Determinants of 3G Mobile Video Adoption by the South African Mobile Consumer

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ABSTRACT

Cellular technology has evolved dramatically within the last decade. Real-time visual communication via cell-phone is arguably the most distinguishing feature offered to mobile subscribers with the introduction of 3G technology. The concern is whether 3G will provide any interest and explosive uptake by the mobile user community. In a South African context with the technology being relatively new, it proved difficult to anticipate the South African cellular user community's response to 3G mobile video. This paper explores what factors the South African mobile user regard as most likely to influence the intention to adopt 3G mobile video. Since there is minimal literature on 3G mobile video, this research relied on Diffusion of Innovations Theory, Technology Acceptance Model and Theory of Planned Behaviour.

INTRODUCTION

The third generation (3G) of mobile technology has generated both excitement and confusion. Whilst the technology has yet to reach South African mobile users, European and Asian network operators are already experiencing returns on their investments.

Universal Mobile Telecommunication System UMTS (2003) market studies also suggest that the adoption of 3G technology and services will be slow with a small proportion of the global mobile consumer base (30%) actively using 3G services. This is based on the assumption that adoption of any new technology is typically a slow process because end users are unfamiliar with the technology and inevitably require new behavioural adjustments.

The explosive growth rate of cell phone ownership and usage in South Africa (SA) has exceeded all projections and expectations of cellular network companies within the last decade. The demand for second generation (2G) basic telephony and data cellular services proved phenomenal. However, 3G cellular technology is relatively unknown in South Africa and, as a result, not much research has been done on the adoption of 3G mobile video within a South African context.

Managers of South Africa's networks and service providers of mobile services a keen to know what factors will influence mobile consumer's intention to adopt 3G mobile video. Since consumer reaction to 3G varies, this research may inform service providers on those factors that will drive the South African mobile consumer's intention to adopt the technology, particularly in the light of the cultural and economic differences between other countries and South Africa.

The objective of the research is thus: To determine the factors affecting adoption of 3G mobile video based on variables derived from the Diffusion of Innovations Theory, Technology Acceptance Model and Innovation Diffusion Theory (IDT).

REVIEW OF RELEVANT LITERATURE

Mobile technology has changed the South African landscape. It has transformed and revolutionized the way people work and interact and unleashed a powerful communication medium for influencing business and social life. However, it is the consumer who determines and defines market success. Since SA is lagging European and Asian countries in adopting 3G mobile video technology, it is necessary to understand the key factors that influence adoption of 3G mobile video in SA. This section of the paper shall reviewed relevant theories that underpinned this research.

Overview 3G Mobile Technology

3G is a generic name used to describe the development of mobile communications in terms of "generations" (ITU, 2003). It refers to high-tech infrastructure networks, handsets and other equipment to provide mobile consumers with high-speed Internet access video telephony messaging and streaming capability.

The 3G "family of standards" involves three main modes of operation which support Wideband CDMA (WCDMA), EGDE and to a lesser extent CDMA2000. 3G is characterised by high data rates enabling multimedia services such as real- time video (from 144 kbit/s in motion to 2 Mbit/s in low-mobility environments), packet-switched services such as Internet Protocol (IP) traffic, greater capacity & improved spectrum efficiency and global roaming (ITU, 2003). All cellular network operators have started releasing limited 3G services to South African consumers by the end of 2005.

3G Mobile Video Adoption

Mobile video is defined as real-time and two-way communication medium and classified as a "rich" voice service category (UMTS, 2003). Simply put, the term mobile video typically implies a video clip viewed on a 3G mobile handset. Real-time video telephony/conferencing and streaming video distribution services on the other hand is best supported by 3G technology, since it offers circuit switched data rates of 64Kbps both to and from the mobile handset (Northstream, 2002).

Three types of mobile video services currently exists (Northstream, 2002). Mobile Video Messaging is a communication service which enables the transfer of video content and other media together on a non-real time from one mobile to another. Mobile Video Distribution Services present the mobile user with the option of either downloading or streaming video content to their mobile phones. Video Telephony is a person-to-person communication service using visual and voice data. It differs from video messaging in that it provides for real-time two-way streaming of audio and video signals between mobile phones or a mobile and fixed videophone. The focus of this report is on video telephony.

Theoretical Models of Technology Adoption

To assist in determining which factors are relevant in predicting the intention to adopt 3G mobile video the following behavioural theories related to technology adoption were reviewed and considered: Technology Acceptance Model (TAM); Diffusion of Innovations Theory;

Theory of planned behaviour (TPB) and the Innovation Diffusion Theory (IDT). These theories have proved useful for previous research conducted on m-commerce and t-commerce adoption research.

