

1. Introduction

1.1 Introduction

QUALITY models are important since they allow us to evaluate the main characteristics of a software product, especially for software that are useful for citizens such as E-government systems.

Many government organizations have applied the capability of electronic media to upgrade services from direct contacts with government organizations to services provided through electronic media. This is called electronic Government services (e-Government services). The e-Government services can replace the government's traditional services for better quantity, quality, and satisfactory results using Information and Communication Technology (ICT).

The services are provided to related stakeholders such as citizens, non profit organizations, private sectors, and public sector organizations. E-Government services aim at providing services to promote government commerce which help save time and increases the quantity of services per time unit.

We need a quality model for e-Government services organizations to acquire the necessary drive and motivation in the form of 'push services' or called the supply side, and to increase the trust of related stakeholders to use the services in the form of 'pull services' or called the demand side. Both views are considered mainly from the needs and satisfaction in e-Government services of related stakeholders.

In this research quality models are going to be that used to evaluate and assess an e-government services that is provided by the e-government organizations and this research focus my study to maturity model also are propose a best practices quality model for E-Government website in Sudan base on maturity model.

1.2 Research problem

- There is no suitable model in Sudan that evaluates and assesses the websites and services that government provides to citizens through the electronic devices. A few available model not cover all issues of designed e-government websites
- There is a need to propose a new model for evaluating the quality e-government websites covers all issues of websites.

1.3 Research overview

This research presents a theoretical model to evaluate the quality of e-government Websites. The model is called WEGM (Website E-Government Model).

The model develops an instrument for evaluating the quality e-government services and Websites.

1.4 Research aim

The aim of this research is to propose a model for evaluating of e-government website in Sudan.

1.5 Research Objective

1. Study available models in the literature, comparing and contrasting them in order to propose a model.
2. Construct the Proposed model for the evaluation of e-government website in Sudan.

1.6 Thesis Outline

The outline of the thesis is as follows:

Chapter 2 present the literature review related to E-government services and E-government QM, Chapter 3 describe the research methodology used in the thesis, Chapter 4 describes the results, and finally Chapter 5 presents the conclusions and recommendations of the thesis

2. LITERATURE REVIEW

2.1 Introduction

A quality model of E-government services is very important to evaluate and assess in order to provide satisfaction and correct services to citizen and stakeholders.

2.2 E-Government system

E-government is still an exploratory knowledge area and consequently it is difficult to define e-government accurately Davies, P. (2007) [19] , however the most used definition of e-Government and the one adopted by this research is the definition adapted from state the name of the author Cascadis (2007) [20]. According to Cascadis' definition E-Government is “the continuous transformation of public sector internal and external relationships through internet-enabled operations, information and communication technology to optimize service delivery, constituency participation and public governance.”

2.3 Classification of E-Government Services Interaction

It is strongly believed that the essence of government centers on relationships Asgarkhani, M. (2005) [21]. Therefore, one of the major concerns of e-services is to interconnect various stakeholders with the government entities. However, due to the diversity of stakeholders' needs, e-services are classified into different realms: citizens, businesses, government and employees. These categories are abbreviated respectively into G2C, G2B which present the interaction of government with external users, and G2E, G2G which are for internal purposes Backus, M. (2001) [22].

Figure 2.1 adopted from name Wei, X. and Zaho, J. (2005) [23] with a slight modification to include G2E shows the different e-services' interactions.

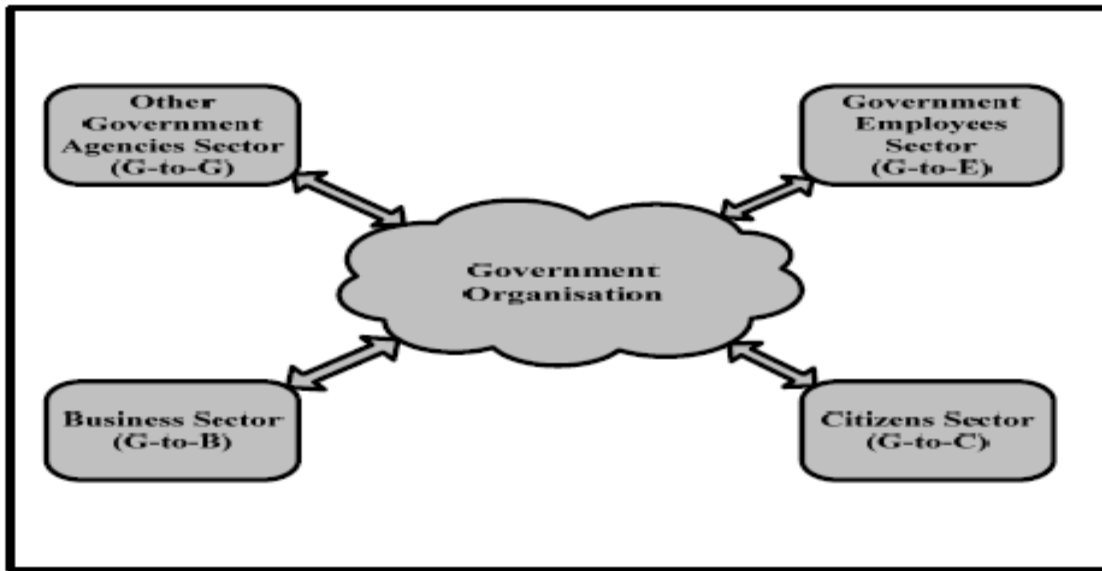


Figure 2.1 : E-government Services Interaction with Community Sectors

2.4 The Research Context: E-government in Sudan

The E-Government project in Sudan is the responsibility of the National Information Centre (NIC). This centre was formed in 2004, and it is in charge of all ICT related projects within government. Initially the centre worked under the command of the Council of Ministers. After the creation of the Telecommunications and Information Technology Ministry, the NIC became one of its administrations. The E-Government project implementation will carry out the daily process automation and reengineering the existing process for optimizations to save time and cost. E-Government implementation will offer opportunities for citizens, business and others stakeholders to participate in decision making by allowing them to provide and share their own ideas and suggestion in online communities.

The government of Sudan has carried out few projects for E-Government implementation comparing with others nations adopted E-Government projects. For example Sudan government has carried out National Identification System which started in 2010, E-Passport in the year 2009 and E-license and others. Although E-Government encompasses a wide range of activities and areas, we can concentrate on some public sector institutions in Sudan have priorities to adopt E-Government in their work to improve the work and performance as follows:

2.4.1 Education

Education field E-Government can enable through the following:

School and institutes online management or electronic management, which enable and speedup the information flow in and between the school and the local education administrations, states ministry of education and federal ministry of education. Also, the application of E-G in the education sector could promote the school and families digital interaction, save a staff records for promotions and training chances even so, illustrate the needs of staff appointment and so on.

2.4.2 Health field

The implementation of E- Government will enhance the possibility of the hospital clinical information automation which lead to electronic health records and online emergency desk, thus result in digitalization of prescription and medical certificate cycle. All these can promote the citizen life due to expedite and easiness of delivering the government services throughout using the new technologies.

2.4.3 E-Justice

The implementation of E- Government could result in improving the productivity and efficiency in the justice system; this can be achieved through keeping electronic records of justice to fastening the sort, storage and retrieval of the needed records. In recent apart from justice cases the court administration in Sudan has established computerize land management systems to overcome the land registration problems.

2.4.4 Electronic office environment

E-Government will lead to assigning tasks electronically, accessing documents online, meeting schedule and mail checking electronically all these lead to reduce the use of papers which will help in cost reduction in office tasks

2.5 Sudan e-government initiatives

For Sudan to flourish and prosper need to become innovative users of Information and Telecommunication Technology (ICT), and have a high performing government that providing efficient electronic services to all citizens, thus there are some public sectors institutes initiated to adopt and implement web services to provide, deliver and disseminate services and information to the public such as the following institutions:

2.5.1 Mohe e-government initiative

MOHE (Ministry of High Education) established National Universities Network (NUN) project with aim of facilitating access to information and delivering services electronically. Therefore, there are two main initiatives under the NUN project:

- The Sudanese universities information network
- The Sudanese universities virtual library

The goal of these initiatives is to provide connectivity among educational institutions, increase sharing of knowledge, guide the universities and the institutes to build their information infrastructure and enable digital libraries. This project has serves a large number of students and staff members.

2.5.2 Ebs e-government initiative

CBOS (Central Bank of Sudan) in 1999 established EBS (Electronic Bank System) the company introducing technological banking solutions with aim of linking the

banks electronically through the country and provide electronic payment services in and out of the country. EBS started its activity in mid 2000 and began project implementation in early 2001 [11]. This initiative results in changing the old bank system to modern fast and efficient bank systems, due to EBS adopted several services such as National Electronic Cheque Clearance, Card Personalization Services and Banking Information Network Services etc.

2.6 Reviews for Related Work

The field of Quality model of E-government Service research has been extensively examined by researchers like:

2.6.1 E-government Maturity Models

An Overview

Layne and Lee [4] developed a four stages maturity model of e-government. The model is developed based on observations on e-government initiatives in the US. The stages of the models are:

1. Catalogue: At this stage, the public authority is presented on the web.
2. Transaction: The citizen at this stage can make transactions with the government.
3. Vertical integration: This stage, involves integration with higher level systems within similar functionalities or jurisdictions.
4. Horizontal integration: Systems at this stage are integrated across various government jurisdictions, the e-portals are real one stop shops for citizens.

Andersen and Henriksen [5] developed a four stage maturity model of e-government. The maturity model was used in Denmark in an assessment of 110 state agencies. The stages of the model are:

1. Cultivation: At this stage, horizontal and vertical integration is present along with the use of intranet by governments.
2. Extension: At this stage, there is an extensive use of intranet. The stage also features customized Web interfaces and extensive use of intranet.
3. Maturity: At this stage, there is an abandoning of intranet. The organization is mature and the processes are transparent.

