Investigation of Smartphone Usage Mobile Applications Versus Mobile Websites

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Abstract― **The utilization of mobile applications and services by the smartphone users is ever increasing over the last two decades. A considerable amount of research work has been done in this field with different aims and objectives. The aim of the work done in this study is to understand the preferences of smartphone users regarding the usage of the Internet in their devices either by mobile applications or via mobile websites. Our findings will be useful for mobile application developers to understand the main aspects of consumers and what they expect from their mobile usage experience. The study was conducted in two phases. In the first phase, a survey was conducted with over 250 participants. In the second phase, interviews were conducted with 30 participants based on testing two implemented applications (a native mobile application and a mobile website). The collected data is analyzed using different statistical methods. Obtained results show that mobile applications are mostly preferred, especially for the most common and frequently used applications among users. Moreover, respondents find that mobile applications are better in most aspects. However, we cannot ignore the proportion of participants who make their preferences according to site.**

Index Terms: **Smartphones, Mobile applications, Mobilewebsites**

I.   INTRODUCTION

The mobile phone industry has been growing and developing precipitately during the last couple of years. Old mobile devices with limited capabilities are being replaced by new and advanced mobile technology supporting a wide range of mobile services.

Smartphones have become more than just a mean of communication; they are considered the most representative type of multimedia systems. The popularity of mobile applications is rising dramatically due to the accelerating rate of adoption of smartphones. In addition, more and more users are accessing the internet via mobile devices. In 2020, total of 1.017 billion of smartphone units have been sold compared with a total of 145.1 million of PCs and laptops according to Canalys [1].

Smartphone users have the potential of using their smartphones in many ways. They download mobile applications from application stores such as Google Play and Apple App Store for various utilizations. These native applications are programs written in specific language for a particular platform or operating system [2]. They are accessed by just clicking a tab on smartphone's desktop and some of them are accessed without an internet connection. However, users also attend to use mobile website on their smartphones which are accessed through an internet browser without the need to download.

Mobile websites are built with web technologies such as HTML5, CSS and JavaScript. They are accessed through a web browser, which presuppose the smartphone needs to be online and connected to the internet for accessing the mobile web. Mobile websites have a major advantage over native mobile applications, cross-platform compatibility, which making them accessible to the largest audience for the least effort. Any web developer can create a mobile website without specific knowledge about the mobile OS's [3]. Mobile websites are comparatively, easy, cheap, fast to build, despite some device-specific customization is often required. Moreover, mobile web browsers are reasonably standardized which make it much easier to create a universal mobile web app than a native one [4, 5].

Nevertheless, mobile websites are limited by the browsers sandbox, so they have limited capabilities to interact with the phone itself. This means restricted access to anything non-web. For storage, a web app can use the local storage, as defined in the HTML5 specification [6]. There are also proposals for GPS and camera support directly from the browser. In addition, websites cannot be distributed through an application store, nor will it be available like a native app on the phone. This also reveals that updates to the app are independent of the application store and do not require any update action from the end user [7, 8].

Native mobile applications can leverage the capabilities of the mobile device especially hardware such as camera, GPS and graphics, and software such as calendar, email, contacts, picture/video gallery and file manager. In addition, native applications can be published in app stores and can be discovered by users [9]. App stores remind customers to upgrade apps, so apps that update repeatedly are more frequently brought to the user's attention [9]. However, developing, testing, and porting apps for different environments cost more money compared to web-based applications, especially maintenance and promotion costs are high.

Studies on smartphone user behavior [10] suggest that, there's a lot less time spent on the mobile websites than there is in the world of apps but weirdly, there's more traffic overall [11]. So, the mobile web is about twice bigger in terms of raw traffic, and it is growing faster than the mobile app world [12, 13]. Some sources are showing that just the top 5 apps are responsible for 80% to 90% of all app usage and that users spend at least three hours per day [14].

