# ANALYSIS OF MOBILE HEALTH ADOPTION IN CHIVI DISTRICT, ZIMBABWE

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## ABSTRACT

This document focuses on the determination of the key success factors of the adoption of mobile health in Chivi District, Zimbabwe. The main objective was to construct a Mobile Health adoption model which clearly analyses the factors leading to adoption and an exploration of people's perceptions leading to the adoption of this new technology (m-health). Various technology adoption models were discussed and from these, the Mobile Health adoption model for Chivi District was developed. Data was collected through questionnaires and hypotheses were tested using Regression and the Pearson Correlation Coefficient methods. Results obtained show that perceived cost, behavioral control and external influence are less effective in determining adoption of mobile health services. Trust, social economic background, perceived usefulness, perceived ease of use among others proved to be the most effective success factors in determining adoption of mobile health in Chivi District.

**Keywords:** Mobile Health, TAM Model; Chivi District.

## 1.0: INTRODUCTION

The unparalleled growth of the internet, coupled with the progress of web technologies has resulted in the extensive use of many electronic-based applications such as e-learning, e-business and e-health across many different fields. Moreover, the increasing availability of wireless and mobile technologies makes these kinds of internet-based electronic applications even more ubiquitous and unavoidable (Yuen & Ma, 2008). A lot of citizens in marginalized areas who lack proper tap water, basic health and sanitary facilities and electricity indeed have got access to mobile technology. This is substantiated by the increase in mobile penetration from 90.3% from the previous quarter to reach 90.8% this year, (POTRAZ Draft: first quarter 2015). This increase in the use of mobile technology, coupled with the astronomic growth in the use of the internet, has created a new platform for delivering health services known as Mobile Health (M-Health). Akter, et al. (2011) define M-Health as, "an application of wireless technologies to transmit and enable various data contents and information services, which are easily accessible by users through mobile devices such as mobile phones, smart phones, PDAs, laptops, and Tablet PCs".

Though still in its infancy stages in developing nations like Zimbabwe, access to ICT equipment matters in the success of m-health or e-health in general, (Mujera, 2009). With the

growing reliance on information systems and increasing rapidity of the introduction of new technologies into the health environment, identifying the critical factors related to user acceptance and adoption of this technology continues to be an important issue (Yi & Hwang, 2003). In addition, knowing users' intentions and understanding the factors that influence users' beliefs about m-health can help health administrators to create mechanisms for attracting more users to adopt this new technology (Grandon, et al., 2005). The Technology Acceptance Model (TAM), which is currently the prevalent predictive tool for testing user acceptance of new technologies, proposed by Davis (1989) is widely applied and empirically tested. Compared with its competing models, TAM is believed to be more parsimonious, predictive, and robust (Venkatesh & Davis, 2000). Davis identified two perceived characteristics about an innovation that he believes that using a particular system would be free of effort" (Davis, 1989, p. 320)and perceived usefulness, defined as "the extent to which a person believes that using a particular system would boost his or her job performance" (Davis, 1989, p. 320).

The greater part of health services in Zimbabwe's rural and urban areas are provided by public sector ministries which include Health and Child Welfare. Following the launch of the E-Health Strategy/draft (2012-2017), the Ministry of Health and Child Welfare launched the mobile-phone-based FrontlineSMS Weekly Disease Surveillance System (FWDSS), which has now been rolled out to more than 75% of health facilities nationwide. The objective of the system was to improve people's access to and use of relevant health information thereby minimizing the social and economic impact of preventable and non-preventable diseases and illnesses. Chivi District benefited from this initiative and thus has a computerized health information department which links all the eighteen clinics in the district. The clinics are connected via mobile phones embedded with electronic forms that enable facilities to easily transmit data via SMS text messaging to a central server that automatically forwards data to the District Health Information System (DHIS2). 2014 saw the official launch of the new Zimbabwe National Health Information System (HIS), DHIS2, and the MoHCC website as well as M-Health (mHealth) in Zimbabwe through the successful implementation of mobile phone-based reporting of HIV results for Early Infant Diagnosis (EID) in the Prevention of Mother to Child Transmission of HIV (PMTCT), (Machingura, 2014).