International Journal of Software Engineering & Applications (IJSEA) [24]

4. Revolution: At this stage, data can be shared between organizations and also applications can be shared across vendors.

The United Nations developed a four stage maturity model of e-government. The maturity model was used for ranking the UN member states. The stages of the models are:

1. Emerging information services: In this stage, e-government Web sites provide static information.
2. Enhanced information services: In this stage, the presence is enhanced with one way or simple two way communication.
3. Transactional services: In this stage, a two way interaction with citizens is possible.
4. Connected services: In this stage, Web sites are proactive in requesting citizens' feedback via Web 2.0 tools. Government agencies are citizen centric and services are customer centric.

Alhomod et al. [7] developed a four stage maturity model of e-government. The stages of the models are:

1. Presence on the web: At this stage, the e-portal provides only information.
2. Interaction between the citizen and the government: At this stage, the user can download and email forms to the concerned authority.
3. Complete transaction over the web: At this stage, citizens are able to complete entire tasks over the internet.
4. Integration of services: At this stage, various departments share information with each other.

Hiller and Belanger developed a five stage maturity model of e-government. The stages of the models are:

1. Information: It represents the most basic form of Web sites i.e. posting information.
2. Two way communications: It involves communication between the citizens and the government.
3. Transaction: At this stage, online services and financial transactions are available for use by citizens.
4. Integration: At this stage, all services are connected. A single e-portal can be used to access all e-government services.

5. Participation: It features political participation, posting comments and voting.

Almazan and Gil-Garcia (IJSEA) [7] developed a six stage maturity model of e-government. The maturity model was used in Mexico in a systematic analysis of 32 state portals. The authors concluded that Mexican state portals are in the initial stages of electronic government. Besides that the authors provided weaknesses of those e-government portals. The stages of the models are:

1. Presence: At this stage the Web site contains static and limited information.
2. Information: At this stage, information is frequently updated and there is a greater number of available WebPages.
3. Interaction: At this stage, the users can download forms and communicate with the government by mail.
4. Transaction: This stage features secure online Web services with the possibility of payments.
5. Integration: This stage offers a one stop shop to the citizens.
6. Political participation: At this stage users can vote and participate in opinion surveys and public forums.

Cisco developed [10] a three stage maturity model of e-government. The stages of the models are:

1. Information interaction: This stage features departmental Web sites, legislative posting, public notices, online forms, webcasting and personalized e-portals.
2. Transaction efficiency: it is a citizen self-service e-portal that can include electronic payments like online taxes and e-procurement.
3. Transformation citizen centric: The administrative services at this stage are consolidated and shared across various government jurisdictions.

Gartner group [11] developed a four stage maturity model of e-government. The stages of the models are:

1. Web presence: At this stage, the Web site is static and used to provide basic information to the citizen.
2. Interaction: This stage features tools for interaction with stakeholders like search engines, documents downloading and emails.
3. Transaction: At this stage the user can perform complete transactions online. This includes payments like buying and selling.

4. Transformation: At this stage, the processes are integrated and personalized. West developed a four stage maturity model of e-government. The maturity model was used in a content analysis of US state and federal governmental Web sites. This included 1,813 government Web sites in 2000, and a follow-up study of 1,680 government Web sites in 2001. The authors concluded that many government agencies have mastered the first and second stage, while few government Web sites have achieved the 3rd and 4th stage. The stages of the models are:

1. Bill-board: At this stage, Web sites are just billboards mainly used for posting information (IJSEA) [7].
2. Partial-service-delivery: At this stage, users have the ability to search for data via search engines with limited online services.
3. Portal or the one stop shop portal: At this stage, all information and services are located in a single place.
4. Interactive democracy: The e-portal at this stage offers personalization, push technology and feedback forms.

Moon developed a five stage maturity model of e-government. The authors examined the current state of municipal e-government initiatives in the US based on data from 2000 e-government surveys for municipalities. The authors concluded that e-government was adopted by municipalities but it is still in an early stage. The stages of the models are:

1. Simple information dissemination (one-way communication): At this stage, governments are simply posting data and information on the Web sites.

1. Two-way communication (request and response): This stage features an interactive mode between the governments and the stakeholders. Email systems and data transfer technologies are also present at this stage.

2. Service and financial transactions: At this stage, the users can execute self services with the possibility of electronic payments.

3. Integration (horizontal and vertical integration): This stage features horizontal and vertical integration which help data sharing between various departments.

4. Political participation: This stage features surveys, forums and online voting. It also focuses on political activities.

World Bank developed a three stage maturity model of e-government. The stages of the models are:

1. Publish: This stage features a variety of information published in the Web site. This includes rules, regulations, documents and forms.
2. Interact: In this stage, the users can provide feedback and submit comments on legislative or policy proposals.
3. Transact: In this stage, the users can complete secure transactions online.

Deloitte and Touches developed a six stage maturity model of e-government. The model was used in the following countries: Australia, Canada, New Zealand, the United Kingdom and the United States. The authors concluded that the majority of governments are at least in stage 1. The stages of the models are:

1. Information publishing: The Web site at this stage serves as a static way to provide information.
2. Official-two way transaction: This stage features transactions and exchange of information between the citizens and the governmental agencies.
3. Multipurpose portal: The e-portal at this stage is a single point of entry to provide services to the citizen (IJSEA) [7].
4. Portal personalization: At this stage, the e-portal can be personalized according to the citizen's needs.
5. Clustering of common services: At this stage, the services and processes are clustered to provide unified services to the customer.
6. Full integration and enterprise transaction: At this stage, the e-portal is fully integrated and the services are personalized to customer needs.

Howard developed a three stage maturity model of e-government. The stages of the models are:

1. Publish: At this stage, the government just publishes information about itself and its activities.
2. Interact: At this stage, the users can interact with the government via e-mails and chat rooms.
3. Transact: Where the users can complete transactions over the web.

Shahkooh et al. developed a five stage maturity model of e-government. The stages of the models are:

1. Online presence: At this stage, information is published online.
2. Interaction: At this stage, citizens can interact with governments by emailing officials and downloading forms.
3. Transaction: The users at this stage can conduct secure transactions like payments and tax filling.

4. Fully integrated and transformed e-government: At this stage government services are organized as a single point of contact.
5. Digital democracy: This stage features online voting, public forums and opinion surveys.

Lee and Kwak proposed a five stage maturity model of e-government which focus on open government and the use of social media and Web 2.0 tools. The model was developed based on case studies from US Healthcare Administration agencies. The stages of the models are:

1. Initial conditions: This stage is a one way static interaction with the citizen. It is only used for broadcasting information to the public.
2. Data transparency: At this stage, the use of social media is limited. Feedback is get from the public on usefulness and data quality.
3. Open participation”: This stage features social media tools to increase open participation. Input from the public is welcomed and used in policy decisions. This stage includes also e-Voting and e-Petitioning.
4. Open collaboration: This stage features interagency collaboration by sharing data and public input. Public contests are organized and data is analyzed for obtaining new insights and improving decision-making.
5. Ubiquitous engagement: At this stage, data is easily accessed by mobile devices and tablets. Data is vertically and horizontally integrated. Besides that, data analytics is (IJSEA) [7] used for decision making processes. The agencies are focused on enabling continuous improvements.

Siau and Long [19] developed a five stage maturity model of e-government. The stages of the models are:

1. Web presence: Web sites at this stage contain only static information.
2. Interaction: This stage provides a simple interaction like forms download and features basic search engines and email systems.
3. Transaction: In this stage, the users can perform complete transactions over the web.
4. Transformation: This stage includes vertical and horizontal integration. The governments provide a single unified e-portal.
5. E-democracy: This stage features tools for online voting, polling and surveys to enable political participation and citizen engagement.

Wescott developed a six stage maturity model of e-government that focuses on the development of e-government in the Asia-Pacific region. The authors

concluded that most of the Asia-Pacific countries are still in the initial phases of e-government. The stages of the models are:

1. Setting up an email system and internal network: This stage features e-mail systems to improve information sharing, coordination and feedback.
2. Enabling inter-organizational and public access to information: At this stage, information is department centric, shared between organizations and can be accessed by the public over the internet.
3. Allowing 2-way communication: This stage features online services. The citizens can make suggestions using emails or ask questions in forums and receive answers.
4. Allowing exchange of value: This stage features applications such as tax assessments and license renewals. At this stage, the citizen can make secure payments on the Web.
5. Digital democracy: This stage focuses on empowering the civil society (ex. increasing awareness of government corruption) and allowing citizens to vote and express their opinions and feedback.
6. Joined-up government: At this stage, citizens can execute services without knowing which government agency is responsible for. Vertical and horizontal integration is present at this stage.

Chandler and Emanuel developed a four stage maturity model of e-government. The stages of the models are:

1. Information: This stage features the availability of online information about government services and policies.
2. Interaction: This stage features basic level of interaction between governments and citizens such as email systems (IJSEA) [7].
3. Transaction: At this stage, the user can conduct transactions online.
4. Integration: This stage features integrated services across various departments and agencies.

Kim and Grant developed a five stage maturity model of e-government. The stages of the models are:

1. Web presence: This stage features simple and limited information available on the web.
2. Interaction: This stage features search engines and downloadable forms.
3. Transaction: This stage features online transactions with the possibility of electronic payments.

4. Integration: This stage features horizontal and vertical integration. Moreover, performance can be measured at this stage using statistical techniques.
5. Continuous improvement: This stage features political activities. Besides that, there is a great focus on continuous improvements.

