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Thematic Analysis of User Experience of Contact Tracing Applications for COVID-19 Using Twitter Data

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ABSTRACT

This paper aims to explore Kuwaiti users' perspectives and experiences with Shlonik, the mandatory contact tracing application that was used during the COVID-19 pandemic. A sample of 2,450 tweets about users' experiences was collected and thematically analyzed. The analysis used DeLone and McLean's information system success model to explore aspects of the degree to which this app can be judged a "success," using parameters of system quality and service quality. A novel finding identified by this qualitative study was the significance of themes identified in the analysis such as social privacy (timing, privacy, and female privacy, which are related to the cultural and religious norms of Kuwait) and technical privacy (related to data protection). The research identified significant conflict with cultural and social norms in users' experience of the Shlonik app – factors not normally identified or discussed in existing literature. This research supports a need for improved strategies and designs in future m-government applications in developing countries.

KEYWORDS

Applications, Contact Tracing, COVID-19, M-Government, Twitter Data, User Experience

INTRODUCTION

During the initial phase of the COVID-19 crisis, Kuwait introduced the Shlonik mobile contact tracing application (app). Implemented by the Central Agency for Information Technology and developed by the mobile communications company Zain, the app was designed to support tracing quarantined citizens, allow a connection with them, and support the delivery of critical information (Ministry of Health, Kuwait). Through the Shlonik app, the ministry could monitor the location of quarantined people 24/7, along with persons with whom they may come into contact. Quarantined people could also enter their vital data into the app and communicate with relevant medical teams if any symptoms appeared (Communication & Information Technology Regulatory Authority, 2022).

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Digital contact tracing apps symbolized the permeation of technology into all aspects of citizens' lives and were particularly stringent during the pandemic (Akinbi et al., 2021). Social media was another prevalent technological tool during this period, providing a source of trending information for many domains. Both users and providers utilized social media in all areas of business, crisis management, healthcare, and politics. This also resulted in "[an] enormous growth of social media usage… [leading to] an increasing accumulation of data, which has been termed Social Media Big Data" (Stieglitz et al., 2018, p. 156). Twitter, one of the most prominent social media platforms, contributed to this mass accumulation (Naseem et al., 2021). Not unexpectedly, the outbreak of the pandemic and accompanying lockdowns prompted a flood of social media postings as people sought information to allay their fears and share opinions and experiences (Chen et al., 2014; Zou et al., 2018). Twitter recorded the lived experiences of diverse groups (Tsao et al., 2021), introducing a new potential format for research data collection differing from conventional methods such as interviews, surveys, and focus groups (Chen et al., 2014). Notably, some researchers perceive traditional sources as restrictive when collecting respondents' opinions compared to the potential of disorganized and unstructured data on social media platforms (Chen et al., 2014). Therefore, social media data gained considerable attention and legitimacy from policymakers and academics (Stieglitz et al., 2018). We considered Twitter data appropriate for this study, with its specific aim of exploring users' experiences with contact tracing.

Kuwait, one of several oil-rich developing countries, has a population of 4.329 million (World Bank, 2021). As in other countries, Kuwaiti residents resorted to social media to express their opinions about contact-tracing apps (Akinbi et al., 2021). The Shlonik contact-tracing app generated feedback from Kuwatis, who posted comments about their experiences on Twitter. This research uses the Twitter dataset to explore users' opinions about the system quality (usability, availability, reliability, adaptability) and service quality (technical and medical features) of the Shlonik app.

The research offers significant and novel findings based on a fine-grained exploration of users' experiences of contact-tracing apps and mobile government in Kuwait using social media sources. Most research on contact tracing focuses on the design of the technology (Bente et al., 2021; Chuenyindee et al., 2022), privacy and cybersecurity (Azad et al., 2021; Bengio et al., 2020), and concern about the operability of the technology (Deters et al., 2021; Osmanlliu et al., 2021; Parker et al., 2020). Few studies have explored system and service quality simultaneously within an information system model, and most studies overlook cultural and social factors in favor of a focus on technical aspects. This study's application of Delone and McLean's (2003) Information System Success (D&M ISS) model as a theoretical lens to explore the phenomenon is novel. The usefulness of the D&M ISS model to understand users' perspective of system quality is pivotal, given the inability to pilot test the technology because of time constraints. Feedback of this nature on health informatics will prove helpful to both users and governments regarding the administration of medical technology in the future. The following research questions guided the study: What were users' lived experiences of the quality of the contact tracing Shlonik app, and what factors influenced its audience reception, take-up, and use?

The study makes several unique contributions to the field. First, few studies use Delone and McLean's model to explore contact tracing apps. Existing studies mostly take a quantitative rather than a qualitative approach to exploring underlying factors or influences on user behavior. Here, we use the D&M ISS model as a framework for qualitative data analysis. The research draws upon a unique data source (tweets) concerning the app users' lived experiences and uses large data sets. This adds to the richness and depth of the analysis, which in turn adds to the study's credibility. Although this study uses a qualitative, thematic analysis methodology, it utilizes a large dataset, building confidence in the results. Second, this research identifies significant conflicts between the app and cultural and social norms. The existing literature on m-Government and contact tracing apps does not commonly discuss these conflicts. The study highlights significant issues, such as privacy concerns across various dimensions, including social privacy (timing and female privacy) and technical privacy (data protection). As such, the paper's relevance extends beyond information

systems researchers to include policymakers, healthcare administrators, and technology designers. Without research on user experience, a technology-based assessment of an app's success offers only a limited perspective. This research addresses this gap.

