



ASHESI UNIVERSITY

**MOBILE MONEY AS A MEANS FOR FINANCIAL
INCLUSION AND CONVENIENCE IN E-COMMERCE
PAYMENT WITHIN THE INFORMAL SECTOR IN
GHANA**

UNDERGRADUATE THESIS

B.Sc. Management Information Systems

Maame Cobbold

2021

ASHESI UNIVERSITY

**MOBILE MONEY AS A MEANS FOR FINANCIAL
INCLUSION AND CONVENIENCE IN E-COMMERCE
PAYMENT WITHIN THE INFORMAL SECTOR IN
GHANA**

UNDERGRADUATE THESIS

Thesis submitted to the Department of Computer Science, Ashesi University College in
partial fulfillment of the requirements for the award of Bachelor of Science degree in
Management Information Systems.

Maame Cobbold

2021

DECLARATION

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:

MEC

.....

Candidate's Name:

Maame Cobbold

.....

Date:

13th May 2021

.....

I hereby declare that preparation and presentation of this thesis were supervised in accordance with the guidelines on supervision of thesis laid down by Ashesi University.

Supervisor's Signature:



.....

Supervisor's Name:

Mr. David Sampah

.....

Date:

13th May 2021

.....

Acknowledgements

I would like to say a special thank you to my supervisor, Mr David Sampah. His support, guidance and overall insights in this field have made this an inspiring experience for me.

I would also like to thank everyone who participated in the study's questionnaires.

Finally, I would like to thank my family and friends for supporting me during the compilation of this dissertation.

Abstract

In this era of the coronavirus pandemic, which has affected individuals in all spheres of life, businesses have had to move operations online. With remote working more prevalent than it has ever been, people are spending more time online. Online shopping has become popular over the past few months due to the decline in offline shopping – as a result of the existence of lockdowns. The payment systems used in online shopping, unfortunately, do not favour the unbanked populations because they mostly center around the use of bank accounts and cards. This thesis seeks to investigate the feasibility of a solution that addresses the issue of financial inclusion in e-commerce payment. The research focuses on the integration of a mobile money payment option to e-commerce sites and how it could promote or decrease financial inclusion and convenience for the informal sector workers in Ghana.

Table of Content

DECLARATION.....	<i>i</i>
Acknowledgements	<i>ii</i>
Abstract	<i>iii</i>
Chapter 1 : Introduction.....	<i>1</i>
1.1 Background & Objective	1
1.2. Motivation.....	2
1.3. Research questions	2
1.4. Hypothesis.....	3
Chapter 2 : Literature Review and Related Works.....	<i>4</i>
2.1. Chapter Overview	4
2.2. Financial Inclusion	4
2.3. E-commerce Adoption in Ghana	5
2.4. Tonaton	6
2.5. Zoobashop	7
2.6. Jumia Ghana	8
2.7. Gaps in existing works.....	10
Chapter 3 : Methodology & Architecture	<i>12</i>
3.1. Chapter Overview	12
3.2. Population	12
3.3. Sample method.....	12
3.4. Steps for the study	12
3.5. Data Processing method.....	13
3.6. Architecture.....	13
3.7. Use Cases.....	13
3.7.1. Functional Requirements	15
3.7.2. Non-Functional Requirements.....	15
3.7.3. Database	15
3.8. Technology Overview	16

3.8.1.	Programming Languages	16
3.8.2.	Application Programming Interfaces (API)	17
3.8.3.	Local Server	17
Chapter 4 : Methodology 2 – Implementation, Data Collection and Analysis		18
4.1.	Chapter Overview	18
4.2.	Implementation	18
4.2.1.	Components of the system	19
4.2.1.1.	Product Management	19
4.2.1.2.	Cart Management.....	22
4.2.1.3.	Payment Management.....	24
4.3.	Data Collection.....	29
4.4.	Data Analysis	30
Chapter 5 : Conclusion and Recommendations		37
5.1.	Chapter Overview	37
5.2.	Conclusion	37
5.3.	Recommendations for future works.....	37
Appendix.....		39
	Questionnaire	39
References.....		40

List of Figures

Figure 2.1: Diagram of buyer-seller interaction page.....	7
Figure 2.2: Diagram of payment options available on Zoobashop.....	7
Figure 2.3: Diagram of mobile money payment on Zoobashop.....	8
Figure 2.4: Different payment methods available on Jumia.....	9
Figure 2.5: Networks Jumia accepts mobile money from	10
Figure 3.1: Use case diagram for the user	14
Figure 3.2: Relational database schema.....	16
Figure 4.1: Diagram of the contents of the capstone	18
Figure 4.2: Excerpts from the cart class	19
Figure 4.3: Snippet code for product display.....	20
Figure 4.4: Front-end for product display.....	21
Figure 4.5: Snippet of code for product search.....	22
Figure 4.6: Front end for product search	22
Figure 4.7: Snippet code for adding item to cart	22
Figure 4.8: Snippet of code for updating quantity in cart.....	23
Figure 4.9: Snippet of code for deleting items from cart.....	23
Figure 4.10: Snippet of code for deleting entire cart	24
Figure 4.11: Authorization for Paystack API	24
Figure 4.12: Snippet of code for payment button	25
Figure 4.13: Snippet of code to call Paystack popup.....	25
Figure 4.14: Paystack popup.....	26
Figure 4.15: Snippet of code for payment	27
Figure 4.16: Paystack one time pin.....	28

Figure 4.17: Mobile money prompt from Paystack.....29

Figure 4.18: Consent form.....30

Figure 4.19: User response 131

Figure 4.20: User response 231

Figure 4.21: User response 332

Figure 4.22: User response 433

Figure 4.23: User response 533

Figure 4.24: User response 634

Figure 4.25: User response 734

Figure 4.26: User response 835

Figure 4.27: User response 936

Figure 4.28: User response 1036

Chapter 1 : Introduction

1.1 Background & Objective

Electronic commerce or e-commerce can be described as any type of commercial transaction that is conducted over a computer network such as the Internet [4]. There are different categories of e-commerce with Business to business (B2B), Business to Consumer (B2C) and Consumer to Consumer (C2C) being the most common [6]. In the B2C model, businesses provide goods and services to consumers over the internet. Examples of B2C includes online shopping and internet banking.

According to a survey conducted by Pew Research Center [8], online shopping is one of the fastest-growing activities that takes place over the internet. The survey also revealed that many consumers prefer online shopping due to several reasons, such as convenience, a wide variety of products, easy price comparisons and discounted products. Businesses have an online presence because it enables them to reach a wide range of customers in different locations who may be impossible to reach through traditional business channels. According to the reports of Internet World Stats [9], the number of Internet users increased nearly eight-fold from 2000 to 2014 and it continues to increase every year. As different countries also entered lockdowns due to the coronavirus pandemic, internet usage has also surged between 50% to 70% [12].

This continuous increase in the number of worldwide Internet users [9], coupled with the surge in recent times [12], provides an opportunity for e-commerce transactions to expand even larger. Various payment systems have been adopted to facilitate the use of e-commerce sites, such as the Online Credit Card Payment System [18]. Payment systems like these benefit the population that uses bank accounts, excluding the greater unbanked population. The formal financial market of Ghana has been able to cover only 40 per cent of the population, which means an overwhelming 60 per cent of the population still remains unbanked [10]. Over the

years, systems such as mobile money have been developed and adopted, and these systems give the unbanked some access to the formal financial market. According to the World Bank's Consultative Group to Assist the Poor (CGAP) Financial Inclusion Insights Survey, "access to formal financial services in Ghana increased significantly from 41 percent to 58 percent between 2010 and 2015, yet 42 percent of the population still lacks access to financial services" [5]. In this 17% increase in access, mobile money accounted for 8% [5]. Mobile money plays a huge role when it comes to financial inclusion in Ghana. This research aims to investigate the feasibility of a possible solution to address the concerns of the unbanked population by testing the positive reception of an e-commerce platform that integrates a mobile money payment option.

1.2. Motivation

Mobile money system provides financial transaction services via a mobile phone, including to the unbanked global poor [10]. According to Aron [10], "the technology has spread rapidly in the developing world, "leapfrogging" the provision of formal banking services. " Taking into consideration the fact that about 60% of the population remains largely unbanked [13], the integration of the mobile money payment system into e-commerce sites could make e-commerce a more financially inclusive service. "The lack of an efficient payment system and mistrust is affecting the use of e-commerce sites by Ghanaians, especially those in the informal sector who are largely unbanked" [11]. The integration could also allow Small and medium-sized enterprises (SME's) see the benefit of moving their operations online since a solution would be proposed that could address their problems of a lack of trust and an efficient payment system.

1.3. Research questions

This research seeks to find answers to the following questions:

1. Does mobile money payment provide financial inclusion for the unbanked in Ghana?
2. Does mobile money payment increase convenience when using ecommerce sites?
3. Does the lack of trust in payment methods affect the adoption of e-commerce by individuals and businesses?

1.4. Hypothesis

1. Mobile money payment provides financial inclusion for the unbanked.
2. Mobile money payment provides convenience for the banked.
3. Mobile money payment solves the problem of trust in payment methods in e-commerce.
4. Integrating mobile money into e-commerce platforms makes it more inclusive.

