
ABSTRACT

This study explores mobile payment in Sudan. It addresses the factors affecting its acceptance by customers. Technology Acceptance Model (TAM) was adopted and extended by adding perceived security and service quality to the basic constructs (perceived ease of use and perceived usefulness). Moreover, demographic factors were added as external variables; age, income, and banked/unbanked users. A questionnaire was designed and randomly distributed to a selected sample of Sudanese customers. Data were analyzed using different statistical tests and an extended TAM was developed. The result is believed to support decision makers in the banking industry to consider the factors supporting the acceptance and the diffusion of more efficient and more effective mobile payment services in Sudan.

KEYWORDS: Mobile banking, acceptance, TAM, Sudan.

INTRODUCTION

Payment has evolved from the physical exchange of notes and coins, to writing transferring payment card details over the phone or the internet. e-Payment, however, has involved a shift from the physical transference of tangible tokens of value to an exchange of information between parties. The shift from physical to virtual payments has brought enormous benefits to consumers and merchants. However, it has put extra pressure on payment service providers, including banks and card companies, and mobile operators [1]. Sudan has witnessed rapid technical development in the banking industry, many new systems and settlement mechanisms emerge, starting from ATMs, electronic clearing, bank cards and mobile banking. All services aim to provide services to the citizens, and pursuing to spread the culture of using m-payment in line with the global development in mobile financial services.

RESEARCH PROBLEM AND OBJECTIVES

Financial services through mobile devices are spreading revolutionary in Sudan. Although different categories of people in Sudan have mobile devices, it is noticed that the use of mobile payment (m-payment) is limited. This research attempts to address the factors influencing the acceptance of users to m-payment. This is to investigate if m-payment is a reliable service.

LITERATURE REVIEW**Definition & Concepts:****A) m-Payment:**

Is the process of two parties exchanging financial values using mobile devices in return for goods or services [2]

B) Technologies of Implementing m-Payments [1]:

- Short Message Service (SMS): a service that enables short messages (140-160 characters) to be transmitted from a mobile phone. Short messages are stored and forwarded by SMS centers. SMS messages have a channel of access to phone different from the voice channel. SMS can be used to provide information about the status of one's account with the bank (informational) or can be used to transmit payment instructions from the phone (transactional).
- Unstructured Supplementary Services Delivery (USSD): Unstructured Supplementary Service Data (USSD) is a technology unique to Global System for mobile communications (GSM). It is a capability built into the GSM standard for support of transmitting information over the signaling channels of the GSM network.

USSD provides session-based communication, enabling a variety of applications. USSD is session oriented transaction-oriented technology while SMS is a store-and-forward technology. Turnaround response times for interactive applications are shorter for USSD than SMS.

- WAP/GPRS: General Packet Radio Service (GPRS) is a mobile data service available to GSM users. GPRS provides packet-switched data for GSM networks. GPRS enables services such as Wireless Application Protocol (WAP) access, Multimedia Messaging Service (MMS), and for internet communication services such as email and world wide web access in mobile phones.
- Phone-based Application (J2ME/BREW): The client m-payment application can reside on the mobile phone of the customer. This application can be developed in Java (J2ME) for GSM mobile phones and in Binary Runtime Environment for Wireless (BREW) for CDMA mobile phones. Personalization of the phones can be done Over The Air (OTA).
- SIM-based Application: The subscriber identity module (SIM) used in GSM mobile phones is a smart card i.e., it is a small chip with processing power (intelligence) and memory. The information in the SIM can be protected using cryptographic algorithms and keys. This makes SIM applications relatively more secure than client applications that reside on the mobile phone. Also, whenever the customer acquires a new handset only the SIM card needs to be moved. If the application is placed on the phone, a new handset has to be personalized again.
- Near Field Communication (NFC): NFC is the fusion of contactless smartcard Radio-frequency identification (RFID) and a mobile phone. The mobile phone can be used as a contactless card. NFC enabled phones can act as RFID tags or readers. This creates opportunity to make innovative applications especially in ticketing and coupon in.
- Dual Chip: Usually the m-payment application is integrated into the SIM card. Normally, SIM cards are purchased in bulk by telecom companies and are then customized for use before sale. If the m-payment application service provider has to write an m-payment application in the SIM card, this has to be done in collaboration with the telecommunications operator (the owner of the SIM). To avoid this, dual chip phones have two slots one for a SIM card (telephony) and another for a payment chip card. Financial institutions prefer this approach as they can exercise full control over the chip and the m-payment process. But, customers would have to invest in dual chip mobile devices.
- Mobile Wallet: M-payment application software that resides on the mobile phone with details of the customer (and his or her bank account details or credit card information) which allows the customer to make payments using the mobile phone is called as a mobile wallet. Customers can multi-home with several debit or credit payment instruments in a single wallet. Several implementations of wallets that are company-specific are in use globally.