Chen et al. developed a three stage maturity model of e-government. The model was proposed based on theoretical research and the authors' experience in China's regional e-government. The stages of the models are:

1. Catalogue: At this stage, there is an online presence on the web. The stage features presentation catalogue and downloadable forms.
2. Transaction: This stage features working databases supporting online transactions. Services and online forms are also made available at this stage.
3. Vertical integration: This stage features vertical integration with higher levels within similar jurisdictions.

Windley developed a four stage maturity model of e-government. The model was applied to the 'Utah.gov' state portal in the US. The author concluded that the portal is solidly at the second stage of maturity. The stages of the models are:

1. Simple Web site: This stage features static pages with downloadable forms.
2. Online government: This stage features interaction mechanisms such as emails, Web forms, help and FAQs.
3. •Integrated government: This stage features end to end transactions. Moreover, information is shared between departments at this stage.
4. Transformed government: At this stage, the services are customer centric and organized according to citizens' needs and segmented according to population groups and life events. Vertical and horizontal integration is also present at this stage.

Reddick developed a two stage maturity model of e-government. The model was used in the US context in examining the current stage of municipal e-government in the American cities. (IJSEA) [7] Author concluded that the G2C Websites are in the first stage of maturity. The stages of the models are:

1. Cataloguing: At this stage, information about the government and its activities is presented on the web.
2. Transactions: At this stage, citizens can make transactions over the web. Furthermore, one stop shops are considered as a desired feature at this stage of maturity.

Accenture developed a five stage maturity model of e-government. The model was used to rank the following countries in e-government: Canada, Singapore, United States, Denmark, Australia, Finland, Hong Kong, United Kingdom, Belgium, Germany, Ireland, France, The Netherlands, Spain, Japan, Norway, Italy, Malaysia, Mexico, Portugal, Brazil, and South Africa.

The stages of the models are:

1. Online presence: At this stage, information is published online.
2. Basic capability: At this stage, security and certification is developed. The online presence is broad.
3. Service availability: At this stage, many services are available in the e-portal. This stage also features cross agency cooperation. Moreover, the services are designed to meet customer needs.
4. Mature delivery: At this stage, the services are clustered. There is a clear ownership and authority – CIO (Chief Information Officer) or central agency. The customer is involved in the process of e-government and the services are marketed.
5. Service transformation: At this stage, improved customer service delivery is the target. This stage also features multichannel integration.

The UK National Audit Office presented a report to the House of Commons, in which an e-government maturity model was developed using five stages. The stages of the models are:

1. Basic site: At this stage, few pages are available in the Web site which gives basic information about the agency.
2. Electronic publishing: At this stage, the Web site contains many pages.
3. E-publishing: This stage features personalization options and customizable search tools. Some forms can be submitted online and others can be downloaded. Moreover, at this stage there is an extensive use of emails and the responses are timely. Besides that, email alerts to notify the users about new content is an offered functionality.
4. Transactional: At this stage, the users make secure transactions over the Web.
5. Joined-up e-governance: This stage features one stop shops and joined up governments (vertical and horizontal integration).

Netchaeva developed a five stage e-government maturity model without giving names to designate each stage. The stages of the models are:

1. Features online Web sites with department information.
2. Features FAQs and email systems.
3. Features forums and opinion surveys.
4. Features online services such as: license renewals and payment of fines.
5. Features one stop shops. The citizens can vote, contribute in online discussions and make comments on policy and legislation proposals.

2.7 Comparison of The E-government Maturity Models

Several authors have conducted a synthesis based on existing maturity models and then provided their own maturity model. Examples of these studies are as follows:

- Almazan and Gil-Garcia provided their six stage maturity model after a synthesis of 5 theoretical models (out of the 25 in this study) including the United Nations and the American Society for Public Administration, Hiller and Belanger, Layne and Lee, Moon, and Holden et al.
- Shahkooch et al. presented their five stage maturity model after reviewing 9 (out of the 25 in this study) maturity models including Deloitte and Touche, UN, Layne and Lee, Accenture, Gartner, World Bank, Wescott, West, and Hiller and Belanger maturity models. The authors provided a mapping between their maturity model and the compared maturity models.
- Siau and Long compared 6 (out of the 25 in this study) e-government maturity models including UN, Hiller and Belanger, Deloitte and Touche, Layne and Lee, Moon, and Gartner before introducing their model. The authors applied a quantitative meta synthesis approach to integrate those maturity models into a new synthesized one.
- Kim and Grant provided their 5 stage maturity model after making a literature review of seven maturity models (out of the 25 in this study) including Layne and Lee, the United Nations, the American Society for Public Administration, Moon, Siau and Long, Anderson and Henriksen, and Hiller and Belanger. However, in those studies the authors did not provide weaknesses and strengths of each maturity model. Besides that, the authors did not compare the maturity models between them based on some criteria such as stages focus, features and names etc. Moreover, the fact of missing many e-government maturity models from literature could yield into missing best practices in their new maturity models.

Compared to the above studies, the comparison conducted in this paper takes a large number of e-government maturity models that is 25 (see previous section). Moreover, we highlighted 4 main issues related to the e-government maturity models:

- Maturity models' stage names.
- Maturity models' stage numbers, year and country.
- Maturity models' stage focus.
- Maturity models' stage features.

The result of this comparison and discussion is useful in order to identify the strengths & weaknesses of the existing maturity models and to figure out what is missing in these maturity models in order to take them into account in the new e-government maturity model dedicated for e-government e-portals. 3.1. Maturity models' stage names

From our investigation of the 25 e-government maturity models, we have noticed that this table:

Model \ Stage	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Layne and Lee [4]	Catalogue	Transaction	Vertical integration	Horizontal integration	NA	NA
Andersen and Henriksen [5]	Cultivation	Extension	Maturity	Revolution	NA	NA
United Nation [6]	Emerging information services	Enhanced information services	Transactional services	Connected services	NA	NA
Alhomod <i>et al.</i> [7]	Presence on the web	Interaction between the citizen and the government	Complete transaction over the web	Integration of services	NA	NA
Hiller and Belanger [8]	Information	Two way communication	Transaction	Integration	Participation	NA
Almazan and Gil-Garcia [9]	Presence	Information	Interaction	Transaction	Integration	Political Participation
Cisco [10]	Information interaction	Transaction efficiency	Transformation citizen centric	NA	NA	NA
Gartner group [11]	Web presence	Interaction	Transaction	Transformation	NA	NA
West [12]	Bill-board	Partial-service-delivery	Portal	Interactive democracy	NA	NA
Moon [13]	Simple information dissemination	Two-way communication	Service and financial transactions	Integration	Political participation	NA
World Bank [14]	Publish	Interact	Transact	NA	NA	NA
Deloitte and Touche [15]	Information publishing	Official-two way transactions	Multipurpose portals	Portal personalization	Clustering of common services	Full integration and enterprise transaction
Howard [16]	Publish	Interact	Transact	NA	NA	NA
Shahkooh <i>et al.</i> [17]	Online presence	Interaction	Transaction	Fully integrated and transformed e-government	Digital democracy	NA
Lee and Kwak [18]	Initial conditions	Data transparency	Open participation	Open collaboration	Ubiquitous engagement	NA

Table2.1. Maturity models' stage names

3. Methodology

3.1 Introduction

This presents the proposed model for evaluating the quality of e-government Websites. The model is called WEGM (Website E-Government Model). The model provides an instrument for evaluating the quality of e-government e-service and Websites. The model will be used to evaluate the following:

- 1- Website design
- 2- Navigation
- 3- Website aesthetics
- 4- information quality
- 5- Security
- 6- Communication

The model also highlights the factors that influencing the quality of e-government Websites as follows:

- 1- usability
- 2- Content
- 3- Services
- 4- Citizen participation and features.

3.2 The Proposed Model

This study proposed a model for assessing the quality of website the model call WSQM (Website Quality Model). The proposed model determined the quality of E-governments websites.

The model suggests factors that designers of E-government websites should take into consideration when designing website.

There are:

Accessibility, Navigation, Design, Content and Security

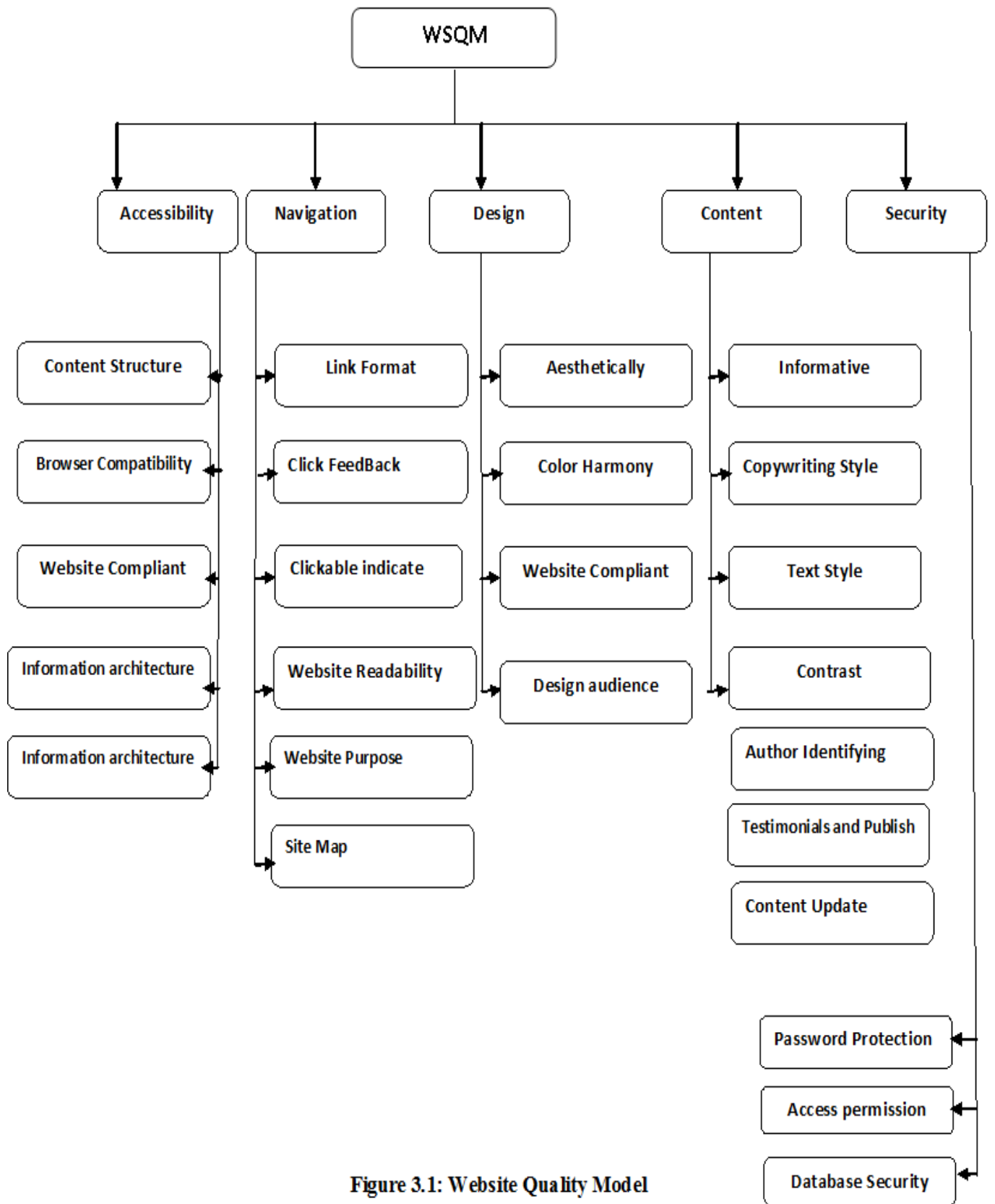


Figure 3.1: Website Quality Model

Table [3.1] below provides detailed description of the characteristic of model.

#	Characteristic	Description
1.	Accessibility	<ul style="list-style-type: none"> ▪ Content structurally separate from navigation elements. ▪ Website cross-browser compatible ▪ Website compliant with W3C coding standard ▪ 'Alt' tags in place on all significant images ▪ Text-based alternatives in place to convey essential information if this is featured within images or multimedia
2.	Navigation	<ul style="list-style-type: none"> ▪ Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text ▪ Responsive on click feedback given immediately after a click is made on a hyperlink ▪ Clickable items stylistically indicate that they are clickable ▪ Is the website readable consider type face , font size and color ▪ The purpose of website must be clear ▪ Available logical site map and a keyword-based search feature
3.	Design	<ul style="list-style-type: none"> ▪ The design of website must be aesthetically appealing ▪ Colors harmony and logically related ▪ The website design audience must be appropriate (font must be readable)
4.		<ul style="list-style-type: none"> ▪ The website copy succinct must be but informative ▪ The copywriting style suit the website purpose and speak

	Content	<p>to its target audience</p> <ul style="list-style-type: none"> ▪ Text must be resize through the browser or do CSS settings restrict size alternation ▪ The contrast between text and its background color sufficient to make reading easy on the eyes ▪ Text must be broken into small and readable chunks ▪ Website must have about us page to identifies the author of the content ▪ Website must have testimonials and publish them on the site ▪ The content update must be regularly
5.	Security	<ul style="list-style-type: none"> ▪ Password must be protected via .htaccess ▪ The public non-document directories must be index able or are blank index.html pages or appropriates permission settings in place to block access ▪ Customer data store in database must protected from external access
Total		

3.3 Collecting and Measuring Data

3.3.1 Data Collection

The propose template used to collect data

Table [3.2]: Proposed Template

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	4
3.	Website compliant with W3C coding standard	4
4.	'Alt' tags in place on all significant images	4
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	4
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	4
7.	Responsive on click feedback given immediately after a click is made on a hyperlink	4
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	4
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-	4

	based search feature	
12.	The design of website must be aesthetically appealing	4
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	4
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	4
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	4
20.	Website must have about us page to identifies the author of the content	4
21.	Website must have testimonials and publish them on the site	4
22.	The content update must be regularly	4
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4

25.	Customer data store in database must protected from external access	4
Total		100%

3.3.2 Measuring the factors

Point scoring method

Table [3.3]: Factor Percentage Evaluation

Grade	Interpretation
4	quality factor is available
2	a good percentage of the factor is available
0	quality factor is NOT available

3.4 Tools

This research used a survey to evaluate and assess the selected website also it used Website testing for BDC website to evaluate that websites it cover some factors in this research. The domain name of it is Website testing for BDC

3.5 E-government websites

This research will use some e-government website in Sudan to evaluate and assess it. this website provides services to citizens.

This website is:

1. Khartoum university website
2. Neelain university website
3. High educational ministry website
4. Sudan e-government website
5. Parliament website

6. Council of states website

Purposive sampling techniques were used to gather subjects, that is, Websites for the study. The template apply for this websites because it's a very famous popular website and all Sudanese citizen visited it .The data analysis is a Website that had some information about

- country of Sudan
- deferent news that is relisted to government in Sudan like (ministries news , hot news like the result of secondary school,.....etc)
- the guide of services that's provided by government
- guide to related link of e-government websites like ministries and government organizations
- And others of related government information.

The web site address is:

<http://www.esudan.gov.sd>



Figure 3.2 Sudan e-government website



Figure 3.3 Sudan e-government website

Also proposed model are assessing the website of parliament of the Sudan that is provide information about parliament and

- Information about council of states
- Activities of parliament
- Provide documentation that related with parliament
- General news that related with e-government in Sudan
- Archive of news

The website address is: <http://www.parliament.gov.sd/ar/index.php/site>

File Edit View History Bookmarks Tools Help

...بوابة حكومة السودان | ...جمهورية السودان | المجلد

www.parliament.gov.sd/ar/index.php/site

Search

English

جمهورية السودان
المجلس الوطني

الرئيسية الهيئة التشريعية عن المجلس الوطني الأمانة العامة اللجان الأنشطة والأعمال الوثائق الكتل والمجموعات البرلمانية إتصل بنا

خطاب السيد/ رئيس الجمهورية أمام الهيئة التشريعية القومية في افتتاح أعمال دور الانعقاد الثالث أبريل 2016م

خطاب السيد / رئيس الجمهورية في الجلسة الافتتاحية لدورة الانعقاد الثاني للهيئة التشريعية 19 أكتوبر 2015م

خطاب فخامة المشير عمر حسن أحمد البشير أمام الهيئة التشريعية القومية بمناسبة أدائه اليمين الدستورية رئيساً

خطاب السيد/رئيس الجمهورية أمام الهيئة التشريعية القومية الخميس 30 أكتوبر 2014م

رؤساء المجلس الوطني

رئيس المجلس الوطني - / البروفيسور ابراهيم احمد عمر

السابق <<

أخبار المجلس جدول الأعمال أنشطة اليوم أنشطة قادمة

ندوة بالبرلمان تشجيع الدول الإفريقية المصادفة للتصالح مع المحكمة الجنائية الدولية

التاريخ: 02-08-2016

أكد رئيس المجلس الوطني بروفيسور ابراهيم احمد عمر لدى مخاطبته بمقر المجلس الوطني اليوم الندوة التي نظمتها لجنة التشريع والعدل حول المحكمة الجنائية في الميزان أكد ان المحكمة الجنائية الدولية اضرت بمفاهيم العدالة والعالمية وقال ان تنشئة هذه المحكمة بأنها عالمية ظلم كبير لتكيز وتوطنين هذه المفاهيم التي لطختها بأيد

بحث في الموقع

اكتب كلمة البحث

بحث

بحث متقدم

Figure 3.4: Parliament website

File Edit View History Bookmarks Tools Help

www.parliament.gov.sd/ar/index.php/site

التاريخ: 02-08-2016

استمع بروفيسور ابراهيم احمد الى شرح للأوضاع السياسية والأمنية على الساحة الصومالية جاء ذلك لدى لقائه رئيس لجنة العلاقات الخارجية والتعاون الدولي بالبرلمان الصومالي الدكتور عبد الغادر عيسى على الذي أكد على اهتمام الصومال بحكومة وشعبها على تطوير العلاقات مع السودان مؤكدا حرص البرلمان الصومالي على تنسيق العمل مع المجلس الوطني على مستوى المنظمات الدولية مشيدا بالدعم الذي تجده الصومال من السودان في كل قضاياها الداخلية على الصعيد الدولي

المزيد <<

التاريخ: 30-07-2016

رئيس البرلمان يخاطب المنقلى التفاوضي لرؤساء المجالس التشريعية بالولايات

خاطب بروفيسور ابراهيم احمد عمر رئيس الهيئة التشريعية القومية بمقر المجلس الوطني اليوم الجلسة الافتتاحية للمنقلى التفاوضي الأول لرؤساء المجالس التشريعية بالولايات الذي نظمتها منظمة البرلمانيين السودانيين بحضور وزيرى العدل والحكم الاتحادي ورؤساء المجالس التشريعية بولايات السودان المختلفة ورؤساء لجان المجلس الوطني ومجلس الولايات وأكد البروف على اهمية المنقلى وتناوله لقضايا المؤسسات التشريعية والرقابية واهمية النظر فيها والتجاوز حولها وفاعليتها وقدرتها على القيام بأدوارها التشريعية في اطار النظام الدولي والرقابة على المال والاستعراض بالولايات ووجه رئيس الهيئة بأن تذهب مخرجات المنقلى للجهات المختصة ، من جهتها اكدت دكتورة بدرية سليمان نائب رئيس المجلس الوطني رئيس المنظمة ان المنقلى يأتي وعلى الاعتاب تقييم وتقييم الحكم اللامركزي

المزيد <<

التاريخ: 28-07-2016

رئيس الهيئة التشريعية القومية يخاطب منقلى المجالس التشريعية الولائية

بخاطب بروفيسور ابراهيم احمد عمر رئيس الهيئة التشريعية القومية الجلسة الافتتاحية للمنقلى التفاوضي الأول لرؤساء المجالس التشريعية الولائية الذي نظمه منظمة البرلمانيين السودانيين برئاسة دكتور بدرية سليمان بعد غد السبت بمقر المجلس الوطني الساعة العاشرة صباحا . ويقدم وزير الحكم الاتحادي كلمة بالاضافة لممثل رؤساء المجالس التشريعية وبدرية سليمان رئيس المنظمة .