Chapter 2 : Literature Review and Related Works

2.1. Chapter Overview

This section seeks to understand the research and theories that have been conducted and developed around the area of financial inclusion and the convenience mobile money payment could provide when it comes to shopping and doing business online.

2.2. Financial Inclusion

Several studies, such as Donovan [11] and Akudugu [13], have provided evidence of low financial inclusion across developing countries in Sub-Saharan Africa such as Ghana. Financial inclusion has been defined by Beck et al [16] as a “state in which everyone can access a range of quality financial services at affordable prices in a convenient manner.” Factors such as “the age of individuals, literacy levels, wealth class, distance to financial institutions, lack of documentation, lack of trust for formal financial institutions, money poverty and social networks as reflected in family relations are the significant determinants of financial inclusion in Ghana” [13]. Akudugu [13] conducted a study on a sample of 1000 Ghanaians which included 49% males and 51% females. The sample also included people between the ages of 15 to 98 years. With this sample, he tried to establish with a logistic regression model how the various factors affected the probability of being included in the formal financial market. According to Akudugu [13], the results from his study show that the “formal financial market of Ghana has been able to cover only 40 per cent of the population which means an overwhelming 60 per cent of the population is still unbanked. In other words, two in five adult individuals are included in the formal financial sector of Ghana with the remaining three being excluded.”

Ahmad et al [2], in their research, discuss how mobile technology has the ability to increase financial inclusion in more ways than just the provision of mobile money. They establish the clear difference between mobile money and mobile banking (the situation where customers access their bank accounts through their phones). From their study, they established that the unbanked preferred mobile money services to safely store money, which, if they had access to formal financial services, would have been stored in a bank account.

2.3. E-commerce Adoption in Ghana

Sumanjeet [18] discusses the various payment systems that have emerged over the years to facilitate the use of e-commerce sites, and since most of these systems benefit the banked population, the unbanked population are unable to partake in e-commerce activities, as discussed in section 1.1. Amankwa and Kevor [14] investigates why Ghanaian Small and Medium-sized Enterprises have failed to adopt e-commerce despite the numerous benefits to be derived; and further proposes a model on how these barriers hindering e-commerce adoption can be circumvented. Their research identified the cost of IT Infrastructure, Security and Trust and lack of an Efficient Payment System as the perceived barriers. Their model proposes mobile money payment system introduced by the Mobile Network Operators (MNOs) as a way to overcome the problem of efficient payment system. The model also suggests a Certificate Authority that will provide digital certificates for encryption and decryption as a way of overcoming the issue of security and trust in the e-commerce circles.


Lastly, a broker who will provide the IT infrastructure for e-commerce to circumvent the problem of high cost of IT infrastructure.

2.4. Tonaton


Tonaton (<https://tonaton.com/>) is an online marketplace that offers a platform for customers to buy and sell everything from used cars to mobile phones and computers. Customers are also allowed to search for property and jobs on the site. Tonaton, in this case, would be described as a consumer-to-consumer e-commerce site as it provides a platform for individuals to sell and buy from each other. The seller often decides the payment method. Hence, some products are paid for on delivery and others through mobile money and bank deposits.


The downside of leaving the payments medium to the seller's discretion is that it becomes easy for customers to be scammed by sellers. Sellers can choose to either receive payment on delivery, through mobile money or bank transfer. If the seller agrees to pay through mobile money or bank transfer, there is no way to verify that the transaction taking place is legitimate. There is no guarantee that once payment is made, the item would be delivered. Tonaton thus tries to protect its customers by encouraging them to opt for payment on delivery.


Posted on 08 Nov 11:42 pm, Other, Accra





For sale by **Kobbi Louis**

 **0542XXXXXX**
Click to show phone number

 **Chat**

 Stay safe on Tonaton.com!

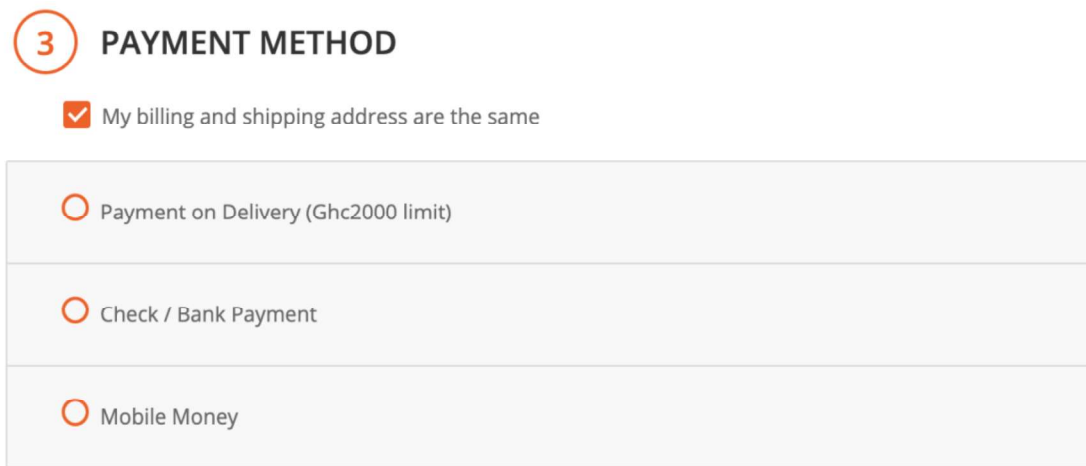
GH¢ 1,200 *Negotiable*

Condition: Used
Brand: Apple
Model: iPhone 6S Plus

Figure 2.1: Diagram of buyer-seller interaction page

2.5. Zoobashop

Zoobashop (<https://www.zoobashop.com/>) is a Ghanaian owned online store that offers a wide range of products such as electronics, home appliances and clothes. Zoobashop offers delivery packages for customers. The payment options available include payment through mobile money, bank deposits and pay on delivery.



The screenshot shows a web form titled "3 PAYMENT METHOD". Below the title is a checked checkbox labeled "My billing and shipping address are the same". There are three radio button options listed in a light gray box: "Payment on Delivery (Ghc2000 limit)", "Check / Bank Payment", and "Mobile Money".

3 PAYMENT METHOD	
<input checked="" type="checkbox"/>	My billing and shipping address are the same
<input type="radio"/>	Payment on Delivery (Ghc2000 limit)
<input type="radio"/>	Check / Bank Payment
<input type="radio"/>	Mobile Money

Figure 2.2: Diagram of payment options available on Zoobashop

When a customer chooses to pay through mobile money, a mobile money account number is made available for the customer to make payment outside of the system. This reduces trust in the payment system as the process is no longer smooth and seamless.

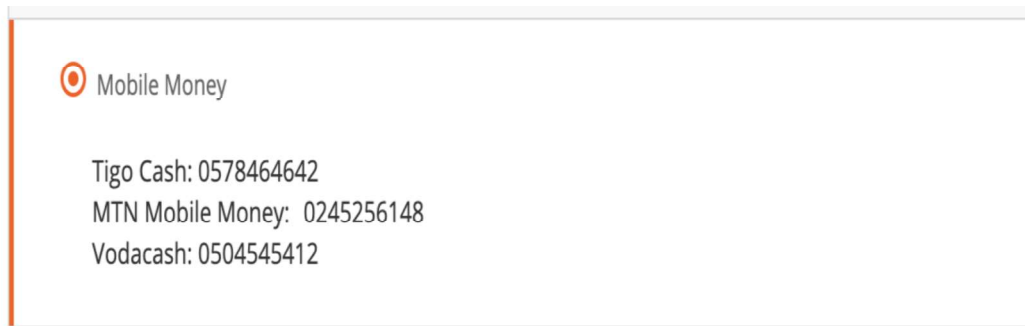




Figure 2.3: Diagram of mobile money payment on Zoobashop

2.6. Jumia Ghana

Jumia (<https://www.jumia.com.gh/>) is an online store that provides a platform for the buying and selling of a wide range of products from electronic gadgets to clothes. The company also provides shipping and delivery for customer packages and a payment platform to facilitate payments between buyers and sellers.

Customers who make purchases can make payment through mobile money, MasterCard and visa, Jumia force (open only to Jumia Force agents) and on delivery (currently not in use due to the covid-19 pandemic).

How do you want to pay for your order?



☐   **Mobile Money - MTN, AirtelTiGo**

Go Cashless and Stay Safe - Eligible for Contactless Safe Delivery
Please ensure you have enough funds on your mobile money wallet to make payment instantly to avoid order cancellation.


How to pay

1. On the JumiaPay payment platform, select mobile money
2. Select your operator (service provider)
3. Enter your mobile money number
4. Click on pay now
5. Check your phone for payment request
6. Enter your MoMo PIN
7. Approve payment to Jumia
8. You will receive SMS/Email confirmation message for a successful payment.


Your payment is safe. If anything goes wrong, we've got your back!

