

PAPER

Usability Evaluation of North African E-Government Services in the Context of Optimizing User Experience when Using Mobile Phones

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dr.benaïda@iu.edu.sa**ABSTRACT**

E-governments are considered the primary gateway through which citizens can access services and benefit from the information provided by electronic platforms when needed. Although the situation in developed countries has shifted from electronic governments to local electronic services, many developing countries still encounter various challenges, such as ease of use and enhancing user experience. This study aims to help address the obstacles faced by North African countries, including Morocco and Tunisia, in the context of e-government usability. It evaluates the accessibility of these sites, addresses the issues involved in using them, and suggests solutions that could enhance user experience by improving ease of use. The limited previous research on this region makes this study even more relevant. Research-based web design and usability guidelines (RBWDUG), specifically the chapter on optimizing user experience, serve as the foundation of this research, facilitating the assessment of ease of use and user satisfaction. Converting this valuable tool into a questionnaire enabled the research to achieve valuable results through evaluation. The evaluation of ten websites in each country, with 100 participants involved in the assessment, reveals a common pitfall when it in improving user experience and ease of use. This issue impacts user satisfaction and the effectiveness of e-government services. An important relationship has been established between these usability issues and the effectiveness and efficiency of these services. The study emphasizes the vital connection between usability and e-government service efficiency while recommending improvements based on user feedback.

KEYWORDS

human computer interaction, usability evaluation, web design, e-government, user satisfaction, mobile phone

1 INTRODUCTION

E-government services in the Arab world require attention, improvement, and significant investments in infrastructure such as the internet and telecommunications.

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Most Arab countries have established strategies to transition from traditional government services to e-government services. However, these strategies have yet to be implemented, and services are still paper-based. As a result of this delay, citizens suffer from inconvenience and are unable to benefit from effective and efficient online services. The target of any system is user satisfaction. Furthermore, a good design is one that enhances the efficiency and effectiveness of the system, thereby assisting users in achieving their goals with minimal effort and obstacles.

The definition of “user experience” is not unanimously agreed upon, as each expert has a different way of defining it based on their field of expertise. User experience can be considered a broad term that encompasses various aspects of web design, including usability, user interaction, and more. Because this study focuses on the usability of e-services, the authors decided to follow the definition of Norman and Nielsen, who state that user experience encompasses all aspects of the end-user's interaction with the company, its services, and its products, [1] as well as the ISO 9241-11:2018, 3.2.3 definition, which identifies user experience as the “user's perceptions and responses that result from the use and/or anticipated use of a system, product, or service.” [2], [3] User experience is of great importance to the success of any system, as it aims to help users achieve their goals and entice users to employ the services repeatedly. [4] It relies on understanding users' expectations and, at the very least, delivering the product or service according to those expectations. [5] Given the importance of user experience, this study evaluates it based on the principles outlined in the research-based web design and usability guidelines (RBWDUG).

E-government can be defined as “the use of information technology to enable and improve the efficiency of government-provided services to citizens, employees, businesses, and agencies.” [6] The World Bank defines e-government as “the use by government agencies of information technologies (such as wide area networks (WAN), the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government.” [7]

E-government services do not rely solely on the quality of the services; instead, they involve considering the culture and values of the user and adjusting the usability settings based on these factors. The users' level of understanding of the internet and technology as a whole, literacy rates, age groups, and so on are also factors that should be considered when designing e-government services. [8], [9], [10], [11], [12]

Due to its popularity, this research chose to use RBWDUG [13] to extract and evaluate one guideline variable (optimizing the user experience) for measuring Moroccan and Tunisian e-government services. This category emphasizes the importance of effectiveness and efficiency in the human capital index (HCI). Web designers should present information clearly and simple, avoiding over-clustering that can negatively impact user experience. This section is divided into 16 sub-guidelines.