Recent observations from individuals in most rural communities indicate a tremendous decline in the health of individuals (Aryee, 2014). According to WHO (2013), despite the effort in improving health and access to information related to health, health literacy continues to be a huge challenge for both individuals and the nation as a whole. Prinsloo, et al.(2011), attribute most of these health challenges to cultural beliefs and traditional herbal treatment practices in certain communities which are largely buoyed by low levels of health literacy. Mobile literacy is also a challenge among the varying age groups in the district being unable to retrieve messages or make calls pertaining to health issues. Health care providers and nurses also experience difficulty in computing data from manual forms to the electronic system as evidenced by a mismatch in totals displayed on manual monthly return forms and monthly DHIS2 data. Health service providers also face enormous difficulty in achieving successful strategies, including the delivery, effectiveness, and acceptance of the technology, (Saadé, 2003).

## 2.0: LITERATURE REVIEW

### 2.1: Mobile Communication

The birth of wireless technology can be traced back to the 1890s when Guglielmo Marconi travelled from Italy to England to show the British Telegraph Authorities what he had

developed in the way of a wireless telegraph apparatus (Dubendorf, 2003). A tremendous revolution has been witnessed in the mobile communication technology industry world over, so has it revolutionized the way business is conducted in some parts of the world over the years. Goldsmith (2005) remarked that wireless communications regardless of any measure, is among the fastest growing segments within the communications industry. From a mere means of communication, nowadays this technology confers a wide array of services which include voice, data and even video conferencing.

The tremendous speed of the spread of mobile devices across the developing world is indeed one of the most remarkable technology stories of the past decade. Sustained by prepaid accounts and relatively cheap handsets from Asia, hundreds of millions of first-time telephone owners have made voice calls and text messages part of their daily lives (Donner & Tellez, 2008). Rapid change is normal when it comes to technology and health. Zimbabwe has also witnessed this technological growth that has engulfed the world. The liberalization of the telecommunications industry by the government has created vistas for new players in the industry who have with no doubt facilitated explosive growth in the telephony industry.

**2.2: Mobile Health**

Mobile Health is the application of mobile devices in health delivery. The mobile tools comprise mobile phone technologies used in disease monitoring and reporting, mobile computing tools such as wireless laptops, and tablet computers that provide easier mobility than more localized devices. Key health related applications that can be used in mobile health include:

- National disease surveillance and monitoring tools
- Patient information repositories
- Helpline
- Education and training resources. (Zimbabwe's E-Health Strategy 2012-2017).

Mobile health incorporates a wide range of programs. Although definitions vary, the World Health Organization's Global Observatory for eHealth defines mHealth as "medical and public health put into practice by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices" (WHO, 2011, p. 6). Mobile Health has been incorporated into the field of healthcare in an attempt to address the wide variety of challenges facing developing country systems, such as skilled worker shortages; a lack of timely reporting for surveillance and diagnostics; an influx of counterfeit drugs; poor treatment adherence; and poor inventory and supply chain management (Lemaire, 2011).

Mobile technologies may be used by patients, healthcare providers, the general population, or a combination of all involved parties. When used by the general population, services tend to be more simplistic in nature: awareness messages, treatment and/or appointment reminders, or help lines (WHO, 2011, p. 6). Healthcare workers may use the technologies for more advanced purposes, such as patient surveys, population surveys (e.g. vaccination rates), diagnosis algorithms, and mobile telemedicine (WHO, 2011b). Focusing on developing countries, Vital Wave Consulting's mHealth report (2009a) identified the six categories of mobile applications which are education and awareness, remote data collection, remote monitoring, communication and training for healthcare workers, disease and epidemic outbreak tracking and diagnostics and treatment support. (Chib, et al., 2015)in their research points out that mHealth literature in low- and middle-income countries reveals a burgeoning body of knowledge; yet, existing reviews suggest that the projects yield mixed results. The

research adopted a stage-based approach to understand the varied contributions to mHealth research.