LITERATURE REVIEW

Contact Tracing Applications

Digital contact tracing apps joined the suite of new technologies developed during the Covid-19 pandemic (Riemer et al., 2020). Apps kept track of infectious patients and meetings between individuals and informed populations about the virus (Akinbi et al., 2021; Albouy-Llaty et al., 2021). The ubiquitous use of smartphones assisted public health authorities (Davalbhakta et al., 2020). Nonetheless, public skepticism about user privacy and security issues, the quality of the applications, and mistrust of governments' surveillance of private lives produced mixed results globally (Bengio et al., 2020; Seberger & Patil, 2021). Whether and how these apps succeeded in managing the spread of the virus constitutes ongoing research (Davalbhakta et al., 2020). The following sections review the quality factors of the contact tracing applications and privacy and security issues.

Quality Factors

"System quality," based on DeLone and McLean's (2003) work, refers to the measurement of quality and depends on several factors, including ease of use, functionality, reliability, flexibility, data quality, portability, integration, and significance. "Service quality" refers to the quality of service that users receive from IT support personnel or the information system association in general or for a specific information system.

The public's use of these apps has inspired several studies of users' experiences and perspectives on their quality. Saleh et al. (2021) proposed an assessment of 1,208 users' experiences with Jordan's contact tracking app (AMAN). The app was categorized as satisfactory, based on feedback judging it as excellent for its attractiveness, efficiency, dependability, and stimulation. The app also ranked well for clarity and novelty. In Thailand, Chuenyindee et al. (2022) explored factors affecting the perceived usability of their app by integrating protection motivation theory, the extended technology acceptance model, and the system usability scale, using a questionnaire to which 800 persons responded. Structural equation modeling showed that understanding COVID-19 significantly affected perceived severity and vulnerability, subsequently leading to perceived usefulness. Moreover, perceived usefulness and ease of use significantly affected attitude, subsequently increasing intention to use, actual use, and perceived usability. In the Netherlands, a study investigated whether digital apps supported the traditional contact tracing employed by public health authorities (Bente et al., 2021). The CoronaMelder app was evaluated with scenario-based, think-aloud usability tests and additional interviews. The findings revealed that the app was easy to use, but participants found its function was ambiguous. This perceived lack of clarity led to misconceptions about the app, such as its usefulness and privacy-preserving mechanisms.

Other researchers have examined the design and implementation of contact tracing apps (e.g., Han et al., 2021; Osmanlliu et al., 2021) and app quality. Davalbhakta et al. (2020) assessed COVID-19 apps using the Mobile Application Rating Scale for overall quality, engagement, functionality, aesthetics, and information in three regions (India, the UK, and the USA). Through qualitative assessments, they analyzed the apps' strengths and limitations and provided an overview of salient features that should be available in future apps. However, they failed to collect or analyze users' reviews. From the 63 apps assessed, only 24 had overlapping functions (information dissemination, symptom self-checking, and contact tracing). Alassaf et al. (2021) assessed COVID-19 apps in Saudi Arabia using a qualitative content analysis method. During the COVID-19 pandemic, three apps emerged in Saudi Arabia, each serving a different purpose: information, symptom checker, and contact tracing. The authors

found more strengths than shortcomings in their implementation, but the study also failed to look at user experiences or reviews. Meanwhile, Shubina et al. (2021) constructed a compact mathematical model comprising technical, epidemiological, and social factors. They evaluated the effectiveness of contact tracing apps based on these factors and discussed the limitations and challenges of their adoption. The authors proposed building a holistic model from a technical, social, and epidemiological perspective to estimate the maximum prevention probability these apps can offer. Correspondingly, Dar et al. (2020) proposed an evaluation framework for contact tracing apps to determine their usability, feasibility, scalability, and effectiveness.

In Qatar, similar to Kuwait, the use of the app is obligatory. Al-Soni and Abu-Shanab (2021) found that several factors, such as performance expectancy, effort expectancy, system quality, and trust, influenced the utilization of the Ehteraz app. However, information quality, technical experience, and privacy did not significantly predict satisfaction. Chan et al. (2021) aimed to investigate the factors that impacted the willingness of Malaysian citizens to use the MySejahtera application. This study was guided by the unified theory of acceptance and use of technology (UTAUT2). The findings indicated that four factors—social influence, facilitating conditions, habit, and perceived privacy credibility—were significantly and positively associated with using the MySejahtera application. On the other hand, the study revealed that performance and effort expectancy were not significantly linked to people's willingness to use the tracking application. This research contributed to media information technology scholarship by highlighting the importance of perceived privacy credibility as a crucial factor (Chan et al., 2021). This issue becomes relevant in the present study. Wulandari and Hidayanto's (2023) study used text mining techniques to analyze user reviews of the PeduliLindungi contact tracing app and found four primary service quality dimensions: system efficiency, functional benefit, system availability, and emotional benefit. The study revealed that system efficiency and functional benefit were the most significant factors in determining the service quality of a contact tracing application from a user perspective. The emotional benefit dimension received the lowest score, 46.2%, indicating a need for the government to focus more on this aspect. To improve service quality, user issues such as app crashes, unresponsive displays, inconsistent availability of vaccine certificates, and inadequate app functionalities must be addressed.

Alfarrel's (2023) research explored how privacy concerns, trust, belief, and risk belief impacted user satisfaction with PeduliLindungi, a contact tracing app developed by the government of Indonesia. Additionally, it examined the effect of various factors proposed by DeLone and McLean (2003) and Davis (1989) regarding the adoption of information technology. Analyzing data from 242 participants, the research confirmed the correlation between user satisfaction and privacy concerns, risk belief, system quality, perceived usefulness, service quality, and perceived ease of use. This research suggested that information quality and trust did not significantly affect user satisfaction. Moreover, the study demonstrated that risk belief mediated the relationship between privacy concerns and user satisfaction. Another use of the DeLone and McLean model can be seen in Purwanto et al. (2021), who explored the success factors of an information system. According to their findings, the quality of the system had a positive impact on its use and user satisfaction, while the quality of service had a positive influence on the use of the system but not on user satisfaction. On the other hand, the quality of information did not have a significant effect on either use or satisfaction, but both use and user satisfaction had a significant impact on the net benefits of the systems.