This study identifies the flaws in the current system by examining the shortcomings of these services. Through this evaluation, we can pinpoint areas for improvement and enhance the quality of e-government services in these countries by addressing these issues diligently. Thus, they can fulfill their needs without any barriers affecting their experience with these e-services. This research facilitates the discovery of pertinent information on the quality of electronic services in Arab countries, thereby promoting in-depth studies that enhance and advance these services—a crucial undertaking in today's technological landscape. Nevertheless, the results of this study can benefit all e-government websites around the world, as the ultimate goal is to achieve positive user feedback and interaction. This research builds upon a previous study [10] to assess the quality of e-government services in North Africa, ultimately contributing further insights into e-Government services in the region.

2 LITERATURE REVIEW

E-governments play a pivotal role in citizens' lives by offering a multitude of advantages. Key among them is the efficient reduction in time, effort, and financial resources compared to conventional methods. From this perspective, one can argue that the effectiveness of e-governments in achieving their mandate is a critical determinant in advancing electronic service-related aspects within both private and public institutions and sectors. [14]

While developed countries have advanced from e-government to local e-government, and ultimately smart e-government, developing countries are in the process of integrating e-services into their developmental frameworks [15], [16], with the aim of elevating them to become significant components of national policies. However, most of these countries face numerous challenges, including a lack of infrastructure such as high-speed internet, service quality, service diversity, and coverage of citizens' needs, including regulations and laws. [17] It is vital to develop these aspects to move closer to the latest available technologies.

2.1 E-government services

The vast technological landscape, including the content provided by government services and the quality of the platforms and websites, is intended to offer citizens [18], [19] with essential services such as passports, national cards, academic certificates, and those related to economic activities, banks, schools, hospitals, etc. However, many e-government services responsible for overseeing the provision of these services are not supervised by experts in information technology and information systems. [20] This complexity complicates the situation. Transparency and the quality of services provided to users are crucial factors influencing e-government services. [21], [22] The design and efficiency of e-government documents require greater attention to reach and satisfy user needs. Effective document design is a key success factor [23] in streamlining information organization and improving access speed and responsiveness [24].

Administrative reform is a cornerstone of the success of e-government strategies, enabling the required efficiency and effectiveness. [25] Restructuring e-services, whether related to service offerings or technology utilization, helps enhance the services that e-government agencies provide to citizens. This, in turn, helps citizens save time and effort while reducing the public costs they bear. It also minimizes bureaucracy and enhances transparency—issues that citizens in developing countries often encounter. [26] It transforms e-governments into an effective and appealing part of government digital transformation, engaging citizens by seeking their opinions and addressing their concerns through observations and comments. [27] This approach helps improve services, making them more user-friendly and efficient. Therefore, it is essential to focus not only on information diversity and internet speed but also on evaluating the efficiency and effectiveness of services provided to citizens based on their feedback. [28], [29] This evaluation must be a priority in assessing e-government, as it serves as the gauge of its success or failure.

Many government agencies require budgets and human resources to improve access to these services more effectively and efficiently. [30] The development of e-government is a growing trend influenced by various factors, including social, economic, and political dynamics, which amplify its importance.

2.2 E-government models

Several models have been proposed to illustrate the evolution of e-government services. These stages encompass digitization, transformation, and participation, as well as governance models focused on policies regulating e-government operations [31], often referred to as the context. Furthermore, a regulatory framework has been developed to encompass efficiency, effectiveness, and accountability as key performance indicators for evaluating the administrative and technical components of the e-government system [32]. This approach fosters trust among government agencies by emphasizing efficiency and accountability, thereby enhancing its appeal to users. Standards have been formulated to assess the success of e-government, primarily based on users' perceptions of the value of these services. These standards encompass efficiency, effectiveness, and social value.

According to this study, [33] citizens' perception of e-government success hinges on nine influential factors: cost, timeliness, customization, communication, information retrieval, trust, knowledge ability, participation in decision-making, and net benefits (based on the theory of general value). Additionally, it considers citizens' expectations on social media, encompassing positive, negative, and participatory roles.