Albabtain, et al. (2014) highlighted the essential need for using mHealth to overcome various healthcare issues in the developing world. Facts revealed that various challenges and barriers exists, however, good planning and effective solutions will enable the developing countries to reap the maximum benefit of mHealth technology and improve their healthcare services as well as enhance the quality of people's life. It is considered that mHealth offers an effective solution for various healthcare issues in the developing countries. In spite of the challenges, the developing countries have the capability to control these issues. With time, the mHealth applications will be used by all people regardless of their education level or social classes. They will remotely monitor their health information, consult their doctors, see their high quality health-related images and videos whenever and wherever they want, and use the valuable applications to control their health at home which will result in healthier communities in the developing world.

Amos (2013) conducted a quantitative quasi-experimental research study to evaluate access to health care services in the rural community in Etim Ekpo Local Government Area of Akwa Ibom State, Nigeria by introducing mobile phones and community health care educators. Four sets of hypotheses were tested to provide answers to two research questions using statistical analysis. The results indicated the importance of health care facilities and access to qualified health care professionals and the direct link to improved clinical outcome. The myriad of evidence presented in the literature that telemedicine infrastructure has been effectively used to create access to rural communities in most third world and developing countries was supported through this study. The results indicated mobile communication technology can make the difference in the Nigerian health care service delivery, particularly in remote villages. Busagala & Kawono (2013) conducted a study aimed at bridging the knowledge gap of ehealth (where mhealth is derived from) adoption for improved healthcare services in Tanzania. The survey was conducted in regions namely Iringa and Morogoro, Tanzania using a structured questionnaire to health service recipients and providers.

The findings show that the challenges include inadequate ICT skills, high cost of ICT in relation to economic status of community members, less developed infrastructure including lack of imaging equipment, small proportion of Internet users and lack of information about suitable ICT solutions. The findings have an important implication in various sectors including policy formulations aimed at increasing the adoption of ehealth for improved services. For the mobile health project (Cell-POS) an in-depth research analysis evaluating the efforts and initiatives of mHealth solutions in Peru was done with a focus on how the use of mobile technology can help people with HIV feel empowered. In addition, it was explored how mobile health is being positioned in the area of training through the lens of the QUIPU project. It was found that the challenges and needs are very similar across Latin America; however, through collaboration and partnerships, global health initiatives are on a rise. The Cell-POS project examined the feasibility, acceptability, perceived ease of use, and usefulness towards mHealth in relation with patient empowerment. The primary finding was that participants were satisfied and accepted the Cell-POS platform quickly and without difficulty. After six months of use, the results demonstrated that the participants perceived that the messages were clear, effective, and understandable and it was easy to incorporate the Cell-POS system to their daily activities.

Most participants perceived that Cell-POS enhanced their knowledge related to HIV treatment and improved their ability to take their medications correctly and on time. Through proper planning, research initiatives and collaborative work, a successful project can be achieved, (Castillo.G, 2003). Free, et al. (2013), in their study searched for all controlled trials of mobile technology based on health interventions using MEDLINE, EMBASE, PsycINFO, Global Health, Web of Science, Cochrane Library, UK NHS HTA (Jan 1990–Sept 2010).The results for health care provider support interventions on diagnosis and management outcomes were generally consistent with modest benefits. Trials using mobile technology-based photos reported reductions in correct diagnoses when compared to the gold standard. SMS appointment reminders have modest benefits and may be appropriate for implementation. High quality trials measuring clinical outcomes were needed.

### 2.3: Factors Affecting Adoption Of Mobile Health

User adoption of mobile health can be affected by many factors. Literature has identified some of the issues and factors associated with Mobile Health. These factors may also be related to other technology oriented applications. These factors also assisted in generating the constructs applicable to this research in order to build the initial research model and investigate the research objectives. The factors can be organized into the following categories: risk and security, socio economic background and culture, cost of service and device, and device features.