C) Classification of m-Payment Solutions:

- Bank Account based M-Payment: In this model, the bank account is linked to the mobile phone number of the customer. When the customer makes an m-payment transaction with a merchant, the bank account of the customer is debited and the value is credited to the merchant account.
- Credit Card based M-Payment: In the credit card based m-payment model, the credit card number is linked to the mobile phone number of the customer. When the customer makes an m-payment transaction with a merchant, the credit card is charged and the value is credited to the merchant account. Credit card based solutions have the limitation that it is heavily dependent on the level of penetration of credit cards in the country.
- Telecommunication Company Billing of M-Payments: Customers may make payment to merchants using his or her mobile phone and this may be charged to the mobile phone bills of the customer. The customer then settles the bill with the telecommunication company. This may be further classified into prepaid airtime (debit) and postpaid subscription (credit).

D) Stakeholders of e-Payment

- Consumers
- Merchants

- Mobile Network operators
- Mobile device manufacturers
- Financial institutions and banks
- Software and technology providers
- Government

E) Advantages of m-Payment:

m-Payment is becoming a user-friendly way of payment; most important is that it is characterized by being¹:

- Simple and Usable.
- Cheap
- Speed: The speed of any transaction very fast than other payment at which m-payments are executed.
- Convenient
- Secure.
- Economic.

F) Challenges for M-Payment [3]

- Standards: M-payments lack cohesive technology standards that can provide a universal mode of payment. The lack of standards will give rise to lot of local and fragmented versions of m-payments offered by different stakeholders (network operator centric models and bank centric models). Standards need to address security and privacy concerns of consumers as well as interoperability between various implementations.
- Business Models: Since there are several stakeholders in the system, a viable and sound business model needs to be developed to provide a reliable framework for revenue sharing.
- Regulatory Issues: Although m-payment may allow parties to make economic exchanges at the international levels, still some developing countries do not have legislation for m-payment transactions.

e- Banking in Sudan:

In 1999 The Central Bank of Sudan (CBOS) has formulated a comprehensive banking policy. It was to automate all banking services, and to connect all the banks in Sudan with CBOS. The implementation of this policy continued over the years to adopt full banking technology (BT) and eventually shifting to complete e-banking [4].

A) m-Payment in Sudan:

General components of any e-payment system are of 2 main parts; technical part constituting computers, networks, storage units and other hardware devices and units. The other part is regulatory constituting all policies, laws, regulations and business rules that operate to direct, organize, and promote of payment systems [5]. CBOS is providing all this requirements to ensure secure m-payment system in Sudan.

B) Stakeholders [6]:

- Central bank of Sudan (CBOS):
- National Telecommunication Corporation (NTC)
- Mobile Network Operators (MNOs)
- Electronic Banking Services Company (EBS)
- Agent

RESEARCH HYPOTHESES

Based on past research [9], there are different factors affect the acceptance of people to use technology. These are basically; perceived ease of use (PEOU), perceived usefulness (PU). This research consider more factors, these are; perceived security (PS), service quality (SQ) and external variables (age, income, banked/unbanked user).

To test the acceptance of people to pay via their mobile devices, the researchers stated the following hypotheses:

H1: PU positively affects the intention to use m-payment

- H2: PEOU positively affects the intention to use m-payment
- H3: PS positively affects the intention to use m-payment
- H4: SQ positively affects the intention to use m-payment
- H5: Elder age of users positively affects PEOU
- H6: Elder age of users positively affects PU
- H7: Users with lower income are more affected by PEOU
- H8: Users with lower income are more affected by PU
- H9: Unbanked users are more affected by PU than banked users
- H10: Unbanked users are more affected by PEOU than banked users
- H11: Banked users are more affected by PS than unbanked users
- H12: Banked users are more affected by SQs than unbanked users

RESEARCH METHODOLOGY

To test the hypotheses the researchers first studied the most popular models used to test for the acceptance of technology; they were [7]: Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM). This was to choose the most suitable for the study.

