) relative to the out- degrees and explore empirically the threshold of hub influencers versus those the hub influences. How could the hub influencers be classified?
- One of the suggestions for future studies by Goldenberg et al. (2009) was that their study be replicated on more “classic” products which defuse more slowly. Electricity in the context could be classified as one but perhaps stronger branded consumer products could be explored in this regard.
- There is no doubt that hubs influence adoption. A study testing the influence of hubs over that of marketing efforts could also yield valuable results for both marketers and academics. The implications of the results could influence the way marketers view hubs versus their advertising and marketing budgets.

6.3 Managerial Implications

Managerial implications are that if hubs for products are identified and their opinion sought for further product development the adoption rates and speed of hubs could increase the success of the product even more. The early adoption of products by hubs could also help managers test the positioning, pricing and other aspects of the product in real life situations. In this way hubs can also then be used to identify potential markets or networks of success before a lot of money is spent on distribution and marketing in areas that may not yield great success for the product. The literature argued that cultural norms will have an impact on the behaviour of the market and therefore have an impact on the market's approach to a product. Cultural nuances and practices like societing where there is high reliance on the network, (Chipp and Corder in review), may determine the success or failure of a product. If the network does not identify with the product or a negative sentiment is filtrated about a product, hubs can then assist in influencing a positive perception and adoption of that product. Guzman and Paswan's (2009), argue that brands are socially constructed, thus making them a cultural phenomenon.

From a BOP point of view the effects of societing and the dependency on one another present a great opportunity if marketers get the right influencers to initially drive adoption.

Societing theory (Chipp and Corder in review), suggests that, a BOP network would then assume the role of follower hubs and defuse the product further as there is information sharing especially if the product performs positively or is perceived to perform positively. Dunphy and Herbig (1995) argue that for a product to succeed it must be relevant and have demonstrated value.

The speed at which hubs adopt products can be used by managers in estimating the future performance of the product. This however cannot be at the expense of a relevant performing product that the market perceives to be valuable. That perception however can be influenced at the early stages of product life cycles by innovator hubs, who will influence early adopters and follower hubs who in turn will influence the rest of the market. Watts and Dodds (2007) make a case that this simple process of influencing was the birth of the theory on influentials as it is understood today. At every step of influence, more people are affected.

Based on the evidence on the prediction of future success through early adoption performance, managers can forecast better, on a time bases, how long it is likely to take for a product to succeed or reach growth considered to be success. Based on this, critical investment, disinvestment and research and development decisions can be aided. Product life cycles within a market can also be more accurately pre-determined based on the early adoption of hubs.

7 REFERENCE LIST

Antonelli, C. (2006). Diffusion as a Process of Creative Adoption. *Journal of Technology Transfer*, *31*, 211–222.

Argo. J.J., Dahl. D.W., & Manchanda, R.V. (2005). The Influence of a Mere Social Presence in a Retail Context. *Journal of Consumer Research. Inc. Vol. 32.*

Barki, E., and Parente, J. (2010). Consumer Behaviour of the Base of the Pyramid Market in Brazil. Greener Management International, 56.

Belk, R.W., Ger.G, & Askergaard, S. (2003). The Fire of Desire: Multisited Inquiry into Consumer Passion*. Journal of Consumer Research. Inc. Vol. 30.*

Berger, J., & Fitzsimons. G. (2008). Dogs on the Street, Pumas on Your Feet: How Cues in the Environment Influence Product Evaluation and Choice. *Journal of Marketing Research 1 Vol. XLV,* 1–14.

Chipp, K., Corder, C. (In review). Where practice meets theory: Defining and reviewing the bottom of the pyramid for South African Marketers.

Chipp, K. (2007) SAMRA paper incomplete

Choi, H., Kim, K., and Lee, J. (2010). Role of network structure and network effects in diffusion of innovations. Industrial Marketing Management, 39. 170–177.

Couter, R.A., Feick, L., Price, R. (2002). Changing Faces: Cosmetics Opinion Leadership among Women in the new Hungary. *European Journal of Marketing, 36*, 1287–1308.

Cui, G., Bao, W., Chan, T-S. (2009). Consumer's Adoption of New Technology Products: the role of coping strategies. *Journal of Consumer Marketing 26(2),*110–120.

Dunphy, S. and Herbig, P.A., (1995). Acceptance of Innovations: The Customer is the Key! Journal of High Technology Management Research, Volume 6, Number 2, 193–209.

Groves, D., Obenour, W., and Lengfelde, J. (2003). Colas and Globalization: Models for Sports and Event Management. *Journal of Sport Tourism* 8*(4), 2003,* 320–334*.*

Goldenberg, J., Han, S., Lehmann, D.R., & Hong, J.W. (2009). The Role of Hubs in the Adoption Process*. Journal of Marketing, Vol. 73,* 1–13*.*

Goldenberg, J., Libai, B., Maldovan, S., and Muller, E. (2007). The NPV of bad news. *International Journal of Research in Marketing, 24,* 186–200.

