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CRITERIA AFFECTING OF USER EXPERIENCE DESIGN OF E-COMMERCE IN SUDAN

A Thesis Submitted in Partial Fulfillment of Academic Requirements for Master Degree in Computer Science

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Quran

أعوذ بالله من الشيطان الرجيم

قُلْ إِنَّ صَلَاتِى وَنُسُكِى وَمَحْيَاىَ وَمَمَاتِى لِلَّهِ رَبِّ ٱلْعَـٰلَمِينَ ﴿١٦٢﴾

سورة الأنعام

Dedication

This Thesis is dedicated to my mother and my father ..

My darling .. and my way to Paradise ..

My God! bestow on them your mercy as they raised me when I was small.

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In the name of Allah and praise to Allah the Lord of the Worlds before and after. Peace and blessings be upon our Prophet Mohammed, the seal of all prophets.

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Finally, I must express my very profound gratitude to my beloved my parents, and to my sisters and brothers for providing me with unfailing support and continuous encouragement throughout my years of study.

Abstract

Recent advances in information and communication technology have contributed to maximizing the role of e-commerce, becoming an independent science in world's trade and economy sciences. However, the current e-commerce initiatives in Sudan still face challenges and shortcomings that prevent the adoption of these initiatives by the citizens. Hence, there is a need to evaluate e-commerce sites, identify the user needs and requirements, and measure its experience. User experience is measured by functional specifications, security, content, information architecture, navigation, interaction factors, interface design, and qualities of aesthetics. The main objective of this research is to investigate retail e-commerce sites to discover criteria and factors affecting the user experience design UXD of these sites in Sudan as a case study. A questionnaire was designed to collect data from e-commerce users that are related to information technology field in government institutions, universities, and banks that fund e-commerce projects. The data was analyzed using SPSS. The study found that e-commerce sites have negative aspects such as having non-guessable and non-meaningful domain names and non-efficient navigation. Besides the lack of aesthetics, functional specifications, and interaction characteristics. The research findings contributed to the definition of critical factors towards designing a better user experience, and highlighting the problems which serve as a guide to the development and re-engineering of e-commerce sites.

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Abbreviations

ACRONYM	DEFINITION
UXD	User Experience Design
E-Commerce	Electronic Commerce
ICT	Information and Communications Technology
POS	Point of Sale Systems
B2B	Business to Business
B2C	Business to Consumer
C2C	Consumer to Consumer
C2B	Consumer to Business
B2B2C	Business to Business to Consumer
G2G	Government to Government
G2C	Government to Consumer
C2G	Consumer to Government
G2B	Government to Business
B2G	Business to Government
P2P	Peer to Peer
M-Commerce	Mobile Commerce
E-Learning	Electronic Learning
E2E	Exchange to Exchange
C-Commerce	Collaborative Commerce
HCI	Human Computer Interaction
HCD	Human Centered Design
UI	User Interface

CHAPTER 1

INTRODUCTION

1.1 Research Background

The use of ICT has allowed innovations in the business world by adding the concept of e-commerce. E-commerce is a means that enables a user to buy products and services (Zin, 2010) over the Internet or other electronic networks and there may or may not be a payment involved. E-commerce is not limited to sales but goes beyond that to include commercial advertising operations, electronic exchange of data, and point of sale systems (POS systems). The growth of e-commerce is linked to financial movements, techniques and ensure security. Sudan still suffers from many problems that limited the exposure of Sudan to the world of e-commerce (Mohamed, WANG, and Elhadi, 2014).

Despite these facts, there are some serious attempts by the companies to introduce its e-commerce by creating special sites and marketing their products through them to collect the money electronically, but they are facing a lot of the problems. The difficulty of linking between the customer and the company, and the lack of confidence required and the weakness of advertising of these sites are some of these problems. Therefore, the user experience should be taken into account in the design phase before the project is implemented as it is a priority to ensure that user needs are represented (Garrett, 2000).

User experience design (UXD, for short) "is the creation and synchronization of the elements that affect users' experience with a particular company, with the intent of influencing their perceptions and behavior" (Unger and Chandler, 2009). In addition, ISO standards 9241-210 on ergonomics of human system interaction defines UX as "all aspects of the user's experience when interacting with the product, including all aspects of usability and desirability of a product from the user's perspective" (ISO DIS 9241-210, 2008).

In other words, UXD is the process of enhancing user satisfaction by improving the usability, accessibility, and pleasure provided in the interaction between the user and product.

1.2   Problem Statement

Despite the huge potential for e-commerce, there are problems hindering deployment and use of it in Sudan. These problems are the weakness of the network in rural regions, the need for confidence, the cultural resistance of e-commerce on the Internet and the lack of interest in the electronic service in private organizations.

The research problem is to assess e-commerce websites to determine how user experience criteria can affect using the retail e-commerce sites, as well as to identify users needs that facilitate for designers and programmers in the development of e-commerce sites.

1.3   Research Hypotheses

H1: E-commerce sites are distinguished by a set of criteria, ease of use, efficiency, and characteristics of aesthetics, which contribute to improving the user experience.

H2: Provide content requirements and information structure that make the site used continuously.

H3: E-commerce sites meet the standards of security and navigation is one of the factors that increase competition with similar sites.

H4: Lacking functional specification and features limit the spread and development of e-commerce over the Internet.

1.4   Aims and Objectives

1.4.1   Aim

The aim of this research is to present and examine the critical factors or ergonomics to create a better user experience of e-commerce websites that meeting user's needs and requirements.

1.4.2 Objectives

The objectives of this thesis are to:

- Determine criteria that affect user experience design of e-commerce in Sudan.

- Extract the factors that help in building an effective interface through user experience.

- Provide recommendations that can facilitate the design, development, and re-engineering of e-commerce towards achieving high-quality user experience.

1.5 Research Scope

The term 'e-commerce' has three basic types: e-commerce between businesses and companies (B2B-business to business), e-commerce between companies and customers (B2C- business to consumers) and e-commerce between the customers and the customers (C2C- consumers to consumers).

The use and description of e-commerce in this research will be limited to the context of e-commerce between business to consumers only where of the e-service is usually associated with the private sector in Sudan.

1.6 Research Importance

Users have great expectations when they visit the site and want to increasingly gain experience on trust, ease of use and emotional satisfaction. The site continues to win the hearts and minds of customers by providing a user experience is easy of use, useful and desirable.

If the e-commerce site does not meet the needs of users and their insights, it will provide a bad experience for the user; therefore, customers are likely to go elsewhere to request services. Moreover, this research is important because there is not much research in regard to different user needs, culture and design of B2C e-commerce sites in Sudan.

1.7   Overview of Research Methodology

In order to achieve research objectives, we start to gather and monitor data from users via questionnaires to analyze user mentality through age groups that identify the metrics and factors of users. Many questions will put to cover the experiences of a large group of users to e-commerce sites and will use postal service or the Internet for distributing questionnaires.

This research will depend on a quantitative survey questionnaire as user research. It determines the behavior and attitude of users about site interfaces through the collected information and in light of user feedback during the experiment.

1.8   Thesis Outline

The thesis has five main chapters, namely introduction, literature review, research methodology, research findings, followed by a final chapter dealing with conclusions. They are distinguished as follows:

Chapter One: the introduction, gives a brief overview of the content of the study. This includes the research problem, the scope and importance of the study, the research methodology, and the report layout of the thesis.

Chapter Two: discusses e-commerce in general, concepts and perspectives that revolved around it and its history and benefits, as well as e-commerce challenges in Sudan. It also includes the literature review of the study.

Chapter Three: illustrates the survey methodology. The research questions are set out, explaining how and where they are answered. User experience criteria for evaluation of retail e-commerce are synthesized.

Chapter Four: explains how collected data is analyzed. It also demonstrated the findings that lead to designing the user experience.

Chapter Five: summarizes the study, provides recommendations and suggestions for future work.
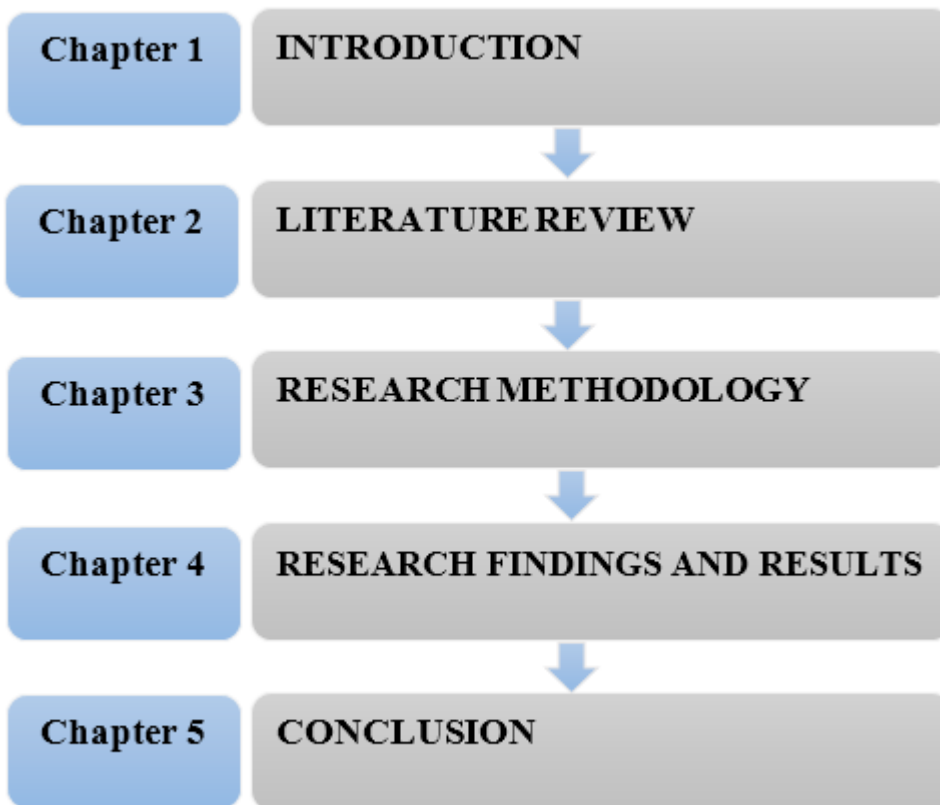
Figure 1.1: Structure of Thesis

CHAPTER 2

LITERATURE REVIEW

2.1 An Overview of e-Commerce

2.1.1 E-Commerce: Definitions, Perspectives and concepts

There are many different definitions of e-commerce by various authors. Some authors defined e-commerce from different perspectives. Let's talk about some of them:

(Awad, 2005): "E-commerce is the revenue generator for businesses that choose to use the Internet to sell their goods and services".