Technology Acceptance Model
The Technology acceptance model (TAM) developed by Davis is still one of the most widely used research models (Davis *et al*, 1989). The TAM model, or one of its extensions, has been used for many studies as a theoretical basis for predicting those factors that influence the use or adoption of information technology or new technological innovation. Two key constructs are perceived usefulness (PU), which relates to extrinsic characteristics such as efficiency and effectiveness, and perceived ease of use (PEOU) which relates to intrinsic characteristics such as ease of use and flexibility. These two perceptions combined influence the adoption of new technologies (Adams et a.l, 1993).

Diffusion of Innovations Theory
According to Rogers (1995) this theory is based on the two fundamental characteristics of diffusion and innovation and provides some point of departure for understanding the process of social change. He further makes clear distinction between the process of diffusion and adoption.

As an expansion of Rogers (1995), Clarke (1999) regards the following as important characteristics of an innovation:

- Relative Advantage i.e. the degree to which an innovation is perceived as being better than the idea, object or technology it seeks to replace.
- Complexity i.e. the degree to which an innovation is perceived as being difficult to use and understand.
- Compatibility i.e. the degree to which an innovation is perceived in aligning itself with existing values, beliefs and the experiences of potential adopters.
- Trialability i.e. the degree of experimentation allowed with an innovation under limited circumstances.
- Observability i.e. the degree that results of an innovation is visible to everyone.

Theory of Planned Behaviour
This theory is essentially an extension of the Technology Acceptance Model. It expands the Theory of Reasoned Action by including perceived behavioural control as a third component which represents a person's beliefs about his or her ability to perform the behaviour in question. The Theory of Planned Behaviour can thus provide an improved framework for understanding people's actions and emphasizes the importance of assessing the degree to which target audiences possess the information needed to adopt a promoted action and the skills, resources and opportunities to act (Azjen, 2002).

Innovation Diffusion Theory
Moore and Benbasat (1991) operationalized the previous models by expanding the various constructs and systematically developing instruments to measure the perceived characteristics.

RESEARCH HYPOTHESES
The objective of this research is to determine the factors determining (intended) 3G mobile video adoption in South Africa. Consequently, the proposed hypotheses relate to the factors identified that could possibly affect adoption. Intention to adopt has been identified as the dependant variable that all the other variables were analysed against.

Relative Advantage
Refers to the degree with which an individual believes that a new innovation or Information Technology offers a relative advantage over another. According to Clarke (1999), the relative advantage of one technology over another is positively related to its rate of adoption. 3G mobile video communication will enable a real-time visual communication experience anywhere anytime and subsequently offer a relative advantage to those who prefer to hear and see who they communicate with.

- H1: The greater the relative advantage of using 3G mobile the more likely the intention to adopt 3G mobile video.

Compatibility
Agarwal and Prasad (2002), indicates that compatibility is best described where an innovation is more likely to be adopted when it supports an individuals lifestyle, needs, job responsibilities and values. Consequently, the more an individual perceives his/her cell phone to be compatible with his/her lifestyle the more likely 3G mobile video will be adopted.

- H2: The greater the compatibility of using 3G mobile the more likely the intention to adopt 3G mobile video.

Complexity
Within the context of this study, complexity is the degree of difficulty to understand and use the technology or new innovation. When considering the TAM model, complexity stands in direct contrast with "Ease of Use". It implies that the greater requirement for technical skills to operate or use the technology, the less likely that it will be adopted.

- H3: The greater the complexity of using 3G mobile the less likely the intention to adopt 3G mobile video.

Trialibility
Allowing potential adopters to experiment with the new technology makes them more comfortable using it and subsequently more likely to adopt it. This can also be defined as the degree to which new technology may be experimented with on a limited basis.

- H4: The greater the trialibility of using 3G mobile video the more likely the intention to adopt 3G mobile video.

Technological Experience
Refer to the amount of experience that an individual have with technology and more specifically cell phones and the Internet in the context of this study. This view is supported by Agarwal and Prasad (2001).

- H5: The greater the technological experience of the individual, the more likely the intention to adopt 3G mobile video.

Self-Efficacy
In the context of this study, the more confident an individual is in his/her technical skills or the greater the experience he/she has with a cell phone, the more likely that 3G mobile video would be adopted. This view is supported by Taylor and Todd (1995) who states that the higher the level of self-efficacy, the more likely the intention to adopt the technology.

- H6: The greater the self-efficacy of using 3G mobile the more likely the intention to adopt 3G mobile video.

Cost
This refers to the extent that an individual perceives that 3G mobile video would be a costly technology to adopt [Azjen 2002]. The greater the cost the less likely would be the intention to adopt the technology.