Guzmán, F., & Paswan, A. K. (2009). Cultural brands from emerging markets: Brand image across host and home countries. *Journal of International Marketing, 17*(3), 71–86. doi:10.1509/jimk.17.3.71.

Huh, Y.E., and Kim, S-H. (2008). Do early adopters upgrade early? Role of post-adoption behaviour in the purchase of next generation products. *Journal of Business Research*, *61,* 40–46.

Iyengar, R., Van den Bulte, C., and Velante, W.T. (2010). Opinion Leadership and Social Contagion in New Product Diffusion. The Wharton School, University of Pennsylvania.

Kiss, C., and Bichler, M. (2008). Identification of influencers – Measuring influence in customer Networks. *Decision Support Systems 46,* 233–253.

LeBoeuf, R. A., & Simmons, J. P. (2010). Branding alters attitude functions and reduces the advantage of function-matching persuasive appeals. *Journal of Marketing Research (JMR), 47*(2), 348–360. doi:10.1509/jmkr.47.2.348.

Martinez, E., Polo, Y., and Flavian, C. (1998). The Acceptance and Diffusion of New Consumer Durables: differences between first and last adopters. *Journal of Consumer Marketing*, Vol.15(4), 323–342.

Martinez, J.L., & Carbonell, M. (2007). Value at the Bottom of the Pyramid. Journal Compilation London Business School, Business Strategy Review. Autumn.

Mehrara, M. (2007). Testing the purchasing power parity in oil-exporting countries. *Organization of the Petrol Exporting Countries (OPEC) Review.* December 2007.

Ndubisi, N.O., Malhotra, N.K., Wah, C.K. (2009). Relationship Marketing, Customer Satisfaction and Loyalty: A Theoretical and Empirical Analysis from an Asian Perspective. *Journal of International Consumer Marketing, 21*, 5–16.

O'Cass, A., and McEwan, H. (2004). Exploring Consumer Status and Conspicuous Consumption, *Journal of Consumer Behaviour, Vol. 4(1),* 25–39.

Prahalad, C.K. (2010). *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. Upper Saddle River, NJ: Wharton.

Rajagopal, initial>. (2009). Branding Paradigm for the bottom of the pyramid markets. Measuring Business Excellence, Vol. 13(4), 58–68.

Rogers, E.M. (1976). New Product Adoption and Diffusion. *Journal of Consumer Research.* Vol. 2. March 1976, 290 - 300

Rogers, E.M. (1962). Innovation Adoption Curve. http://www.valuebasedmanagement.net/methods_rogers_innovation_adoption_curve.html. Accessed on 10 August 2010.

SAARF. (2010). LSM presentation May (2010). Available from http://www.saarf.co.za/LSM/lsm-presentations.htm (accessed 19/07/10).

Sexton, D.E. (1972). Black Buyer Behaviour. *Journal of Marketing Vol. 36, 36–39.* October*, 1972.*

Steyn, G., (2009). Black Middle Class Keeps Growing but Unemployment keeps increasing. *Finweek.* 15 October.

Subrahmanyan, S., Gomez-Ariaz, J. (2008). Integrated Approach to Understanding Consumer Behaviour at Bottom of Pyramid. *Journal of Consumer Marketing*, *Vol. 25(7)* 402–412.

Sweeney, J., Swait. J. (2008). The Effects of Brand Credibility on Customer Loyalty. *Journal of Retailing and Consumer Services, 15,* 179–193.

Szmigin, I. and Foxall, G. (1998). Three forms of innovation resistance: the case of Retail payment Methods. Technovision, 18(6/7) 459–468.

Thomas Jr, G.M. (2004). Building the buzz in the hive mind. *Journal of Consumer Behaviour Vol. 4(1)* 64–72..

Truong, Y., Kitchen, P.J., and McColl, R. (2009). New Luxury Brand Positioning and the Emergence of *Masstige* brands. *Journal of Brand Management*, 16, 375–382.

Tzou, R.-C., Lu. H.-P. (2009). Exploring the emotional, aesthetic, and ergonomic facets of innovative product on fashion technology acceptance model. Behaviour and Information Technology, 28(4), 311–322.