(Laudon, 2014): "The use of the Internet and the Web to transact business. More formally, we focus on digitally enabled commercial transactions between and among organizations and individuals. Each of these components of our working definition of e-commerce is important".

(Greenstein and Feinman, 1999): "Exchanging of products and services via some form of telecommunication medium from one location to another".

(Fredriksson, 2013): "An e-commerce transaction is the sale or purchase of goods or services over computer mediated networks (broad definition) the Internet (narrow definition)".

(Goel, 2007): "The e-commerce can be defined as a modern business methodology that addresses the needs of organizations, merchants, and consumers to cut costs while improving the quality of goods and services and increasing the speed of service delivery, by using Internet".

(Zwass, 2014): "E-Commerce is the sharing of business information, maintaining business relationships and the conducting business transactions by means of telecommunications networks".

(Turban et al., 2008): "Electronic commerce (EC) is the process of buying, selling, transferring, or exchanging products, services, and /or information via computer networks, including the internet".

And also defined e-commerce from different perspectives which include but not limited to:

From business process perspective: E-Commerce is doing business process electronically by achieving business over electronic networks.

From the service perspective,: E-Commerce is a tool that addresses the desire of governments, firms, consumers, and management to cut costs while improving the quality of service and increasing the speed of service delivery.

From the collaborative perspective,: E-Commerce is the framework for inter and intra-organizational collaboration.

From learning perspective: E-Commerce is an assistant tool in online training and education in schools, universities and other organizations including businesses.

From the above definitions, we note that some of the authors clarified that e-commerce is a concept which is synonymous with the concept of e-business and others clarified they differ. But here we see that e-commerce is part of e-business.

After scanning all of this can be summarized the concept of e-commerce as a definition comprehensive show from which all operations and activities that include inside it and the difference between it and the concept of e-business as follows:

E-Commerce or electronic commerce (EC), a subset of e-business, is the purchasing, selling, and exchanging , transferring of products and services over electronic systems such as the internet and other computer networks through which transactions or terms of sale are performed electronically using technology such as Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT).

E-business or electronic business is a structure that includes not only those transactions that center on buying and selling products and services to generate revenue, but also those activities that support revenue generation. These activities include generating demand for products and services, offering sales support and customer service, or facilitating communications between business partners.

EDI is the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system through VANs (Value-Added Networks). **EFT** is the electronic exchange or transfer of money from one account to another.

2.1.2 History of e-Commerce

E-commerce was made possible by the development of electronic data interchange (EDI) and Electronic Funds Transfer (EFT) these technologies, which first appeared in early 1970's, allowed for the exchange of information and the execution of electronic transactions between businesses, typically in the form of electronic purchase orders and invoices (M. and A., 2012). Throughout the 1980s, the proliferation of credit cards, ATM machines, and telephone banking was the next step in the evolution of electronic commerce. However, the diffusion of EDI was slow. Starting in the early 1990s, e-commerce would also include things such as enterprise resource planning (ERP), data warehousing and data mining (Team, 2009).

By the late 1990s, The huge expense for getting connected to an EDI network and some technical problems limited the diffusion of EDI. The second generation of e-commerce is characterized by the transaction of products and services through the Internet. It wasn't until 1994 that e-commerce (as we know it today) really began to accelerate with the introduction of security protocols and high-speed internet connections such as DSL, allowing for much faster connection speeds and faster online transaction capability.

In 1960, the Advanced Research Projects Agency Network (ARPANET), the precursor to the Internet, was established for research in high technology areas. The nodes of ARPANET increased from 4 in 1969 to 15 in 1971. The term Internet actually did not come into use until 1982, when the number of hosts on the ARPANET rose to 213. Then, in 1983, the Internet Protocol (IP) became the only approved way to transmit data on the Net (Becker, 2008).

By the end of the 1980s, the Internet had still maintained its non-commercial nature, and all of its networks were based on the free use of the NSFNET backbone, directly or indirectly. The development of a graphical user interface (GUI) and the navigability of the World Wide Web (WWW) that changed the nature of Internet use.

In the early 1990s, the creation of the hypertext markup language (HTML), with specifications for uniform resource locators (URLs) enabled the Web to evolve into the environment that we know today. The Internet became usable for ordinary people without the sophisticated understanding of computer science and techniques (Tian, 2008). Hence, with the increasing number of Internet users, it became attractive to the commerce world.

2.1.3 Types of e-Commerce

There are a variety of different types of e-commerce and many different ways to characterize these types. According to (Singh, 2005) classified e-commerce into:

- Classification by seller/buyer (Government, consumer, business, etc.).

- Classification by product or activity (Search engine, online commercial, Education, etc.).

- Classification by sources of revenue (Advertising revenues, fees from referrals, Commission, etc.).

- Classification by tasks (Shopping, banking, investments, etc.).

- Classification by Technology (Internet infrastructure, internet application framework, etc.).

There are other varieties of e-commerce are described below as types of e-commerce transactions as outlined by (Abraha, 2001). Based on who orders the products and services to be sold and who sold those products and services and the nature of transactions.

1. **Consumer to Consumer (C2C):** conducts the selling and buying the products or services among people. Individuals can do these transactions on sites which offering free classifieds, auctions, and forums and individuals will not fulfill the transactions without the online payment systems. It enables customers to deal with each other directly.

2. **Consumer to Business (C2B):** Individuals who seek sellers to bid on product or services. A consumer posts the need whether product or service with a set budget online and organizations compete to provide the product or service to consumers. The consumer reviews the bids and selects the company that will complete the need.

3. **Business to Business (B2B):** holds electronic transactions among businesses. Companies doing business with each other such as manufacturers selling to distributors and wholesalers selling to retailers. Pricing is based on a quantity of order and negotiation. These transactions are usually executed through Electronic Data Interchange (EDI) whichever exchanging information between businesses over private networks that enables flowing of business more efficiently. B2B consists of the largest form of e-commerce.

4. **Business to Consumer (B2C):** called E-tail, this category focuses on the mechanisms able to satisfy the consumers' needs (sale/purchase of goods and services, information, etc.) The basic concept of this model is to sell the product online to the individuals through catalogues utilizing shopping cart software. Directly interact with the customers is the main difference with another model. As B2B it manages directly relationship with consumers.

5. **Business-to-Business-to-Consumer (B2B2C):** Business provides a product or service to client business. Business owner provides product or service to a client without increasing any value to it. In this type of transaction, the client acts as an intermediary.

   Other types of e-commerce transactions the government entity engages into are illustrated below.

6. **Government to Government (G2G):** Government helps to exchange information, government services and to do businesses with other governments.

7. **Government to Consumer (G2C) and Consumer to Government (C2G):** In the first case, the government provide services to its citizens via EC technologies that have government policies, rules and regulations while Citizens creates a platform for feedback and acknowledgements on happenings and policies to the government and also inquiries about governmental services in C2G.

8. **Government to Business (G2B) and Business to Government (B2G):** In this, commercial transactions conduct between organizations and public sector. In the first type, the public sector is informing the business about the statutes and organizations use the Internet for procurement, filing taxes, licensing procedures, business registrations, and other government-related operations while through B2G organization run activities for the benefit of the public sector (procurement contracts, auctions, etc.).

Other categories also include:

9. **Peer to Peer (P2P):** this model can be used in C2C, B2B, and B2C. Internet users enable to share files, data processing and computer resources with each other directly without having to go through a central web server.

10. **Mobile Commerce (M-Commerce):** helps interacting consumers with each other through wireless technology, such as mobiles. This includes the change of ownership or rights to utilize products and services.

11. **Intra-Business (Intra-Organizational) E-Commerce:** involves the exchange of products, services or information among various departments and employee in that organization (selling corporate products, online training and collaborative design efforts, cost reduction activities, etc.).

12. **E-Learning:** Training or education is through the internet loaded by universities, organizations and government agencies. It also called e-training in an organization.

13. **Exchange to Exchange (E2E):** E2E system is a public electronic market that connects two or more exchanges from buyers and sellers (e.g. stock exchange).

14. **Collaborative Commerce (C-Commerce):** In this category of EC, collaboration occurs online among business partners, groups, individuals along the supply chain.

15. **Non-business E-Commerce:** includes academic institutions, non-profit organizations, religious corporations and government agencies that are using e-commerce to reduce expenses, to improve customer services and to develop their activities.

The most widely used type is B2B category for several reasons. From these reasons, B2B is easier to implement than traditional off-line types and the volume of transactions and the savings are larger.

In this research, the study will be based on the type of B2C. Therefore, we will refer to some of the benefits of e-commerce and present overview of e-commerce challenges in Sudan.

2.1.4 Benefits of e-Commerce activities

(Mirescu, 2010) presents many benefits of e-commerce that can be classified according to various criteria which include:

- **To Organizations or producing companies:**

  - Expands company's marketplace to national and international markets.
  - The reorganization and streamlining of internal structures within the company.
  - Maintaining and strengthening relationships with customers and suppliers.
  - Providing logistical flexibility and just-in-time manufacturing.
  - Reduced costs associated with various business processes and improved communication speed.
  - The adoption of online sales as an alternative way of trade.
  - Enables companies to procure material and services from other companies, rapidly and at less cost.
  - Helps small businesses compete against large companies and allows lower inventories.

- **To Consumers or buyers:**

  - Provides less expensive products and services by allowing the consumers to conduct quick online comparisons.
  - Give consumers more choices than they could easily locate otherwise.
  - Enables customers to shop or make other transactions 24 hours a day, from almost any location.
  - Delivers relevant and detailed information in seconds and leading to more knowledgeable customers.
  - Enables consumers to get customized products.
  - Makes possible electronic auctions.
  - Instant delivery and high convenience for the customer.

- **To Producers "The opportunity to attract new customers":**

  - Easy access to markets that were inaccessible otherwise.
  - Reduced costs beyond what concerns the provision of products and services.