The objective of the present work is to investigate the behavior of smartphone end users and find out the most desirable way to use the phone applications, i.e. whether they prefer to use a mobile application or a mobile website. The research on the use of mobile applications and services is thought to be a continuous trend and ever growing over the last two decades [15]. The most common ways to understand user behavior include different kinds of interviews and surveys among smartphone users.

Previous studies [16,17,18,19] focused on comparing the native mobile applications and mobile websites in terms of performance and technologies used for both without measuring or estimating the usage of both applications as our study do. Our findings will be useful for mobile application developers to understand the main aspects of the smartphone consumers and what they expect from their mobile usage experience.

II.   DATA COLLECTION

Our data was first collected through the use of self-administrated questionnaire that have been applied to 250 participants in both hard copy forms and online questionnaires disseminated through social networking and maintained through a Google Form. And then followed by interviews on different sectors of smartphone users. The last is set in the form of a questionnaire and based on testing two implemented applications (one native mobile application that developed using Android Studio and the other one was a mobile website implemented in HTML5 shown in figure (1)) in order to answer the questions which are set in a suitable order to easily input and extract information
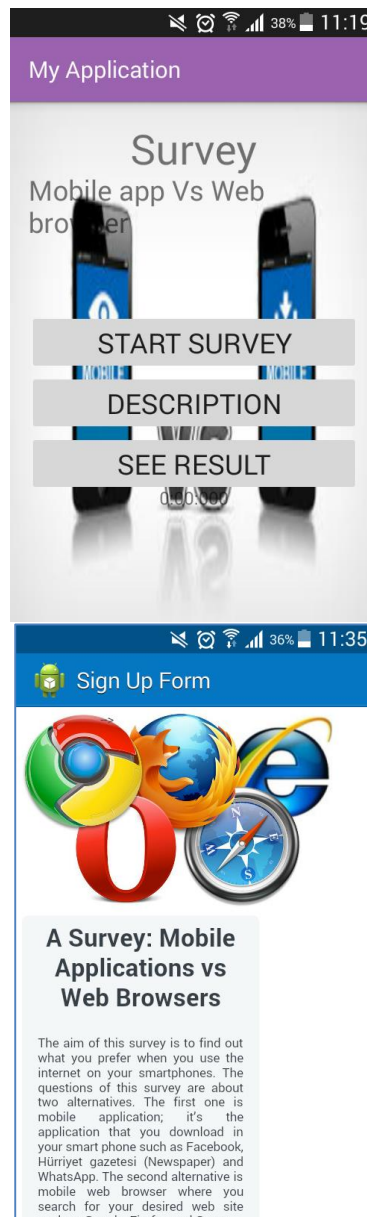

Figure 1. The implemented mobile application and mobile website

III.   RESULTS AND DISCUSSION

The data collected from both online survey and paper survey was gathered and organized in an Excel spread sheet then imported to PSPP (a free alternative propriety statistics program SPSS) for Correlation tests. Following is an overview of the results of the study.

Descriptive statistics
Demographic

The participants are split into four age groups; 51% of participants are aged between 18-25, 25% are aged between 26-30 and 24% are aged above 30. And they are also split into three graduation level groups; 61% are undergraduate students, 26% are graduate students and 23% are faculty members.