المزيد <<

البرلمان الاتحادي

- المؤتمر 34 للاتحاد البرلماني الافريقي
- الاتحاد البرلماني الدولي

الخدمات

- تقارير الدورات
- تقديم العرائض والشكاوى
- المكتبة والمحوث
- خدمة الرسائل القصيرة
- الخدمات المؤقتة

الأعمال التشريعية

الميزانية العامة للدولة

الأعمال الرقابية

البريد الإلكتروني

البريد الإلكتروني

كلمة المرور

دخول

أذهب الى أرشيف الاخبار

Figure 3.5: Parliament website

Also proposed model are assessing the website of the Sudan that is provide information about parliament and

- Information about council of states
- Activities of council of states
- Provide documentation that related with council of states
- General news that related with e-government in Sudan
- Archive of news
- Contact us page

The website address is: <http://www.councilofstates.gov.sd>



Figure 3.6: council of states website

File Edit View History Bookmarks Tools Help

...بوابة حكومة السودان | مجلس الولايات

www.councilofstates.gov.sd Search

آخر تحديث

الاثنين 28 يونيو 2016

التاريخ : 28 يونيو 2016م

تم مجلس الولايات دورة انعقاده الثالثة يوم الثلاثاء 2016/6/28 حيث استمع لبيان السيد وزير مجلس الوزراء حول موقف تنفيذ قرارات مجلس الولايات كما استمع لتقرير حول أداء المجلس خلال دورة الانعقاد الثالثة .

التاريخ : 28 يونيو 2016م

بستمع مجلس الولايات في جلسته اليوم الثلاثاء 2016/6/28 لبيان السيد وزير مجلس الوزراء حول موقف تنفيذ قرارات مجلس الولايات كما يستمع لتقرير حول أداء المجلس خلال دورة الانعقاد الثالثة ومشروع قرار بنض دورة الانعقاد الثالثة

التاريخ : 27 يونيو 2016م

أجاز مجلس الولايات في جلسته اس الاثنين 2016/6/27 برئاسة الدكتور عمر سليمان آدم رئيس المجلس تقرير لجنة التنمية والخدمات حول بيان وزير الزراعة والغابات حول الخطة الوطنية للاستثمار الزراعي 2016-2020 قلمه يوسف العوض دبلو رئيس اللجنة.

التاريخ : 21 يونيو 2016م

أجاز مجلس الولايات في جلسته ليوم 2016/6/21 برئاسة الدكتور عمر

Figure 3.7: council of states website

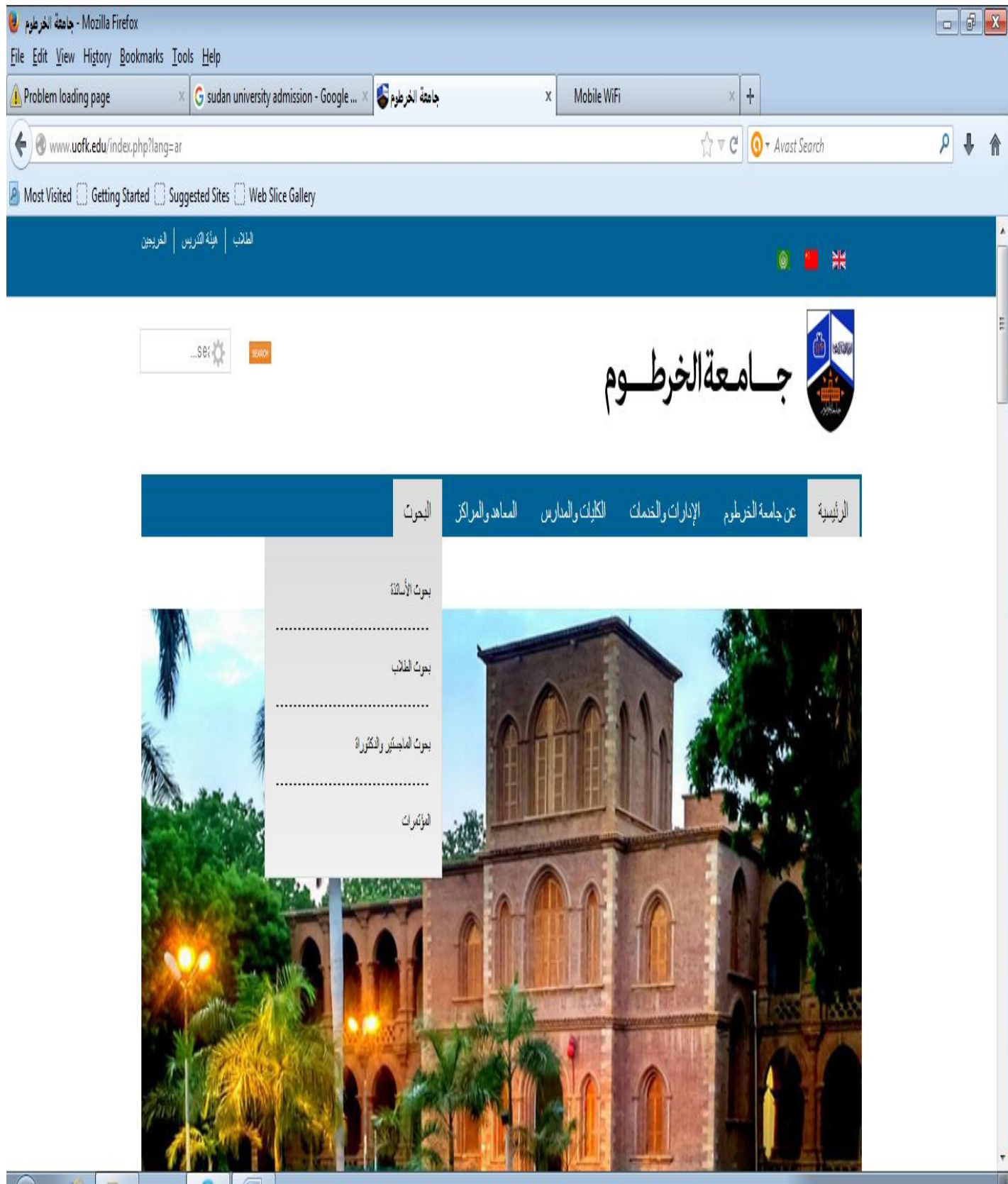


Figure 3.8: Khartoum university website



Figure 3.9: neelain university website



Figure 3.10: high educational ministry website

4.1 RESULTS

$$\text{Quality} = f(x) = \sum_{n=1}^{25} X$$

Where

x=model characters

n=factors

The proposed model was used to evaluate E-government websites in Sudan using the proposed template for measuring the quality characteristics of the model. The template was applied to e-government websites. The result of the evaluation showed the following:

1.

Table [4.1]: sudan e-government website assessment

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	4
3.	Website compliant with W3C coding standard	4
4.	'Alt' tags in place on all significant images	4
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	4
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	4
7.	Responsive on click feedback given immediately after a click is made on a	4

	hyperlink	
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	2
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-based search feature	4
12.	The design of website must be aesthetically appealing	4
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	2
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	4
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	2
20.	Website must have about us page to identifies the author of the content	4
21.	Website must have testimonials and publish	2

	them on the site	
22.	The content update must be regularly	4
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4
25.	Customer data store in database must protected from external access	4
Total		92

2.

The template was applied to the parliament e-government website and the result is:

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	4
3.	Website compliant with W3C coding standard	4
4.	'Alt' tags in place on all significant images	4
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	4
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	2
7.	Responsive on click feedback given	4

	immediately after a click is made on a hyperlink	
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	4
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-based search feature	0
12.	The design of website must be aesthetically appealing	4
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	2
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	2
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	4
20.	Website must have about us page to identifies the author of the content	4

21.	Website must have testimonials and publish them on the site	2
22.	The content update must be regularly	2
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4
25.	Customer data store in database must protected from external access	4
Total		86

Table [4.2]: parliament e-government website assessment

3.

The template was applied to the council of states e-government website and the result is:

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	0
3.	Website compliant with W3C coding standard	2
4.	'Alt' tags in place on all significant images	4
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	2
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	2
7.	Responsive on click feedback given immediately after a click is made on a hyperlink	2
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	2
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-based search feature	0

12.	The design of website must be aesthetically appealing	4
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	2
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	0
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	2
20.	Website must have about us page to identifies the author of the content	0
21.	Website must have testimonials and publish them on the site	2
22.	The content update must be regularly	2
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4
25.	Customer data store in database must protected from external access	4
Total		66

Table [4.3]: council of states e-government website

4.

The template was applied to the Khartoum university website and the result is:

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	4
3.	Website compliant with W3C coding standard	4
4.	'Alt' tags in place on all significant images	4
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	2
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	2
7.	Responsive on click feedback given immediately after a click is made on a hyperlink	4
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	4
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-based search feature	0
12.	The design of website must be aesthetically	4

	appealing	
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	2
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	4
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	4
20.	Website must have about us page to identifies the author of the content	4
21.	Website must have testimonials and publish them on the site	4
22.	The content update must be regularly	4
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4
25.	Customer data store in database must protected from external access	4
Total		96

Table [4.3]: Khartoum university website

5.