Theory of Reasoned Action

Theory of Reasoned Action (TRA) was formulated in 1967. It is based on two main concepts; “principles of compatibility” and “behavioral intention”. Principles of compatibility specify that in order to predict a specific behavior directed to a specific target in a given context and time, specific attitudes that correspond to the specific target, time and context should be assessed. Behavior intention indicates how much effort an individual would like to commit to perform such behavior. TRA was criticized for neglecting the importance of social factors that in real life could be a determinant for individual behavior¹². Fig. 1 illustrates TRA model

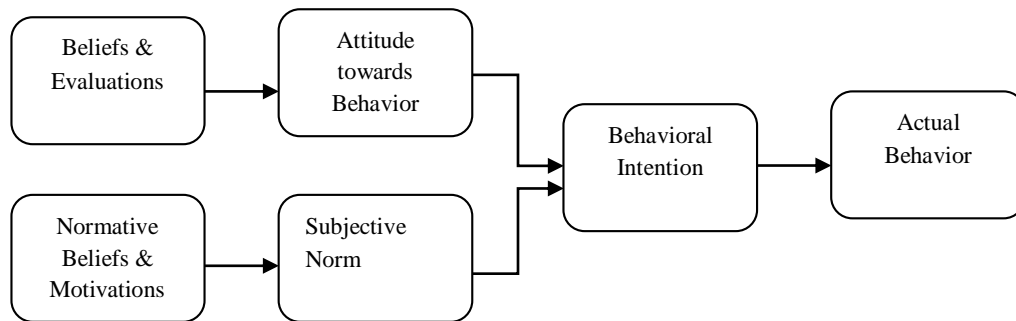


Fig. 1: TRA Model

Technology Acceptance Model

Fig 2 illustrates the Technology Acceptance Model (TAM). It suggests that the acceptance of any technology is determined by two main factors: perceived usefulness and perceived ease of use [9]. In addition, external variables can also have some impact on users' internal attitudes, beliefs, and intentions, further influencing TAM. Moreover, previous studies proved that different external variables actually influence perceived usefulness and perceived ease of use⁷.

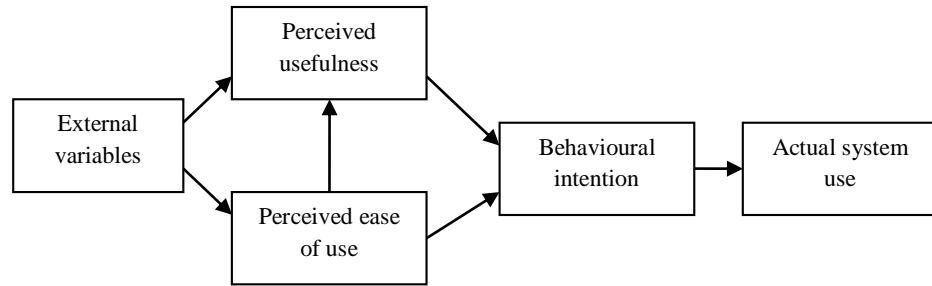


Fig. 2: TAM

Reasons for Using TAM as model for this research

TAM has been chosen as a model for this study because it consider different social factors that were proved to greatly affect the intension to use new technology [8].

The Hypothesized Research Model

Fig 3. illustrates the TAM considering the research hypotheses.