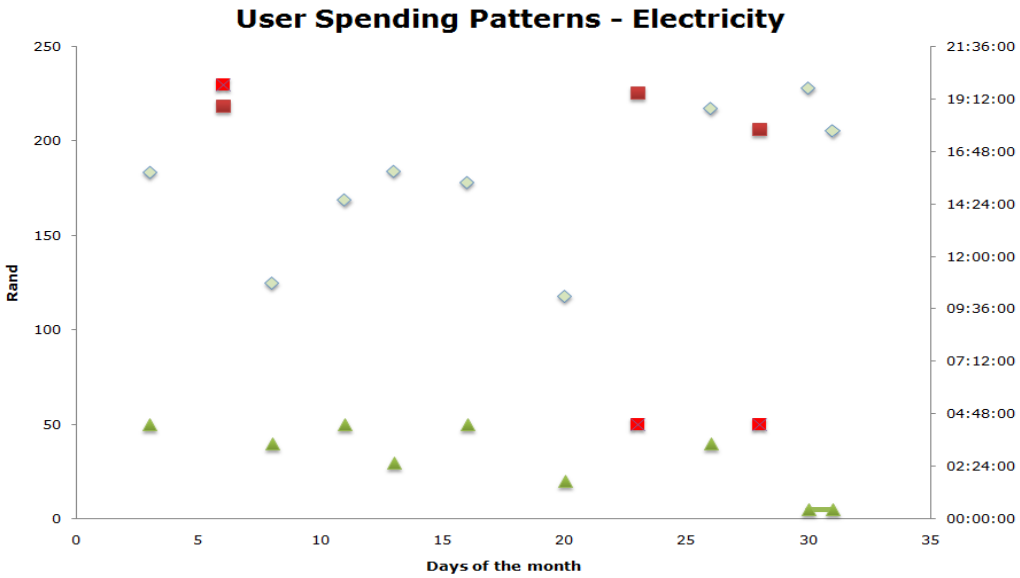
Venkatesh, V., Brown, S.A. (2001). A Longitudinal Investigation of Personal Computers In Homes: Adoption Determinants and Emerging Challenges*. MIS Quarterly Vol. 25 (1*), 71–102.

Venter, E. (2004). The Notion of Ubuntu and Communalism in African Educational Discourse.*Journal of Studies in Education and Phylosophy*, *Vol. 23 (2).*

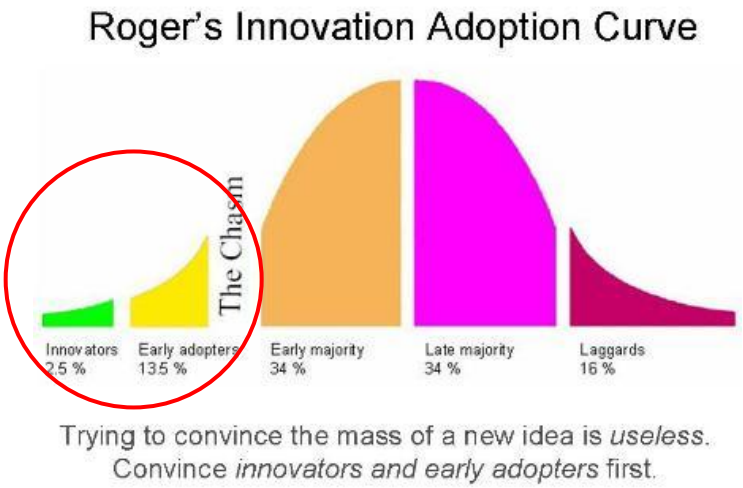
Watts, D.J., & Sheridan Dodds, P. (2007). Influentials, Networks, and Public Opinion Formation. *Journal of Consumer Research, Inc., Vol. 34. 441-458.*

8 Appendices

8.1 Appendix 1



8.2 Appendix 2

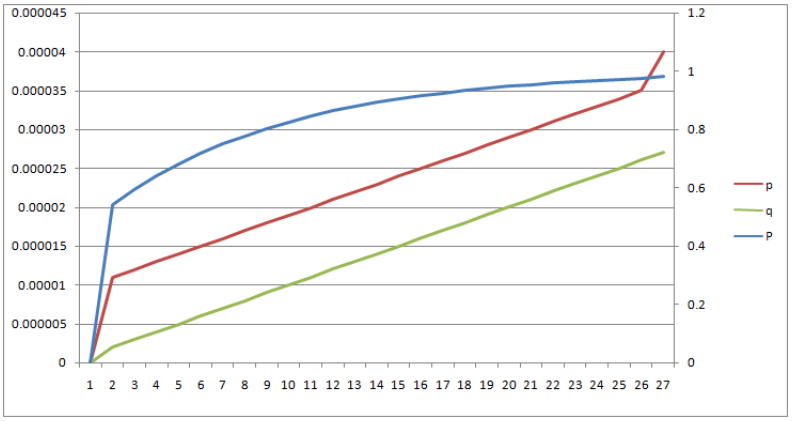


Source: Value based Management.net/ Rogers (1962)