3 METHODOLOGY

Data was collected on the e-government services of Morocco and Tunisia, representing North African Arab countries. Ten websites from each country were evaluated and analyzed to compare these services.

This study gathered 100 participants randomly, with the only condition being proficiency in both the Arabic and French languages to ensure that participants could effectively evaluate the websites. Most participants were males aged 20–35. It can be argued that older people may lack the necessary skills to use the internet [34], [35] or they may feel less comfortable using it. [36] Table 1 displays the education level and internet usage (97% used the internet for ≥ 5 years) along with the detailed demographics of the participants.

Table 1. Respondent demographics

Demographic	Category	N = 100	%
Age	< 20	20	20
	20–35	37	37
	36–50	31	31
	50+	12	12
Gender	Male	66	66
	Female	34	34
Education level	School and college	24	24
	Undergraduate degree	56	56
	Postgraduate degree	20	20
Usage of the internet	< 5	3	3
	5–10	48	48
	> 10	49	49

3.1 Procedure

The RBWDUG, established by the Department of Health and Human Services in the United States of America, contains 209 guidelines divided into 18 chapters. Each chapter contains multiple guidelines, enhanced by the ratings of experts and researchers. Moreover, the ratings of these guidelines are assessed based on the importance and strength of the evidence. [8] This study chose to research “Optimizing the User Experience” and its 16 guidelines for evaluating the usability of Moroccan and Tunisian e-government websites. Each sub-guideline is assessed based on the relative importance and strength of the evidence [8]. These guidelines are converted into a questionnaire (refer to Table 2) so that the selected websites can be evaluated accordingly. Because the guideline uses a scale from one to five to assess the relative importance rate and strength of evidence, this study opted to incorporate this scale into the guidelines questionnaire and utilize the same five-point scale for assessment.

Table 2. Optimizing user experience proposal questionnaire

Optimizing the User Experience Questionnaire					
	1	2	3	4	5
1. Do Not Display Unsolicited Windows or Graphics					
2. Increase Web Site Credibility					
3. Standardize Task Sequences					
4. Reduce the User's Workload					
5. Design for Working Memory Limitations					
6. Minimize Page Download Time					
7. Warn of 'Time Outs'					
8. Display Information in a Directly Usable Format					
9. Format Information for Reading and Printing					
10. Provide Feedback when Users Must Wait					
11. Inform Users of Long Download Times					
12. Develop Pages that Will Print Properly					
13. Do Not Require Users to Multitask While Reading					
14. Use Users' Terminology in Help Documentation					
15. Provide Printing Options					
16. Provide Assistance to Users					

The researcher published a Google Forms link on Facebook in appropriate pages and groups to advertise the opportunity for 100 individuals to voluntarily participate in a research study. Participants were briefed online via Messenger private messaging to explain the purpose of the research and open the floor to questions. The briefing contains a list of the websites to be visited in the specified order. Furthermore, it specifies that participants are required to spend five minutes on each website before filling out the guideline questionnaire and proceeding to evaluate the next website. To avoid bias, the order of the websites evaluated by participants was randomized. Once participants completed their evaluation of all ten websites, they returned the guideline questionnaires to the researcher via private messaging on Messenger for result interpretation.

4 RESULTS AND DISCUSSION

Ten e-government websites from Morocco and Tunisia underwent testing through an experiment and questionnaire. The aim was to evaluate user satisfaction levels and offer recommendations to enhance the quality of e-government services for users.