Privacy and Security

Low global uptake rates of the apps were widely attributed to security and privacy concerns. In a large-scale study exploring public support for contact tracing apps in France, Germany, Italy, the UK, and the USA, Altmann et al. (2020) found that concerns about cybersecurity and privacy and low trust in the government were the main barriers to adoption. Another study found that perceptions of low prioritization of privacy contaminated UK citizens' attitudes toward contact tracing apps, although citizens gave more credence to the National Health Service's (NHS) centralized system. In

other words, trust in the NHS overrode privacy concerns (Dowthwaite et al., 2021). However, these results appear anomalous or inconsistent (Horvath et al., 2020) with the results from a study based in South Korea, which studied acceptance rates and concerns over COVID-19 app usage among 1,148 respondents (Park et al., 2021). Despite the high intention to use these apps, users were also concerned about privacy issues and media exposure. In South Africa, thematically analyzed data based on online user reviews and government reports confirmed low trust concerning privacy and security (Albertus & Makoza, 2022). A study by Villius Zetterholm et al. (2022) reviewed 25 studies from different parts of the world to explore the public acceptance of contact tracing apps and found that acceptance varied depending on cultural and sociodemographic factors. Among the significant aspects that affected acceptance were trust, privacy, and social responsibilities.

Duan and Deng (2022) explored the adoption of contact tracing apps and privacy issues in Australia using the privacy calculus theory. The study found that the *perceived benefits, perceived privacy risk, and trust* highly influenced the adoption of contact tracing apps. This research also found that perceived ease of use in the adoption of contact tracing apps had an insignificant influence on perceived privacy risk. Huang et al.'s (2022) study in China investigated perceived privacy protection among the users of China's app. They found that *users' perceived convenience*, *attention towards privacy policy*, *trust in government*, and *acceptance of government purposes* regarding China's contact tracing app data management significantly contributed to users' *perceived privacy protection* in using the apps.

Hong and Cho's (2023) study investigated citizens' decision-making around the adoption of AI-based contact-tracing technology. This study highlighted *negative affect*, *perceived net equity*, and *uncertainty* on *individuals' privacy-related decisions*. This research noted the complex interplay between emotions, rational judgments, and perceptions when understanding attitudes, motivations, and behaviors around the adoption of new health technologies. The study found that the perception of fairness in the distribution of benefits and risks (perceived net equity) was positively related to lower levels of uncertainty around contact-tracing apps and willingness to engage with them. The specific user-perceived level of uncertainty was found to mediate the association between perceived net equity and adoption intentions. This study drew attention to the importance of reducing uncertainty—critical in individuals' assessment of an app and subsequent decision-making. Additionally, the authors noted relationships between perceived net equity and uncertainty as moderated by a range of anxieties more broadly related to AI technology and COVID-19 risks, with consequent implications for adoption intentions towards specific contact-tracing technology. This study is also notable for its consideration of users' emotions and feelings—factors that played a significant role in people's attitudes and behaviors around technology and governance.

Security and privacy appear widely as significant issues (e.g., Abeler et al., 2020; Cho et al., 2020; Parker et al., 2020), but researchers have proposed different alternatives to counter concerns. For instance, Fitzsimons et al. (2020) offered a practical framework from a computer science perspective. They proposed a protocol to maintain the location privacy history of two parties who came in close direct contact based on their absolute locations. In this way, they demonstrated the adequacy of the existing infrastructure to support anonymized contact tracing at a national level. Xu et al. (2021) also proposed an app using blockchain technology that could provide higher security and privacy. Meanwhile, in Singapore, Cho et al. (2020) proposed a model incorporating three notions of privacy: privacy from snoopers, privacy from authorities, and privacy of contacts. Despite these recommendations, the public's reservation was not assuaged as the research demonstrated that technological weaknesses forced a compromise. Azad et al.'s (2021) analysis of different security and privacy metrics found many breaches of users' privacy through access to storage media, cameras, and microphones. Several app owners outsourced data without providing users with adequate details about the type of data shared or the identity of third parties. Moreover, some failed to adopt appropriate security measures for data exchange between users and data centers. Ali and Zaaba (2021) found that a third of contact tracing apps failed to provide a privacy policy in their documentation.

Johnson et al. (2023) investigated factors in mobile contact tracing apps' acceptance by utilizing the theory of reasoned action and rational choice theory. Given the broader set of factors that impact chosen behaviors, this approach had limitations, as discussed above and in the rest of this paper. For instance, Johnson et al.'s (2023) results revealed that an individual's attitude towards usage intention was positively influenced by the perceived benefits of usage and the perceived costs of non-usage. Conversely, information security concerns, such as perceived usage costs, had a negative impact. The present study aims to examine what kinds of factors might appear as perceived benefits or costs.