- **The overall benefits:**
    - The ousting of intermediaries from the e-commerce activities.
    - Reducing the time devoted to various activities, from the double perspective of the seller and the buyer.
    - Some of the Geographical barriers are dissolved, reaching out to rural areas.

2.1.5   E-Commerce in Sudan and its challenges

Efforts of public and private sectors are working on the development of e-commerce applications in Sudan to monitor the economic environment, provide protection and confidentiality to all parties and to deal with global changes and keep pace with developments. Although Sudan is a very advanced country in the telecommunications field and phone network with fiber optic in Africa and the Arab world.

However, there are challenges facing the development of electronic commerce in Sudan. Technically, the high cost of Internet, non-proliferation of the electronic payment system (credit cards), and the weakness of the role of email and network in rural areas. Socially, language barrier (most e-commerce transactions by the English language), relative poverty and lack of awareness on the use of information technology, hardware, and websites (Mohamed, WANG, and Elhadi, 2014). Add to these challenges the need for confidentiality in trade via the Internet.

Some of these obstacles can fade focusing on the parties related to this activity, and determine their requirements in order to promote e-commerce in Sudan.

2.2 An Overview of User Experience Design

2.2.1 User Experience Design (UXD)

The term 'user experience' (UX) is understood in many different ways by several disciplines. The definitions and approaches range from a psychological to a business perspective (V. Roto et al., 2013) but there is no one definition that fits all perspectives.

Below, a set of definitions of user experience is listed by different authors. These definitions are collected from (Community, 2013).

- All aspects of the end user's interaction with the company, its services, and its products. The first requirement for an exemplary user experience is to meet the exact needs of the customer, without fuss or bother. Next, simplicity and elegance come to produce products that are a joy to own, a joy to use (Nielsen Norman Group).

- UX is about how a person feels about using a system. User experience highlights the experiential, affective, meaningful and valuable aspects of human-computer interaction (HCI) and product ownership, but it also covers a person's perceptions of the practical aspects such as utility, ease of use and efficiency of the system (Wikipedia).

- All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they're using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it (Alben, 1996).

- A result of motivated action in a certain context. User's previous experiences and expectations influence the present experience; this present experience leads to more experiences and modified expectations (Mäkelä and Fulton Suri, 2001).

- Users' perceptions of interaction that constitute qualities of use (Colbert, 2005).

- A set of material rendered by a user agent which may be perceived by a user and with which interaction may be possible (W3C).

User experience design (UX, UXD), A discipline focused on designing the end-to-end experience of a certain product. To design an experience means to plan and act upon a certain set of actions (Treder, 2013).

Experiencing refers to an individual's stream of perceptions and behaviors, interpretations of those perceptions, and resulting emotions during dealing with a system.

User experience design (UXD) can be found in the principles of Human Centered Design (HCD ISO 13407:1999; revised by ISO 9241-210), which can be summarized as:

- Positioning the user as a central concern in the design process.

- Identifying the aspects of the design that are important to the target user group.

- Developing the design iteratively and inviting users' participation.

- Collecting evidence of user-specific factors to assess a design.

2.2.2 Human Centered Design and Usability, Relationship between them and UXD

Human-centered design (HCD) or User centered design (UCD) is characterized by the active involvement of users and a clear understanding of user and task requirements, an appropriate allocation of function between users and technology, the iteration of design solutions, multi-disciplinary design **- ISO 13407**.

UXD adds important dimensions to the challenge of implementing the human centered design. The main dimensions distinguishing UXD from a traditional view of HCD include UX factors, methods, tools and criteria used in UX work.

Usability is concerned product in terms of its use by specific users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use**- ISO 9241-11**. Whilst **user experience** is concerned with all aspects of the user's experience when interacting with the product, service, environment or facility **- ISO 9241-210**.
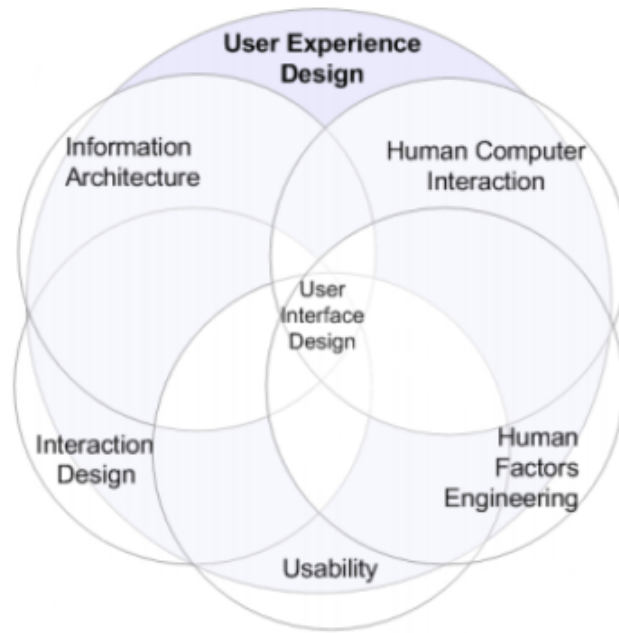
Figure 2.1: Relationship between UX and other concepts

User interface is the system by which people (users) interact with a machine or website. The user interface includes physical and logical components. It allowing the users to manipulate a system and allowing the system to indicate the effects of the users' manipulation (Group, 2011). The rest of the concepts are explained in the next section.

Usability is a narrower concept than user experience since it as perceived by the user is typically an aspect contributing to the overall UX. It focuses on goal achievement when using a web site. By contrast, the user experience is a consequence of the presentation, functionality, system performance, interactive behavior, and interactive system (Mifsud, 2011).

This substantially means that user experience includes aspects such as human factors, interaction design, interaction experience, ergonomics, user interface, web site appeal, emotion, accessibility, marketing as well as usability and human computer interaction (HCI). This is best illustrated by representing the relationship between all of these concepts and user experience design, as shown in the figure above.

2.2.3 Elements of User Experience

(Garrett, 2000) is clarified elements of user experience into the model, in the form of planes or layers and each plane containing components. The five planes split down the middle. On the left and placed the elements specific for functionality. On the right, elements for information. Building from the bottom to the top, strategy, scope, structure, skeleton, and surface. Each plane depends on the plane below it.
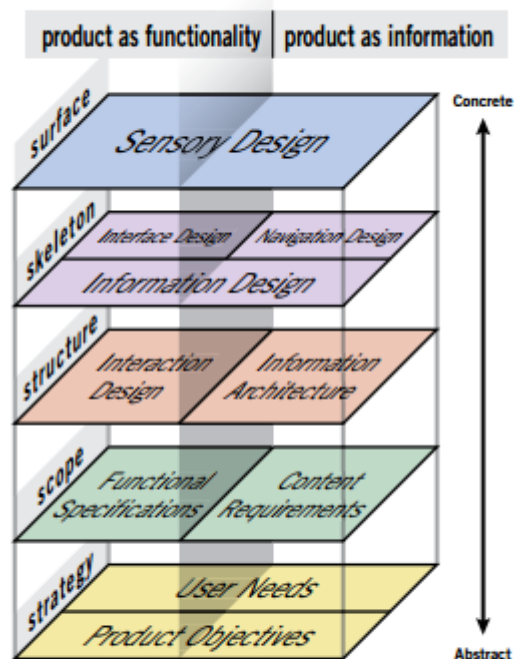
Figure 2.2: Elements of User Experience

The Strategy Plane: On both sides, functionality and information medium, the strategic concerned with user needs and the product objectives. **User needs** must understand the audience needs that want from the site and how that fits in with the other goals for product or organization. **Product Objective** represent be in business goals or other kinds of goals.

The Scope Plane: In this plane, elements of the Strategy are translated into **functional specifications** that describe the feature set of the product in terms of functionality, and **content requirements** in terms of information that describe the various content elements that will be required.

The Structure Plane: This scope on the functionality side contains **interaction design**, in which we define how the system behaves in response to the user. For information resources, contains the **information architecture**, an arrangement of content elements to facilitate human understanding.

The Skeleton Plane: This plane includes three components. On both sides, we address the **information design**, a submission of information easy to understand. In terms of functionality contains the **interface design**, order interface elements to facilitate user interaction process with the functionality of the system. On the other side, **navigation design**, a series of screen elements that enable the user to move through information architecture.

The Surface Plane: In the last plane, the surface is concerned on both sides with the **sensory design**, gathering the content, function, and aesthetics and accomplished goals by the other four planes to extract system that pleases the senses.

2.2.4 Facets of User Experience

A diagram, called the **UX Honeycomb**, includes seven hexagons which explain qualities of the user experience created by (Morville, 2004).

1. **Useful:** We must have the courage and creativity to question whether our products and our systems are useful and to apply deep knowledge to identify creative solutions that are more useful.

2. **Usable:** Ease of use remains necessary, indispensable and yet the interface-centered methods and perspectives of human-computer interaction do not address all dimensions of web design. In short, usability is necessary but not sufficient.

3. **Desirable:** our quest for efficiency should mix by estimation of the strength and value of image, identity, class, and other elements of emotional design.

Figure 2.3: UX Honeycomb

4. **Findable:** We must strive to design a navigable Website and locatable objects, so users can find what they need.

5. **Accessible:** Our site must be accessible to people.

6. **Credible:** We begin to understand the design elements that affect both users who trust and believe what we tell them.

7. **Valuable:** Our sites must deliver value to our sponsors. The user experience must contribute to the bottom line and improve customer satisfaction.

2.3   Past Research

1. **An Investigation of User-Experience Design of E-Commerce Websites (Eksioglu, Varol, and Duman, 2015):** this published-research paper aimed to identify and compare user experience issues and provide suggestions for the three e-commerce websites by conducting heuristic evaluation and usability testing methods. The investigation of e-commerce websites via constructed functional diagrams led to the division of the websites experience into four parts: discovery, browsing, check-out and after check out.

   Performance variables of the descriptive statistics of the values of each user were as follows: task completion time, a number of page views, success rate (or failure or abandon). Also, this paper used post-test questionnaire and statistical analysis of the data to summarize data and determined the factor effects on the response variable (the task completion time).

   The result of evaluation was some principles of web design for usability were not followed in the three e-commerce companies and gave recommendations relating to design mistakes of the sites but this paper is not fitted with a re-design that handles these mistakes.