- H7: The higher the cost of using 3G mobile the less likely the intention to adopt 3G mobile video.

Awareness
Awareness in the initial stages of the innovation is a significant determinant in the intention to adopt or reject the innovation. Since 3G mobile video is a relatively unknown and new innovation in South Africa, awareness of the innovation will influence the acceptance of 3G mobile video.

- H8: The greater the awareness of 3G mobile video the more likely the intention to adopt 3G mobile video.

Figure 1. Research framework and hypotheses
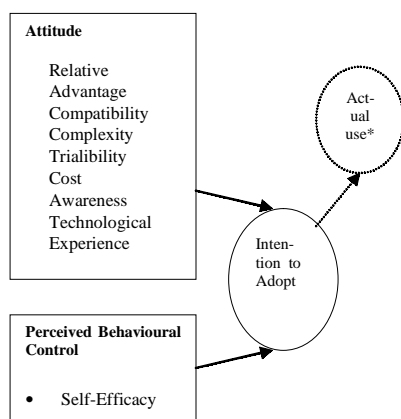
RESEARCH METHODOLOGY

Positivism will be used as the major philosophy to obtain quantifiable data that can be statistically analysed. The time horizon was cross-sectional. The research strategy was survey/questionnaire based.

Data collection method and sampling

The focus and particular interest of the study is aimed at the South African mobile consumer. The sample considered for the study was thus limited to the general public living in South Africa. In order to collect a non-biased and representative sample of respondents, a few Cape Town malls were visited.

The research questionnaire was developed in both hard-copy and online format. To overcome geographical constraints, an internet website was used to host the online survey questionnaire. The test items were based on previous studies, substituting "mobile video" where necessary. However, the number of test items was reduced to a maximum of two per construct in order to keep the length of the questionnaire manageable.

Sample Demographics

In the end, 128 usable questionnaires were received. The median respondent was found to be in the 19-26 years age category, English-speaking with some tertiary education, employed on a full time basis with an annual disposable income of less than R100,000 (H"US$15000), living in Cape Town and with an intermediate level of computer literacy.

Whilst great effort was made to gain access to survey participants in all South African cities, the sample does not appear to be representative of the countries population which could possibly have impacted on the analysis performed on the collected respondent data.

Construct Validity - Factor Analysis

Since no construct was measured by more than two test items, Cronbach-Alpha coefficients were not calculated but the correlation coefficient between the test items for constructs exceeded 50% in all case. Instead, factor analysis was applied to determine the validity of the test items in the questionnaire in respect of the eight constructs. Only six factors were identified, with relative advantage, self efficacy and cost loading very significantly on different factors subsequently proving their validity in measuring the same underlying concept. Most other items had factor loadings ranging between 0.30 and 0.70 on the remaining factors. However, awareness and complexity did not load onto any single factor. Although this may be due to the small sample size, it is important it limits the validity of some of the hypotheses. On the whole, however, there is sufficient assurance that the questions posed in the questionnaire did in fact measure the proposed constructs.

FINDINGS AND DISCUSSION

Regression and Correlation Analysis

Multiple linear regression was used to analyze the survey responses in an effort to determine:

*   The level of statistical significance of each of the hypotheses on the intention to adopt 3G mobile video.
*   Whether any of the independent variables will affect the intention to adopt 3G mobile video.

The result of these analyses will show confirmation or rejection of the hypotheses by examining the p-value. A p-value less than 0.05 (*) indicate a statistically significant hypothesis i.e. a factor which affects the intention to adopt 3G mobile video. A p-value of 0.01 (**) indicates high significance. H1 to H7 all relate to the construct "attitude towards the technology" while H8 is the separate construct "behavioural control". Where significant correlation was found, the correlation coefficient has been shown. Note that the significant variables explain between 5% and 10% of the variance each.

It is interesting to note that all the constructs which were postulated in the model taken together, including the non-significant ones, explain only a relatively small amount of the variation on intention to adopt mobile video. The adjusted R^2 is only 0.164 (p=0.0017). Although it was not the intention of the research to test the overall model fit, it does demonstrate that the constructs postulated in the various models only appear to offer a very partial explanation of the intention to adopt mobile video.

Accepted Hypotheses

Based on the p-values displayed by the regression analysis the following hypotheses hold true:

H2: The greater the perceived *compatibility* of using 3G mobile video the more likely the intention to adopt 3G mobile video.
Although 3G mobile video is only becoming available towards the end of 2005, this result can possibly be explained by the respondent associating the current 2.5G services like GRPS and MMS with his/her lifestyle and values.

H3: The greater the *complexity* of using 3G mobile video the less likely the intention to adopt 3G mobile video.