Cultural Factors

The literature has widely confirmed the powerful influence of cultural context on technology acceptance. Contact tracing has been accepted more in socio-centric Asian countries than in individualist societies such as the US and Europe, irrespective of privacy design. Some societies displayed other specific and dominant issues. For example, a survey study undertaken in Qatar by Al-Soni and Abu-Shanab (2021) found that privacy was not a significant predictor of satisfaction. Instead, performance and effort expectancy, system quality, and trust emerged as more significant. Meanwhile, a Japanese survey by Shoji et al. (2021) found that it was essential to differentiate between the generations by sending different messages to distinct age groups to increase the adoption of contact tracing apps. For example, older adults wanted to be informed of health benefits, middle-aged adults were more focused on security and privacy concerns, while younger users thought it was more important to show community attachment. Psychological factors also play a part. Deters et al. (2021) explored motivations for adopting contact tracing apps in Germany and Switzerland. They found that personal health concerns played a role in adoption, while the possibility of unknowingly infecting others did not. Accordingly, the researchers recommended various communication strategies to encourage use. Ødeskaug et al. (2023) examined the Norwegian contact tracing application among citizens by focusing on trust, privacy concerns, and risk beliefs towards the Smittestopp app. The study found that privacy concerns reduced trust and increased risk beliefs, while trust and perceived advantages enhanced the intention to use the app. Negative emotions moderated the relationship between risk beliefs and intention to use, whereas positive emotions amplified the influence of perceived benefits on app usage intention. Ultimately, citizens' intention to use the app resulted in the actual utilization of the Smittestopp app. In India, Prakash and Das (2022) found that distrust and information privacy concerns were among the factors increasing resistance to the use of contact tracing applications. Abramova et al. (2022) found that individual privacy calculus highly influenced the intention to use and the actual use of contact tracing applications in Germany and Switzerland.

In most of the studies mentioned above, the use of contact tracing apps was voluntary, in contrast to the obligatory use ordered by Kuwait's government. Therefore, the present study's findings might be more beneficial in Kuwait and other countries whose governments require the use of an app.

Most of the studies reviewed were observational quantitative studies. Therefore, this research fills a gap in the literature by using a more subjective, interpretative qualitative method, which is deeper and more context-based compared to previous studies based mainly on surveys and quantitative methods. The research also incorporates and considers those countries that are often under-represented in the literature.

Theoretical Framework

The study is grounded in DeLone and McLean's (2003) information system success model. This widely recognized multidimensional and interdependent model explores the efficiency of technical communication and the semantic level used to study the success of an information system (DeLone & McLean, 2003). Although the model has been used mainly in quantitative papers, its application within a qualitative approach is not an anomaly. Indeed, the qualitative approach has been increasingly featured in information systems and information technology to explore humans, processes, procedures, and their relationships (Subiyato et al., 2015). For instance, Sabani et al. (2019) used the model to

assess user satisfaction and usage intent of e-government services in Indonesia. Correspondingly, Shim and Jo (2020) used a qualitative approach to apply the D&M model to assess information quality and user satisfaction of an online health information site. The results indicated that these significantly increased users' perceived benefits, especially in building trusted relationships, but system quality had no significant relationship with user satisfaction. In the present study, the model provides a comprehensive understanding of the quality of contact tracing apps that goes beyond their perceived effectiveness by using the following dimensions: system quality, service quality, and user satisfaction.

RESEARCH METHODOLOGY

Study Design

This study incorporates a large dataset to increase confidence and applies a qualitative method, which is best suited for exploring a relatively new phenomenon. The study is grounded in the interpretivist paradigm and, as such, is not concerned with technical or operational issues but with human experiences and understandings of the technology and its uses.

Analysis Technique

We used thematic analysis to evaluate the perspectives of users who tweeted about the Shlonik app. The rationale for using Twitter data, as opposed to traditional data collection methods (e.g., surveys and interviews), was that Twitter allowed the observation of the phenomenon in real time, and the data were available via Open Authentication. The Twitter platform also facilitated the recording of emotions, perceptions, opinions, and other sentiments. Moreover, Twitter is well-known in Kuwait as a platform to criticize the government or parliament's performance without adverse effects. Therefore, it was deemed the best place to capture lived, unfiltered user experiences. This offered a distinct advantage over time-bound data collection, and the impartial and honest data added value to the study.

Data Collection

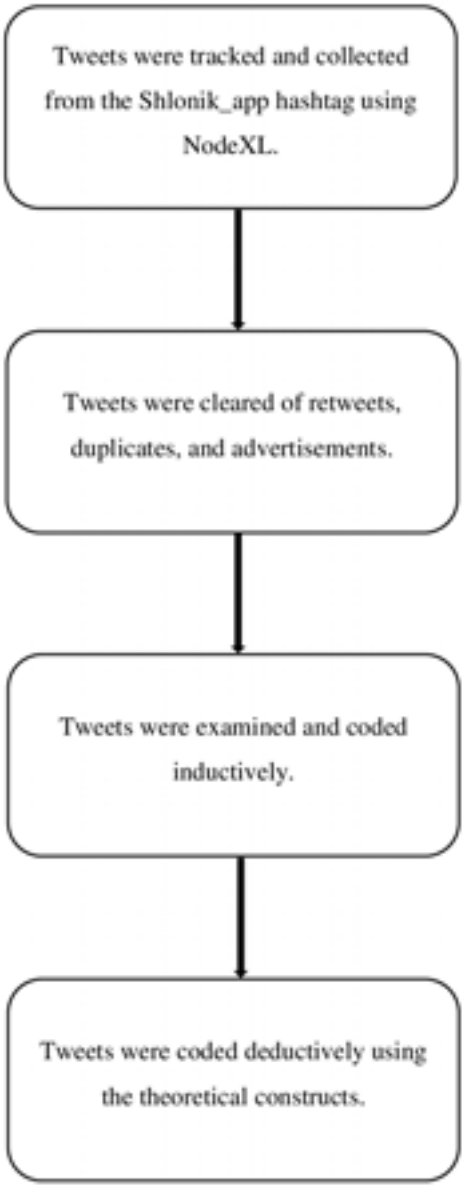
Data were collected from Twitter through NodeXL (social media analysis software) from April 1, 2020, to March 31, 2021. The period represented the launch of the Shlonik app and coincided with the end of the first wave of coronavirus and the start of this research. Data collection involved two stages. First, we collected data from hashtags (Shlonik app) written using two Arabic spellings (*shlonik* and *eshlonik*). Initially, we intended to use keywords without the hashtag, but since "shlonik" in Arabic means "How are you?" a search using this term produced many unrelated tweets. Therefore, we limited the collection of data to hashtags with the Shlonik app, including the word "app," which limited the focus to the intended tweets. At the end of the period, approximately 10,000 tweets were collected.