2. **A Set of Heuristics for User Experience Evaluation in E-commerce Websites (Bonastre and Granollers, 2014):** this paper is presented 64 heuristics as a tool to evaluate the grade of user experience in e-commerce sites. It aims to develop the recommendations and standards for measuring and evaluating the user experience in e-commerce websites based on three studies.

   The heuristics were arranged on the stages of customer's buying behavior in the following six parts: need recognition and problem awareness, information search, purchase decision making, transaction, post-sales services and collect factors that affect user experience during the purchase process.

   This paper focused on the functional requirements and also does not cover all facets of user experience. The only factor that any of the three studies is the accessibility.

3. **Designing the User Experience for Different User Needs for B2B E-Commerce (Conde, 2013):** this thesis has focused on how to design a site to meet the demands of their users who are using the Seco tools online store (has 28,000 products globally) or may use it while creating a good user experience depending on user research and previous research into design.

   The thesis used several different design approaches include user interviews, contextual interviews, user scenarios, personas, sketching and prototyping and testing to make the web shop geared to the different user needs and solve problems such as out of date, browsing for an item, searching for an item and handling order at the current site.

Besides this, It used mental models that linked to usability as user's mental models can match and predict the actions of a product. It drawn from previous studies that have tried to incorporate culture into their designs then did this research with users from different cultural backgrounds.

It recommended with web analytic, be culture friendly, changes order button, make the site feel safe and secure to use, make the content findable and open the online store for everyone to see and better integration.

4. **Dual-Method Usability Evaluation of E-Commerce Websites: In Quest of Better User Experience (Maria, 2011):** this dissertation focused on retail e-commerce websites that market products and services over the Web. It identified the means providing better user experience and improve usability on websites by applied two different evaluation methods, usability testing, and heuristic evaluation to distinguish the design guidelines that facilitate the design of e-commerce websites and applied usability evaluation method to four e-commerce websites in the telecommunication sector. The heuristic evaluation characterizes usability problems while usability testing focused on measuring the efficiency and effectiveness and user satisfaction.

   The user experience assessed by using four methodologies: think-aloud method with user observation, drawing, mood board and heuristics and used notes, audio and video recording for data gathering. The researcher improved the user experience by enhancing three aspects user interface, functionality, and content.

   The results are obtained from a two indicative usability testing and heuristic evaluation: improving the design of the interaction from initial viewing, loading the page takes a long time because of the large amounts of image and non-sufficient information to make the purchasing decision.

Previous research used approaches that limited to measure user experience, the effectiveness measure, the subjective interpretation of the results and the lack of theoretical underpinning. Processing and analyzing the data is complex and time-consuming.

This research concentrates on evaluating particular UX qualities of e-commerce sites used by survey questionnaire as try to benefit from the previous studies in selecting suitable methodology and tool to cover all aspects of the user experience, where the descriptive analysis is used to discover problems and propose guidelines to create a good user experience.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Overview

Research methodology defined by (Crotty, 1998) is the strategy or action plan, process, or design that lies behind the choice and use of specific methods and linking the choice and use of methods to the desired results.

Research methodology is the science of systematically solving the research questions or problem of research. It is how to use the methods or tools in the search. Research methodology involves various techniques used in the conduct of research such as the conduct of tests, experiments, surveys and critical studies. Research methodology aims toward appointment the correct procedures to discover solutions and paves the way for research methods to be conducted properly (Pedia.com, 2015).

Selecting the research methodology depends on several factors, the research objectives, the research questions, type or nature of the research, time and possibility of the physical researcher.

3.1.1 Research Design

The research design is a plan for analyzing data and information to help to achieve the goal. There are five steps of research design: problem identification, methodology, data collection, data analysis and reporting writing (Williams, 2007).

A few of them mentioned in (Basnet, 2012) and stated here:

(Kerlinger 1986): defined research design as the plan and structure and strategy of the investigation so conceived as to obtain answers to research questions.

(Zikmund 2007): defined it as a master plan specifying the methods and procedures for collecting and analysing information.

(Young 1966): "Research design is the logical and systematic planning and directing a piece of research".

3.1.2   Research Methods

There are three known types of research methods: quantitative methods, qualitative methods and mixed methods to choose one of these methods based on research objectives to be achieved.

Quantitative Method: is used to quantify the problem by way of generating numerical data or data that can be transformed into usable statistics. It is used to quantify attitudes, opinions, behaviors, and other defined variables - and generalize results from a larger sample population. Quantitative Research uses measurable data to formulate facts and uncover patterns in research. Quantitative data collection methods are much more structured than Qualitative data collection methods (Wyse, 2011).

The main emphasis of quantitative research is on **deductive** reasoning, which tends to move from the general to the specific. This is sometimes referred to as a top-down approach. The validity of conclusions based on prior data or results or conditions to be true. More studies include an element of inductive reasoning at some stage of the research (Europe, 2013).

Qualitative Method: Qualitative data collection methods using unstructured techniques, or semi-structured techniques. Some common methods include focus groups, individual interviews, and participation/observations. The sample size is typically small (Wyse, 2011).

The qualitative method adopted to be **inductive** which means that developing a theory or look for a pattern of meaning on the basis of the collected data. This involves a move from the specific to the general and is sometimes called a bottom-up approach (Europe, 2013).

Mixed Method: Mixed method involves the mixing of quantitative and qualitative methods or paradigm characteristics. They may also use different techniques at the same time or one after the other. In some cases, the quantitative and qualitative methods are used simultaneously. In other cases, the first method is used in the first part of the search, and then the second method (Creswell, 2013).

Depending on which procedures have been used, the collected data is analyzed in the appropriate method. In any case, it is sometimes possible to transform qualitative data into quantitative data.

Here is table 3.1 for the explanation the Difference between Quantitative Method, Qualitative Method and Mixed Method From (Creswell, 2013).

Table 3.1: The Difference between Methods.

Quantitave Methods	Qualitative Methods	Mixed Methods
Pre-determined	Emerging methods	Both pre-determined
Instrument based questions	Open-ended questions	Both open- and closed-ended questions
Performance data, attitude data, observational data and census data	Observation data, document data, and audio visual data	Multiple forms of data drawing on all possibilities
Statistical analysis	Text and image analysis	Statistical and text analysis
Statistical interpretation	Themes, patterns interpretation	Across database interpretation

The research objectives are achieved by conducting **quantitative questionnaire**. It used explicit and specific questions to get effective results.

3.2 User Experience Methods

A better user experience on the site is crucial for firms to distinguish themselves from the competition and to gain loyalty and trust from users. Therefore, it is impossible to design an experience on a site without right methods of evaluating the user experience (Väätäjä, Koponen, and Roto, 2009). Determine the most appropriate methods for assessing user experience still ambiguous and unclear. The following table describes some methods used to design and evaluate UX.

Table 3.2: UX Methods.

Methods	Description
Usability-Lab Studies	In the context of usability testing, participants are brought to the in the lab and one-on-one with the researcher, giving a range of scenarios that lead to the tasks and the use of specific interest in the product or service. Or ask the observers to take notes what participants (Groups of users) say and do, without trying to explain their actions and words, especially referring to the places that were having difficulty (Rohrer, 2014).
Ethnographic-Field Studies	Ethnography is a qualitative design, where researchers meet participants in their natural environment and illustrate about learning styles of common values, behavior and beliefs, and the language of a common culture by a large group of people (Wikipedia, 2015).
Eye-tracking	Eye tracking method is configured to measure and classify attitudes precisely where participants look while performing tasks or interact naturally with sites, applications, physical products, or environments (Maria, 2011).
Surveys	Surveys are a quick and good way of measuring user satisfaction and collecting quantitative data and feedback about users' opinions about website or product by using postal service or the Internet for distributing (Braga and Teixeira, 2012). They can be used in the early stages of designing and can be used to evaluate an existing website.

Mood-board	A collaborative collection of images and texts, fonts, colors and references, and other graphical elements that are used to depict the structure of the overall look and feel of the design. It is an interactive tool to gather design ideas and the user perspectives in the early stages of the design process. It also can serve as an assessment tool to measure the user experience through the visual and emotional description (Braga and Teixeira, 2012).
Heuristic	Heuristic or usability method to find usability problems and highlights good and bad practices in the design of the user interface, interaction, and architecture information. It includes a small set of evaluators examine and visualize the current state of the product in terms of usability, efficiency, and effectiveness of the experience (Nielsen, 1994).

Survey questionnaires are effective tools for reaching a large number of people and take less time to administer, and it can be analyzed more accurately (Dalal et al., 2012).

In this research, we used **survey method** to answer the research questions and to reach more accurate results. This method was used to gather information to evaluate an existing site.

3.3 Data Collection

Data is collected through various means of strict procedures and prepared of statistical analysis with the aid of advanced statistical software. Statistical analysis allows researchers to discover the complex causal relationships and to determine the extent to which affect one another variable (Wyse, 2011).

This research is complemented with a **survey quantitative method** of Sudan e-commerce users, to analyze users' experience and attitude towards enhancing e-commerce in Sudan.

We collected data via questionnaires and set many questions to cover a large group of users for e-commerce sites. These questionnaires were distributed to users of e-commerce that studied computer science or any related field.

3.4 User Research

User research is dedicated to gathering data needed to develop user experience. There are some research tools, such as surveys, interviews, focus groups or user tests. They are best suited to gather information about attitudes, behaviors, public perceptions of users and interaction with your product (Garrett, 2000).

The segments of users depending on the different experience and needs of the user:

- **Demographic factors:** gender, age, nationality, education level, marital status, income.

- **Psychographic:** the attitudes of users toward the Internet and technology itself. How much time do you users spend using the Internet? What are the activities practiced during the use of the Internet?

Styles of question that can be included in the questionnaire, **general:** includes (Demographic and Psychographic factors) and **scalar:** judge a specific statement on a numeric scale and corresponding to a measure of agreement or disagreement with the statement (Dix et al., 2004).

3.5 Research Questions and How to Answering them

The main goal of this research is to establish criteria for user experience evaluation of e-commerce sites, and how to measure results of UX efforts for make e-commerce site more desirable, as well as identifying features and criteria can facilitate the design, development, and re-engineering of e-commerce sites towards promoting user experience.