Participant's device ownership was significantly focused on two smartphone platforms; Android and Apple (iPhone) which together represent 95% of the survey responses, Apple (iPhone) 32% compared to Android 63%. For time spent on smartphone we found that 41% of participants spend from 1 to 3 hours daily using the Internet on their smartphones while only 14% of them spend more than five hours, as shown in figure (2) and figure (3).
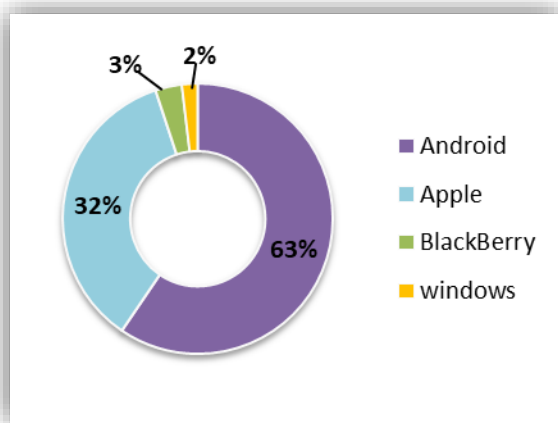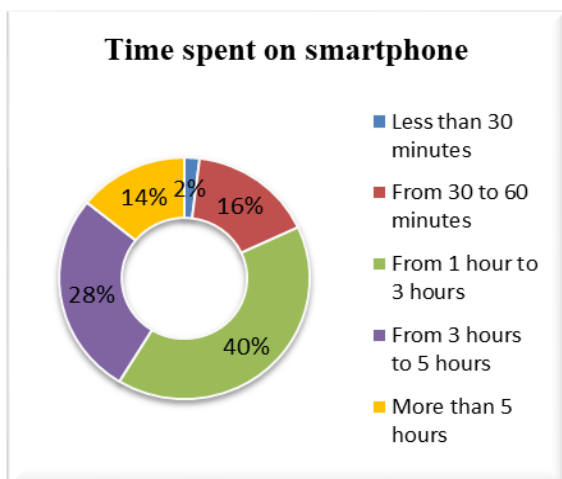

Figure 2. Platform scale

Figure 3.Time spent on smartphone

For a list of 9 categories of mobile device functionality, participants showed their most purposes for using the Internet on smartphones. The most two preferred categories are social media and E-mail while the least ones are books and games. Figure (4) shows most preferred applications.
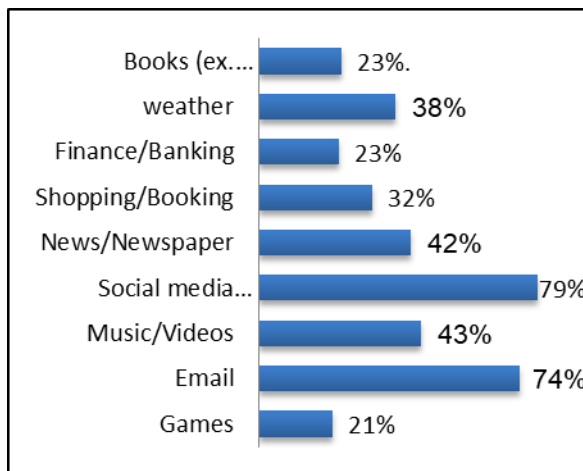

Figure 4. Most popular applications in smartphones

Participants were asked to report the number of native applications they have on their smartphones and how many of those applications they really use in a typical day. We found that 34% of participants have or download from 11-20 applications and 25% have more than 20 applications. But it is obvious that most participants use from 1-5 top applications in a typical day.

For a list of 9 popular applications, participants indicated their preferences for "Mobile application" versus "Mobile website". Figure (5) illustrates how participants' preferences split between mobile applications and mobile websites. It is clear that mobile applications are extremely preferred for social media (like Facebook) and E-mail. We can see that the gap is the widest for social media (76% to 11%), Games (62% to 8%) and E-mail, while it is getting closer for shopping (38% to 42%). However, participants prefer mobile website when they read news or books. Along with this, we can say that participants prefer mobile applications to access the most frequently used applications while they prefer mobile websites for the less commonly used applications
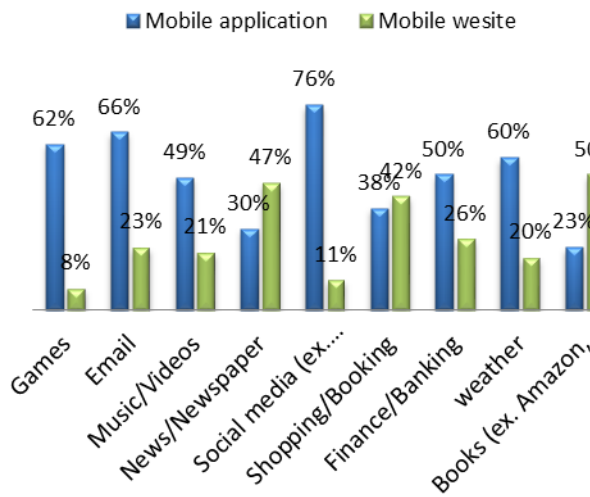
Figure 5. Preferences for mobile access to popular applications