#### 2.3.1: Trust as a Factor in the Adoption of Mobile Health

Lots of research has been done about trust in diverse fields such as anthropology, economics, organizational behavior, psychology, and sociology (Cho, et al., 2007)Trust can be defined as "the eagerness of a party to be exposed to the actions of another party based on the anticipation that the other will carry out a particular action significant to the trustier irrespective of the ability to be in charge of that other party" (Mayer, et al., 1995). Rousseauet al., (1998) defined trust as "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another." In the electronic commerce environment, (Jarvenppa & Tractinsky, 1999) cited in (Cho, et al., 2007) redefined trust as "a consumer's willingness to rely on the seller in an online environment and take action in circumstances where such action makes the consumer vulnerable to the seller." Trust allows people to partake in risky activities that they are not familiar with, although they may be disappointed by the results. Therefore, trust is actually an essential antecedent of attitude toward the Mobile Health adoption behaviour.

#### 2.3.2: Cost of Service and Device

According to Nah et al, (2005) the cost of mobile devices and mobile services was acknowledged as a savings concern. Luarn & Lin, (2004) argued that financial cost was one of the greatest concerns in adoption of mobile health services. Moreover, Ram & Sheth, (1987; 1989) established that it was not feasible for users to alter their way of performing their tasks without offering a tough performance-to-price advantage. The price of mobile services may have a conflicting effect with regards to the adoption of mobile health, which may lead to consumers preferring the traditional health services (Laukkanen, et al., 2007)Provision of a lower service cost is also a huge benefit for users using mobile health and performing transactions through a mobile device; so the "value for money" obstacle may be another factor influencing the adoption of mobile health services.

### 2.3.3: Mobile Device Features

The rather inadequate input and display capacity of current mobile devices is seen as limiting the use of mobile health applications (Pousttchi & Schurig, 2004; Laukkanen & Lauronen, 2005). For instance, a mobile phone's small screen cannot contain sufficient information about an operation, and scrolling up and down would be required. Nevertheless, the mobile phone device itself may have slight effect. Laukkanen, (2007) established that when users had practice in using a mobile phone service, they did not stress the significance of screen size in the service, but rather focus their attention on the spatial issues in the service consumption. Therefore device features may not be a concern for users when considering using mobile health.

### 2.4.4: Socio-Economic Background and Culture

Laforet & Li, (2005) established that lack of perceptive of the concepts and benefits was a main obstruction to users using mobile health, consequently; users of mobile health were not intended to be highly educated. Heinonen, (2004) instituted that some users simply prefer to deal directly with a service provider instead of using "arms-length technology" (e.g. mobile health). Obtaining and receiving health-related information, particularly for individuals living in remote communities with limited healthcare resources, are made possible through practices of multi-literacy, (Cope & Kalantzis, 2009; Hibbert, 2013); including digital literacy (Gee, 2009), and other media such as posters, healthcare personnel, and the Internet for obtaining health-related information media for communication. Digital literacy can be implored which involves ways of acting and interacting with a device; images, sounds, and multimodal texts (Gee, 2009). Moreover, a negative, hard-to-use image of technologies and computers may have been perceived by users when thinking about adopting mobile health (Fain & Roberts, 1997). As a result, the socio-economic background and culture of potential users could be factors that influence the adoption of mobile health.

## 3.0: METHODOLOGY

Literature study on m-health, technology acceptance models and interviews combined with questionnaire findings were used to analyze the adoption of mobile health and explore the perceptions of users towards this innovation in Chivi district, Zimbabwe. A combination of qualitative and quasi-quantitative deductive approach was used so as to get a greater degree of accuracy and validity in the results, thus strengthening the findings obtained from the study. Questionnaires were distributed in order to widen the geographical representation. The questionnaires were distributed to doctors, nurses, administrative staff and patients.

The data collected was ordinal, nominal and quantitative, thus data analysis was based on a quantitative method. A sample of 20 health workers and 100 patients (120) was used in the research for data collection. Individuals were asked to indicate the extent of agreement or disagreement with various statements concerning mobile health services on a five –point Likert scale ranging from (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree. The outputs were generated using the SPSS software package. The data was analysed using descriptive statistical methods, regression analysis, correlation analysis.