The template was applied to the neelain university website and the result is:

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	0
3.	Website compliant with W3C coding standard	2
4.	'Alt' tags in place on all significant images	2
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	4
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	4
7.	Responsive on click feedback given immediately after a click is made on a hyperlink	4
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	4
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-based search feature	4
12.	The design of website must be aesthetically	4

	appealing	
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	4
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	4
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	4
20.	Website must have about us page to identifies the author of the content	4
21.	Website must have testimonials and publish them on the site	4
22.	The content update must be regularly	4
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4
25.	Customer data store in database must protected from external access	4
Total		92

Table [4.3]: neelain university website

6.

The template was applied to the high educational ministry website and the result is:

#	Factor	%
1.	Content structurally separate from navigation elements.	4
2.	Website cross-browser compatible	0
3.	Website compliant with W3C coding standard	2
4.	'Alt' tags in place on all significant images	4
5.	Text-based alternatives in place to convey essential information if this is featured within images or multimedia	2
6.	Link labeled with anchor text that provide a clear indication of where they lead without over using exact match anchor text	2
7.	Responsive on click feedback given immediately after a click is made on a hyperlink	4
8.	Clickable items stylistically indicate that they are clickable	4
9.	Is the website readable consider type face , font size and color	2
10.	The purpose of website must be clear	4
11.	Available logical site map and a keyword-based search feature	0

12.	The design of website must be aesthetically appealing	4
13.	Colors harmony and logically related	4
14.	The website design audience must be appropriate (font must be readable)	2
15.	The website copy succinct must be but informative	4
16.	The copywriting style suit the website purpose and speak to its target audience	4
17.	Text must be resize through the browser or do CSS settings restrict size alternation	0
18.	The contrast between text and its background color sufficient to make reading easy on the eyes	4
19.	Text must be broken into small and readable chunks	2
20.	Website must have about us page to identifies the author of the content	4
21.	Website must have testimonials and publish them on the site	4
22.	The content update must be regularly	2
23.	Password must be protected via .htaccess	4
24.	The public non-document directories must be indexable or are blank index.html pages or appropriate permission settings in place to block access	4
25.	Customer data store in database must protected from external access	4
Total		84

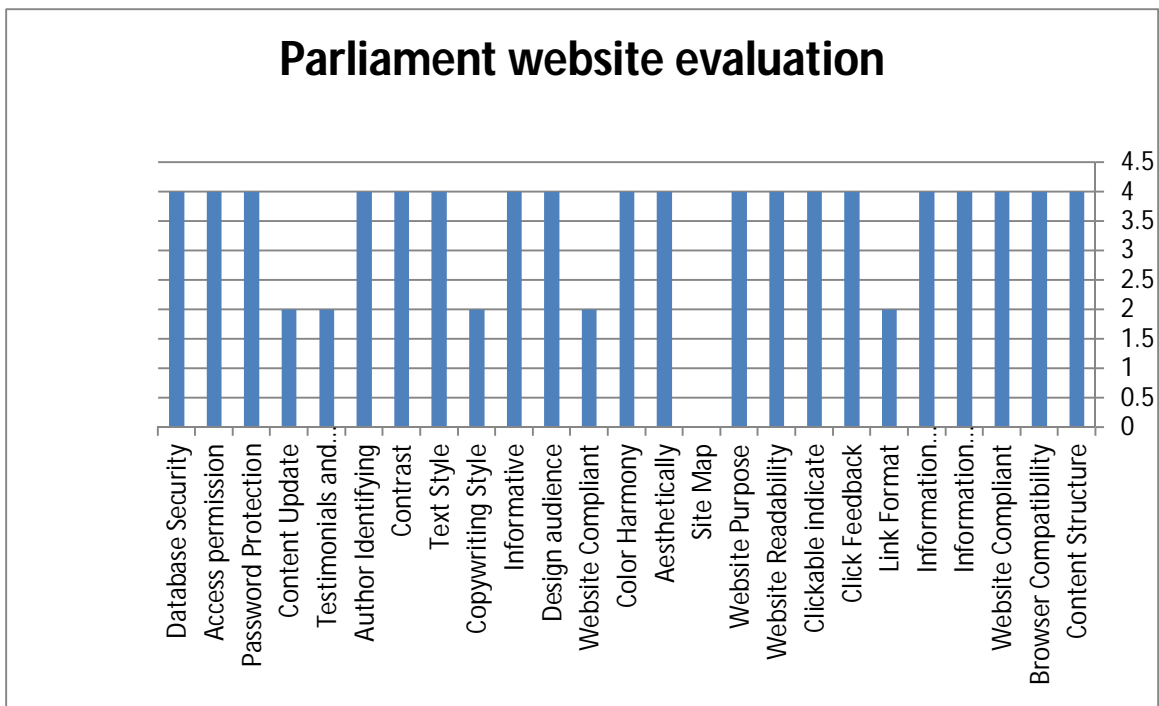
Table [4.3]: high educational ministry website

4.2 Discussions

The proposed model used to evaluate and assess some e-government website in Sudan. When the proposed template was applied to this websites found this:

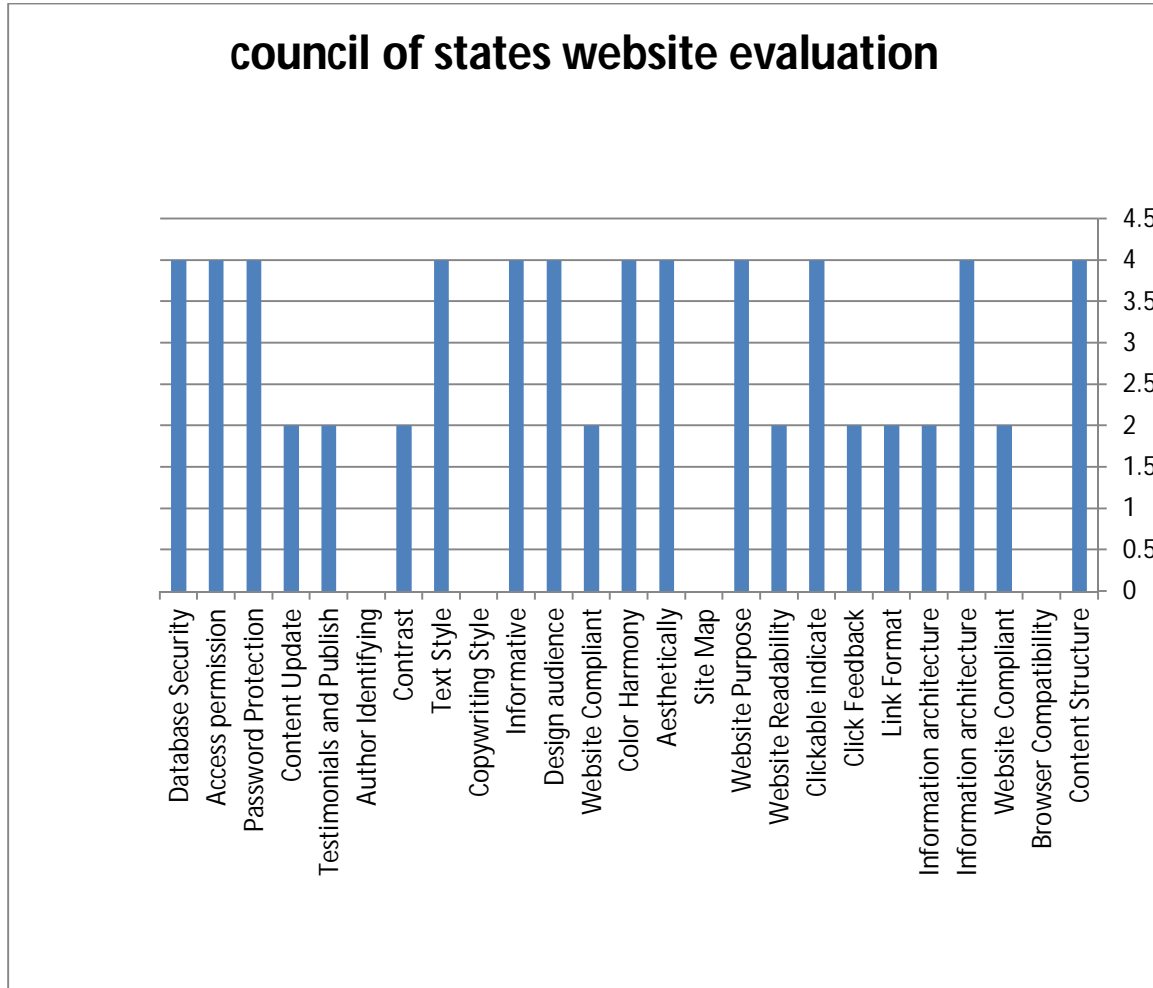
- The design of a website of the parliament e-government is a very good design because many factors of the proposed model are available.

Figure 4.1: parliament website evaluation



- The design of a website of the council of states e-government is a poor design because many factors of the proposed model are un-available.

Figure 4.2: council of states website evaluation



- The design of a website of the Sudan e-government is an excellent design because many factors of the proposed model are available.