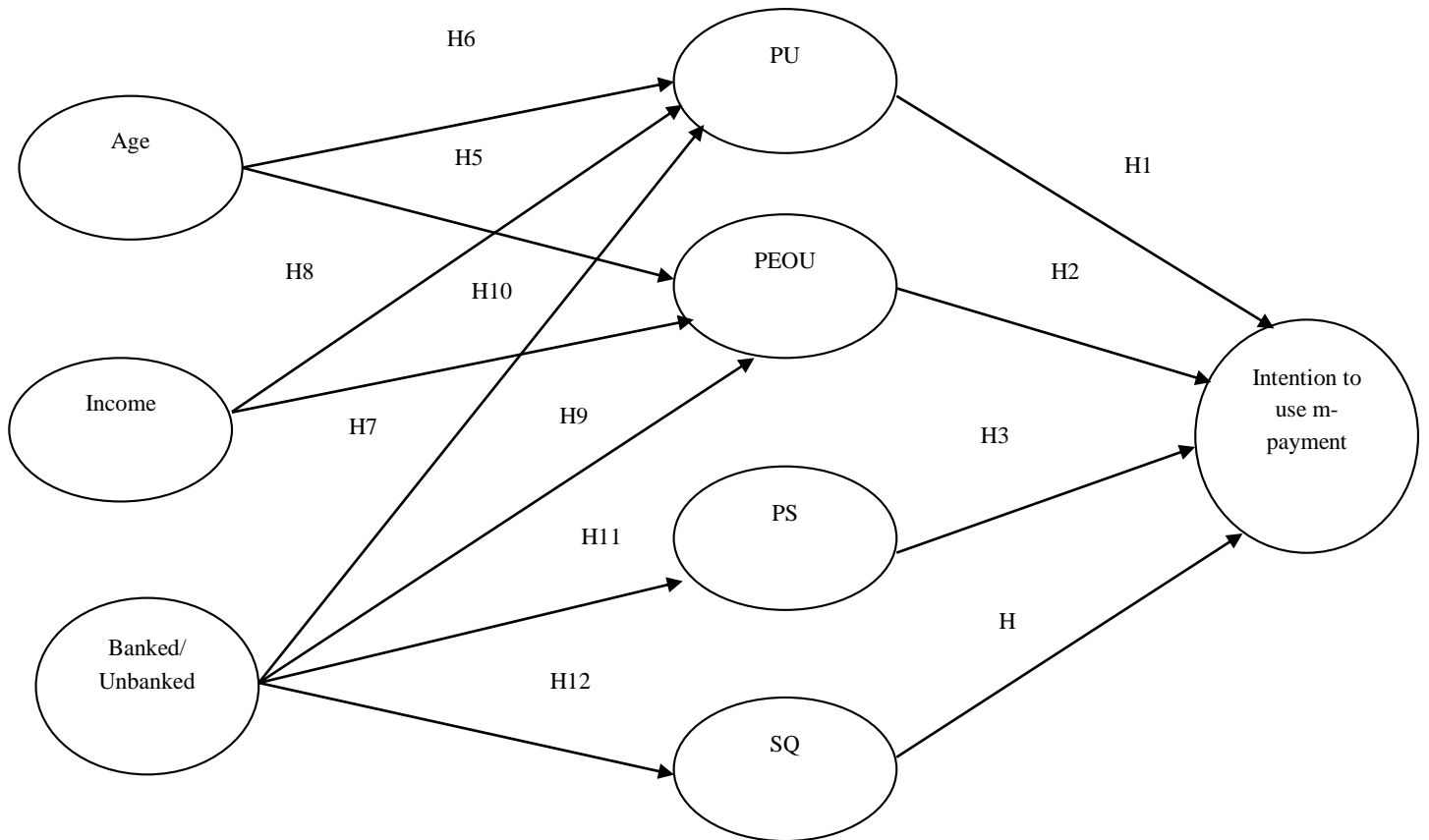


Fig. 3: Hypothesized Research Model

Population, Sample Size and Procedure

Population: All people in Sudan who practice m-payment. Sample size = 80. A questionnaire of 19 questions was designed and was distributed to a random sample. The questionnaire was of 2 parts; part 1 consists of 3 demographic questions, part 2 was of 16 statements (5-Likert scale was used for each item). Part 2 was about transactions costs, simplicity and quickness of processes, security services and after sale services. Responses to the questionnaire were considered to be the main data of the study. Fully answered questionnaires = 60, partially answered questionnaires = 6, questionnaires not returned = 14. Fully answered questionnaires were statistically analyzed and the results were applied to test the hypotheses and to design a new TAM.

Data Analysis

Part 1- personal information (3 questions): frequencies and percentages were measured.

Table 1: Age of Sample

Age (years)	Frequency	Percentage (%)
Less than 25	10	16.7
From 25 to 40	29	48.3
More than 40	21	35.0
Total	60	100.0

Table 1 illustrates that the age of most of the customers ranges between 25 and 40 (48.3%). This indicates that most of the sample

Table 2: Income of Sample

Income (Sudanese Pound)	Frequency	Percentage(%)
Less than 500	5	8.3
From 500 to less than 1500	19	31.7
From 1500 to less than 3000	24	40.0
3000 and more	12	20.0
Total	60	100.0

Table 2 illustrates that most users (91.7%) earn high income (500 Sudanese Pound or more). 8.3% of the users earn less than 500 Sudanese pounds and yet they practice m-payments.

Table 3: Banked Vs Unbanked Users

Users	Frequency	Percentage (%)
Banked	22	36.7
Unbanked	38	63.3
Total	60	100.0

Table 3 illustrates that 63.3% of the m-payment users do not have bank accounts while 36.7% of the users have bank accounts. This is an indicator that m-payment do not require bank customers.