☐   **Mastercard/Visa Debit & Credit Cards**

Pay through JumiaPay by Mastercard and Visa. All banks are supported.
Go Cashless and Stay Safe

☐  **JUMIA FORCE** **J-Force Payment**

For Use by Jumia Force agents only

☐  **Pay on delivery (Pay via Jumia Pay at delivery for more precaution)**

Unavailable [Why?](#)

Figure 2.4: Different payment methods available on Jumia

On requesting to pay with mobile money, the customer is redirected to Jumia Pay. The customer is then asked to input his or her mobile money number, after which a payment request be sent to the customer's phone. This request asks for the user to insert his or her pin and also for the customer to approve the request. This process is smooth and seamless, and an improvement from payment systems offered on the sites in sections 2.4 and 2.5. Jumia Pay, however, limits the networks that can be used to AirtelTigo and MTN. This means that Vodafone users cannot benefit from this process.

The screenshot shows the Jumia Pay checkout interface. At the top left is the 'JUMIA PAY' logo. The main section is titled 'ORDER SUMMARY' with a 'SEE DETAILS >' link. Below this, a box displays 'TOTAL TO PAY' as 'GH¢ 75.00'. The next section is 'CHOOSE A NEW PAYMENT METHOD'. It features two options: 'Bank Cards' (with Mastercard and Visa logos) and 'Mobile Money' (which is selected with a blue radio button). Under 'Mobile Money', there is a 'Select your operator' dropdown menu with 'MTN' selected and 'AirtelTigo' as an alternative. Below the dropdown is a form for a mobile number, starting with '+233' and a placeholder 'insert mobile number without 0'. A CAPTCHA section follows, showing a distorted image 'F4pRwg' and the text 'Please insert your CAPTCHA'. At the bottom is a large blue button labeled 'PAY NOW: GH¢ 75.00'.

Figure 2.5: Networks Jumia accepts mobile money from

2.7. Gaps in existing works

1. Some e-commerce sites are built with Content Management Systems (CMS). Jumia, for example, is built with WordPress and WPbakery (a WordPress-based web page builder). WordPress provides a plug-in that allows MTN and AirtelMoney users to make mobile money payments. The companies may not have skilled developers to build extra plug-ins that come with all the recognized mobile networks in the country. In this way, the mobile money payment option benefits only a few people and not the whole population.
2. MTN, AirtelTigo and Vodafone have their respective mobile money APIs that can be used to include the mobile money payment option to a website. However, getting

access to these APIs can be difficult. Also, not all the APIs have publicly accessible documentation and working with an API you do not understand would be difficult.

3. Payment aggregators exist to make it easy for e-commerce sites to accept payments in different forms from customers. The payment aggregators in Ghana include Hubtel, Slyde Pay, Flutterwave and Paystack. Using these aggregators comes with extra charges such as setup fees, monthly fees and percentage transaction fees. Paystack, for example, has no setup fee but charges a 1.95% fee on mobile money, local and international card transactions. Flutterwave also has no setup fee but charges a 2.5% fee on mobile money and local card transactions and a 3.8% charge on international card transactions. These charges are often borne by the merchants or e-commerce sites, and that may deter some businesses from using payment aggregators.

Chapter 3 : Methodology & Architecture

3.1. Chapter Overview

This chapter explains the research methodology, the architecture of the system and the various technology to be used in implementation. It would also give an insight into the user experiences with existing e-commerce platforms, the anticipated user journey with this interface, and the functional and non-functional requirements of the system.

3.2. Population

The focus of this research was on workers in the informal sector. This mainly comprised of people who are self-employed and not on a regular payroll. The total population for this research was one hundred and fifty (150) informal workers. The purpose of this research was to collect data on the struggles these informal sector workers face, especially the unbanked when making payments on e-commerce sites. The information gathered from this project was then used to make recommendations aimed at improving the overall experience for the unbanked.

3.3. Sample method

The snowballing sampling method was used to get only people that fit the category of “informal sector worker”. This was done by leveraging the participant’s network and following the resulting network tree to obtain more participants. The sample obtained was then broken down into two (2) different strata representing the users of e-commerce sites and non-users. The e-commerce site users were then further broken down into the banked and the unbanked.

3.4. Steps for the study

A simple e-commerce site was built and used to test user response. This site allowed the users to register, browse through the catalogue, choose a product, add to cart, and make payment with their mobile money accounts.

Questionnaires were then sent out to understand the different user experiences with having mobile money as the primary payment method. These allowed users to express their thoughts on the interface in terms of the integration of mobile money payment.

3.5. Data Processing method

The data was collected with the help of a google form, graphs and charts were then generated from the various user responses.

3.6. Architecture

3.7. Use Cases

Example 1:

Auntie Mansa is a food vendor in Accra. She does not understand how the banking system works and so does not have a bank account. She sees a lot of ads from e-commerce stores when she is using Facebook. Unfortunately, she cannot purchase from them because the primary payment method is through visa and Mastercard. She will like to buy and sell online with her mobile money account because that is the only mode of payment she has.

Example 2:

Kofi is a mechanic who is paid daily through cash. He saves the little money he can in his mobile money account because it is more convenient for him. Kofi has some experience with

e-commerce sites but does not enjoy it because he does not trust the payment systems. He does not have a bank account and can neither use visa nor Mastercard. The sites that accept mobile money also provide a number for payment to be made to. The fact that the payment process is not integrated into the overall process of the website makes it difficult for Kofi to trust the system.

Example 3:

Ajele is a shop owner in Accra. She is a frequent user of e-commerce platforms. She has both a mobile money account and bank cards and, thus, payment is not a problem. She trusts using mobile money to make payments over bank cards, because she does not have to worry about someone stealing her card information. She would appreciate it if more sites adopted mobile money as one of their modes of payment.

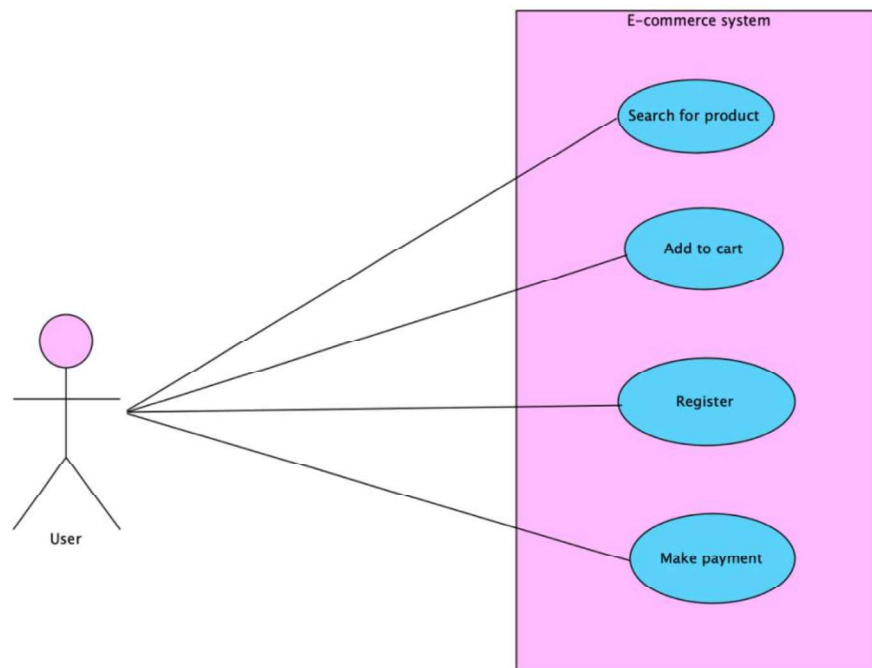


Figure 3.1: Use case diagram for the user

3.7.1. Functional Requirements

1. Product management: Products are displayed to customers like a catalogue. They can search through a list of available products to find a product they are interested in.
2. Cart Management: The users can add products to their carts and manage their carts (update quantities and delete products from the cart).
3. Payment Management: This includes the APIs that will allow the users to make payment smoothly through the website. Users will enter their numbers and choose the networks they use. An alert will be sent to the number that has been entered for the user to enter his/ her pin. All payment verification will be done on the user's phone.

3.7.2. Non-Functional Requirements

1. Navigation: Moving between pages should be easy and smooth for the user.
2. Usability: The interface should be simple to use by a person who has never interacted with such a platform.

3.7.3. Database

The website for testing contained seven (7) tables, customer, payment, order, cart, products, order details and category. The customer table stored all information related to the customer, such as name, password and address. The payment table stored information related to a customer's payment. It had the customer's id which was automatically given once they registered, the amount paid and the date the payment was made. The orders table stored the customer's order information and contained information, such as the order id, the date the order was placed and the invoice number. The cart table stored information about the user's cart and

contained information such as the products the user chose and the corresponding quantity. The products table stored information on the products available and had the product name, product price and the product description. The order details table was related to the order table and gave more information on the order such as the quantity of the product. The category table also gave information on the various product categories such as the product category names.