4.1 SPSS analysis

Stemming from the results, Table 3 displays the relative importance rating and the strength of evidence rating gathered from the RBWDUG, along with the detailed SPSS analysis results obtained after data collection and input into this statistical software for analysis. The results include paired samples statistics mean (PSSM), paired samples test mean (PSTM), and the significant difference. The PSSM represents the average scores collected from the 100 participants in this study for each section, with the boxes highlighted in green indicating the higher values in their respective categories. PSTM values represent the differences between the mean values of the Moroccan and Tunisian e-government websites. A negative value indicates that the Tunisian e-government services have a higher paired samples statistics mean value, while a positive value indicates that the Moroccan average score for that particular section is higher. The significant difference values represent the correlation in data between the results of the same section based on the two independent variables (Morocco and Tunisia). If the significance value displayed is less than 0.05, the results are deemed to be significantly different. If the value is greater than 0.05, the results are considered to be insignificantly different.

Ultimately, this test compares data between two test subjects, hence the name “paired samples test.” Overall, users found the Tunisian e-government services to be marginally better than the Moroccan e-government services, as nine sections were rated higher in favor of the Tunisian e-government services, as shown in Table 3. Users rated Moroccan e-government services as advantageous in only five specific sections.

Table 3. Optimizing the user experience

	Optimizing the User Experience					
	Relative Importance	Strength of Evidence	Paired Samples Statistics Mean (SD)		Paired Samples Test Mean (SD)	Significance
			Moroccan	Tunisian		
Do Not Display Unsolicited Windows or Graphics	5	3	3.9	3.9	0.000	1.000
Increase Web Site Credibility	4	3	2.0	3.7	-1.665	0.000
Standardize Task Sequences	4	5	2.9	3.0	-0.070	0.631
Reduce the User's Workload	4	3	3.3	3.7	-0.440	0.019
Design for Working Memory Limitations	4	5	3.3	3.6	-0.360	0.015
Minimize Page Download Time	4	4	3.2	3.0	0.195	0.058
Warn of 'Time Outs'	4	3	2.7	2.5	0.185	0.072
Display Information in a Directly Usable Format	4	3	3.0	2.1	0.915	0.000
Format Information for Reading and Printing	4	3	3.1	3.0	0.170	0.144

(Continued)

Table 3. Optimizing the user experience (Continued)

	Optimizing the User Experience					
	Relative Importance	Strength of Evidence	Paired Samples Statistics Mean (SD)		Paired Samples Test Mean (SD)	Significance
			Moroccan	Tunisian		
Provide Feedback when Users Must Wait	4	4	2.8	3.0	-0.210	0.046
Inform Users of Long Download Times	4	3	2.0	2.0	-0.040	0.728
Develop Pages that Will Print Properly	4	2	2.5	2.6	-0.065	0.528
Do Not Require Users to Multitask While Reading	3	4	3.3	2.5	0.850	0.000
Use Users' Terminology in Help Documentation	3	3	3.0	3.3	-0.250	0.004
Provide Printing Options	3	2	2.7	2.8	-0.165	0.056
Provide Assistance to Users	2	3	2.9	3.5	-0.605	0.000

4.2 Evaluation scores of Moroccan and Tunisian e-government services

According to the guidelines, “Do Not Display Unsolicited Windows or Graphics” is one of the most crucial aspects of optimizing user experience. Users believe that both e-government services are delivered similarly in this aspect, with a score of 3.9, which is considered relatively good. Users did not feel that they were repeatedly distracted by unwanted pop-ups. Both e-government services received the same average score. The paired samples test showed a mean of zero and a significance value of one, indicating no significant difference. Based on the guidelines provided to assist them in their evaluation, users believed that Tunisian e-government services showed more credibility due to their clear FAQs, absence of broken links, and other factors. As a result, the Tunisian team scored 3.7, while the Moroccan team received a low score of 2.0. The standard deviation (SD) value was -1.665, and the significance value was highly significant (0.000).

Furthermore, users believed they became almost equally familiar with the sequencing of tasks on both services. Hence, the scores for the third section across both test subjects were relatively similar, with a small SD value of -0.070 and an insignificant difference of 0.631. Regarding the reduction of user workload and service design for addressing working memory limitations, participants scored both sections similarly. They believed that the Tunisian services offered shortcuts for their tasks and did not overwhelm them with information to be memorized for an extended period. The data shows that the SD values for sections four and five were -0.440 and -0.360, respectively, and that the significance values were statistically significant (0.019 and 0.015, respectively). The next four sections were dominated by Moroccan services, according to the participants of this study.