The second stage involved further cleaning the data, as a quick examination revealed retweets, duplicates, replies, and advertisements, which we subsequently excluded. In the third stage, the data revealed approximately 2,450 original tweets, which we used for the final analysis. Figure 1 presents a model of the data collection process.

Data Analysis

We analyzed the tweets using thematic analysis (Braun & Clarke, 2006) to better understand users' satisfaction with and perspectives on the performance of the Shlonik app. Collecting and analyzing social media data can be challenging because it is user-generated content (Chen et al., 2014). Another challenge involved the synonyms between words because of the different accents used in Arabic. Kuwaitis (and other Gulf countries) understand the hidden meaning of such tweets better than non-native researchers or automatic algorithms. Therefore, the tweets were manually coded because of the Kuwaiti context, the type of data, and the topic itself. We extracted rich, in-depth information to quantify and report on general themes.

Figure 1. Data collection process



Two Kuwaiti researchers coded the tweets manually using Excel spreadsheets and triangulated the data with the literature to increase the validity of the analysis. The first round of coding was done inductively through content analysis to explore the data and identify trends—topics, events, and experiences shared by app users. Table 1 presents a chronological analysis of events and includes actions at the organizational level and general reactions from users. We generated a list of preliminary codes and added a column to the Excel sheets for short memos during coding.

The second round of deductive coding was conducted using the D&M ISS model. A list of codes was generated regarding system quality, service quality, and use of and satisfaction with the app.

Table 1. Chronological events for coding

Date	Events	General User Experiences/Reactions
April 2020	• Release of the Shlonik application by the Ministry of Health with bracelets for tracking; bracelets later abandoned • Evacuation of Kuwaitis from abroad • The Kuwait government gives away mobile phones for Kuwaitis without one to allow them to run the Shlonik application	• Kuwaiti citizens are satisfied with the government's decision to use technology in managing the crisis • Kuwaiti citizens spread awareness of the app to minimize virus spread • Kuwaiti citizens are surprised by the "selfie" option
May 2020	• Complete lockdown • New protocol to keep affected people without severe symptoms at home, monitored by the Shlonik app	• Kuwaiti people are annoyed with the viral spread of an image of a woman and an older man in a supermarket wearing a bracelet using the Shlonik app • People question the reliability of the app's tracking feature
June 2020	• The government offers testing, but people must register using the Shlonik app to make an appointment • The Ministry of Health asks all Kuwaiti residents to download the Shlonik app to find out who around them is affected (but this did not happen; it was only used by affected people)	
June 2020	• Amnesty International raises privacy and security concerns over "invasive" contact-tracing apps rolled out by Bahrain, Kuwait, and Norway to fight the coronavirus pandemic • Added a new feature for tracing and voice recognition, as well as the selfie option	• Users start raising privacy concerns
July 2020	• Parliamentary members ask about the privacy of Shlonik app data (selfies) and how it will be disposed	• Users continue to question privacy issues
Nov 2020	• The suggestion is made to use the app to manage parliamentary elections of December 2020	
Dec 2020	• 600,000 app users • People in quarantine who want to participate in the election must get approval to attend through the Shlonik app • Shlonik app wins the Salem Alali prize for digital technologies • Ease on airport restrictions with PCR testing and 14 days' quarantine through Shlonik app	
Jan 2021	• The end-of-quarantine certificate is issued through the Shlonik app	
Feb 2021	• The government mandates quarantine in hotels for travelers; people are annoyed and demand home quarantine for those with an active Shlonik app	• Rumors spread about registering more than one person to the same telephone number in the app. The Ministry of Health addresses this via Twitter
March 2021	• E-gov conference held to discuss the Shlonik app	

Following a meticulous deductive and inductive coding process, we consolidated the codes within the Excel spreadsheets. We pursued thematic identification while maintaining a holistic view of the extensive dataset. We executed this phase manually, employing color-coded markers and adhesive notes. Lists were curated to delineate connections amongst codes, facilitating their clustering. Subsequently, we categorized the codes into broader thematic groups (see Table 2).

Table 2. Major codes grouped into themes

No.	Themes		Codes
Theme 1	System quality	Some major codes	• Ease of use • Annoying • App features • Selfies frequency • App updates • Trust • Adaptable • Available
Theme 2	Service quality	Major codes	• Bad service • Good service • Medical support • Technical support • App activation • Satisfaction
Theme 3	Social privacy	Major codes	• Culture • Norms • Ramadan • Hijab • Selfies privacy • Selfies security • Trust
Theme 4	Privacy	Major codes	• Tracking • Selfies management • Selfies privacy • Questioning • Bad management • Data protection • Trust

- Codes related to system quality.
- Codes related to service quality.
- Codes related to privacy (based on cultures and norms).
- Codes related to privacy and security (based on technical considerations).

We convened periodically to discuss emerging themes, combining, removing, and restructuring codes within these themes in alignment with the study's objectives. We then established a definitive set of themes and sub-themes, as illustrated in Figure 2.