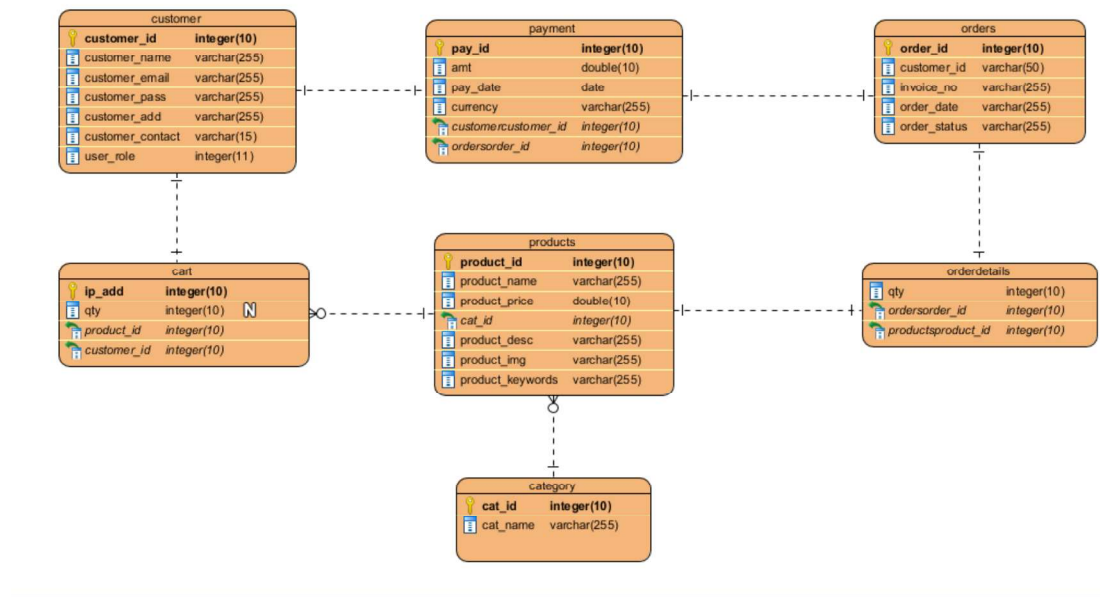


Figure 3.2: Relational database schema

3.8. Technology Overview

3.8.1. Programming Languages

HTML, CSS and JavaScript was used to design the front-end of the website; the part that the client sees and interacts with. HTML was used to design the body of the website. CSS was used for styling – outlining colors, fonts and positioning content. JavaScript was used to make the page responsive. The backend of the website was developed with PHP and SQL. SQL

was used to build the database which stored product and customer information. PHP is the server-side language which was used to make the page dynamic; every participant saw different content based on the selections they made.

3.8.2. Application Programming Interfaces (API)

The Paystack API was used to facilitate mobile money payments on the website. It required some form of business registration, but the process was not cumbersome. Using the API came at no extra cost , only standard mobile money charges applied.

3.8.3. Local Server

Xampp (Cross-platform, Apache, MySQL, PHP and Perl) makes it possible to build websites and host them on a local server. It works on multiple platforms – Windows, Linux and Mac, hence the name “cross-platform”. It is made up of the Apache HTTP Server, which allows for the creation of the local server. MySQL, which you can use as a database for your website, and interpreters for scripts written in PHP.

Chapter 4 : Methodology 2 – Implementation, Data Collection and Analysis

4.1. Chapter Overview

This chapter focuses on the steps that would be followed in the implementation, data collection, and analysis process. . This includes the various procedures, tables and techniques used to analyse the extent to which mobile money promotes financial inclusion in e-commerce payment.

4.2. Implementation

When Xampp is started, a folder called “Capstone” is created in the htdocs folder. The htdocs folder contains the files and directories that are accessible by the server. In the capstone folder, different folders that control the model, view and controllers are created.

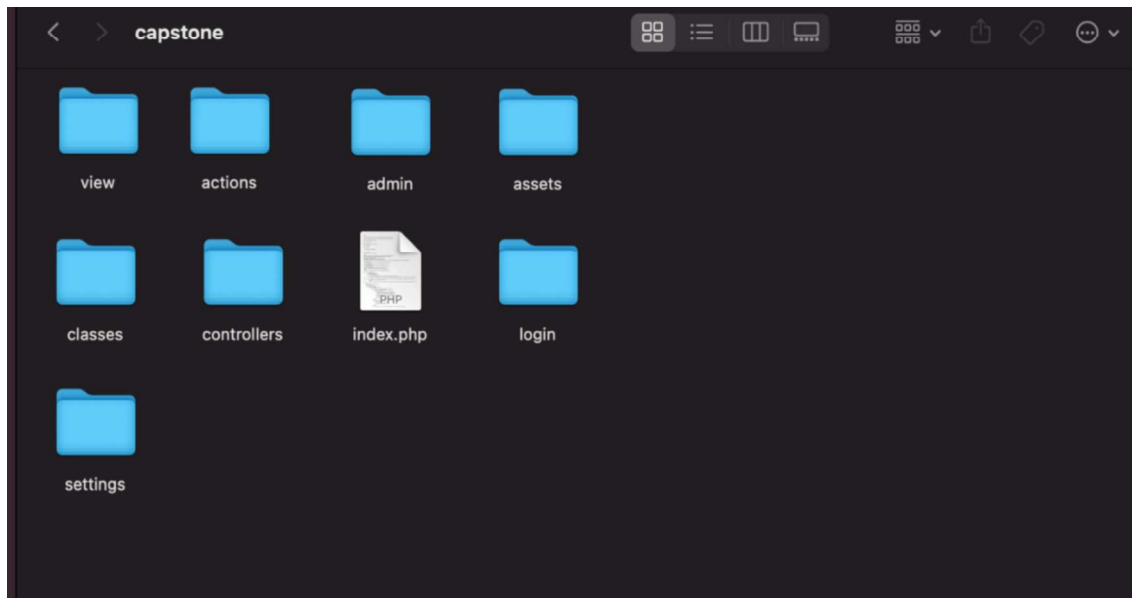


Figure 4.1: Diagram of the contents of the capstone

The view folder contains files that the end-user sees and interacts with. This includes pages like the cart and checkout pages. The actions folder contains the files that control the backend

processes of the website. It contains pages such as the backend code that controls the “add-to-cart” process, login and registration process. The admin folder controls all front-end files that are concerned with the administrator of the business, such as the “add-product” file and the “add category” file. The assets folder contains the CSS and JavaScript files that control the layout and the interactions on the pages. The classes folder contains the cart, customer and product class files. These files contain different functions that perform operations on data. For example, in the cart class, the following functions control all cart-related operations.

```
class Cart extends Connection
{
    public function insertCart($pid, $ipadd, $cid, $qty){
        $sql = "INSERT INTO `cart`(`product_id`, `ip_add`, `customer_id`, `qty`) VALUES ('$pid', '$ipadd', '$cid', '$qty')";
        return $this->db_query($sql);
    }

    public function checkCart($pid, $cid){
        $sql = "SELECT `product_id`, `customer_id` FROM `cart` WHERE `product_id`='$pid' AND `customer_id`='$cid'";
        return $this->db_query($sql);
    }

    public function checkCartNoID($pid, $ipadd){
        $sql = "SELECT `ip_add`, `product_id` FROM `cart` WHERE `ip_add`='$ipadd' AND `p_id`='$pid'";
        return $this->db_query($sql);
    }
}
```

Figure 4.2: Excerpts from the cart class

The controllers folder also contains the cart, customer and product controllers. These files control the data in the classes. The login folder controls all files concerned with user login and registration. The settings folder contains files that control the connection to the server.

4.2.1. Components of the system

In section 3.6.2, it was stated that the requirements for the system included product search, cart management and payment management.

4.2.1.1. Product Management

The product search can be broken down into two components:

1. **Product Display:** This handles the display of all products currently in stock.

```
<?php

    foreach ($products as $prodlist => $proditem) {

        ?>

        <div class="col-6 col-sm-6 col-md-4 col-lg-2 item">
            <!-- start product image -->
            <div class="product-image">
                <!-- start product image -->
                <a href="#">
                    <!-- image -->
                    " alt="image" title="img" height="170" width="200">
                    <!-- End image -->
                    <!-- Hover image -->
                    " alt="image" title="img" height="170" width="200">
                    <!-- End hover image -->
                </a>
            <!-- end product image -->
            <!-- Start product button -->
            <form class="variants add" method="GET"
                onclick="window.location.href='<?php echo '../actions/addcart_process.php?pid='.$prodlist ?>'">
                <button class="btn btn-addto-cart" type="button">Add To Cart</button>
            </form>
            <div class="button-set">
                <a href='<?php echo 'get-product-info.php?pid='.$prodlist ?>' title="Quick View" class=""
                    data-toggle="" data-target="">
                    <i class="icon anm anm-search-plus-r"></i>
                </a>
                <div class="wishlist-btn">
                    <a class="wishlist add-to-wishlist" href="#" title="Add to Wishlist">
                        <i class="icon anm anm-heart-l"></i>
                    </a>
                </div>
            </div>
        </div>
    }
}
```