The hypothesis for each and every construct on the mobile health adoption model (figure 2) was tested as follows:

Step 1: $H_0$: Construct$_i$ is not significant for $i=1,2,3,\ldots,12$

Against

$H_1$: Construct$_i$ is significant for at least one $i$.

Step 2: Reject $H_0$ if modulus of t-value $|t| < 2$ and significant figure (sig) is greater than 0.05.

Step 3: Make a decision on whether to reject $H_0$ or accept $H_0$.

Step 4: Make a conclusion based on the decision in step 3.
Table 1 below guides us on the interpretation of the relationship between two variables and the nature of that relationship.

**Table 1: Interpretation of Correlation Coefficients**

| Correlation Coeff (r) | Interpretation |
|---|---|
| $r = \pm 1$ | Perfect positive/negative relationship |
| $\pm 0.70 \leq r \leq \pm 0.99$ | Strong positive/negative relationship |
| $\pm 0.5 \leq r \leq \pm 0.69$ | Weak Positive/negative relationship |
| $\pm 0.1 \leq r \leq \pm 0.49$ | Very weak positive/negative relationship |
| $r = 0$ | No relationship |

## 4.0: RESULTS AND DISCUSSIONS

### 4.1: Descriptive Statistics

**Table 2: Descriptive statistics of variables**

| | N | Mean | Median | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Attitude towards use | 120 | 3.37 | 3.00 | 1.076 | 1 | 5 |
| Perceived Usefulness | 120 | 3.57 | 4.00 | 1.075 | 1 | 5 |
| Intention to use | 120 | 3.24 | 3.00 | 1.108 | 1 | 5 |
| Trust | 120 | 2.74 | 3.00 | 1.134 | 1 | 5 |
| Actual use | 120 | 3.73 | 4.00 | .905 | 1 | 5 |
| Behavioral control | 120 | 2.61 | 3.00 | 1.079 | 1 | 5 |
| Socio Economic Background | 120 | 3.62 | 4.00 | .927 | 1 | 5 |
| External influence | 120 | 3.27 | 3.00 | 1.248 | 1 | 5 |
| Self-Efficacy | 120 | 2.28 | 2.00 | .997 | 1 | 5 |
| Perceived cost | 120 | 3.12 | 3.00 | 1.213 | 1 | 5 |
| Subjective norm | 120 | 2.84 | 3.00 | 1.138 | 1 | 5 |
| Perceived Ease of Use | 120 | 3.43 | 3.00 | 1.143 | 1 | 5 |

Table 2 shows the averages and standard deviations of variables of interest. Each variable has been evaluated on a Likert scale from strongly disagree (1) to strongly agree (5). Actual Use is recording the highest mean of 3.73 with standard deviation of 0.9 and Self Efficacy a mean of 2.28 and standard deviation of 1.00. Small standard deviation means that most of the data points are neighbors of the true mean.

### 4.2: Correlation of Variables

**Table 3: Correlation of variables**

| Variable 1 | Variable 2 | Coefficient | Comment |
|---|---|---|---|
| Perceived Ease of Use | Perceived Usefulness | 0.723 | Relationship |
| Attitude Towards Use | Perceived Ease of Use | 0.176 | no relationship |
| Trust | Behavioral Control | -0.118 | No relationship |
| Behavioral Control | Self Efficacy | 0.042 | no relationship |
| External influence | Socio-Economic Background | 0.562 | Relationship |
| Perceived Usefulness | Attitude towards use | 0.687 | Relationship |

| | | | |
|---|---|---|---|
| Trust | Perceived Usefulness | 0.892 | Relationship |
| Trust | Subjective norm | 0.763 | Relationship |
| External influence | Subjective norm | 0.025 | No relationship |
| Socio-Economic Background | Subjective norm | 0.654 | Relationship |
| Self Efficacy | Behavioral Control | 0.121 | No relationship |
| Self Efficacy | Actual use | 0.724 | Relationship |
| Attitude towards use | Subjective norm | 0.831 | Relationship |
| Perceived Usefulness | Intention to use | 0.784 | Relationship |
| Behavioral Control | Intention to use | 0.211 | No relationship |
| Behavioral Control | Actual use | 0.061 | No relationship |
| Intention to use | Actual use | 0.693 | Relationship |
| Perceived costs | Intention to use | 0.101 | No relationship |
| Attitude Towards Use | Intention to use | 0.782 | Relationship |