Although users believed that page download times and warnings of timeouts were almost the same across both services, they still rated the Moroccan services 3.2 and 2.7 for sections seven and eight, while they rated the Tunisian services 3.0 and 2.5. As a result, the significance values were 0.058 and 0.072, which approach the range of insignificant difference, typically considered to be less than 0.050. The results show that the information presented in the Tunisian services (2.1) was not as user friendly as the information displayed in the Moroccan services (3.0). The SD value was close to 1.000, while the significance value was 0.000, indicating a significant difference in the data. Regarding the formatting information for reading and

printing, the results were quite similar across the board. This is evidenced by the reduced SD value of 0.170 and the increased significance value of 0.144, indicating an insignificant difference in the dataset.

Moving on, users believed that the Moroccan services did not provide as much feedback as the Tunisian services when they had to wait for tasks to be completed. As a result, average scores of 2.8 for the Moroccan services and 3.0 for the Tunisian services were calculated, approaching the threshold for a significant difference of 0.050. The eleventh section assesses the capability of these services to notify users about extended download times by displaying the completion percentage and the amount of data remaining to be processed. Both services received the same below par average of 2.0, indicating a significant issue that needs to be addressed. The twelfth section, “Develop Pages that Will Print Properly,” mainly focuses on the capability to print wide pages in portrait orientation and to ensure that the entire frame is captured in a print-friendly manner. With hardly any difference in the scores of both test subjects (SD value of -0.065), the significance value was 0.528, which is not statistically significant. Section 13 ultimately evaluates the user’s reading speed and their level of distraction by other tasks on the screen. Moroccan services have made it easier for participants to read at their regular pace without being distracted. As a result, they received a higher score of 3.3. Meanwhile, the Tunisian team scored an average of 2.5 points. Therefore, the significance value was 0.000, indicating a significant difference in the results.

Regarding section 14, participants believed that the quality of both tested e-government services (use users’ terminology in help documentation), the quality delivered was lacking. Sufficient guidance, such as marking clicked links with a different color to indicate they have already been visited, was not provided. Nevertheless, Tunisian e-government services (3.3) fared slightly better in this regard compared to the tested Moroccan e-Government services (3.0). The significance value indicates a notable difference in the results of both tested subjects.

The final section, which evaluates the level of assistance provided to users, is considered to be the least important section by the authors of REDBUG. Nevertheless, the results show that Tunisian e-Government services provide significantly more support (significance value = 0.000), scoring 3.5, than Moroccan e-government services, which scored 2.9.

Overall, the Tunisian services received an average score of 3.01, whereas the Moroccan services received an average score of 2.91 (Table 4). Neither score is considered good. Many adjustments must be made to the e-government services, as indicated by the results of the research conducted with the assistance of participant feedback. These results are supported by the United Nations survey, which confirms that Tunisian e-government services are more successful than Moroccan e-government services, although both require significant improvements.

Table 4. Evaluation scores of Moroccan and Tunisian e-government services

Optimizing the User Experience		
	Paired Samples Statistics Mean (SD)	
	Moroccan	Tunisian
1. Do Not Display Unsolicited Windows or Graphics	3.9	3.9
2. Increase Web Site Credibility	2.9	3.0
3. Standardize Task Sequences	2.0	3.7
4. Reduce the User’s Workload	3.3	3.7

(Continued)

Table 4. Evaluation scores of Moroccan and Tunisian e-government services (*Continued*)