Part 2- Personal Opinions (16 statements): 5-Likert scale was used. Table 4 to Table 19 present the different opinions of the users; 0: strongly agree, 1: agree, 2: neutral, 4: disagree and 5: strongly disagree.

Table 4: Statement 1 - Cost Affects Mobile Transactions

Opinion	Frequency	Percentage (%)
0	13	21.7
1	27	45.0
2	18	30.0
3	2	3.3
Total	60	100.0

67.7% (21.7% + 45%) of the sample agree

Table 5: Statement 2 – Ease of Use Affects Mobile Transactions

Opinion	Frequency	Percentage (%)
0	43	71.7
1	16	26.7
2	1	1.7
Total	60	100.0

71.7% of the sample strongly agree

Table 6: Statement 3 – Quickness of Service Affects Mobile Transactions

Opinion	Frequency	Percentage (%)
0	32	53.3
1	23	38.3
2	5	8.3
Total	60	100.0

53.3% of the sample agree strongly agree

Table 7: Statement 4 – Security Affects Decision for Using M-Payment

Opinion	Frequency	Percentage (%)
0	45	75.0
1	13	21.7
2	2	3.3
Total	60	100.0

75% of the sample strongly agree

Table 8: Statement 5 - Mobile Services Satisfy Needs of Users

Opinion	Frequency	Percentage (%)
0	21	35.0
1	30	50.0
2	6	10.0
3	3	5.0
Total	60	100.0

85% (35% + 50%) of the sample agree

Table 9: Statement 6 – Governmental Services are well delivered via Mobile Systems

Opinion	Frequency	Percentage (%)
0	24	40.0
1	28	46.7
2	4	6.7
3	4	6.7
Total	60	100.0

86.7% (40% + 46.7%) of the sample agree

Table 10: Statement 7 –Sound Laws are stated to govern m-Payments

Opinion	Frequency	Percentage (%)
0	39	65.0
1	15	25.0
2	6	10.0
Total	60	100.0

90% (65% + 25%) of the sample agree

Table 11: Statement 8 - Mobile Payments Promotes Banking Services

Opinion	Frequency	Percentage (%)
0	31	51.7
1	18	30.0
2	8	13.3
3	3	5.0
Total	60	100.0

81.7% (51.7% + 30%) of the sample agree

Table 12: Statement 9 - Mobile Payment Services are Efficient and Effective

Opinion	Frequency	Percentage (%)
0	25	41.7
1	30	50.0
2	5	8.3
Total	60	100.0

91.7% (41.7% + 50%) of the sample agree

Table 13: Statement 10 - User Password is Essential for Each Payment Transaction

Opinion	Frequency	Percentage (%)
0	35	58.3
1	17	28.3
2	4	6.7
3	4	6.7
Total	60	100.0

58.3% of the sample agree

Table 14: Statement 11 – m-Payment reduces unnecessary expenditures

Opinion	Frequency	Percentage (%)
0	26	43.3
1	24	40.0
2	7	11.7
3	3	5.0
Total	60	100.0

83.3% (43.3% + 40%) of the sample agree

Table 15: Statement 12 - m-Payment is available everywhere all the time

Opinion	Frequency	Percentage (%)
0	23	38.3
1	22	36.7
2	10	16.7
3	2	3.3
4	3	5.0
Total	60	100.0

75% (38.3% + 36.7%) of the sample agree

Table 16: Statement 13 - Mobile Transactions makes life more interesting

Opinion	Frequency	Percentage (%)
0	13	21.7
1	31	51.7
2	9	15.0
3	5	8.3
4	2	3.3
Total	60	100.0

73.4% (21.7% + 51.7%) of the sample agree

Table 17: Statement 14 – m-Payment is highly trusted in Sudan

Opinion	Frequency	Percentage (%)
0	14	23.3
1	17	28.3
2	23	38.3
3	4	6.7
4	2	3.3
Total	60	100.0

51.6% (23.3% + 28.3%) of the sample agree, 38.3% are neutral

Table 18: Statement 15 – m-Payments promote m-marketing

Opinion	Frequency	Percentage (%)
0	32	53.3
1	19	31.7
2	8	13.3
3	1	1.7
Total	60	100.0

85% (53.3% + 31.7%) of the sample agree

Table 19: Statement 16- After Sales Services for m-payments are attractive

Opinion	Frequency	Percentage (%)
0	44	73.3
1	15	25.0
3	1	1.7
Total	60	100.0

73.3% of the sample strongly agree

The tables 4-16 illustrates that the selected sample strongly agree or agree with the stated statements. More statistical tests were carried to test the research hypotheses.