In the table below have been highlighting the key research hypotheses and how to answer them:

Table 3.3: How to Achieve Research Questions.

Hypotheses	How to achieve this?
E-commerce sites are distinguished by a set of criteria, ease of use, efficiency and characteristics of aesthetics, which contribute to improving the user experience.	Define a set of criteria of the ease, efficiency and flexibility (user interface and interaction), interaction design and visual design. Illustrate criteria into a table 3.4.
Provide content requirements and information structure that make the site used continuously.	Derived a set of criteria from elements of user experience (Garrett 2000) section 2.2.3, So that each element includes a set of criteria(Content Requirements, Information Architecture and Information Design). Illustrate criteria into a table 3.4.
E-commerce sites meet the standards of security and navigation is one of the factors that increase competition with similar sites.	Define a set of criteria of functionality, security, navigation and illustrate that in table 3.4.
Lacking functional specification and features limit the spread and development of e-commerce over the Internet.	The research was determined criteria that users should be measured to achieve the quality of the design of the user experience. In chapter 4 Research Findings and Results.

3.5.1 Criteria that Measured by User Experience

These criteria were summarized and arranged according to the concept of (Garrett, 2000) about the elements of the user experience, as well as according to (Usability.gov, 2016) been translated concepts for questions or sentences measured by a user experience. Security criteria and some of the factors were synthesized by the researcher.

Table 3.4: Criteria of UXD.

Criteria

1. Functional Specification

- Complete tasks without accessing other channels.

- There is contact between users and providers or sellers.

- The site helps users in decision making.

- The store is flexible.

- Ability to search the product alphabetically or by name.

- Search in the catalogue of products without registering or login into the system.

- Track the orders.

- The page and components are loaded quickly.

2. Security

- Level of security is high.

- Terms and conditions link are available at the bottom of each page.

- Privacy link is available at the bottom of each page.

3. Contents Requirements

- Word count for text is suitable and understood.

- Images are visible and all dimensions are included.

- Words and images are arranged.

- Contents and images are well-structured and easily found.

- Content is purposeful and useful.

- Information is updated and archived.

- The site is consistent in terms of language and terminologies used and style.

- The site uses language that is familiar and comfortable for the user.

4. Information Architecture

- Information is found where the user would predict that it will be.

- The intra-page navigation work effectively and logically.

- The navigational heading categories are logically grouped.

- Know the user where are on site at all times.

- Find information easily.

- Items are related to each other on the website.

- Labelling of information on the site is effective.

- The structure and layout of site facilitate usage in any way.

5. Interaction Design

- There any arrows or buttons to move between contents of the page or photos to interact with the interface.

- Ability of the drag and drop across the interface.

- Save the image or copy any text from the site.

- There are meaningful signs on buttons or on shapes or instructions to let you know what will happen before executing the action.

- Appear an explanatory message to explain why and how to avoid the error when it occurs.

- There feedback that appears after performing an activity to show the user what it did.

- The response is immediate.

- The elements of the site have a reasonable size to interact with them (Possibility of pressing the buttons).

- The position of menus, buttons and search box in the suitable place on the edges and corners.

- Site is simple, uncomplicated and learnable.

6. Interface Design

- The interface is simple.

- The interface uses common and consistent elements.

- The interface elements are arranged.

- The page layout is purposeful.

- The use of colours and textures is shining, consistent and draw attention.

- Domain name (URL) is guessable and meaningful to users.

- Domain name (URL) is memorable and easy.

7. Navigation Design

- Navigation labels are clear and meaningful.

- The actions and instructions are visible or easily retrievable whenever appropriate.

- The hyperlinks of the content area are obvious.

- The transition between the related pages and among different sections is easy.

- There must be different types of navigation easy navigation processing.

- The results of the research process are related to that which is looked for.

8. Information Design

- The information appears natural and logical.

- Labels communicate information efficiently and clearly.

- Typography is legible, readable, and appealing when displayed.

- Icons refer to its purpose (their shape similar to what they are).

- Content information is used by priority.

- Placement of information helps you for scanning and readability.

9. Visual Design - Aesthetics

- All the elements on the page show together.

- All the elements are arranged properly and design is understandable and clear.

- The font size of the text is proper and suitable.

- The font style of the text is readable

- The font colour is suitable for each text and specifies the importance of the text.

- The site is attractive and smooth.

- The placement of items helps draw attention to important pieces of information.

- The logo and the title of the site indicate the nature and objectives of the site.

- The size of images and shapes suitable.

- The position of each element is clear for its relevance.

- There any white space to understand each part separately.

CHAPTER 4

RESEARCH FINDINGS AND RESULTS

4.1 Research Population

As we are tried to engage the people from different parts of the sample site. The sample site is consisted of:

- The staff of banks that fund projects of e-commerce.

- The Internet users' who buy internet quota on the Sudanese telecommunications sites.

- It is also targeted the users of e-commerce sites that are related to the field of information technology.

4.2 Sample Size

Data is collected via survey questionnaire, which was distributed to total of 75 citizens in the period between May to July 2016. From 75 potential respondents, 50 responses were received, which constitutes a 66.7% response rate for the survey and a 0.0% were discarded. This means that valid responses are 66.7%.

Before the distribution of the sample, we have collected 10 responses for the purpose of arbitration and ensuring the reliability of the questionnaire.

4.3 Data Analysis

For the purpose of this study, data was analyzed using Statistical Package for Social Sciences (SPSS) and used the distribution of descriptive statistics to test research hypotheses.

Demographic Factors

- **Gender of Respondents**

Table 4.1: Gender of Respondents

	Frequency	Percent
Male	26	52.0
Female	24	48.0
Total	50	100.0
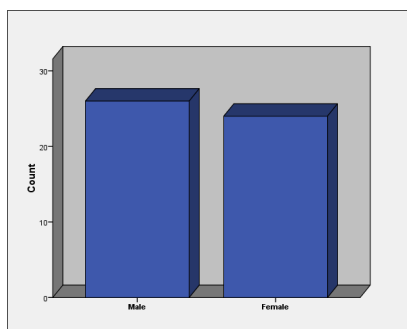
Figure 4.1: Gender of Respondents

In table 4.1, the ratio of females and males is close, and this indicates the culture of retail is spread between females and males.

- **Age of Respondents**

Table 4.2: Age of Respondents

	Frequency	Percent
18 - 24	15	30.0
25 - 34	28	56.0
35 - 44	6	12.0
+ 45	1	2.0
Total	50	100.0
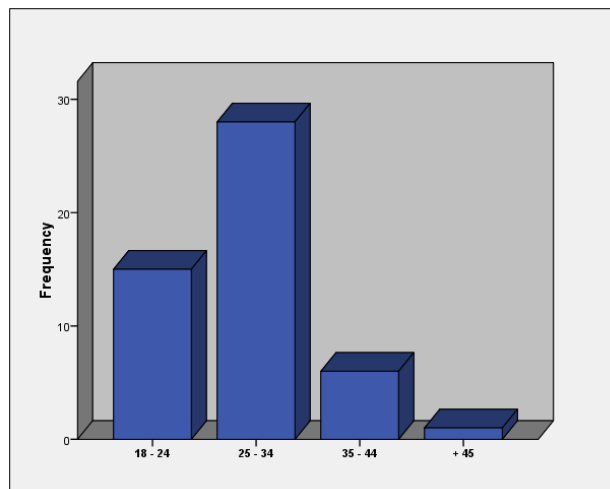
Figure 4.2: Age of Respondents

In terms of age, the results revealed that the largest percentage of respondents were in the age group of 25-35 for youth group from fig. 4.2.

- **Nationality of Respondents**

Table 4.3: Nationality of Respondents

	Frequency	Percent
Sudanese	49	98.0
Other	1	2.0
Total	50	100.0
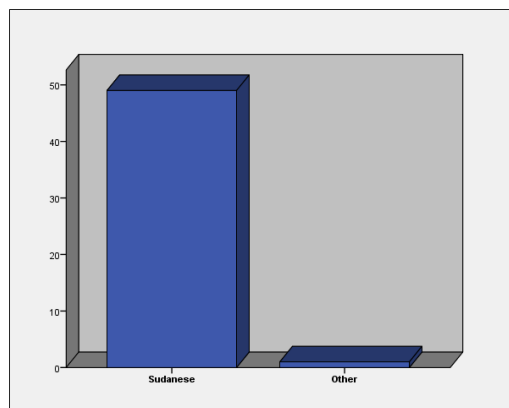
Figure 4.3: Nationality of Respondents

Table 4.3 shows that all respondents are Sudanese, except one respondent.

Psychographic Factors

- **How much time do you spent using the Internet?**

Table 4.4: Internet Experience of Respondents

	Frequency	Percent
1-3 months	1	2.0
1 - 3 years	3	6.0
3 - 9 years	29	58.0
+ 9 years	17	34.0
Total	50	100.0
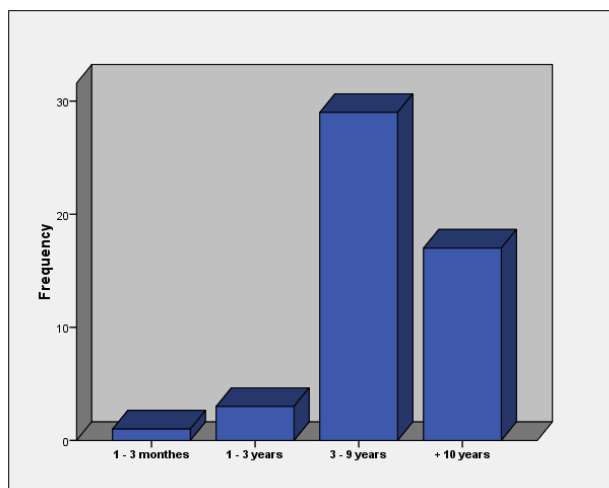
Figure 4.4: Internet Experience of Respondents

From the table 4.4, the largest percentage were in respondents that use Internet in the period (3-9 years) indicating that the citizens began to use the Internet in Sudan before 9 years.