### 4.3: Regression and Anova

**Table 4: Regression and ANOVA for Actual Use as a dependent variable**

ANOVA[b]

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 22.143 | 11 | 2.013 | 2.886 | .002[a] |
| | Residual | 75.324 | 108 | .697 | | |
| | Total | 97.467 | 119 | | | |

a. Predictors: (Constant), Perceived cost, Self Efficacy, Socio Economic Background, Attitude towards use, Behavioral control, Perceived Usefulness, Trust, Intention to use, Perceived Ease of Use, Subjective norm, External influence

b. Dependent Variable: Actual use

Coefficients[a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 2.526 | .869 | | 2.906 | .004 |
| | Behavioral control | -.063 | .075 | -.075 | -.842 | .401 |
| | Perceived Usefulness | .086 | .075 | .103 | 4.154 | .000 |
| | Attitude towards use | .109 | .073 | .129 | 7.484 | .000 |
| | Perceived Ease of Use | -.028 | .074 | -.036 | -3.385 | .003 |
| | Intention to use | .136 | .075 | .166 | 5.797 | .05 |
| | Trust | .062 | .072 | .078 | 2.868 | .005 |
| | Subjective norm | -.056 | .074 | -.071 | -4.761 | .000 |
| | External influence | -.083 | .067 | -.114 | -1.227 | .222 |
| | Socio Economic Background | .091 | .087 | .094 | 3.055 | .004 |
| | Self-Efficacy | .221 | .079 | .244 | 2.787 | .006 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Perceived cost | -.071 | .079 | -.095 | -.895 | .373 |
| b. Dependent Variable: Actual use | | | | | | |

Table 4 shows the regression of Actual use as dependent variable with all other variables of interest (11 independent variables). The ANOVA shows that the null hypothesis (all independent variables are insignificant) is rejected in favor of the alternative hypothesis (at least one of the independent variables is significant). Results from the coefficient table show that; Perceived usefulness, Perceived ease of use, Attitude towards use, Intention to use, Trust, Subjective norm, Socio Economic Background and Self Efficacy are significant to Actual use. On the other hand, Behavioral control, External Influence and Perceived cost are not significant. Summary of results are given in table 5 below.

**Table 5: Factors that are significant to the adoption of m-health**

| Factor | Coefficient | t value | Significance value | Decision | Conclusion |
|---|---|---|---|---|---|
| Behavioral control | -.075 | -.842 | 0.401 | Accept $H_0$ | Not significant |
| Perceived Usefulness | .103 | 4.154 | 0.000 | Reject $H_0$ | Significant |
| Attitude towards use | .129 | 7.484 | 0.000 | Reject $H_0$ | Significant |
| Perceived Ease of Use | -.036 | -3.385 | 0.003 | Reject $H_0$ | Significant |
| Intention to use | .166 | 5.797 | 0.05 | Reject $H_0$ | Significant |
| Trust | .078 | 2.868 | 0.005 | Reject $H_0$ | Significant |
| Subjective norm | -.071 | -4.761 | 0.000 | Reject $H_0$ | Significant |
| External influence | -.114 | -1.227 | 0.222 | Accept $H_0$ | Not significant |
| Socio Economic Background | .094 | 3.055 | 0.004 | Reject $H_0$ | Significant |
| Self-Efficacy | .244 | 2.787 | 0.006 | Reject $H_0$ | Significant |
| Perceived cost | -.095 | -.895 | 0.373 | Accept $H_0$ | Not significant |