Figure 4.3: Snippet code for product display

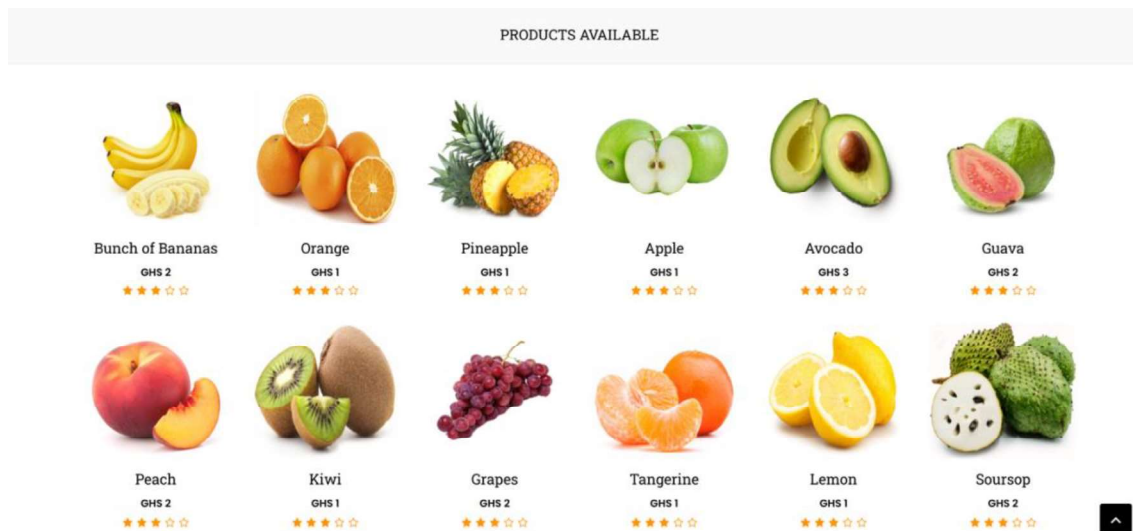


Figure 4.4: Front-end for product display

2. **Product Search:** This feature handles searching through the available items, after which the user can add to his/her cart.

```
require('../controllers/product_controller.php');

$products;

if (isset($_GET['search_btn'])) {
    $uterm = $_GET['usearch'];
    global $products;

    $products = searchProductctrl($uterm);
} else {
    global $products;

    $products = displayProducts_ctrl();
}

$user_perm = check_permission();
foreach ($products as $product)
{
    $product_id = $product['product_id'];

    if ($user_perm == 1) {
        //admin user
        echo "<li class='list-group-item'>".<br> <label class= "font-weight-bold">Product Title: &nbsp;</label>'.
        $product['product_name'].
        '<br> <label class= "font-weight-bold">Product Price: &nbsp;</label>'. $product['product_price'].
        " GHC <br> <a href='addcart_process.php?pid=$product_id'><button type='button' class='btn btn-dark
        font-weight-bold wow black-text'>Add to Cart</button></a>
        <a href='../admin/edit_product.php?product_id=$product_id'><button type='button' name='edit' class='btn
        btn-dark font-weight-bold wow black-text'>Edit Product</button></a>
        <a href= '../actions/del_prod.php?pid=$product_id'><button type='button' name='del' class='btn btn-dark
        font-weight-bold wow black-text'>Delete Product</button></a> </li>";
    }
}
```

Figure 4.5: Snippet of code for product search



Figure 4.6: Front end for product search

4.2.1.2. Cart Management

Cart management can be broken down into three components; add to cart, updating the quantity of items in the cart and deleting from the cart. On the admin side, once the user pays, the cart is also emptied.

1. **Add to cart:** The user can add any item they are interested in to their cart.

```
//CHECK FOR ALREADY EXISTING ITEM IN CART,
$checkDuplicates = checkCart_ctrl($pid, $cid);

if($checkDuplicates){
    ?>
    <script type="text/javascript">
        alert("Product exists in cart. Increase quantity");
        window.location.href = "../view/cart.php";
    </script>
    ?php
}else{

    //ADD TO CART |

    $addtocart = insertCart_ctrl($pid, $ip_add, $cid, $qty);

    if($addtocart){
        //header('Location: ../view/cart.php');
        header('Location: ../index.php?shop=homepage');

    }else{
        ?>
        <script type="text/javascript">
            alert("Error trying to add to cart. Please try again in a few seconds");
            window.location.href = "../index.php";
        </script>
        <?php
```

Figure 4.7: Snippet code for adding item to cart

2. **Update quantity:** The user can either increase or reduce the quantity of an item in their cart.

```
public function editCart($cid, $pid, $qty){
    $sql = "UPDATE `cart` SET `qty`='qty' WHERE `customer_id`='cid' AND `product_id`='pid'";

    return $this->db_query($sql);
}

public function editCartNoID($ipadd, $pid, $qty){
    $sql = "UPDATE `cart` SET `qty`='qty' WHERE `ip_add`='ipadd' AND `p_id`='pid'";

    return $this->db_query($sql);
}
```

Figure 4.8: Snippet of code for updating quantity in cart

3. **Delete from cart:** If the user no longer wants an item, they can delete it from the cart before checkout.

```
public function removeCart($pid,$cid){
    $sql = "DELETE FROM `cart` WHERE `product_id` = '$pid' AND `customer_id` = '$cid' ";

    return $this->db_query($sql);
}
```

Figure 4.9: Snippet of code for deleting items from cart

4. **Delete cart:** After payment is made, the user's cart is emptied to allow another set of items to be purchased.

```

public function deleteCart($id){
    $sql = "DELETE FROM `cart` WHERE `cart`.`id` = $id";

    return $this->db_query($sql);
}

```

Figure 4.10: Snippet of code for deleting entire cart

4.2.1.3. Payment Management

This feature uses the Paystack API, which enables users to make payments with their mobile money accounts.

1. Payment API Implementation

The Paystack API is a REST(RESTful) API which means, it uses HTTP requests to access and use data. The API call is done using cURL. All that is needed is for the specific required parameters to be inserted into the API. Both request body data and response data are formatted as JSON. The authentication of the API is done by including the secret key in the authorization header of the request that is being made.

Authorization is done in this form:

```

CURLOPT_HTTPHEADER => [
    "authorization: Bearer sk_test_9dca7bab6b7cdc244c7fd40cc8b6c73ade443ded", //replace this with your own test key
    "content-type: application/json",
    "cache-control: no-cache"
]

```

Figure 4.11: Authorization for Paystack API

API requests that are made without authentication will fail with the status code 401: Unauthorized.

```
<td>

<input type="hidden" id="email" value="<?= $_SESSION['user_email'] ?>">
<button class="btn btn--small--wide checkout" name="checkout" id="cartCheckout" type="submit" onclick="payWithPaystack()"
style="border-radius: 100px;"><b>Pay with Paystack</b></button>

</td>
```

Figure 4.12: Snippet of code for payment button

When customers are satisfied with the items in their cart and are ready to make payment, they would click the checkout button. The button works with an onclick event that calls up a JavaScript function which, in this case, is the `payWithPaystack()` function.

```
<script src="https://js.paystack.co/v1/inline.js"></script>
<script>

function payWithPaystack(){
  let handler = PaystackPop.setup({
    key: 'pk_live_0a726b0427e7d598dd0f06bc865b84b3b85c2ba0', // Replace with your public key
    email: $('#email').val(),
    currency: "GHS",
    amount: $('#amt').html() * 100,
    // label: "Optional string that replaces customer email"
    onClose: function(){
      alert('Window closed.');
```