Figure 4.3: Sudan e-government website evaluation

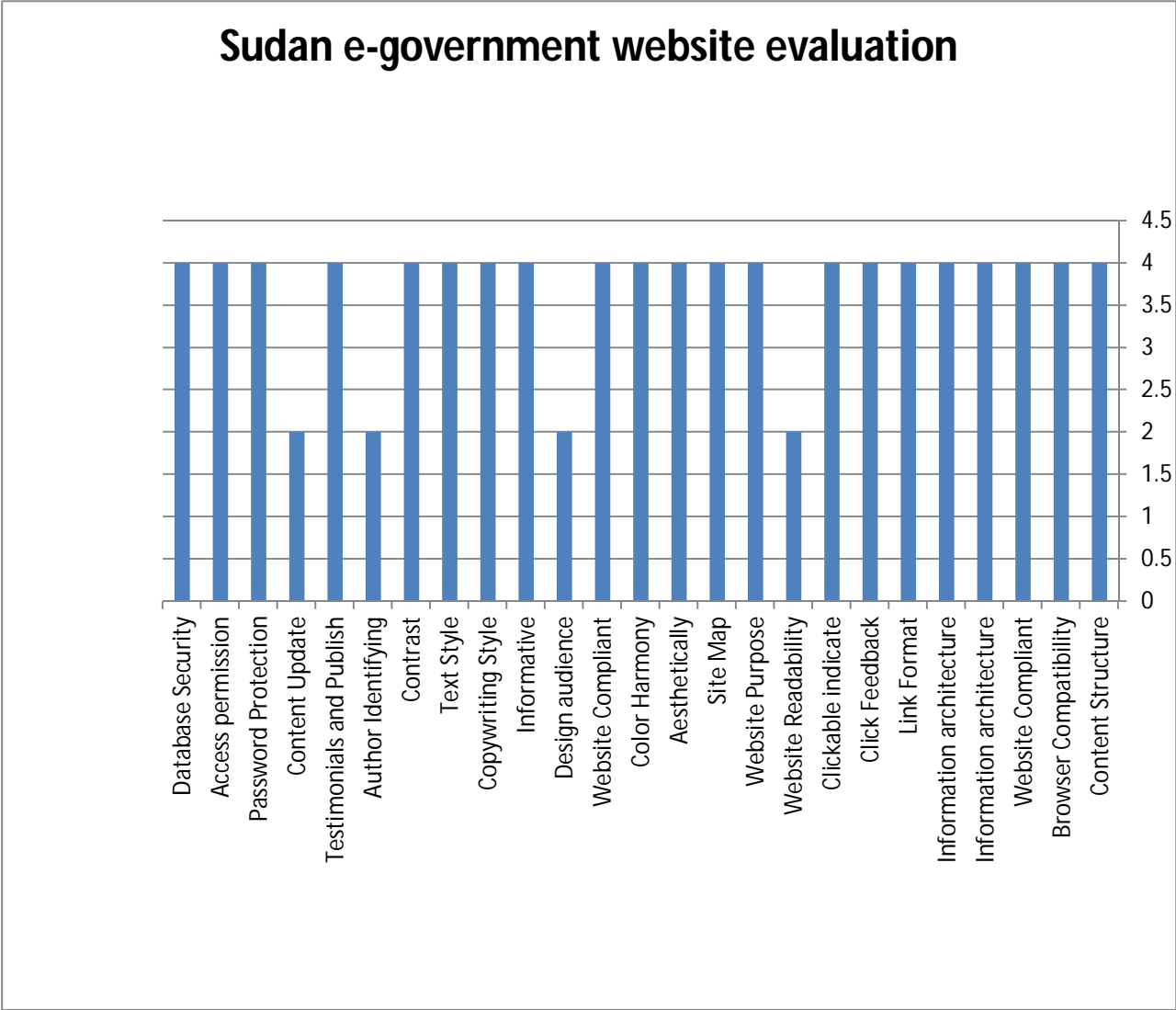


Figure 4.4: Khartoum university website evaluation

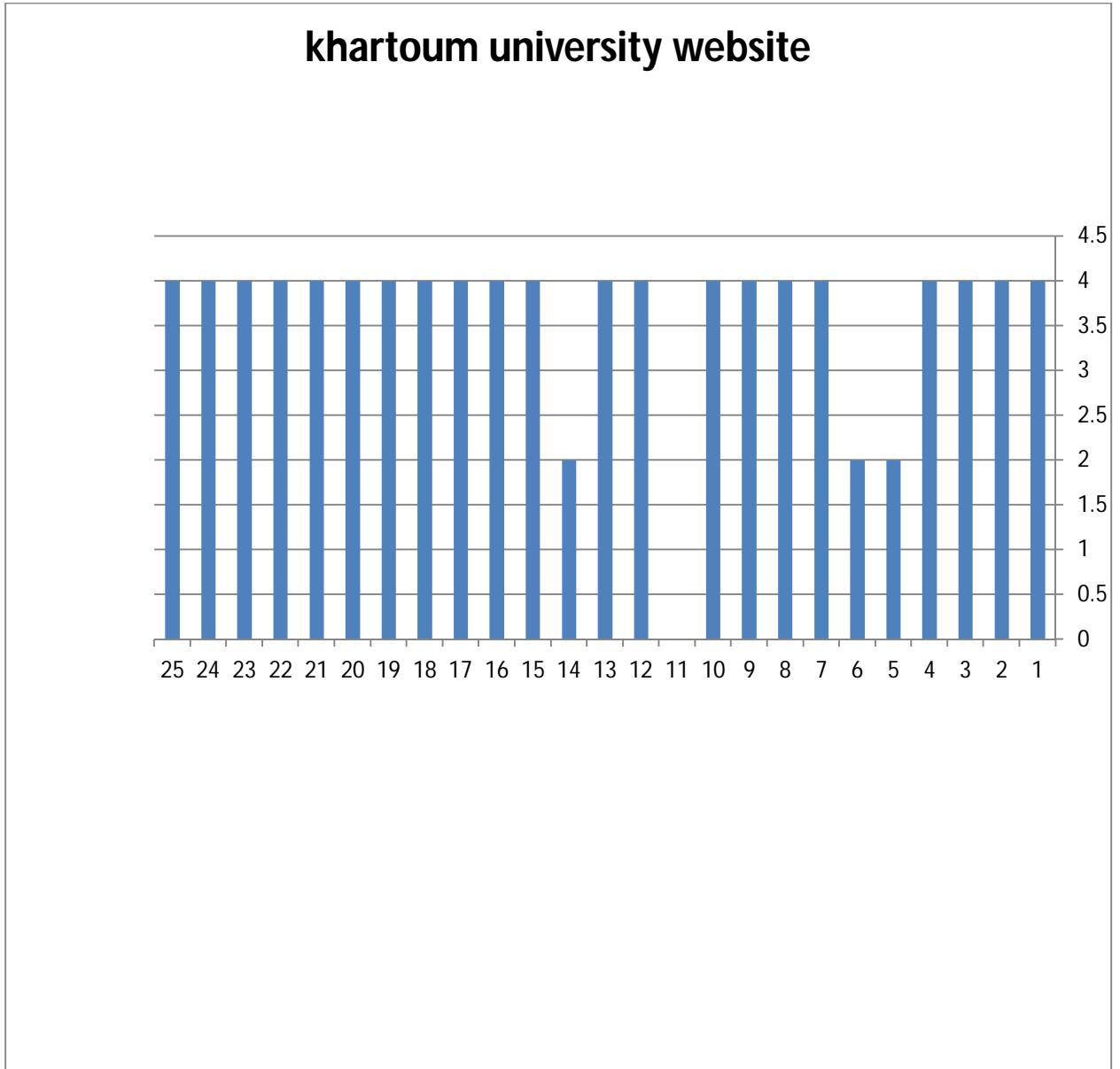


Figure 4.5: Neelain university website evaluation

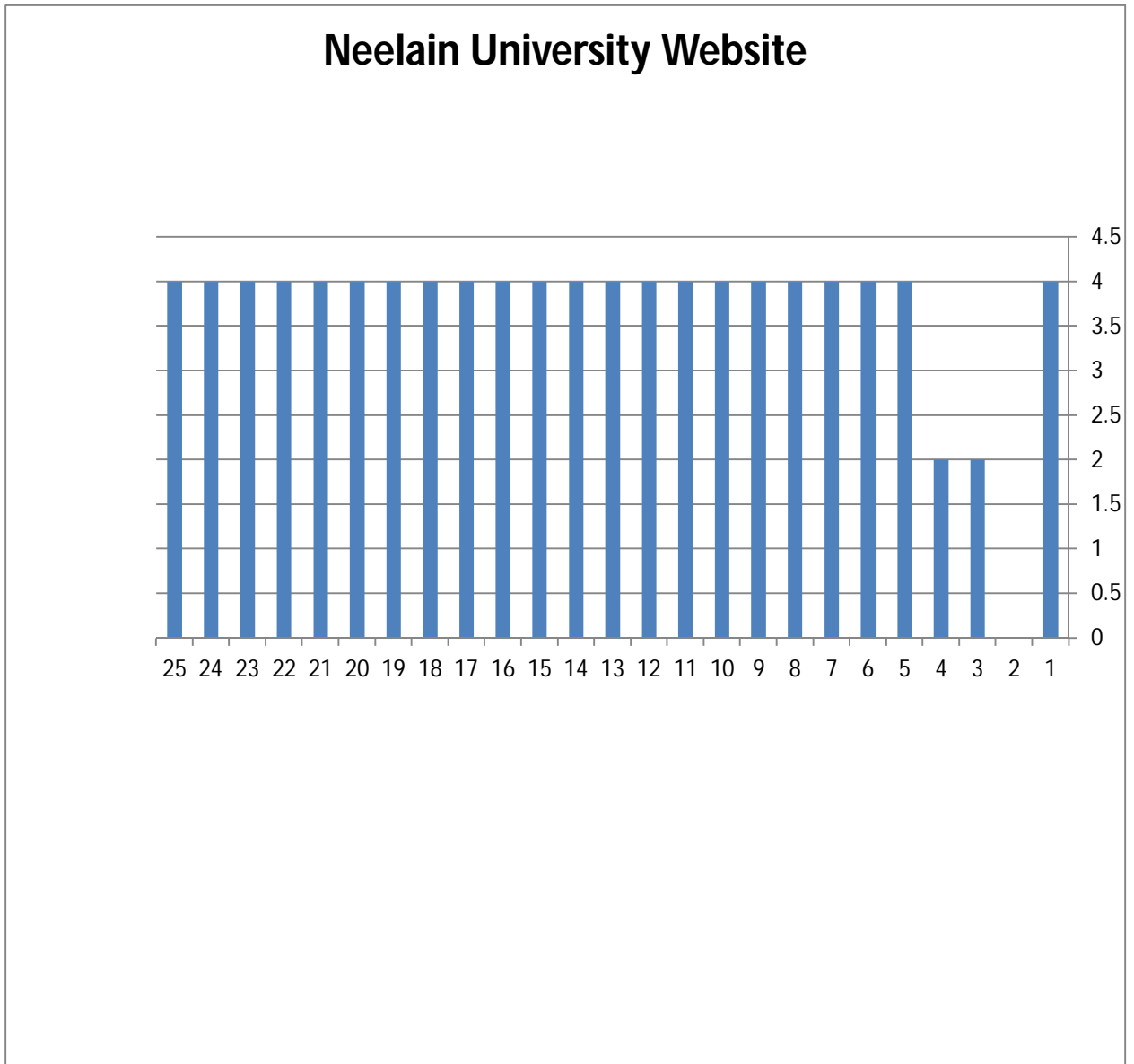
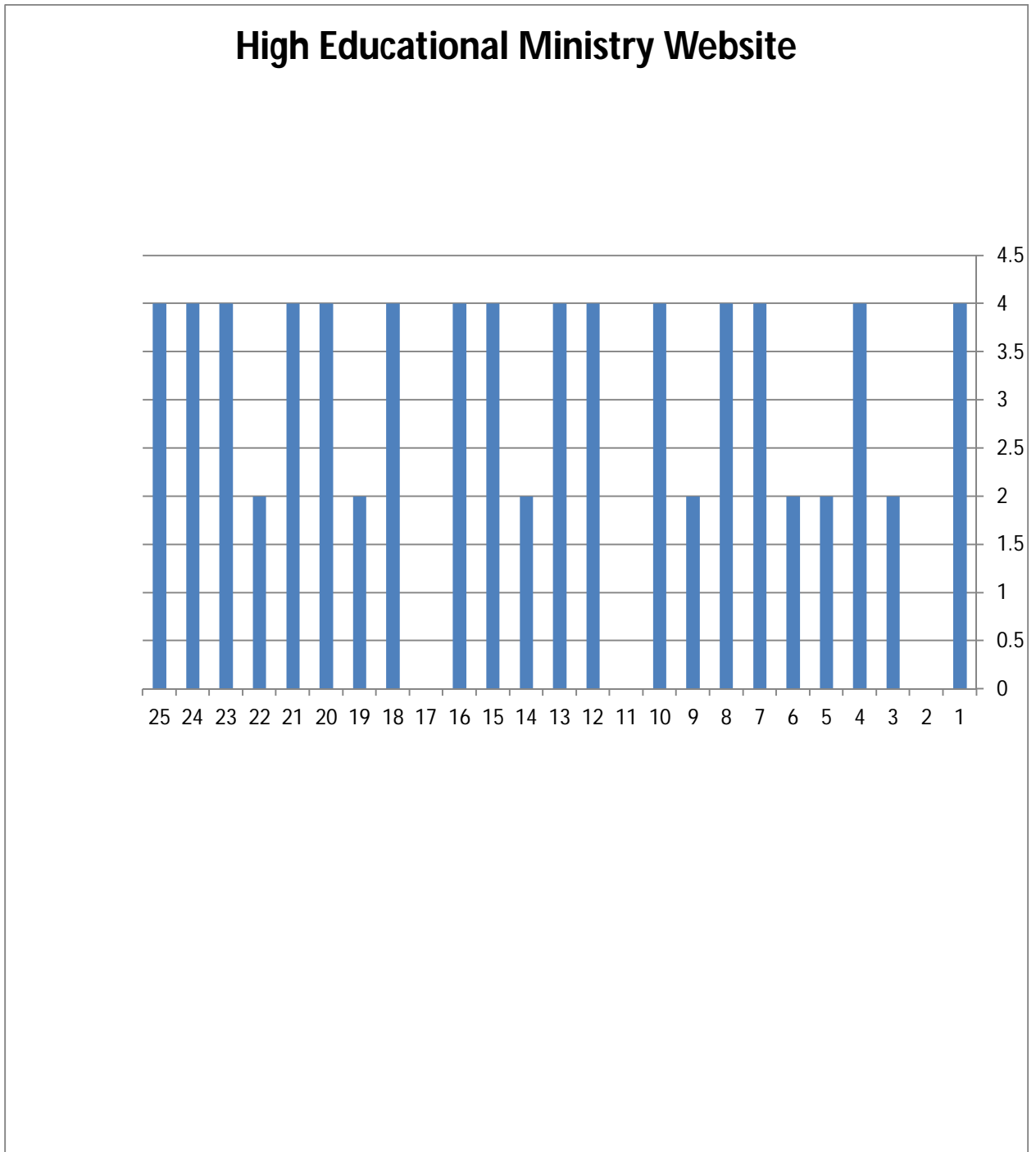


Figure 4.6: High educational ministry website evaluation



The table below shows the comparison analysis of selected website that used in this research

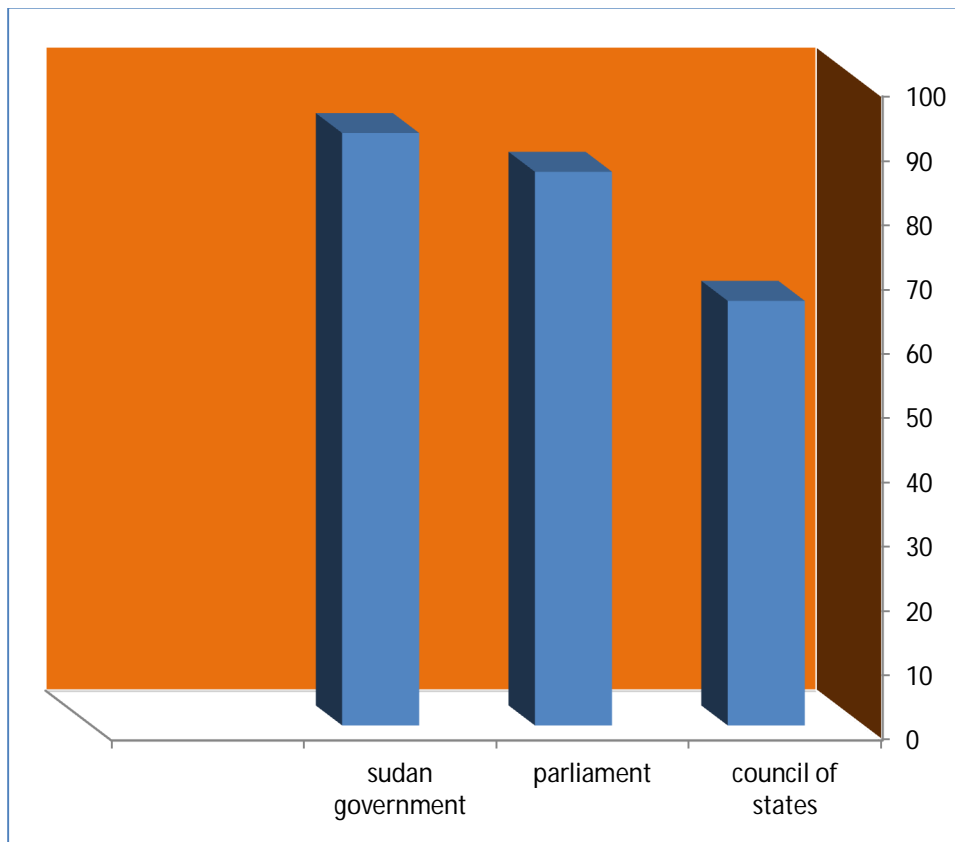
Factor	Sudan e-government website	Parliament website	council of states website
Content Structure	✓	✓	✓
Browser Compatibility	✓	✓	X
Website Compliant	✓	✓	✓
Information architecture	✓	✓	✓
Information architecture	✓	✓	✓
Link Format	✓	✓	✓
Click Feedback	✓	✓	✓
Clickable indicate	✓	✓	✓
Website Readability	✓	✓	✓
Website Purpose	✓	✓	✓
Site Map	✓	X	X
Aesthetically	✓	✓	✓
Color Harmony	✓	✓	✓
Website Compliant	✓	✓	✓
Design audience	✓	✓	✓
Informative	✓	✓	✓
Copywriting Style	✓	✓	X
Text Style	✓	✓	✓
Contrast	✓	✓	✓
Author Identifying	✓	✓	X
Testimonials and Publish	✓	✓	✓
Content Update	✓	✓	✓

Password Protection	✓	✓	✓
Access permission	✓	✓	✓
Database Security	✓	✓	✓

Table [4.4]: comparison analysis of e-government websites

Here the figure show the comparison of total percentage of evaluating the e-government websites used in this research

Figure 4.7: Comparison e-government websites in Sudan



From this result conclude that the proposed model are succeeded in assessing the websites because it shows any mistake in the design of the websites and propose the correct way to resolve it.

5.1 Conclusion

This research proposed a quality model of e-Government services on the basis of the maturity models. This quality model of e-Government services can be a benchmark for government organizations to efficiently develop e-Government services in order to be in accordance with the government objectives and policy. This quality model of e-Government services will lead to easy-to-use, efficient, safe, and stable services that related stakeholders will receive.

5.2 Recommendations

The developers of e-government services should consider the proposed quality model of e-Government services when implementing these services.

Special concentration should be paid to the subjective quality factors which are hard to measure and define.

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