8.3 Appendix 3 (Probability of Adoption) Hypothesis 1 Data

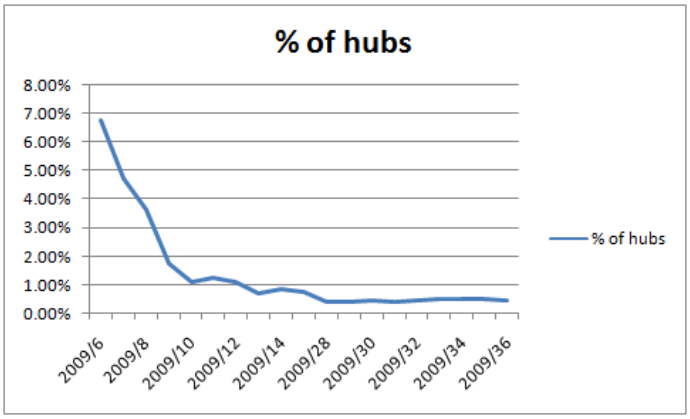
A. Data snapshot (using current period data)

sellerid	reater than x*std	Max	Number of connections per hub	Probability of Adoption	Effect of Exposure to external forces	Effect of Network forces	Total number of connections by hubs
Moodley	0.5	1	2273	P	p	q	a(t)
IshmaelB		1	2212	0	0	0	60327
Royall		1	1884	0.543540258	0.000011	0.000002	
Lechelele		1	1995	0.595421549	0.000012	0.000003	
Aubrey		1	1568	0.641406047	0.000013	0.000004	
Pegasus		1	1723	0.682163973	0.000014	0.000005	
suzanne		1	1462	0.718289371	0.000015	0.000006	
ralebadi		1	1954	0.750308769	0.000016	0.000007	
Modise		1	1443	0.77868885	0.000017	0.000008	
Edith		1	1531	0.803843254	0.000018	0.000009	
sellos		1	1326	0.82613861	0.000019	0.00001	
Shabalala		1	1091	0.845899873	0.00002	0.000011	
Lebese7		1	1255	0.863415068	0.000021	0.000012	
skhura		1	1215	0.87893948	0.000022	0.000013	
Andriess		1	1417	0.892699382	0.000023	0.000014	
Masinga		1	1458	0.904895326	0.000024	0.000015	
8708020949		1	809	0.915705071	0.000025	0.000016	
Anver		1	930	0.925286173	0.000026	0.000017	
solomon4		1	931	0.933778279	0.000027	0.000018	
mmms		1	1104	0.941305165	0.000028	0.000019	
swazi		1	939	0.947976536	0.000029	0.00002	
Everister		1	964	0.953889632	0.00003	0.000021	
Lidiah		1	931	0.959130638	0.000031	0.000022	
nontlantla		1	630	0.963775944	0.000032	0.000023	
janie		1	631	0.967893257	0.000033	0.000024	
mokomane		1	459	0.971542591	0.000034	0.000025	



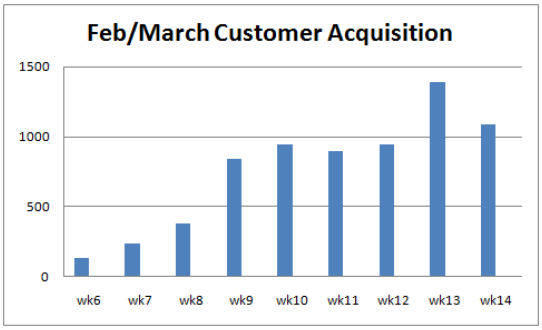
B. Percentage of hubs

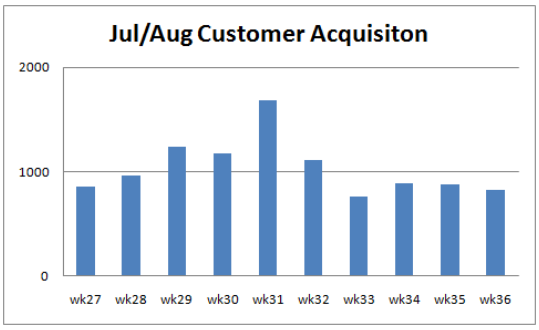
Week	Number_Hubs	Market/Meter Count	% of hubs	Timeperiod
2009/6	19	281	6.76%	1
2009/7	21	446	4.71%	2
2009/8	22	610	3.61%	3
2009/9	26	1516	1.72%	4
2009/10	22	2033	1.08%	5
2009/11	28	2309	1.21%	6
2009/12	32	2949	1.09%	7
2009/13	29	4270	0.68%	8
2009/14	32	3775	0.85%	9
2009/27	35	4810	0.73%	10
2009/28	27	6605	0.41%	11
2009/29	35	9010	0.39%	12
2009/30	35	8377	0.42%	13
2009/31	35	8597	0.41%	14
2009/32	28	6607	0.42%	15
2009/33	32	6694	0.48%	16
2009/34	39	8021	0.49%	17
2009/35	36	7357	0.49%	18
2009/36	31	6874	0.45%	19