- **Indicate if you have done any of the following on the Internet?**

Table 4.5: Activities of Respondents on Internet

	Responses		Percent of Cases
	N	Percent	
Surfing	46	21.3%	92.0%
Email	43	19.9%	86.0%
Online Shopping	31	14.4%	62.0%
Online Learning	37	17.1%	74.0%
Social Networks	40	18.5%	80.0%
Other	19	8.8%	38.0%
Total	216	100.0%	432.0%
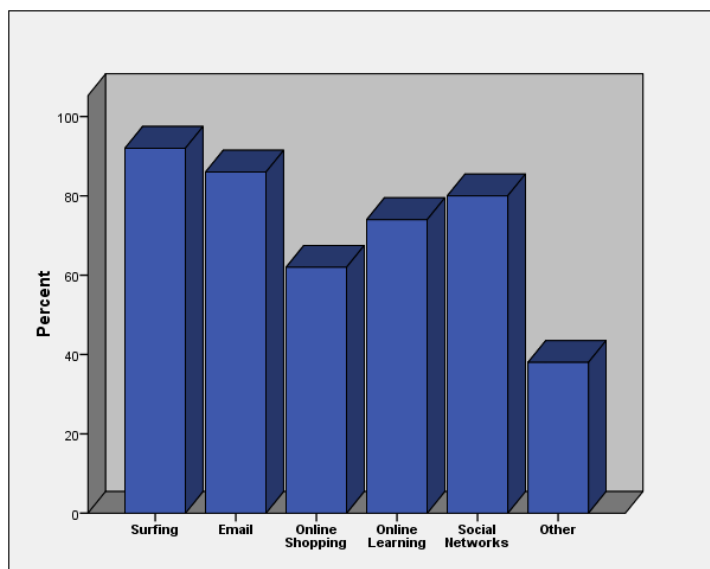
Figure 4.5: Activities of Respondents on Internet

This shows that online shopping (e-commerce, retail) is the least popular activity among respondents in Sudan.

Respondents on the Research Questions

- **Respondents of Functionality**

Table 4.6: Respondents of Functionality

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
You can complete tasks without accessing other channels.	Count	0	16	11	16	7	50
	Percent	0.0	32.0	22.0	32.0	14.0	100.0
There is contact between you and providers or sellers.	Count	0	12	16	13	9	50
	Percent	0.0	24.0	32.0	26.0	18.0	100.0
The site helps you in decision making.	Count	0	2	4	29	15	50
	Percent	0.0	4.0	8.0	58.0	30.0	100.0
The store is flexible.	Count	0	3	11	26	10	50
	Percent	0.0	6.0	22.0	52.0	20.0	100.0
You can search the product by alphabetical and product name.	Count	0	5	10	15	20	50
	Percent	0.0	10.0	20.0	30.0	40.0	100.0

You can search in the catalog of products without registering or login into the system.	Count	3	14	8	17	8	50
	Percent	6.0	28.0	16.0	34.0	16.0	100.0
You can track orders.	Count	1	7	9	19	14	50
	Percent	2.0	14.0	18.0	38.0	28.0	100.0
The page and components are loaded quickly.	Count	0	12	7	18	13	50
	Percent	0.0	24.0	14.0	36.0	26.0	100.0

In table 4.6, the results showed that 46% of respondents see that tasks can be completed without accessing other channels, 44% (of the lowest) of respondents agree that there is contact between you and providers or sellers, 88% of respondents agree that the site helps them in decision-making and 72% agree that the store is flexible. 70% of the study sample see that search can be by product name or the alphabet, 50% agree that they can search in the catalog of products without registering or log-in into the system, 66% agree that they can track their orders and 62% agree that the page and components are loaded quickly.

- **Respondents of Security**

Table 4.7: Respondents of Security

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Level of security is high.	Count	0	0	11	26	13	50
	Percent	0.0	0.0	22.0	52.0	26.0	100.0
Terms and conditions link are available at the bottom of each page.	Count	0	1	7	33	9	50
	Percent	0.0	2.0	14.0	66.0	18.0	100.0
Privacy link is available at the bottom of each page.	Count	1	7	8	29	5	50
	Percent	2.0	14.0	16.0	58.0	10.0	100.0

The above table 4.7 shows that 78% assert that sites have a high level of secrecy 0.84% see that the terms and conditions link are available at the bottom of each page and that 68% consider that the privacy link is available at the bottom of each page(the lowest percentage in the criterion of security).

- **Respondents of Content Requirements**

Table 4.8: Respondents of Content Requirements

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Word count for text is suitable and understood.	Count	0	0	4	30	16	50
	Percent	0.0	0.0	8.0	60.0	12.0	100.0
Images are visible and all dimensions are included.	Count	0	1	7	28	14	50
	Percent	0.0	2.0	14.0	56.0	28.0	100.0%
Words and images are arranged.	Count	0	2	2	30	16	50
	Percent	0.0	4.0	4.0	60.0	32.0	100.0
Contents and images are well-structured and easily found.	Count	1	3	9	25	16	50
	Percent	2.0	6.0	18.0	50.0	32.0	100.0
Content is purposeful and useful.	Count	0	3	11	22	14	50
	Percent	0.0	6.0	22.0	44.0	28.0	100.0
Information is updated and archived.	Count	1	7	8	24	10	50
	Percent	2.0	14.0	16.0	48.0	20.0	100.0

The site is consistent in terms of language and terminologies used and style.	Count	0	1	7	30	12	50
	Percent	0.0	2.0	14.0	60.0	24.0	100.0
The site uses language that is familiar and comfortable for you.	Count	0	1	5	26	18	50
	Percent	0.0	2.0	10.0	52.0	36.0	100.0

Seen from the table 4.8 that 72% of the respondents agree that word count for text is suitable and understood and that 92% see that words and images are arranged, while lowest percentage is 68% see that information is updated and archived.

- **Respondents of Interaction**

Table 4.9: Respondents of Interaction

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
There any arrows or buttons to move between contents of the page or photos to interact with interface.	Count	2	7	9	17	15	50
	Percent	4.0	14.0	18.0	34.0	30.0	100.0
You can drag and drop across the interface.	Count	0	3	2	28	17	50
	Percent	0.0	6.0	4.0	56.0	14.0	100.0
You can save the image or copy any text from the site.	Count	2	9	2	20	17	50
	Percent	4.0	18.0	4.0	40.0	34.0	100.0
There are meaningful signs on buttons or on shapes or instructions to let you know what will happen before executing the action.	Count	1	7	5	17	20	50
	Percent	2.0	14.0	10.0	34.0	40.0	100.0
Appear an explanatory message to explain why and how to avoid the error when it occurs.	Count	1	5	4	20	20	50
	Percent	2.0	10.0	8.0	40.0	40.0	100.0

There feedback that appears after performing activity to show you what it did.	Count	2	9	4	17	18	50
	Percent	4.0	18.0	8.0	34.0	36.0	100.0
The response is immediate.	Count	4	6	8	20	12	50
	Percent	8.0	12.0	16.0	40.0	24.0	100.0
The elements of the site have a reasonable size to interact with them (Possibility of pressing the buttons).	Count	1	3	3	31	12	50
	Percent	2.0	6.0	6.0	62.0	24.0	100.0
The position of menus, buttons and search box in the suitable place on the edges and corners.	Count	0	3	4	30	13	50
	Percent	0.0	6.0	8.0	60.0	26.0	100.0
Site is simple, uncomplicated and learnable.	Count	0	3	10	18	19	50
	Percent	0.0	6.0	20.0	36.0	38.0	100.0

See from the above table 4.9 that the percentage on agreeing is large of 90% that can drag and drop across the interface, that 74% of the respondents agree that the image was saved and text was copied from the site, where 74% agree that site is simple, uncomplicated and learnable and also consider that there any arrows or buttons to move between contents of the page or photos to interact with interface and response is immediate to lowest percentage 64%.

- **Respondents of Page display, layout and site structure**

Table 4.10: Respondents of Page display, layout and site structure

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Information is found where you would predict that it will be.	Count	4	12	13	12	9	50
	Percent	8.0	24.0	26.0	24.0	18.0	100.0
The intra-page navigation work effectively and logically.	Count	4	5	9	21	11	50
	Percent	8.0	10.0	18.0	42.0	22.0	100.0
The navigational heading categories are logically grouped.	Count	2	6	12	22	8	50
	Percent	4.0	12.0	24.0	44.0	16.0	100.0
You can know where you are on the site at all times.	Count	2	8	14	16	10	50
	Percent	4.0	16.0	28.0	32.0	20.0	100.0
You can find information easily.	Count	1	9	6	21	13	50
	Percent	2.0	18.0	12.0	42.0	26.0	100.0

Items are related to each other within website.	Count	2	5	9	26	8	50
	Percent	4.0	10.0	18.0	52.0	16.0	100.0
Labeling of information on the site is effective.	Count	0	3	10	27	10	50
	Percent	0.0	6.0	20.0	54.0	20.0	100.0
The structure and layout of site facilitate usage in any way.	Count	0	5	11	26	8	50
	Percent	0.0	10.0	22.0	52.0	16.0	100.0

The table 4.10 shows that 74% of respondents agree that labeling of information on the site is effective and the lowest percentages 42% for factor of information is found where you would predict that it will be and 64% also agree that intra-page navigation work effectively and logically.

- **Respondents of Navigation**

Table 4.11: Respondents of Navigation

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Navigation labels are clear and meaningful.	Count	0	1	10	23	16	50
	Percent	0.0	2.0	20.0	46.0	32.0	100.0
The actions and instructions are visible or easily retrievable whenever appropriate.	Count	0	8	12	20	10	50
	Percent	0.0	16.0	24.0	40.0	20.0	100.0
The hyperlinks of the content area are obvious.	Count	0	5	7	28	10	50
	Percent	0.0	10.0	14.0	56.0	20.0	100.0
The transition between the related pages and among different sections is easy.	Count	0	5	11	21	13	50
	Percent	0.0	10.0	22.0	42.0	26.0	100.0
There are different types of navigation easy navigation processing.	Count	0	0	16	24	10	50
	Percent	0.0	0.0	32.0	48.0	20.0	100.0

The results of the research process are related to that which is looked for.	Count	0	3	10	24	13	50
	Percent	0.0	6.0	20.0	48.0	26.0	100.0

Most respondents agree that navigation labels are clear and meaningful by 78% and 60% (percentage is the lowest) agree that actions and instructions are visible or easily retrievable whenever appropriate, in table 4.11 .