Figure 4.13: Snippet of code to call Paystack popup

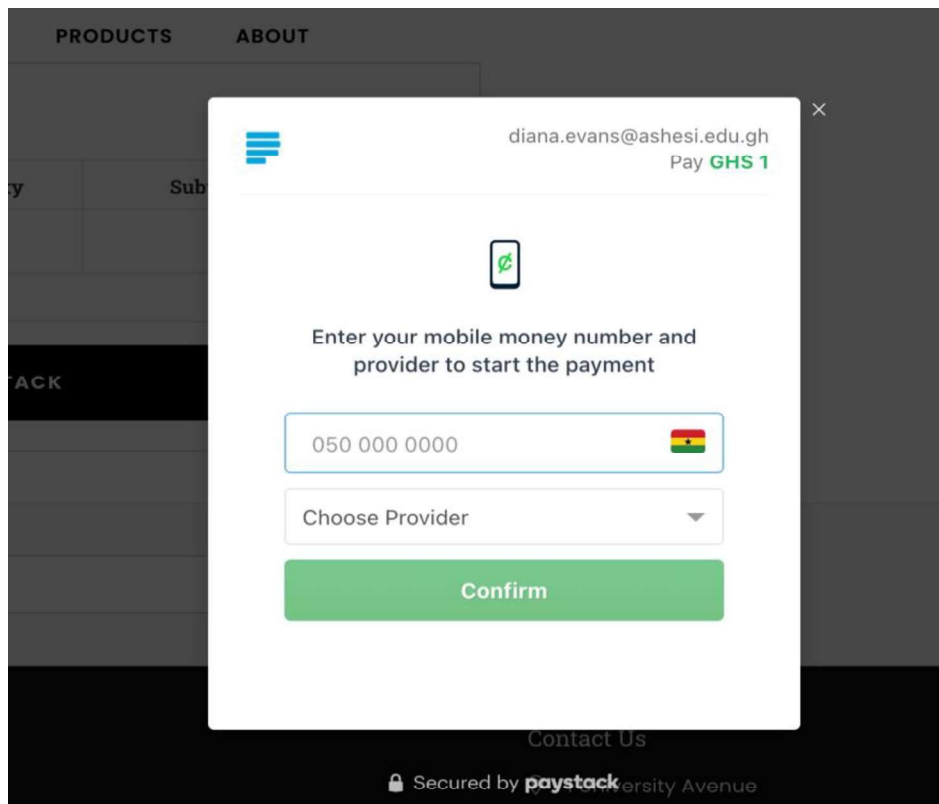


Figure 4.14: Paystack popup

In Figure 4.11, information such as the customer's email, currency and the amount is displayed to the customer. The amount is especially important because the customer needs to know how much they are being charged so as not to have any extra charges sprung up on them.

```

<?php
$curl = curl_init();
session_start();

$email = $_SESSION['user_email'];
$amount = $_GET['amt']*100;
$callback_url = 'localhost/lo/view/callback.php';

curl_setopt_array($curl, array(
    CURLOPT_URL => "https://api.paystack.co/transaction/initialize",
    CURLOPT_RETURNTRANSFER => true,
    CURLOPT_CUSTOMREQUEST => "POST",
    CURLOPT_POSTFIELDS => json_encode([
        'amount'=>$amount,
        'email'=>$email,
        'callback_url' => $callback_url
    ]),
    CURLOPT_HTTPHEADER => [
        "authorization: Bearer sk_live_9ed46ef802b8e0b116533e0fd3d59150ffc6480", //replace this with your own test key
        "content-type: application/json",
        "cache-control: no-cache"
    ],
));
$response = curl_exec($curl);
$error = curl_error($curl);

if($error){
    // there was an error contacting the Paystack API
    die('Curl returned error: ' . $error);
}

$tranx = json_decode($response, true);

if(!$tranx['status']){
    // there was an error from the API
    print_r('API returned error: ' . $tranx['message']);
}

// comment out this line if you want to redirect the user to the payment page
print_r($tranx);
// redirect to page so User can pay
// uncomment this line to allow the user redirect to the payment page
header('Location: ' . $tranx['data']['authorization_url']);

?>

```

Figure 4.15: Snippet of code for payment

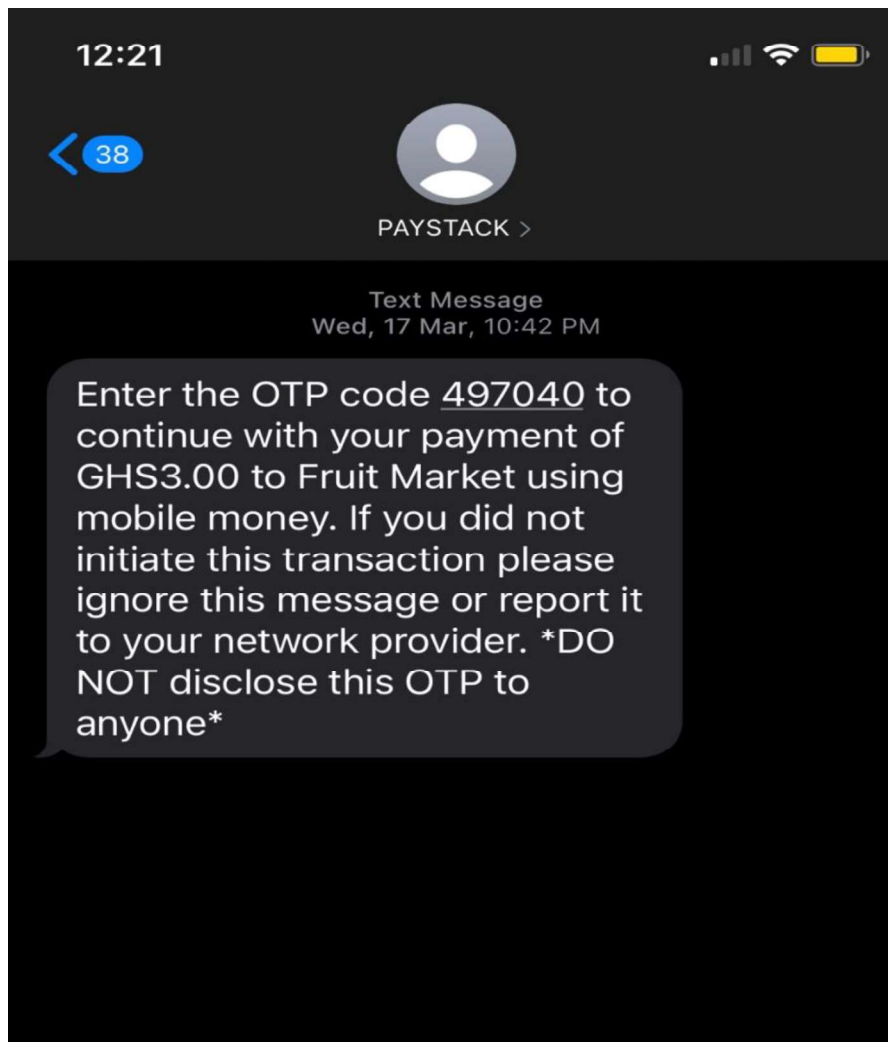


Figure 4.16: Paystack one time pin

The first time payment is made, the customer receives a one-time pin from Paystack, which is one of the many ways to check if the customer is the one who initiated the transaction. Once the code is provided on the website, the customer can then comfortably continue with their payment process. Once the correct pin is entered into the website, the mobile money pop up appears with the amount that the user is being charged. If the user is satisfied with everything, the next step is to enter their mobile money pin and then authorize the transaction.

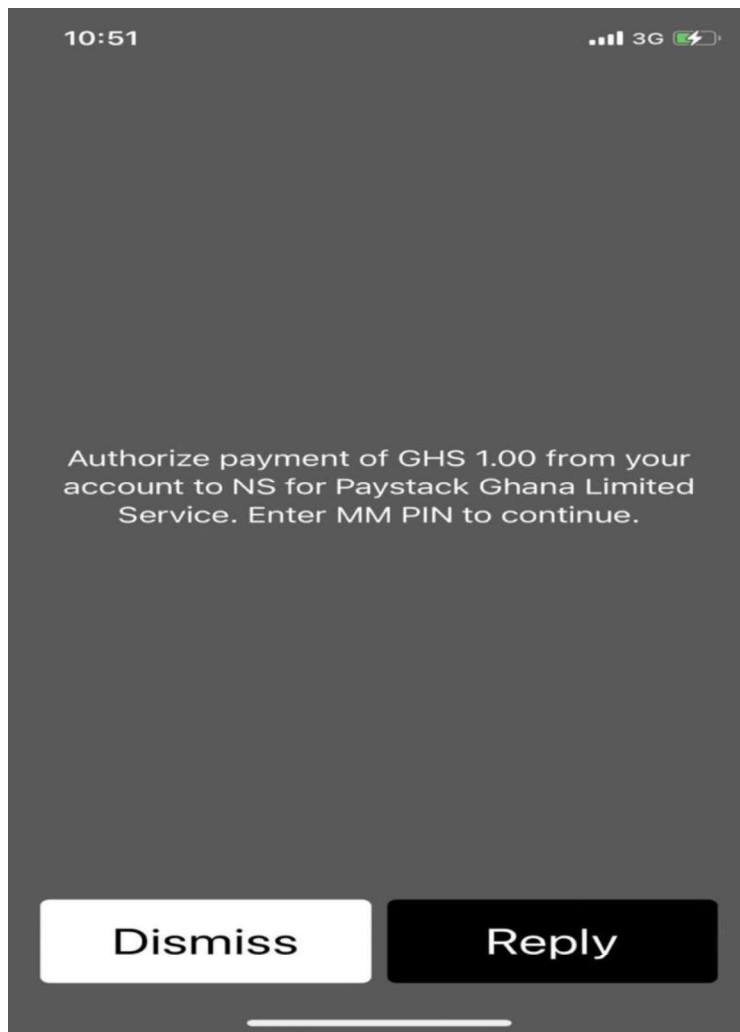


Figure 4.17: Mobile money prompt from Paystack

4.3. Data Collection

The website is hosted on Microsoft Azure which is a live server (<http://52.188.210.99/capstone>); thus, anyone can have access to the application irrespective of their location. For the purpose of testing, this website would be shared via WhatsApp and email platforms, along with the corresponding questionnaire for filling. The main focus of testing is to find out how the users feel about having mobile money as the primary method of payment.

The questionnaire would include a consent form, and the users would only be able to fill the form after consent is given.

CONSENT FORM

1. I voluntarily agree to participate in this research study which is on mobile money and how it could improve financial inclusion and convenience in e-commerce payment within the informal sector in Ghana.
2. I understand that participation involves testing out an e-commerce site and thereafter giving feedback on user experience.
3. I understand that I will not benefit directly from participating in this research.
4. I understand that any money I spend on the website (under 5 ~~cedis~~) would be sent back to me.
5. I understand that all information I provide for this study will be treated confidentially.
6. I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
7. I understand that if I have any questions later, I may contact Maame Cobbold at [maame.cobbold@ashesi.edu.gh] or at [0201522027] or my supervisor at [dsampah@ashesi.edu.gh].
8. This study and consent form has been reviewed by Ashesi IRB for Human Subjects Research. For more information contact the committee through irb@ashesi.edu.gh.

After fully reading and understanding the statement above, are you willing to participate in the survey ? *

☐ Yes

☐ No

Figure 4.18: Consent form

4.4. Data Analysis

The link to the website was shared with 150 different users for testing purposes. After testing the website, the users were redirected to a questionnaire. Out of the 150 users, 105 forms were filled. This implies that 70% of the test subject responded. Within the specified category, which is the informal workers, the link with the forms were sent out randomly, and the forms were filled anonymously. Every user was allowed to fill the form only once.