Optimizing the User Experience		
	Paired Samples Statistics Mean (SD)	
	Moroccan	Tunisian
5. Design for Working Memory Limitations	3.3	3.6
6. Minimize Page Download Time	3.2	3.0
7. Warn of 'Time Outs'	2.7	2.5
8. Display Information in a Directly Usable Format	3.0	2.1
9. Format Information for Reading and Printing	3.1	3.0
10. Provide Feedback when Users Must Wait	2.8	3.0
11. Inform Users of Long Download Times	2.0	2.0
12. Develop Pages that Will Print Properly	2.5	2.6
13. Do Not Require Users to Multitask While Reading	3.3	2.5
14. Use Users' Terminology in Help Documentation	3.0	3.3
15. Provide Printing Options	2.7	2.8
16. Provide Assistance to Users	2.9	3.5
Total Average	2.91	3.01

4.3 EGDI

In 2001, the United Nations released the first in a series of biennial surveys to assess and evaluate e-government services around the world. The latest survey, released to the public in 2022, is available for free download and use on the official United Nations website. The United Nations welcomes feedback and external evaluations of its surveys to promote constructive development. As years pass and experiences are gathered through user experience feedback and new research, governments are enhancing their telecommunications infrastructure indexes (TSIs), human capital indexes (HCIs), and online survey indexes (OSIs), thereby enhancing their overall e-government services. [37] The TSI, HCI, and OSI are the three indexes used to calculate EGDI, which ranks the strength of e-government services. Each index is valued from zero to one and equally accounts for one-third of the total EGDI score. Table 5 shows the latest results of this survey in 2022 for Morocco and Tunisia.

To understand the context of the EGDI rankings of Morocco and Tunisia in 2022, one must compare the results of the previous six years with the current results to evaluate the level of progress and development achieved by the respective countries. Figure 1 displays the EGDI scores and rankings of Tunisia since 2016, revealing that although its EGDI score has been increasing, its EGDI rank compared to those of other countries has decreased by 16 places over the last six years. This shows that countries worldwide are enhancing the standards of their e-government services at a faster pace than Tunisia.

This supports the United Nations' statement regarding an overall increase in the level of e-government worldwide. Nevertheless, Tunisia's e-government services are still considered to be advanced relative to the rest of the world, especially in less economically developed countries. Tunisia also holds the fourth position for

the highest EGDI value in Africa, following South Africa, Mauritius, and Seychelles, respectively.

Figure 2 presents information about Moroccan EGDI scores and rankings over the years. It follows a pattern similar to that of the Tunisian data; although the EGDI score increased, it was not quite sufficient to propel Morocco higher in the rankings. Consequently, the EGDI ranking decreased by 16 positions. Morocco ranks just below Tunisia in Africa in terms of the highest EGDI values. The latest United Nations survey in 2022 ranks both Morocco and Tunisia relatively high. However, Tunisia is 13 ranks above Morocco in the EGDI rankings. The breakdown of the EGDI scores related to OSI, HCI, and TII reveals that Morocco experienced significant challenges in the online services sector, leading to a negative impact on its EGDI score. On the other hand, Tunisia had relatively stable scores across all three variables. Figures 3 and 4 demonstrate a similar pattern of EGDI scores and rankings for Morocco and Tunisia since 2016.

Table 5. EGDI values for Morocco and Tunisia in the 2022 United Nations survey

Country	EGDI Rank	EGDI Score	Region	OSI Value	HCI Value	TII Value
Tunisia	88	0.6530	Northern Africa	0.6031	0.6911	0.6646
Morocco	101	0.5915	Northern Africa	0.4721	0.6350	0.6676