The survey also asked participants to compare between mobile applications and mobile website in terms of speed, eases of use, suitability, user experience and reliability. We can say that mobile application is better, according to participants as shown in figure (6).
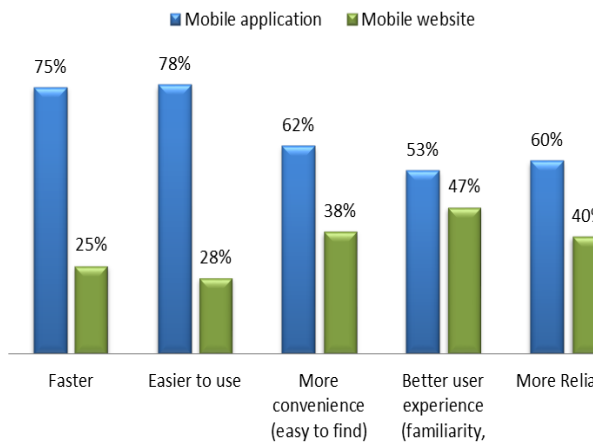

Figure 6. Mobile application vs. Mobile website

In a general question, 45% of participants prefer mobile applications and 16% prefer mobile websites, while 36% says it depends on the site. When participants were asked why they prefer mobile applications or mobile websites; 58% of participants who prefer mobile websites say that they don't want to install more applications on their smartphones while 26% say "because the application related to the website I want to visit doesn't exist or I cannot find it". 35% of participants who prefers mobile applications say that they prefer them because they have a better use, tailored to the mobile phone while 34% of participants say "It is easier to find, straight on my main screen, application list".

Correlations

The result of One-way ANOVA test indicates that there is no difference between graduation level groups by the operating system; (sig=0.234, >0.05) that means the groups are not significantly different. We found that males and females have similar attractions to the operating system. In other words, they are not different.

In order to expose weather, the different graduation level groups spend time on their smartphones differently or not and if there is a relation between the graduation level groups and the time spent on smartphones. The One Way ANOVA result has (sig=0.46; <0.05) that means the variance are significantly different. The pearson correlation value =-0.21. The (-) means the relation is negative which indicates that users who have higher graduation level spend less time on smartphones and the value 0.21 means the relation is not very strong, as shown in Table 1 and Table 2.

Table 1. One way ANOVA: graduation level groups in terms of time spent on smartphones.

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
graduation_level	2,16	4	153	,076

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
graduation_level	Between Groups	11,22	4	2,81	2,49	,046
	Within Groups	172,53	153	1,13		
	Total	183,75	157			

Table 2: Correlation: Graduation level with time spent

Correlations

		graduation_level	time_spent
graduation_level	Pearson Correlation	1,00	-,21
	Sig. (2-tailed)		,007
	N	158	158
time_spent	Pearson Correlation	-,21	1,00
	Sig. (2-tailed)	,007	
	N	158	158

To expose if different age groups and graduation level groups have similar preferences between mobile applications and mobile websites or not; One Way ANOVA test was used. The Levene test result (sig=0.315; >0.05) for age groups and (sig=0.777; >0.05) for graduation level groups indicates that equal variances are assumed. ANOVA result (sig=0.269; >0.05) for age groups and (sig=0.186; >0.05) for graduation level groups indicates that both graduation level and age groups are not different in terms of their preferences.