8.4 Appendix 4 (Hypothesis 2 Data)

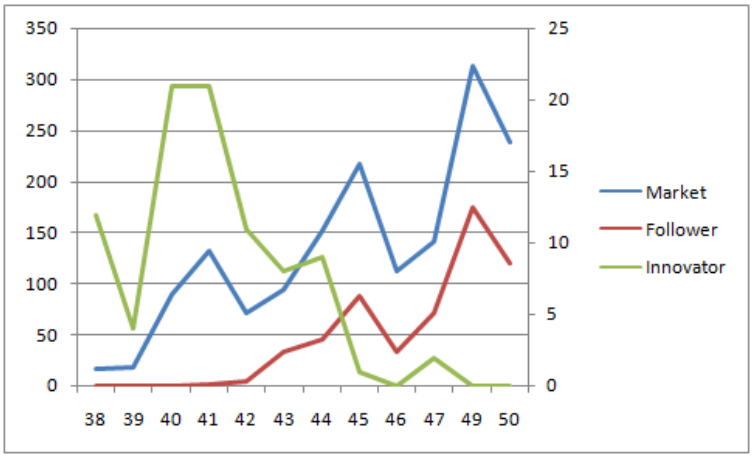
A. Customer Acquisition





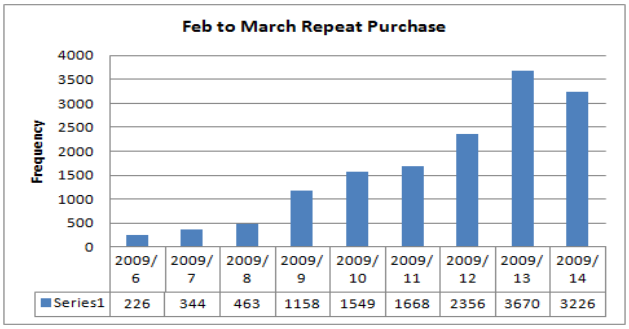
B. Hub and market correlation

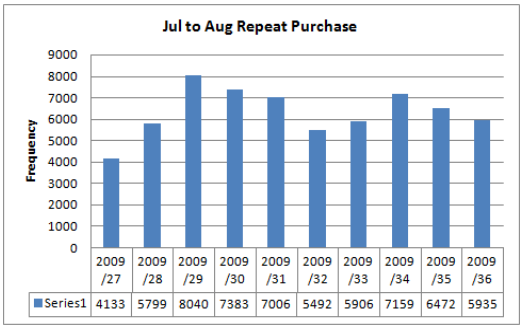
Year	week	Market	Follower	Innovator	Timeperioc
2008	38	16	0	12	1
2008	39	18	0	4	2
2008	40	89	0	21	3
2008	41	132	1	21	4
2008	42	71	4	11	5
2008	43	93	34	8	6
2008	44	152	45	9	7
2008	45	217	89	1	8
2008	46	112	34	0	9
2008	47	141	72	2	10
2008	49	313	175	0	11
2008	50	239	120	0	12
		Correlation	0.929055	-0.46985	



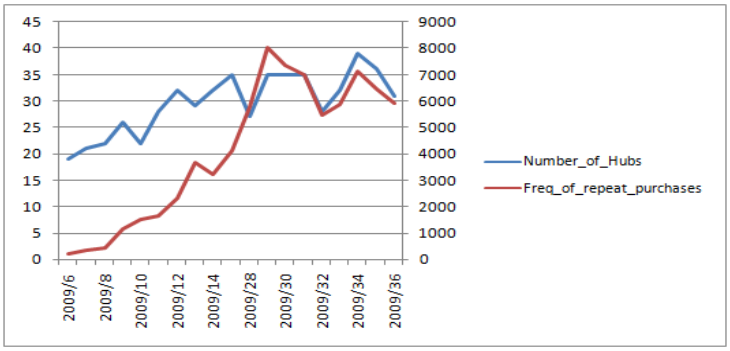
8.5 Appendix 5 (Hypothesis 3 Data)