Data gathered from the forms showed that out of the 105 responses that were received, 101, which is 96.2% of the population, had experience with e-commerce sites before coming into contact with my system.

Prior to using this interface, have you had any experience with buying and/or selling online?

105 responses

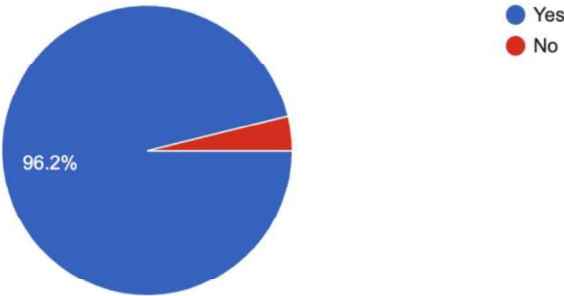


Figure 4.19: User response 1

Out of the 105 responses, 96 users, which is 91.4% of the population, have mobile money accounts with the different available networks in Ghana. The remaining 8 users, which is 8.6% of the population, do not have accounts with any of the networks.

Do you have a mobile money account with any of the recognized networks in Ghana?

105 responses

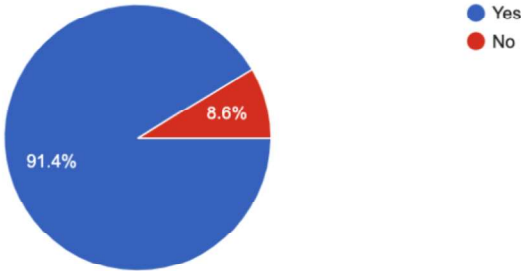


Figure 4.20: User response 2

Out of the 105 responses, 76 users, which is 72.4% of the population, have bank accounts with the different banks in Ghana. The remaining 29 users, which is 27.6% of the population, do not have bank accounts. It can be inferred from the earlier chapters that, in this case, 29 users would not have been able to use the e-commerce site if payment could only be made with a debit or credit card.

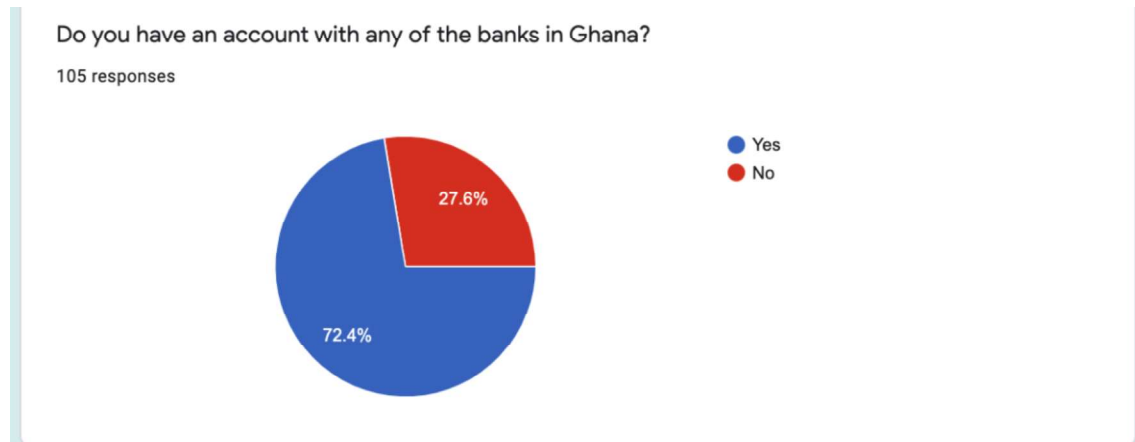


Figure 4.21: User response 3

From the pie chart below, 72 out 105 users, which represents 68.6% of the population, find it difficult or next to impossible to use existing e-commerce sites. The remaining 31.4% had no issues with e-commerce sites regarding the payment options provided. Making a comparison, more people are affected by the limited payment options that exist on many e-commerce sites. The case could be that the site only provides an option for card payments which does not favor the unbanked. It could also be that the site may provide mobile money payment, however, it does not allow payment from all the networks in the country. In this case, not all the unbanked population is catered for.

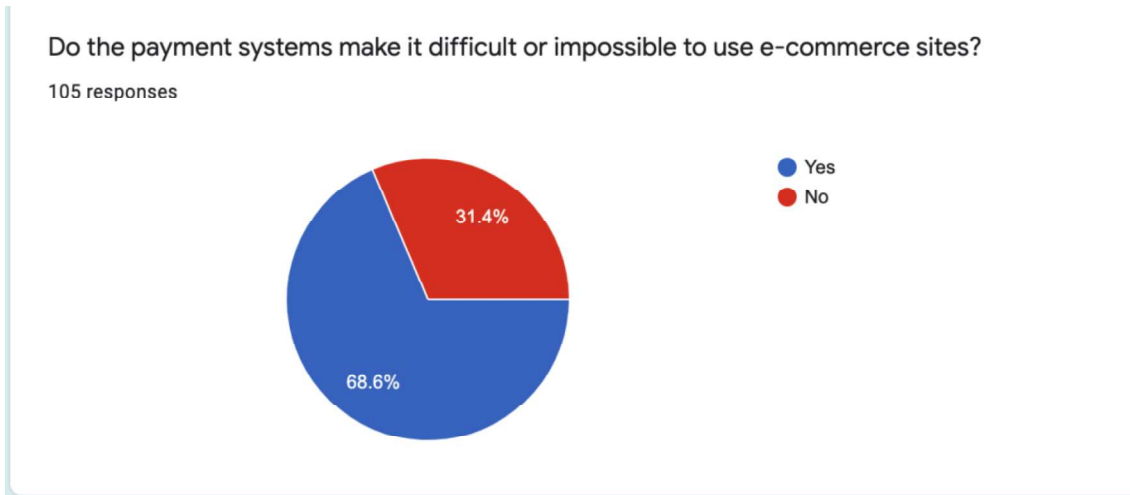


Figure 4.22: User response 4

Below are positive responses to the question, “ Prior to using this interface, what has been your experience with using mobile money for transactions?” A significant number of the participants found mobile money a faster and more convenient method of making payment.

fast and convenient

3 responses

convenient

3 responses

Figure 4.23: User response 5

Below are a few of the negative experiences people have had with mobile money payments. Light was thrown on the fact that not all the recognized networks in the country are provided when mobile money payment options are made available on websites. Another common issue that was raised was that connection problems and slow network sometimes led to double charging.

Online momo is not open to every network.

network challenges

Figure 4.24: User response 6

Analyzing the question, “What challenges do you or have you encountered when buying online?”, the users mentioned that businesses sometimes add the charge for withdrawing mobile money to the customer’s final cost and these costs are often not budgeted for. Also, as mentioned earlier, another challenge people have with mobile money payment is the fact that there are periods of slow network and connection issues which lead to users being double charged.

Good. But sometimes the business let you pay for the extra charges that they would incur when they are trying to remove the money. Sometimes these extra charges are not planned for

1 response

It has been good but the hitches in the network sometimes cause you to pay for one thing twice without even realising

1 response

It has been good. Just that connection problems can sometimes be disturbing especially when you are in a hurry

1 response

Figure 4.25: User response 7

According to the bar chart below, based on the three given options, more people reported that they would trust online payments if there were a mobile money payment option available. It was stated in chapter 2 that one reason why people do not use e-commerce sites is that they do not trust the payment systems, which is payment using debit and credit cards. They fear that their card details could be stolen

and used without their knowledge. This bar chart also answers the research question, “Does the lack of trust in payment methods affect the adoption of e-commerce by individuals and businesses?” in Chapter 1. It is made clear that the least trusted method of payment is using credit and debit cards. From the chart, the users also make it clear that they would trust a system that provides lower costing items over the use of a debit or credit card.