Testing the Hypotheses

To test the research hypotheses, multinomial logistic regression, logistic regression, and correlation coefficient tests were applied using the data represented in tables 1-19. All tests were at 95% confidence degree.

RESULTS AND DISCUSSION

Most important results of testing the basic constructs of the model are presented in the following points:

- The construct that mostly affect the intention to use m-payment is PS.
- Attitude of Sudanese people to use m-payment tools is affected by their intention to use m-payment and by PU and PEOU. This means the m-payment tools are useful and easy to be used, and the Sudanese customers' intention toward m-payment is positive.
- The intention of Sudanese users to use m-payment tools is affected by the SQ.
- Age of customers' is negatively correlated with PEOU of m-payment tools and positively with PU.
- Lower incomes are positively correlated with PEOU and PU.
- Banked/unbanked status of users has no correlation with neither PU, PEOU nor SQ.
- Banked status of users is highly correlated with PS.

The obtained statistical results accepted only hypotheses 3, 9, 10, and 12. Accordingly fig. 4 illustrates the resulting TAM.

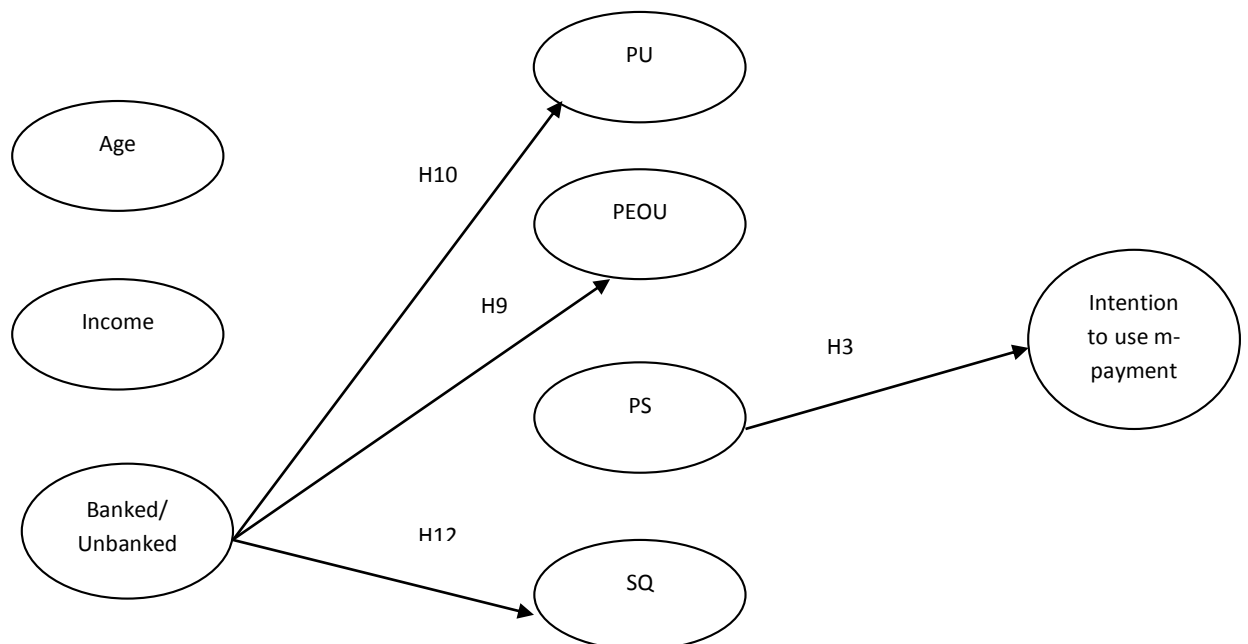


Fig. 4: Resulting TAM

Resulting TAM shows that age and income do not affect the intention to use m-payment. Only status of banked/unbanked users is affected by PEOU, PU and SQ. It illustrates that PS is the only construct that affects the intention to use m-payment.

RECOMMENDATIONS

- Awareness programs should be delivered to user before launching m-payment systems.
- To achieve customer satisfaction m-payment systems should be secure enough to protect users information and financial transactions.
- EOU should be considered as being potential.
- The service should be of low charging rate.
- Sound policies and regulation to govern the m-payment system in Sudan should be stated.
- Using existing agent office for telecommunication corporate to reduces deployment costs and provides greater convenience and lower cost of access to users.

Moreover, the researchers recommend for the following future studies;

- Testing the Acceptance of Using e-Purse in Sudan
- Evaluating e-Payment in Universities in Sudan

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