A. Frequency of Purchases

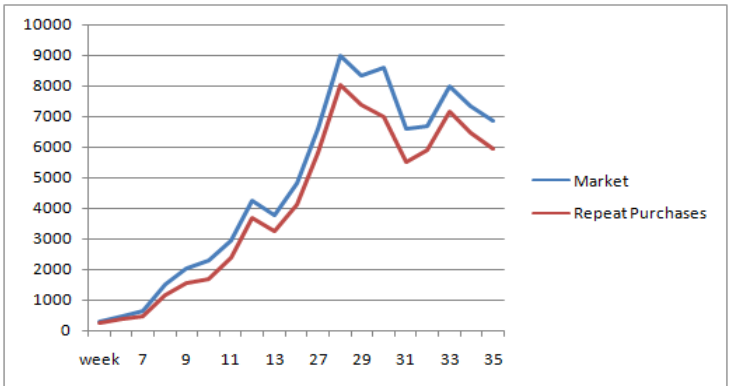




B. Market performance per week data (Regression Data)



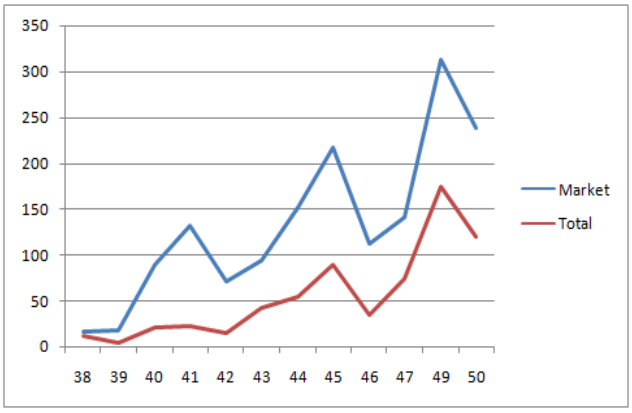
C. Repeat Purchase and Market performance (Correlation: 0.998)



8.6 Appendix 6 (Hypothesis 4 Data)

A. Hub to market correlation

Year	week	Market	Innovator	Follower	Total
2008	38	16	0	12	12
2008	39	18	0	4	4
2008	40	89	0	21	21
2008	41	132	1	21	22
2008	42	71	4	11	15
2008	43	93	34	8	42
2008	44	152	45	9	54
2008	45	217	89	1	90
2008	46	112	34	0	34
2008	47	141	72	2	74
2008	49	313	175	0	175
2008	50	239	120	0	120
		Correlation	**0.929055**	**-0.46985**	**0.94865276**



A. Original Study Regression Studies

TABLE 5
Regression of Market Size Versus Hub Adoptions (Standardized Coefficients)

Time Frame	Innovative Hubs Coefficient	Follower Hubs Coefficient	Adjusted R^2
$t_{5\%}$ (10 days)	.11 (n.s.)	.83 (.00)	.88
$t_{10\%}$ (17)	.15 (.00)	.85 (.00)	.99
$t_{15\%}$ (23)	.12 (.00)	.89 (.00)	.99
$t_{100\%}$ (214)	.14 (.00)	.86 (.00)	.99

Notes: The numbers in parentheses are significance levels. n.s. = not significant.

Source: Goldenberg et al (2009)

8.7 Appendix 7 (Hypothesis 5 Data)

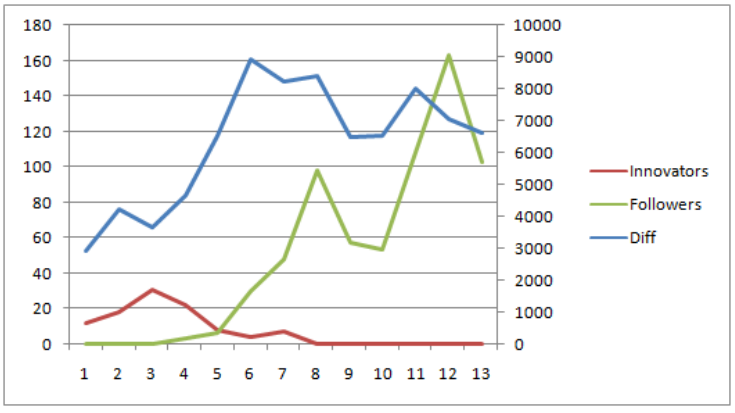
A. Repeat purchases early adoption and current period

Frequency of repeat purchases									
Period	Column Number	Start	End	Total Impact	Mean	Std Dev	Median	Min	Max
2008/38	3	C1	C33	12.00	6.00	7.07	6.00	1	11
2008/39	4	D1	D33	18.00	6.00	5.29	4.00	2	12
2008/40	5	E1	E33	31.00	10.33	6.03	11.00	4	16
2008/41	6	F1	F33	25.00	5.00	3.67	3.00	2	11
2008/42	7	G1	G33	14.00	3.50	2.38	3.50	1	6
2008/43	8	H1	H33	34.00	4.86	3.02	5.00	1	9
2008/44	9	I1	I33	55.00	6.11	3.41	6.00	1	13
2008/45	10	J1	J33	98.00	8.17	6.78	6.50	1	22
2008/46	11	K1	K33	57.00	7.13	5.36	6.50	1	17
2008/47	12	L1	L33	53.00	5.30	5.44	3.50	1	15
2008/48	13	M1	M33	0.00	0.00	0.00	0.00	0	0
2008/49	14	N1	N33	163.00	9.59	11.53	4.00	1	42
2008/50	15	O1	O33	103.00	7.36	5.69	7.50	1	23