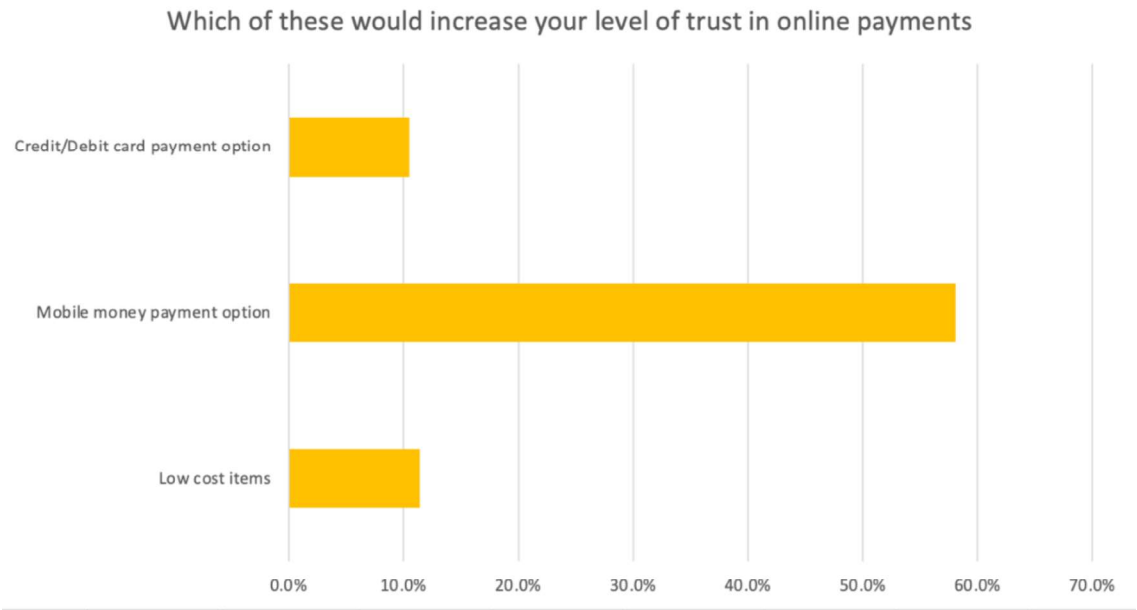


Figure 4.26: User response 8

From the pie chart below, 98 people, representing 93.3% of the population, found mobile money payment more convenient as compared to using debit and credit cards. The remaining 6.7% did not find mobile money a more convenient option. This provides an answer to the research question “Does mobile money payment provide convenience when using e-commerce sites?” in Chapter 1. 93.3% of the population agree that it does, in fact, provide them with convenience.

Is using mobile money for payments more convenient as compared to other payment methods? (debit and credit cards)

105 responses

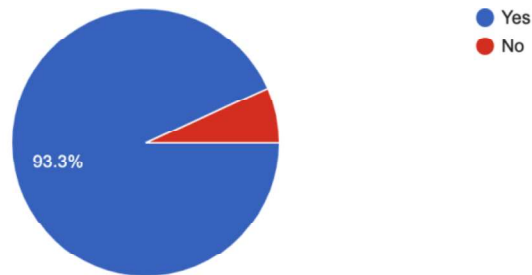


Figure 4.27: User response 9

According to the pie chart below, 102 people, who represent 97.1% of the population, reported that they would use e-commerce sites more frequently if mobile money were included as a method of payment. Seeing as a vast majority of users, the unbanked inclusive, would be willing to use e-commerce sites once a mobile money payment is allowed, it can be said that some form of financial inclusion has been provided. The unbanked, and even the banked who might be having trouble with their bank accounts or cards, can easily fall on mobile money payment.

Would you use e-commerce sites more frequently if mobile money is included as method of payment?

105 responses

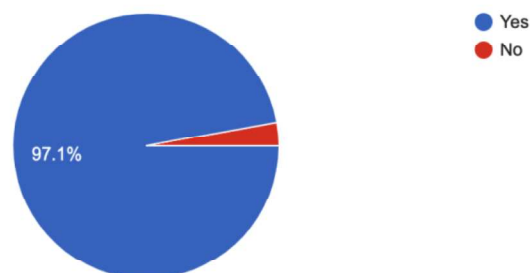


Figure 4.28: User response 10

Chapter 5 : Conclusion and Recommendations

5.1. Chapter Overview

This chapter discusses the results of this research. Analysis done in this paper provides insight into the study of how mobile money provides financial inclusion and convenience in e-commerce payment. Recommendations are also given to those who wish to start e-commerce businesses on making their sites more inclusive.

5.2. Conclusion

The analysis done in Chapter 4, shows that mobile money provides financial inclusion and convenience to users. This means that businesses need to include mobile money payment options on their sites, which should include all registered networks. To maintain user trust in the system, payment should not be carried offline. This means a number should not be provided for payment to be made; it should be done on the site in the full glare of the user. Since obtaining APIs and the corresponding documentation of all recognized networks in the country, small businesses can make use of payment aggregators such as Hubtel, Paystack and Mazzuma. Using their APIs also provides the customer with the option to make payment with all the recognized networks in the country at a small charge. The payment aggregators also provide businesses with the option of choosing who caters for the transaction charges, either the customer or the business. It is, however, advisable for the business to bear that cost in order not to drive their customers away.

5.3. Recommendations for future works

Mobile money has a greater proclivity to encourage economic growth and consequently improve the lives of billions of people across the world, especially those in developing countries. In this regards, future research can look at how some of the issues, such as network instability, can be improved to increase further the trust levels in mobile money transfer services in Ghana. Although from the

questionnaires, it seemed to be the more preferred payment option, there are still challenges that users face when using the system, which when solved, would allow more people to trust online payment completely.

Appendix

Questionnaire

1. Prior to using this interface, have you had any experience with buying and/or selling online?
2. What challenges do you or have you encountered when buying online?
3. Do the payment systems make it difficult or impossible to use e-commerce sites?
4. Do you have a mobile money account with any of the recognized networks in Ghana?
5. Prior to using this interface, what has been your experience with using mobile money for transactions?
6. Would you use e-commerce sites more frequently if mobile money is included as method of payment?
7. Is using mobile money for payments more convenient as compared to other payment methods?
8. Does the method of payment (mobile money, bank account and others) affect your level of trust in the system?
9. What is your overall experience with this interface?

References

- [1]Alex Comminos, Steve Esselaar, Ali Ndiwalana, and Christoph Stork. 2009. Airtime to Cash: Unlocking the Potential of Africa's Mobile Phones for Banking the Unbanked. (2009), 16.
- [2]Ahmad Hassan Ahmad, Christopher Green, and Fei Jiang. 2020. Mobile Money, Financial Inclusion and Development: A Review with Reference to African Experience. *Journal of Economic Surveys* 34, 4 (2020), 753–792. DOI:<https://doi.org/10.1111/joes.12372>
- [3]Araba Sey. 2011. 'We use it different, different': Making sense of trends in mobile phone use in Ghana. *New Media & Society* 13, 3 (May 2011), 375–390. DOI:<https://doi.org/10.1177/1461444810393907>
- [4]Farid Huseynov and Sevgi Özkan Yıldırım. 2016. Behavioral Issues in B2C E-commerce: The-state-of-the-art. *Information Development* 32, 5 (November 2016), 1343–1358. DOI:<https://doi.org/10.1177/0266666915599586>
- [5]Fourth Ghana Economic Update. DOI:<https://doi.org/10.1596/31882>
- [6]Gary P. Schneider. 2017. *Electronic commerce* (Twelfth edition ed.). Cengage Learning, Australia ; Boston, MA.
- [7]Godfred Frempong. 2009. Mobile telephone opportunities: the case of micro- and small enterprises in Ghana. *info* 11, 2 (January 2009), 79–94. DOI:<https://doi.org/10.1108/14636690910941902>
- [8]Internet and Technology: 2020. <https://www.pewresearch.org/internet/>. Accessed: 2020-10-05.

- [9]Internet World Stats - Usage and Population Statistics: 2020.
<https://internetworldstats.com/>. Accessed: 2020- 10- 05.
- [10]Janine Aron. 2018. Mobile Money and the Economy: A Review of the Evidence. The World Bank Research Observer 33, 2 (August 2018), 135–188.
 DOI:<https://doi.org/10.1093/wbro/lky001>
- [11]Kevin Donovan. 2012. Mobile Money for Financial Inclusion. In Information and Communications for Development 2012. The World Bank, 61–73.
 DOI:https://doi.org/10.1596/9780821389911_ch04
- [12]Mark Beech. COVID-19 Pushes Up Internet Use 70% And Streaming More Than 12%, First Figures Reveal. Forbes. Retrieved October 14, 2020 from
<https://www.forbes.com/sites/markbeech/2020/03/25/covid-19-pushes-up-internet-use-70-streaming-more-than-12-first-figures-reveal/>
- [13]Mamudu Abunga Akudugu. 2013. The Determinants of Financial Inclusion in Western Africa: Insights from Ghana. Research Journal of Finance and Accounting (2013), 10.
- [14]Overcoming the Perceived Barriers of E-Commerce to Small and Medium Scale Enterprises in Ghana – A Proposed Model: 2020.
<http://ir.presbyuniversity.edu.gh:8080/jspui/handle/123456789/89>. Accessed: 2020- 10- 05.
- [15]Prosper Koto. 2015. An Empirical Analysis of the Informal Sector in Ghana. The Journal of Developing Areas. 49, 2 (2015), 93-108.
- [16]Raphael Awiagah, Juyoung Kang, and Jay Ick Lim. 2016. Factors affecting e-commerce adoption among SMEs in Ghana. Information Development 32, 4 (September 2016), 815–836. DOI:<https://doi.org/10.1177/0266666915571427>

- [17]Sionfou Seydou Coulibaly. Financial Inclusion through Mobile Money: An Examination of the Decision to use Mobile Money Accounts in WAEMU Countries. 45.
- [18]Sumanjeet. 2009. Emergence of payment systems in the age of electronic commerce: The state of art. In 2009 First Asian Himalayas International Conference on Internet, IEEE, Kathmandu, 1–18. DOI:<https://doi.org/10.1109/AHICI.2009.5340318>
- [19]Thorsten Beck, Asli Demirgüç-Kunt and Ross Levine. 2007. Finance, inequality and the poor. *Journal of Economic Growth*. 12, 1 (2007), 27-49.