We conducted the data analysis process in Arabic, translating the information into English during the writing-up stage "to ensure that [we] captured the users' intended meanings during the analysis process" (Almossa, 2021, p. 7163).

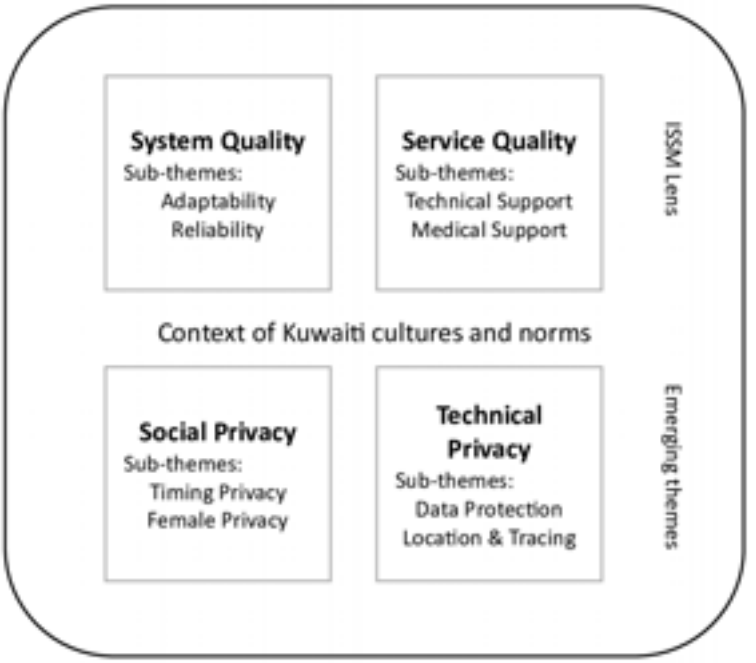
FINDINGS AND DISCUSSION

We present the following research findings based on the D&M ISS model. We then discuss the emerging themes revealed by the inductive open coding process.

Theme 1: System Quality

System quality is a multifaceted construct designed to capture the system's performance from a technical and design perspective (Gable et al., 2008). Most users found the Shlonik app easy to use

Figure 2. Themes and subthemes



and available; however, many felt it was a nuisance. They considered the check-in feature an irritant, as it requested selfies (face recognition) as a verification process. The repeated calls and check-in notifications also annoyed users.

The repeated notifications and orders from the app (a key system feature) affected people's private time (sleep, meals, and breaking fast during Ramadhan). This made the app irritating, especially since check-in times were unplanned. While the app was simple to use and readily available, its features could be overwhelming, negatively affecting the overall user experience. Also, users expressed that the intrusive nature of the app affected their mental well-being, elevating stress levels in an already high-stress situation (see Table 3).

Regarding the adaptability of the Shlonik app, the issue that emerged as most significant involved the app's inability to adapt to different user statuses, places, and conditions. This placed an unnecessary burden on users. The app distinguished between two types of users—travelers and patients—and two types of quarantine locations—private homes and government sites such as hospitals or hotels. In addition, partial and full lockdowns occurred in 2020 and 2021. The Shlonik system could not differentiate between users and places or adapt during full or partial lockdowns or periods of hospitalization (see Table 3).

Users also experienced the app's constant requirement for selfies and check-ins, regardless of user status and context, as a burden. The lack of adaptability to different user statuses and contextual factors represents an inefficiency, placing both human and technological resources under stress. This inefficiency, plainly perceived by the public, further negatively impacted user experience. This could affect the app's effectiveness in achieving its public health goals. Future iterations of such apps should focus on smarter, more context-aware features to improve user experience and effectiveness.

The reliability and trust of the application were highly affected when a photo of a woman and an older man wearing Shlonik bracelets and shopping at a supermarket went viral on Twitter. At this point, people started questioning the app's reliability. Following this event, the app lost credibility,

Table 3. Themes and sub-themes for system quality

Theme/Sub-Theme	Quotations	
Theme 1: System Quality	"The most horrible part of Corona is the Shlonik App."	
	"Every half an hour they [Shlonik app] ask for a selfie, I have taken more selfies for the app than all the selfies I have taken in my life."	
	"I may enter into a psychological state because of the Shlonik App... this is impossible... what is this disturbance?"	
	"Shlonik app, can I sleep please... don't ask for selfies every minute. I swear I'm quarantined."	
	"I'm concerned about the Shlonik app more than about the symptoms of the disease."	
	Sub-theme 1: Adaptability	"Why should I take selfies every 2 hours while I'm in governmental quarantine!"
		"Shlonik is asking me to check in every second; please after 5 pm don't ask, where will I go, I'm quarantined and it is partial lockdown."
	Sub-theme 2: Reliability	"This is a clue that the Shlonik app is useless. It is not tracing, not tracking, nothing; they are relying on calling and selfies not tracking… I say it again it is useless…"
		"If people did not capture the lady in the supermarket wearing the bracelet, nobody would know about her. Where is the app? You said it was tracing movements!!!"
		"The problems are repeated with the Shlonik app and the bracelet attached with it; people are shopping while wearing the bracelet, this means there is a technical fault, and it needs to be quickly reviewed and fixed."

and people began questioning its technical capabilities. The incident provoked an outbreak of tweets and close public attention, including some demands for accountability and response. The event, which caused disillusionment and even negative assessments of the app's fitness for purpose, led to a loss of trust and negatively affected user experience (see Table 3).