Frequency of repeat purchases									
Period	Column Number	Start	End	Total Impact	Mean	Std Dev	Median	Min	Max
2009/6	3	C1	C979	226.00	6.65	5.99	5.50	1	27
2009/7	4	D1	D979	344.00	6.62	6.76	4.00	1	27
2009/8	5	E1	E979	463.00	7.47	8.47	3.50	1	38
2009/9	6	F1	F979	1158.00	12.19	17.88	3.00	1	98
2009/10	7	G1	G979	1549.00	12.10	22.74	3.00	1	168
2009/11	8	H1	H979	1668.00	12.45	21.71	3.00	1	162
2009/12	9	I1	I979	2356.00	18.55	31.52	4.00	1	249
2009/13	10	J1	J979	3670.00	25.49	46.60	6.00	1	398
2009/14	11	K1	K979	3226.00	20.29	34.58	5.00	1	258
2009/27	12	L1	L979	4133.00	18.79	40.18	4.00	1	440
2009/28	13	M1	M979	5799.00	25.00	61.50	4.00	1	682
2009/29	14	N1	N979	8040.00	32.95	75.46	3.50	1	831
2009/30	15	O1	O979	7383.00	30.01	63.68	3.50	1	612
2009/31	16	P1	P979	7006.00	24.50	45.55	4.00	1	324
2009/32	17	Q1	Q979	5492.00	20.80	38.88	5.00	1	324
2009/33	18	R1	R979	5906.00	23.16	46.67	4.00	1	365
2009/34	19	S1	S979	7159.00	29.46	56.47	5.00	1	465
2009/35	20	T1	T979	6472.00	25.09	50.46	4.50	1	411
2009/36	21	U1	U979	5935.00	23.74	47.81	4.00	1	395

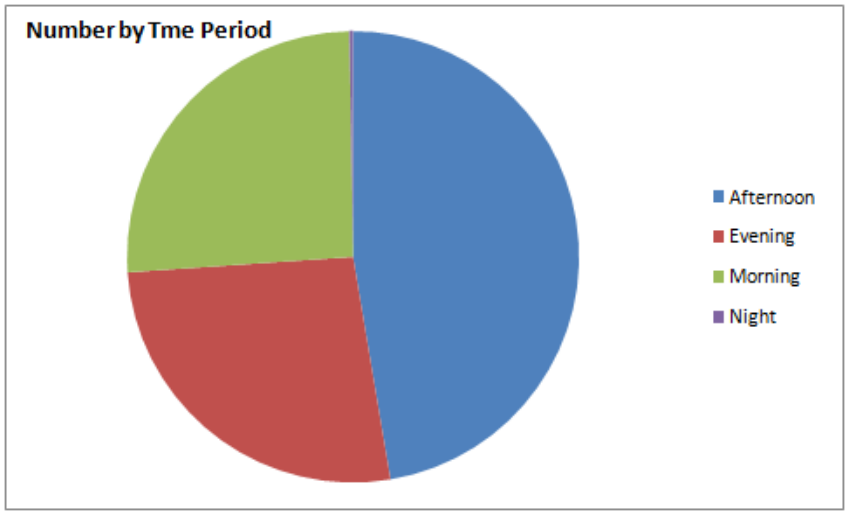
B. Difference in market to type of hub

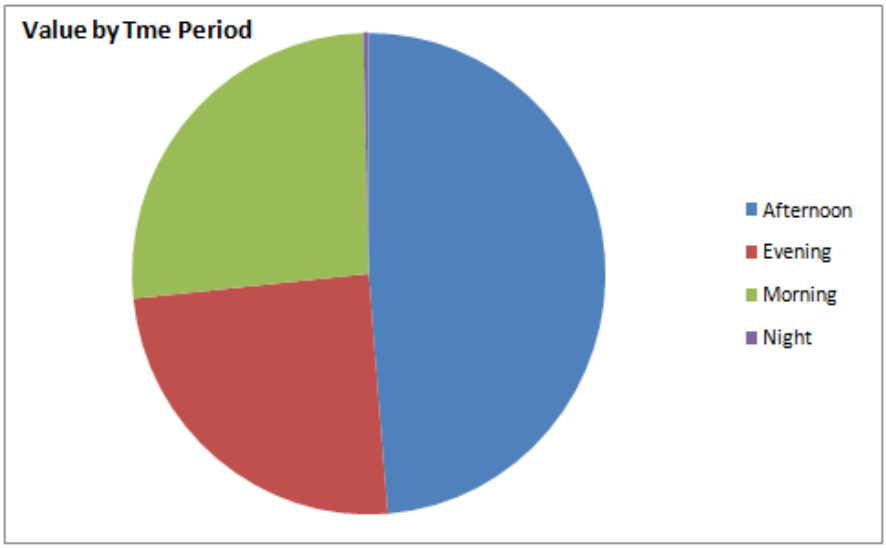
Difference in Market	Innovators	Followers
2933	12	0
4252	18	0
3686	31	0
4678	22	3
6534	8	6
8917	4	30
8225	7	48
8380	0	98
6495	0	57
6553	0	53
8021	0	108
7044	0	163
6635	0	103
	-0.7376733	**0.592157**