• **Respondents of Interface Design**

Table 4.12: Respondents of Interface Design

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
The interface is simple.	Count	0	2	6	22	20	50
	Percent	0.0	4.0	12.0	44.0	40.0	100.0
The interface uses common and consistent elements.	Count	0	3	7	32	8	50
	Percent	0.0	6.0	14.0	64.0	16.0	100.0
The interface elements are arranged.	Count	0	3	7	23	17	50
	Percent	0.0	6.0	14.0	46.0	34.0	100.0

The page layout is purposeful.	Count	0	4	5	26	15	50
	Percent	0.0	8.0	10.0	52.0	30.0	100.0
The use of colors and textures is shining, consistent and draw attention.	Count	0	2	7	24	17	50
	Percent	0.0	4.0	14.0	48.0	34.0	100.0
Domain name (URL) is guessable and meaningful to users.	Count	0	9	10	20	11	50
	Percent	0.0	18.0	20.0	40.0	22.0	100.0
Domain name (URL) is memorable and easy.	Count	0	4	8	25	13	50
	Percent	0.0	8.0	16.0	50.0	26.0	100.0

Table 4.12, 84% of respondents see that the interface is simple, this consider the highest percentage for criteria of flexibility and efficiency, and 62% believe that domain name is guessable and meaningful to users, this is the lowest percentage for criteria of findable.

- **Respondents of Information Design**

Table 4.13: Respondents of Information Design

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
The information appears natural and logical.	Count	0	1	4	25	20	50
	Percent	0.0	2.0	8.0	50.0	40.0	100.0
Labels communicate information efficiently and clearly.	Count	0	2	7	27	14	50
	Percent	0.0	4.0	14.0	54.0	28.0	100.0
Typography is legible, readable, and appealing when displayed.	Count	0	2	3	26	19	50
	Percent	0.0	4.0	6.0	52.0	38.0	100.0
Icons refer to its purpose (their shape similar to what they are).	Count	0	2	8	23	17	50
	Percent	0.0	4.0	16.0	46.0	34.0	100.0
Content information is used by priority.	Count	1	4	9	25	11	50
	Percent	2.0	8.0	18.0	50.0	22.0	100.0

Placement of information helps you for scanning and readability.	Count	1	8	9	21	11	50
	Percent	2.0	16.0	18.0	42.0	22.0	100.0

In table 4.13, most respondents agree that the information appears natural and logical order, typography is legible, readable, and appealing when displayed by 90% and 64% (percentage is the lowest) agree that placement of information helps you for scanning and readability.

- **Respondents of Aesthetics**

Table 4.14: Respondents of Aesthetics

Statement		Severity Rating					Total
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
All the elements on the page show together.	Count	2	9	6	24	9	50
	Percent	4.0	18.0	12.0	48.0	18.0	100.0
All the elements are arranged properly and design is understandable and clear.	Count	1	1	3	34	11	50
	Percent	2.0	2.0	6.0	68.0	22.0	100.0
The font size of the text is proper and suitable.	Count	0	2	5	24	19	50
	Percent	0.0	4.0	10.0	48.0	38.0	100.0
The font style of the text is readable.	Count	0	3	4	25	18	50
	Percent	0.0	6.0	8.0	50.0	36.0	100.0
The font color is suitable for each text and specifies the importance of the text.	Count	0	7	7	24	12	50
	Percent	0.0	14.0	14.0	48.0	24.0	100.0
The site is attractive and smooth.	Count	0	1	12	24	13	50
	Percent	0.0	2.0	24.0	48.0	26.0	100.0

The placement of items helps draw attention to important pieces of information.	Count	0	9	7	17	17	50
	Percent	0.0	18.0	14.0	34.0	34.0	100.0
The size of images and shapes suitable.	Count	0	0	9	23	18	50
	Percent	0.0	0.0	18.0	46.0	36.0	100.0
The logo and the title of the site indicate the nature and objectives of the site.	Count	0	1	3	29	17	50
	Percent	0.0	2.0	6.0	58.0	34.0	100.0
The position of each element is clear for its relevance.	Count	0	9	5	20	16	50
	Percent	0.0	18.0	10.0	40.0	32.0	100.0
There any white space to understand each part separately.	Count	0	10	8	1 9	13	50
	Percent	0.0	20.0	16.0	38.0	26.0	100.0

Table 4.14 illustrates that most of the respondents agree that all the elements are arranged properly and design is understandable and clear by 90% and believe that size of images and shapes are suitable by 92% and also that few of the respondents agree with there any white space to understand each part separately by 64%

4.4 User Experience Findings

Table 4.15 sets the data by introducing the problems or negative aspects of factors on each criterion of e-commerce in Sudan as identified by survey method. Problems are extracted according to factors who received a high percentage of the fewer severity rates.

Table 4.15: User Experience Findings

Criteria	N	Problems Identified
Functionality	32.0	Users should be able to pick up where they left off.
	24.0	No messaging service to communicate between seller and buyer.
	34.0	Inefficient product search, cannot see homepage content without registering or login into the system.
Security	16.0	Privacy link is not available at the bottom of each page.
Content Requirement	16.0	Information is not updated and archived.
Interaction	18.0	No interaction between interface and user.
	22.0	There is no feedback that appears after performing an activity to show user what it did.
	20.0	Delay in responses and comments.
Page display, layout and site structure	32.0	Information is not found where user would predict that it will be.
	18.0	Navigation ineffective and illogical.
	20.0	No home link to know where user is on the site at all times.
	20.0	Scanning is difficult (cannot find information easily).
Navigation	16.0	Not easy retrieval actions and instructions whenever appropriate.

Interface Design	18.0	URL is difficult to guess and not meaningful to the user.
Information Design	18.0	Placement of information cannot help for scanning and readability.
Aesthetics	22.0	Taking too long to load all elements on the page together.
	18.0	The placement of items cannot help draw attention to important pieces of information.
	18.0	The position of each element is not clear for its relevance.
	20.0	There no any white space to understand each part separately.

The questionnaire statements evaluation and extraction of criteria from the literature provided valuable insight on user experience problems in the retail sites in Sudan.

The behaviors and attitudes of the users have a strong and positive influence in enhanced user experience. Therefore, if the website meets the user experience criteria: functionality, security, content requirement, interaction, site structure, effective navigation, and attention to interface design, information design, and aesthetics, it should contribute towards a good user experience.

4.5 Measuring the Reliability of the Model

Cronbach's alpha constancy coefficient was calculated with using SPSS software, which calculates variation coefficient for each question and it deletes questions that have a weak variation or negative coefficient.

Table 4.16: Measuring the Reliability of the Model

Constructs	N of Cases	N of Items	Cronbach's Alpha	Type
Functionality	9	8	0.5508	Poor Reliability
Security	9	3	0.8028	Good Reliability
Content Requirement	10	8	0.9357	Excellent Reliability
Interaction	10	10	0.8685	Good Reliability
Page display, layout and site structure	10	8	0.9226	Excellent Reliability
Navigation	10	6	0.8908	Good Reliability
Interface Design	10	7	0.8571	Good Reliability
Information Design	10	6	0.8918	Good Reliability
Aesthetics	9	11	0.8601	Good Reliability

Cronbach's alpha constancy coefficient is considered to be a measure of scale reliability as follows range between (0.9 and above) the internal consistency is excellent, good reliability (0.8 – 0.9), acceptable reliability (0.7 – 0.8), questionable reliability (0.6 – 0.7), poor reliability (0.5 – 0.6), unacceptable reliability (0.5 and below) (Cortina, 1993).

Internal consistency of the questionnaire questions indicates the strength of the correlation between the degrees of the total questionnaire questions.

The findings indicate that validity and reliability of the constructs have a high degree and all alpha values show this research is reliable. The reliability for each construct is explained in table 4.16 above.

The following table 4.17 shows the results of the study in accordance with the hypotheses that have been set and the questions for each hypothesis:

Table 4.17: Answers to the research questions

Hypotheses	Questions for each hypothesis	Results
E-commerce sites are distinguished by a set of criteria, ease of use, efficiency and characteristics of aesthetics, which contribute to improving the user experience.	**Interaction Design**	The results indicated that the criteria of ease, efficiency, flexibility and aesthetics characteristics directly affect the user experience. E-commerce sites are good which have a possibility of drag-and-drop, save images and text, avoid the error occurred and also is characterized simply interfaces, familiar and ordered elements, and easy to remember domains of sites. As for the visual design is obvious as well as the size, style and color of font illustrate the importance of the existing of the text as well as the logo and title sites represent goals of sites.
	You can drag and drop across the interface.	
	You can save the image or copy any text from the site.	
	There are meaningful signs on buttons or on shapes or instructions to let you know what will happen before executing the action.	
	Appear an explanatory message to explain why and how to avoid the error when it occurs.	
	The elements of site have reasonable size to interact with them (Possibility of pressing the buttons).	
	The position of menus, buttons and the search box in the suitable place on the edges and corners.	
	Site is simple, uncomplicated and learnable.	
	Interface Design	
	The interface is simple.	
	The interface use common and consistent elements.	

Hypotheses	Questions for each hypothesis	Results
	The interface elements is arranged.	
	The page layout is purposeful.	
	The use of colors and textures is shining, consistent and draws attention.	
	Domain name (URL) is memorable and easy.	
	Visual Design	
	All the elements are arranged properly and design is understandable and clear.	
	The font size of the text is proper and suitable.	
	Font style of the text is readable.	
	The font color is suitable for each text and specific the importance of the text.	
	The site is attractive and smooth.	
	The logo and the title of the site indicates to the nature and objectives of the site.	
	The size of images and shapes suitable.	

Hypotheses	Questions for each hypothesis	Results
Provide content requirements and information structure that make the site used continuously.	**Content Requirements**	The study showed that the content requirements for each site represented as follows: The pictures and words for each site are clear, useful, arranged and structured to find them easily and sites are consistent in terms of language and terminologies are familiar to all. In terms of structure and design of information, the labeling of information is effective and all the icons indicate its purpose and contents related to each other and sorted by priority.
	Word count for text are suitable and understood.	
	Images are visible and all dimensions are included.	
	Words and images are arranged.	
	Contents and images are well structured and easily found.	
	Content is purposeful and useful.	
	The site is consistent in terms of language and terminologies used and the style.	
	The site use language that is familiar, comfortable and known for you.	
	Information Architecture	
	The navigational heading categories are logically grouped.	
	Items are related to each other within website.	
	Labeling of information on the site is effective.	
	The structure and layout of site facilitate usage in any way.	