A possible explanation for this could be that respondents are not familiar with the technology currently and perceive it as complex. Another alternative is the experience of respondents with 2.5G services. If these experiences with 2.5G are found to be frustrating and complex it would influence their perceptions of 3G.

H5: The greater the *technological experience* of the individual the more likely the intention to adopt 3G mobile video.

Table 1: Regression analysis summary results

Hypothesis	Variable	p-Level	$R_{X,Y}$
H1	Relative Advantage	0.2527	
H2	Compatibility	0.0192*	0.247
H3	Complexity	0.0036**	0.292
H4	Trialibility	0.1958	
H5	Tech'l/Internet experience	0.0200*	0.251
H6	Cost	0.0097**	0.266
H7	Awareness	0.4633	
H8	Behavioural Control	0.2303	

This hypothesis is consistent with the findings of Tan & Teo (2002). In this study the internet was used as an indicator of experience with other technologies. In using internet experience the following variables were used: years of experience; average usage and main purpose for using internet. This result could possibly be supported by the fact that the internet forms an integral part of communication in 3G mobile video.

H7: The greater the *cost* the less likely the intention of mobile consumers to adopt 3G mobile video.

This hypothesis proves that adoption of mobile technology is very closely related to cost in a negative way. Consumers are aware of cost implications for 3G mobile video as they associate these with 2.5G services like GPRS and MMS. This result could possibly explain the low adoption rate of 2.5G services. Also, if consumers have the option of choosing a normal 2G voice call or 3G video call with a significant difference in price they would according to this result, typically choose the cheaper option.

Rejected Hypotheses

H1: The greater the *relative advantage* of using 3G mobile video the more likely the intention to adopt 3G mobile video.

Contrary to the researcher's expectation, the result in this study proved no statistical significance and relationship between relative advantage and intention to adopt 3G mobile video. This could possibly be attributed to interpretation of the questions which could have resulted in an ambiguous interpretation by the respondent.

H4: The greater the *trialibility* of using 3G mobile video the more likely the intention to adopt 3G mobile video.

A possible reason for the rejection of this hypothesis could relate to most respondents being computer literate and having significant experience with cell phones and also the internet. This could result in a high level of confidence with 3G mobile video.

H6: The greater the *self-efficacy* of using 3G mobile video, the more likely the intention to adopt 3G mobile video.

This result is in contrast with the view of Taylor and Todd (1995) on this hypothesis. In addition, the average respondent profile in this study does not support the outcome of this hypothesis. A possible reason for this unexpected result could be that respondents were not completely aware of the skill level requirements of using 3G mobile video.

H8: The greater the *awareness* of 3G mobile video the more likely the intention to adopt.

The result of this hypothesis is possibly due to the phrasing of the test items for this construct (refer to the low factor loading). Questions were posed on awareness of 3G technology and 3G mobile video respectively.

Thus it appears that only compatibility, complexity, technological experience and cost can be regarded as significant predictors of 3G mobile video.

CONCLUSIONS

To determine which factors affect the intention to adopt 3G mobile video eight hypotheses were identified and analysed. Although the sample was relatively small, the results seemed to be fairly conclusive in terms of isolating the four most important factors which are likely to influence the South African user adoption of 3G mobile video when it becomes available. These four factors are (in order of importance): the complexity of the technology, the level of technological (Internet) experience, the cost and the perceived compatibility with the user's lifestyle.

The hypotheses postulating an impact of relative advantage, trialibility, self-efficacy and awareness towards the intention to adopt 3G mobile video, did not find statistical support.

Implications of the Research

An adaptation of frameworks for m-commerce, t-commerce and Internet banking in South Africa was used in this study. However, overall a low variation of intention to adopt 3G mobile video was explained by the factors contained in these frameworks. The significance of other factors, i.e. factors not found in the "mainstream" adoption theories", influencing the adoption of 3G mobile should be investigated. It is hereby suggested that a more exploratory, qualitative research would be advisable.

Recommendations for Future Research

Finding a target population representative of the entire South African population is important. This needs to occur within a context representing language, ethnic, cultural perceptions and behaviours from all geographical areas within the country. The web survey application was not successful in this study. An alternative for future studies on 3G services adoption could be to secure the services of professional survey agents nationally.

There appears to be little or no research done in South Africa on the perceptions of mobile technology services like 2.5G GPRS and MMS. It is recommended that these are done to provide South African cellular network companies with insight into their consumers and employ marketing strategies using this knowledge for new services like 3G mobile video. It could also assist in making informed decisions when making financial investments for new technology, infrastructure, products and services.

Another recommendation would comprise the inclusion of unique South African cultural, economic, social and political environment factors into the behavioural theories to test technology adoption.

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