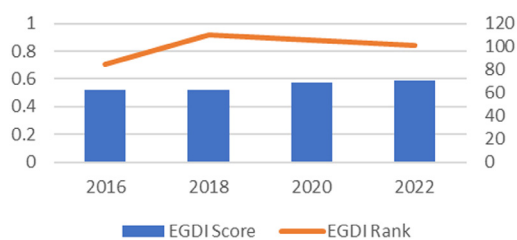


Fig. 1. Tunisia EGDI score comparison

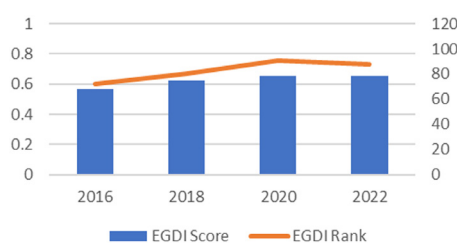


Fig. 2. Morocco EGDI score comparison

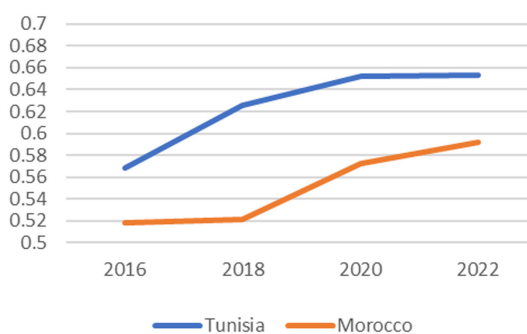


Fig. 3. EGDI score comparisons for Morocco and Tunisia

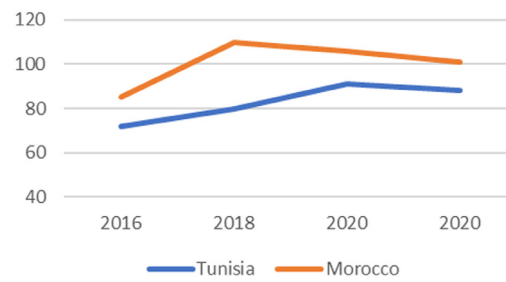


Fig. 4. EGD ranking comparisons for Morocco and Tunisia

5 CONCLUSION

This study aims to explore the quality of e-government services in Morocco and Tunisia by evaluating and comparing their ability to optimize user experience based on RBWDUG. The results of this study support the findings of the United Nations biennial survey of e-government services around the world. Based on user feedback, Tunisia demonstrated stronger services in the tested guideline of “Optimizing the User Experience,” receiving an overall score of 3.01. Although the Moroccan counterpart received a lower score of 2.91, the difference is not drastic. This indicates that both countries are nearly equal in terms of the quality of e-government services they provide. An integral tool used in the assessment of the data gathered from the users is the SPSS program. It enables the researcher to interpret scores based on significant differences in the dataset and provide meaningful interpretations of paired samples statistics means and paired samples test means. Ultimately, Moroccan e-government services excelled in only five categories of the tested guidelines. Their three lowest scores were in the areas of “Increasing Website Credibility,” “Informing Users of Long Download Times,” and “Developing Pages that Will Print Properly.” Therefore, those responsible for developing Moroccan e-government services should prioritize these three variables. The three weakest aspects of Tunisian e-government services regarding the optimization of user experience are “Informing Users of Long Download Times,” “Displaying Information in a Directly Usable Format,” and “Warning of ‘Time Outs’” Both countries suffer from poor results in terms of informing users about long download times, which can affect users’ experience and, ultimately, satisfaction when using these services. As a result, this research highlights areas where e-government services in Morocco and Tunisia need to change and improve in order to advance and enhance their chances of moving up the United Nations EGDI rankings. This can be achieved by offering better services to their citizens and users.

6 LIMITATIONS AND FUTURE WORK

The main limitation of this study is that the researcher investigated only one guideline from the RBWDUG. To expand on this study, additional guidelines should be explored to uncover more flaws and offer constructive feedback to developers in their field. Furthermore, this study could be enhanced by assembling experts to analyze and evaluate these services. Through the utilization of their valuable experience and knowledge, more information can be extracted regarding the errors and shortcomings of these services. Finally, this research evaluates only two countries in

Northern Africa and may not offer a comprehensive picture of the other countries in this region or the Arab world as a whole.

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