In sum, tweets confirmed the ease of use of the Shlonik app, but many design features, such as "check-ins" and poorly timed notifications, annoyed users. Users also considered the app's mandatory use annoying, unlike the options offered in other countries (Horvath et al., 2020). Mandatory use seems to have exacerbated already negative assessments of the app, rooted in some of the poor user experiences noted above. The app also included some non-adaptable features based on the user's place of quarantine or user status, such as infected, traveler, or contact with an infected person. Regarding reliability, citizens' trust in the app was easily influenced (Gable et al., 2008). The app's mandatory usage and lack of flexibility posed the risk that users would attempt to "game" the system. Users questioned the location tracking feature when it could not enforce the isolation of persons at high risk for COVID-19. Public services that are mandatory but unreliable are unhelpful to public health, as they foster mistrust and unease. This can create a climate of broader mistrust towards public services and government. Users have previously evaluated technology and applications regarding issues around design or difficulty of use, but the "annoyance" of the app revealed in this study of user experience was an unusual expression and a unique finding. In addition, the adaptability and reliability of the application are two significant points in any system and highly impact user experience. Table 3 presents several quotes from users illustrating the themes and sub-themes regarding system quality.

Theme 2: Service Quality

Service quality in the D&M ISS model relates to the quality of the support users receive from support personnel such as IT support and chat line operators.

The Shlonik app offered two types of services—technical and medical support (the latter from a physician). Most of the negative tweets were about technical support. Users complained about non-responsiveness to technical questions from the hotlines (see Table 4). Conversely, medical support from doctors received less criticism (see Table 4). Because app use was mandatory, but strong and efficient technical support was not offered, support for the app and trust in its efficacy was lost. This could have broader adverse effects on citizens' attitudes towards the ultimate sponsors of the app, namely public health and government officials. The risk here becomes one of evasion via "gaming" the system and negative or non-compliant attitudes. When technical support fails users, they become disgruntled and still require help; if users then contact other branches of government for support or simply to make complaints, this increases the workload and capacity strain of a system already working at full capacity. When users resort to Twitter to complain about the inadequate services they received or to express anxiety around the legal obligation to use the app, user pressure and frustration become evident, and the app's "success" is heavily compromised.

To conclude, users criticized the app's technical support while offering its medical support less criticism and more compliments. Notably, the two services were managed by different parties, offering one possible explanation for the variance between them. Another reason could be that users considered the information produced by the health services vital, and the output represented precisely what they needed. The difference between the user experience of the medical and technical support systems impacted the app's success and indicates an unevenness in user experience. In the longer term, a poor experience can lead to a loss of trust in the app and poor user take-up or compliance.

Another theme that emerged beyond the ISS model lens and influenced users' experiences with the app was privacy. Privacy concerns were twofold and were categorized as social and technical. The following sub-sections provide in-depth explanations.

Theme 3: Social Privacy

The social privacy theme is based on Kuwait's cultural norms. The Shlonik app requested that users take selfies several times daily. The first issue involved the timing of the requests, and the second involved the selfie request itself.

Table 4. Themes and sub-themes for service quality

Theme	Sub-Themes	Quotation
Service quality	Technical support	"The symptoms of coronavirus are not easy, although the pain the affected person feels is easier than the suffering from the Shlonik App, which does not accept registrations, too many notifications, and no answer when technical support is needed… from a person newly affected with coronavirus."
		"I deleted the app and reinstalled it and now it is not verified. They are not sending the verification code, and there is no way to contact them... what can I do? Moreover, they are calling me through automatic calls to verify the app!!"
	Medical support	"There is a chat function in the Shlonik app for medical consultation; you can send your question and you will get a fast answer... but don't call, they will not answer the phone, but they will answer the live chat faster …."
		"Shlonik app staff are so kind and nice, they answered my questions fast… thank you so much."

Timing Privacy

Regarding timing privacy, users expressed annoyance at Shlonik's repeated requests to check in by taking two-sided selfies. Requests were sent multiple times daily (during private times, early morning, nap times, Ramadhan, and breakfast time—usually a private time for families to break their fast and pray). Shlonik's timing and repeated notifications made it a source of noise and a nuisance. For example, during Ramadhan, the timing of daily events changes in Kuwait, and daytime sleep becomes the norm. The official schedules for schools and government institutes also change, commencing approximately two hours later and finishing one hour earlier.

Female Privacy

On the other hand, the female privacy theme emerged due to women expressing social privacy concerns about using the app and its numerous requests for daily selfies. Kuwaiti women usually cover their heads with scarves (for religious reasons) but remove them at home or in private places. The repeated requests obligated female users to don scarves to take selfies because they were unsure who could access their data. This raised additional privacy issues regarding data protection. Moreover, women felt they could only take selfies in modest clothing. Cultural norms in Kuwait dictate that men and women wear modest and appropriate clothing in public. The Shlonik app proved disruptive as it invaded their privacy by requesting selfies in the privacy of their homes. For example, one user counted 140 requests for selfies as a returning Kuwaiti quarantined for a month in government facilities, illustrating the continuous abnormal requests to check in. The imported technology was based on different cultures and norms, thus challenging cultural and religious norms and negatively affecting user experiences.

The app was designed rapidly and under pressure but with positive intentions of supporting public health and protecting citizens. However, the app's complex technical design and implementation, with its intrusive features, low flexibility, and lack of good tech support, all impacted heavily on user experience in significant and negative ways. As evidenced by users' objections, cultural and social norms around privacy were not fully considered. The lack of a cultural "fit" made the app less likely to be accepted and properly used, increased the risk of non-compliance, and threatened the app's intended use as a public health safety strategy.