Table 3. ANOVA test for graduation level and age groups in terms of preferences

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
age	1,19	3	154	,315
graduation_level	,37	3	154	,777

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
age	Between Groups	3,22	3	1,07	1,32	,269
	Within Groups	124,71	154	,81		
	Total	127,93	157			
graduation_level	Between Groups	5,64	3	1,88	1,63	,186
	Within Groups	178,11	154	1,16		
	Total	183,75	157			

Data analysis of interviews

Based on the face to face interviews with participants who have tested the implemented applications, we have got the following analysis. When participants were asked about how they evaluate the two applications in terms of speed, eases of use, suitability, familiarity and reliability; it seems that the gap between mobile application and mobile website is the widest in terms of easier to find while the area is close for other terms as shown in figure (7). Participants could not define their preference for speed, so we discarded it. Figure (8) shows a comparison between the survey results and the interviews results. It is clear that, the results are close except for easier to use where 78% of participants in survey say mobile applications are easier to use while in the interviews 60% of participants say mobile applications are easier to use.
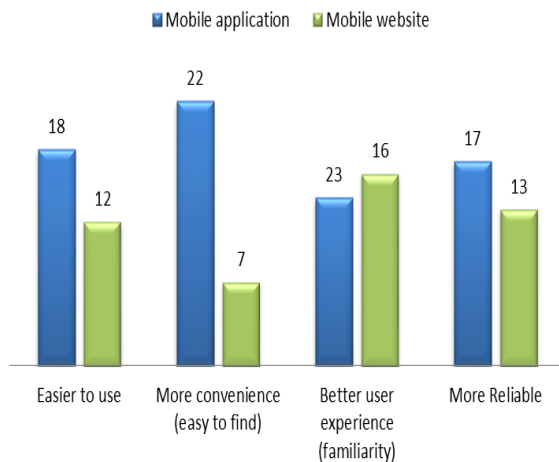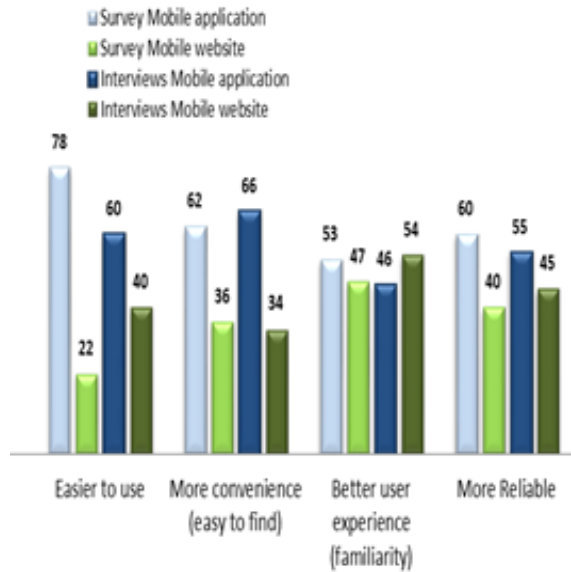

Figure 7. Interviews results

Figure 8. Survey vs. interviews results

IV. CONCLUSIONS

We can conclude our findings as follows:

- We found that 45% of respondents prefer using mobile applications on their smartphones while 37% say it depends on the site and the rest prefer mobile websites. This tells us that mobile applications are mostly preferred, however percentage of participants who make their preferences according to the site is close and cannot be neglected.

- Users who prefer mobile applications attribute this to ease of finding them on the smartphone's main screen and that they have a better use, tailored to the mobile phone. However, users who prefer mobile websites refer this to that they do not want to install more applications on their smartphones.

- Respondents are most likely to use between 1-5 applications per day regardless how many applications they have on their smartphones. This means that mobile application developers have a challenge to develop applications that makes users want to use it again and again.

- The top purposes of using the internet on smartphones are social media, checking E-mail, watching videos and listening to music.

- For most important applications like social media; users prefer mobile application to access them while they prefer mobile websites for the least ones like reading news or books. Along with this, developers have to

tap into the popular sphere to develop a considerably sticky application; otherwise they must develop a mobile website for more chance.

- Majority of respondents (63%) use Android, which means that for any company or individual developers, the Android market must be considered the key market.

- The average time spent on smartphones is 3 hours and we found that respondents with higher education level spend less time as well as that older respondents spend less time than the younger. So, focus should be more on the younger people by mobile developers.

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