8.8 Appendix 8

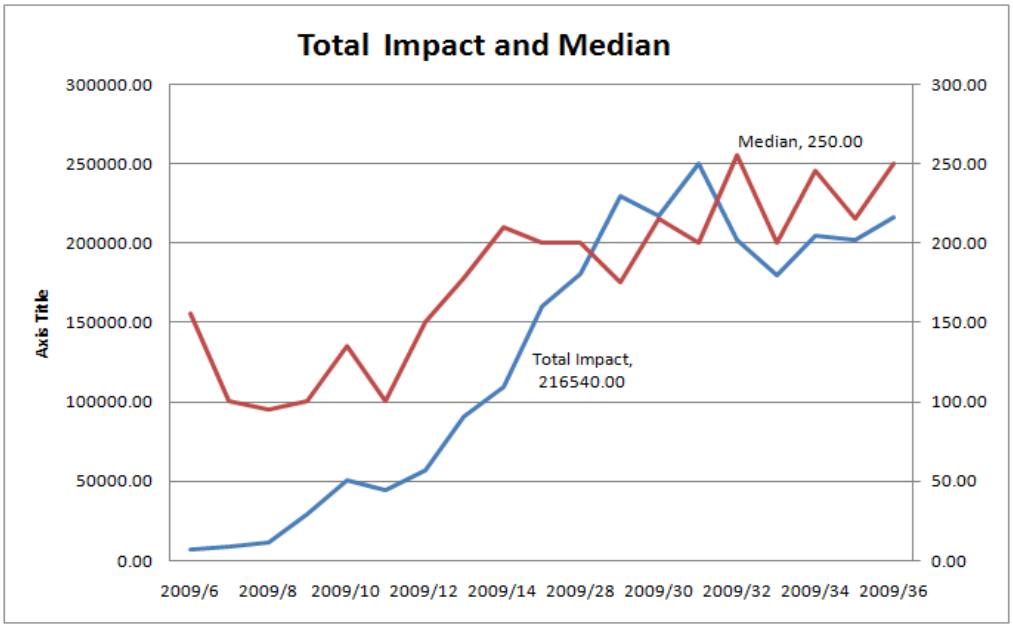
Night: 00:01 to 06:00
Morning: 06:01 to 12:00
Afternoon: 12:01 to 18:00
Evening: 18:01 to 24:00





8.9 Appendix 9

Value of repeat purchaces									
Period	Column Number	Start	End	Total Impact	Mean	Std Dev	Median	Min	Max
2009/6	3	C1	C979	7420.00	218.24	220.25	155.00	10	860
2009/7	4	D1	D979	9370.00	180.19	186.13	100.00	10	680
2009/8	5	E1	E979	12050.00	194.35	234.25	95.00	10	1090
2009/9	6	F1	F979	29900.00	314.74	462.09	100.00	10	2490
2009/10	7	G1	G979	50730.00	396.33	685.00	135.00	10	4580
2009/11	8	H1	H979	44480.00	331.94	571.28	100.00	5	3225
2009/12	9	I1	I979	57400.00	451.97	735.90	150.00	10	4875
2009/13	10	J1	J979	90570.00	628.96	1122.61	177.50	5	9160
2009/14	11	K1	K979	109820.00	690.69	1153.87	210.00	5	6100
2009/27	12	L1	L979	160465.00	729.39	1329.68	200.00	5	11950
2009/28	13	M1	M979	180735.00	779.03	1634.06	200.00	5	15690
2009/29	14	N1	N979	229780.00	941.72	1883.49	175.00	10	18315
2009/30	15	O1	O979	216890.00	881.67	1624.82	215.00	5	14140
2009/31	16	P1	P979	250090.00	874.44	1551.77	200.00	5	10135
2009/32	17	Q1	Q979	201730.00	764.13	1328.56	255.00	5	11115
2009/33	18	R1	R979	180295.00	707.04	1281.71	200.00	5	8820
2009/34	19	S1	S979	204635.00	842.12	1451.61	245.00	5	10850
2009/35	20	T1	T979	202360.00	784.34	1420.97	215.00	5	10060
2009/36	21	U1	U979	216540.00	866.16	1558.52	250.00	5	10730



Total impact is the product of value and the number of repeat purchases. This indicates a growth in value with a growth in repeat purchases. The most observed number is also growing so there is a definite increase in value.