Hypotheses	Questions for each hypothesis	Results
	Information Design	
	The information appear natural and logical order.	
	Labels communicate information efficiently and clearly.	
	Typography is legible, readable, and appealing when displayed.	
	Icons refer to its purpose (their shape similar to what they are).	
	Content information is used by priority.	

Hypotheses	Questions for each hypothesis	Results
E-commerce sites meet the standards of security and navigation is one of the factors that increase competition with similar sites.	**Functional Specification**	Sites characterize by functional specifications such as helping in decision-making and flexibility of the search for a product, as well as store, and components of the page are loaded quickly. As for criterion of security, sites distinguish by high secrecy and there is conditions link available at the bottom of each page. By the criterion of navigation include the navigation labels are clear and meaningful, and existence many types of navigation to facilitate the search process.
	The site help you in decision making.	
	The store is flexible.	
	You can search the product by alphabetical and product name.	
	You can tracking orders.	
	The page and components is loaded quickly.	
	Security	
	Level of security is high.	
	Terms and conditions link is available at the bottom of each page.	
	Navigation Design	
	Navigation labels are clear and meaningful.	
	The hyperlinks inside of the content area are obvious.	
	The transition between the related pages and among different sections is easy.	
	There are different types of navigation easier navigation process.	

Hypotheses	Questions for each hypothesis	Results
	The results of the research process are related to that which is looking for.	
Lacking functional specification and features limit the spread and development of e-commerce over the Internet.	You can complete tasks without accessing other channels.	Users experiments clarified these criteria are not represented on e-commerce sites in Sudan and thus pointed to the problems in the table 4.15 that limit spread of the commerce via the Internet and trust to these sites, and to elevate and spread this technique must be processed all the problems relating to each site to meet these criteria and previous criteria to contribute to a good user experience.
	There is contact between you and providers or sellers.	
	You can search in the catalog of products without registering or login into the system.	
	Privacy link is available at the bottom of each page.	
	Information is updated and archived.	
	There any arrows or buttons to move between the contents of the page or photos to interact with interface.	
	There feedback that appears after performing activity to show you what it did.	
	Response be immediately.	
	Information is found where you would predict that it will be.	
	The intra-page navigation work effectively and logically.	
	You can know where you are on the site at all times.	

Hypotheses	Questions for each hypothesis	Results
	You can find information easily.	
	Actions and instructions visible or easily retrievable whenever appropriate.	
	Domain name (URL) is guessable and meaningful to users.	
	Placement of information help you for scanning and readability.	
	All the elements on the page show together.	
	The placement of items help draw attention to important pieces of information.	
	The position of each element is clear for its relevance.	
	There any white space to understand each part separately.	

CHAPTER 5

CONCLUSION

5.1 Recommendations for Future Work

This thesis presented the concepts of the user experience design and explained the user experience facets and evaluation methods that can be used to evaluate the user experience of e-commerce websites. It contributes to improving the user experience of e-commerce between business to consumer (B2C) by proposing a guide of the critical factors that affect e-commerce in Sudan.

We recommend researchers and designers to follow these suggestions for future work:

- Construction of proposals for the site interface through these results was extracted and in the light of user feedback during the experiment.

- Using the proposed criteria in this research to evaluate other types of the e-commerce including B2B, C2B, C2C, G2G, G2C, C2G, B2G, G2B, and M-commerce.

- Implementing the proposed criteria in this research in the design and development of new sites.

- Using heuristic or usability methods to gain more accurate results based on immediate impressions and reactions of users, and interaction with sites.

- Further research on the impact of user demographics and psycho graphics in usage and development of e-commerce.

5.2   Summary

The main objective of this thesis is to acquire a better user experience on e-commerce websites. To this purpose, a survey is conducted by designing the user experience questionnaire by experts of the users to evaluate the factors and test the validity of the user experience design that affects the e-commerce sites in Sudan. The research set out to determine the user experience issues that cause participants to have positive or negative user experience on e-commerce.

This research is unique because it focused on identifying user's requirements through their experience of e-commerce sites; moreover, the meeting of the user's needs, represent an effective tool for creating a better user experience and these must be considered in each site:

- The ability of users to pick up where they left off and the existence of messaging service to communicate between seller and buyer, product search efficiently and see homepage content without registering or login into the system.

- Privacy link must be available at the bottom of each page.

- Information must be updated and archived.

- There must be interaction between interface and user, feedback that appears after performing an activity to show you what it did and responses to comments must be immediate.

- Information should be found where the user would predict that it will be, and know where there are on the site at all times through home link.

- Ability to retrieve actions and instructions whenever appropriate.

- Ability to guess the URL.

- Placement of information is to help for scanning and readability.

- Load all elements on the page, the placement of items to help draw attention to important pieces of information and there is white space to understand each part separately.

The findings are concluded that users' needs should be the driving force behind design and development of e-commerce websites. Therefore, the designers and developers should have a comprehensive information of the issues of the user experience, and most importantly, the user's needs. They should apply these guidelines in design and development of e-commerce sites.

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Appendix: User Experience Questionnaire

Dear Sir/Madam.........

I am a master student at Sudan University of Science and Technology. My research concerns the identification of user's needs to determining critical factors of e-commerce in Sudan. The aim of the study is to evaluate Sudanese e-commerce sites and extract the user expectations and needs which accelerate increased use and spread of e-commerce in Sudan.

The data providing and information from citizens is significant in order to achieve the research aim and objectives. I would like to assure you that all data and information will be regarded as strictly confidential, as well as the identity of all participants. Finally, I appreciate your taking the time to record information accurately; this is to help in the analysis phase later in the research and to reach effective results.

Thank you very much for agreeing to fill this questionnaire.

Sara Abdallah Hussein
Researcher at Sudan University of Science and Technology

Part - One: User Personal Data:

Directions: Please place a "✔" mark in the box of your answer.

1. Please indicate your gender.

Male	Female

2. Please indicate your age.

18 - 24	25 - 34	35 - 44	45 +

3. What is nationality?

Sudanese	Other

4. How much time do you spent using the Internet?

Less than 3 months	Less than 12 months	Less than 3 years	Less than 9 years	9 +

5. Indicate if you have done any of the following on the Internet.

Surfing	Email	Online Shopping	Online Learning	Social Networks	Other

Part - Two: Research Questions:

Please indicate the extent to which you agree or disagree with the following statements in the context on e-commerce in general and e-commerce site (e-retail) you experienced with in particular that provide the indication of attitudes towards the use of Sudanese e-commerce site.

Tick on any one of the choices given below:

Criteria: Functionality

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. You can complete tasks without accessing other channels.					
2. There is contact between you and providers or sellers.					
3. The site helps you in decision making.					
4. The store is flexible.					
5. You can search the product by alphabetical and product name.					
6. You can search in the catalog of products without registering or login into the system.					
7. You can track orders.					
8. The page and components are loaded quickly.					

Criteria: Security

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Level of security is high.					
2. Terms and conditions link are available at the bottom of each page.					
3. Privacy link is available at the bottom of each page.					

Criteria: Content Requirements

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Word count for text is suitable and understood.					
2. Images are visible and all dimensions are included.					
3. Words and images are arranged.					
4. Contents and images are well-structured and easily found.					
5. Content is purposeful and useful.					
6. Information is updated and archived.					
7. The site is consistent in terms of language, terminologies used and the style.					
8. The site uses language that is familiar and comfortable for you.					

Criteria: Interaction

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. There any arrows or buttons to move between contents of the page or photos to interact with interface.					
2. You can drag and drop across the interface.					
3. You can save the image or copy any text from the site.					
4. There are meaningful signs on buttons or on shapes or instructions to let you know what will happen before executing the action.					
5. Appear an explanatory message to explain why and how to avoid the error when it occurs.					
6. There feedback that appears after performing activity to show you what it did.					
7. The response is immediate.					
8. The elements of the site have a reasonable size to interact with them (Possibility of pressing the buttons).					
9. The position of menus, buttons and search box in the suitable place on the edges and corners.					
10. Site is simple, uncomplicated and learnable.					

Criteria: Page display, layout and site structure

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Information is found where you would predict that it will be.					
2. The intra-page navigation work effectively and logically.					
3. The navigational heading categories are logically grouped.					
4. You can know where you are on the site at all times.					
5.You can find information easily.					
6. Items are related to each other within website.					
7. Labeling of information on the site is effective.					
8. The structure and layout of site facilitate usage in any way.					

Criteria: Navigation

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Navigation labels are clear and meaningful.					
2. The actions and instructions are visible or easily retrievable whenever appropriate.					

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3. The hyperlinks of the content area are obvious.					
4. The transition between the related pages and among different sections is easy.					
5.There are different types of navigation easy navigation processing.					
6. The results of the research process are related to that which is looked for.					

Criteria: Interface Design

Flexibility and Efficiency

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The interface is simple.					
2. The interface uses common and consistent elements.					
3. The interface elements are arranged.					

Useful

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The page layout is purposeful.					

Attractiveness

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The use of colors and textures is shining, consistent and draw attention.					

Findable

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Domain name (URL) is guessable and meaningful to users.					
2. Domain name (URL) is memorable and easy.					

Criteria: Information Design

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The information appear natural and logical.					
2. Labels communicate information efficiently and clearly.					
3. Typography is legible, readable, and appealing when displayed.					
4. Icons refer to its purpose (their shape similar to what they are).					
5. Content information is used by priority.					
6. Placement of information helps you for scanning and readability.					

Criteria: Aesthetics

Statement	Severity Rating				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. All the elements on the page show together.					
2. All the elements are arranged properly and design is understandable and clear.					
3. The font size of the text is proper and suitable.					
4. the font style of the text is readable.					
5. The font color is suitable for each text and specifies the importance of the text.					
6. The site is attractive and smooth.					
7. The placement of items help draw attention to important pieces of information.					
8. The logo and the title of the site indicate the nature and objectives of the site.					
9. The size of images and shapes suitable.					
10. The position of each element is clear for its relevance.					
11. There any white space to understand each part separately.					

Thanks for your time and cooperation.