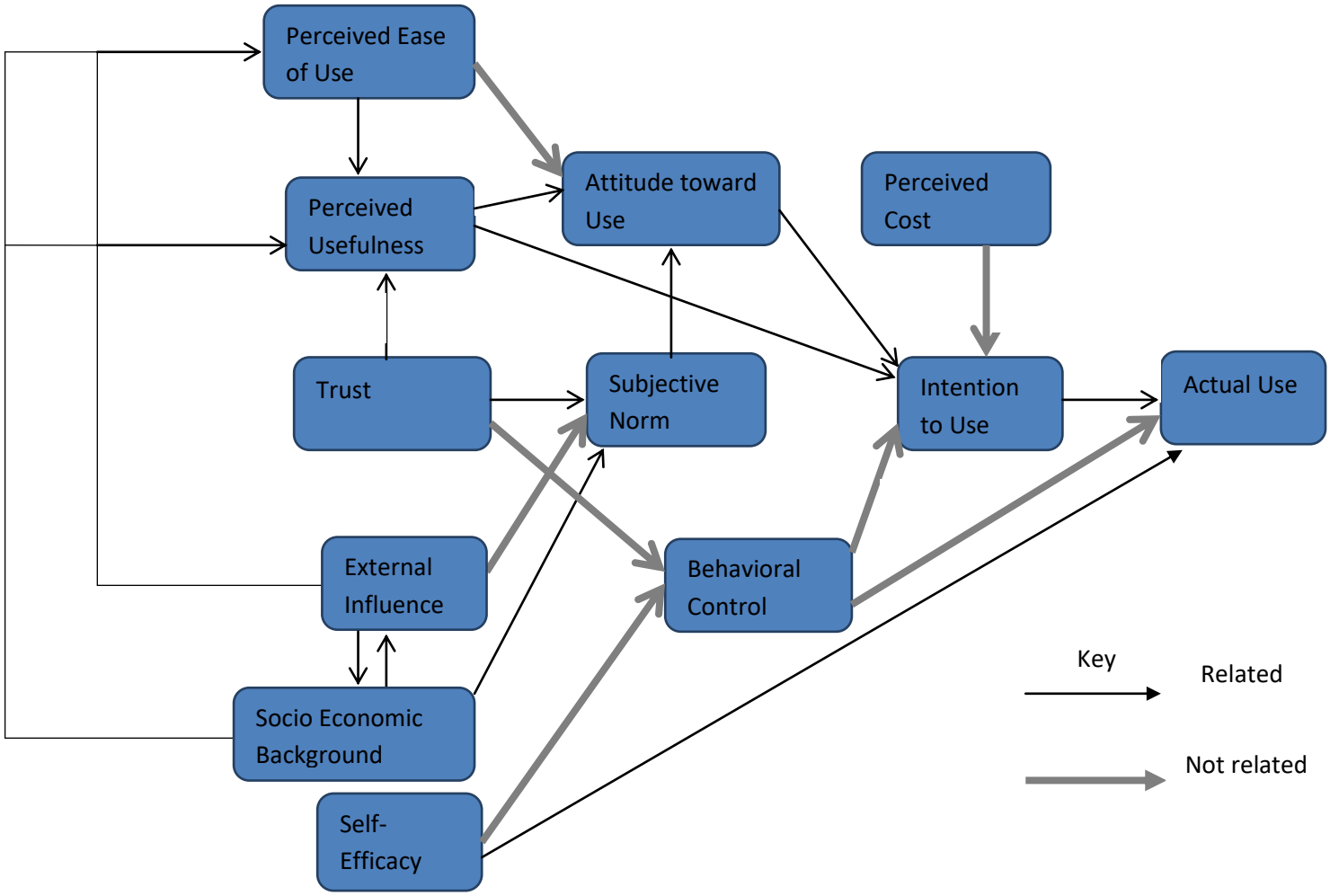


**Figure 1: Chivi District Mobile Health Adoption Model**

This study shows that recognizing trust is a very important aspect to consider in Mobile Health adoption. Many respondents indicated that they didn't trust wireless infrastructure and mobile services providers. Thus, trust, social economic background, perceived usefulness, perceived ease of use among others proved to be the most effective success factors in determining adoption of mobile health in Chivi District. A number also strongly agreed that private health information is easily breached and accessed. The study has also confirmed the significance of the factors outlined by TAM (Davis, 1989) such as Perceived Ease of Use, Attitude towards use and Perceived Usefulness.

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