In conclusion, unique findings emerged from the tweets related to Kuwait's cultural norms. Users found the invasion of privacy and the multiple daily requests for selfies overwhelming. The adversarial points were thus the timing and selfie requests. Most studies of contact tracing apps discuss the privacy of users from a technical standpoint, such as location, data protection, and third-party access (e.g., Ali & Zaaba, 2021; Altmann et al., 2020; Azad et al., 2021; Cho et al., 2020; Fitzsimons et al., 2020; Xu et al., 2021), which emerged as the main reasons for weak adoption. However, timing and female privacy are seldom discussed in the literature. Timing privacy is directly related to the technical features mentioned earlier. The selfie check-ins were requested at inappropriate times and disregarded cultural norms. These check-ins also impacted privacy and gender issues and, in turn, affected users' experiences. Research on the culture of contact-tracing apps is also limited, although Dzandu et al. (2022) noted that national culture moderated the acceptability of contact-tracing apps. Also, Geber and Ho (2022) stressed the need for a cross-cultural perspective in the context of health prevention measures during crises. Users received the Shlonik app as lacking respect and sensitivity for social and cultural norms. When technology is mandatory but under suspicion around efficacy, this presents a problem; when these technical problems and lack of support are compounded by an initially poor design that does not consider user norms and preferences, the problem is magnified. This study has presented data and thoughts on this issue. Table 5 presents the themes and sub-themes related to social privacy.

Theme 4: Technical Privacy

Technical privacy is related to the technical side of the app or privacy within a technical context. This includes data protection and location tracing.

Table 5. Themes and sub-themes for social privacy

Theme	Sub-Themes	Quotation
Social privacy	Timing privacy	"The Shlonik app enjoys asking for selfies at breakfast time." [Ramadan time]
		"Shlonik wakes me from my sleep during Ramadhan; it wants me to wear my scarf and take a selfie then go back to sleep."
		"Is this for real, Shlonik? Every minute annoying people and asking for selfies even at midnight… they send notifications and call, can you confirm this is real?" [tweet mentioned the Ministry of Health]
	Female privacy	"Shlonik has become a source of annoyance for people who are quarantined at home. What is the reason for repeated calls and requests for selfies, it is more difficult for covered women. The app's goal is to make sure that the person is in their place not to penetrate their privacy; therefore, they should not call or ask for selfies unless they doubt they are in their place."
		"Shlonik app, find another way other than 'take a selfie'; this is unbelievable, we are ladies, at sleeping time, at waking-up times, our clothes are not appropriate for selfies, find another way, this is a shame, really a shame, find another way... send us a link to track our location without asking for selfies." [Tweeted by a well-known Kuwaiti journalist who does not normally wear a scarf]
		"Will any men see our selfies in the Shlonik app? I sometimes take selfies without a scarf, please…"

Data Protection

Data protection related to selfies presented a technical privacy concern. Users questioned where the pictures would be saved and who would view them. They also asked why pictures were required if their location was also being tracked. One Kuwaiti parliamentarian questioned the government about the privacy of users' pictures, information, and test results. Afterward, people began to ask more questions about the use of selfies (see Table 5).

Location and Tracing

Location and tracing is another issue related to technical privacy. However, this was reported less often, perhaps due to the technical aspect, as fewer people were aware of its consequences. Users more often mentioned data protection concerning selfies. One user tweeted about the need to spread awareness of the app's privacy and security (see Table 6). Some users' comments reflected limited awareness or knowledge about the privacy and security of apps and software. In contrast, other users were aware of the technology and its consequences and attempted to spread awareness.

Technical privacy includes data protection, location, and tracing. The findings revealed that many users questioned their images' storage and access privileges. The request for selfies and tracked location suggests a flaw in the systems' quality that could adversely impact user satisfaction. A focus on selfies was uncommon in contact tracing studies, save for Pagliari's (2020) work on quarantined COVID-19 app users in Poland who were asked to upload geo-tagged "selfies" every 20 minutes. However, the study did not examine Polish users' experience. Users seldom reported location and tracing privacy concerns, perhaps due to the technical aspect, which means fewer people were aware of its consequences. This aligns with the findings of a study from Qatar, where technical privacy was not a predictor of satisfaction with contact tracing apps (Al-Soni & Abu-Shanab, 2021). However, in other countries, technical privacy was a significant concern for uptake and adoption (Ali & Zaaba, 2021; Albertus & Makoza, 2022; Altmann et al., 2020; Azad et al., 2021; Horvath et al., 2020; Park et

al., 2021). Cultural and social norms seem to have guided the concerns of technical privacy compared to other countries. In Kuwait, this was primarily related to users' selfies. Selfies might not be a cause for concern in some Western countries, but the context around this activity differs significantly in some Islamic countries.

Study participants also mentioned data protection. Data protection concerns could severely impact the degree of trust users place in the application. Trust is fundamental for the successful adoption and sustained use of technology, especially if the government mandates the app's use. Different cultural concerns emerge when it comes to technical privacy. In some Western countries, location tracking might be the more prominent concern, but in Kuwait, the concern is oriented toward the use of selfies. This demonstrates the need for a culturally sensitive approach when designing and implementing contact tracing applications and future m-government services. Cultural variation in terms of privacy concerns makes clear that user uneasiness extends far beyond technical and confidence issues, making one-size-fits-all models for app design or implementation policy more likely to face barriers and to be ineffective, undermining information scientists' attempts to improve app design. The present study highlights the complex and varied nature of user concerns regarding technical privacy. It underlines the need for multidimensional approaches that consider the broad range of cultural, ethical, and technical factors in the design and implementation of contact tracing apps. This emerges as an especially significant issue when their use is obligatory. Table 6 presents the themes and sub-themes of technical privacy.

Table 6. Themes and sub-themes for technical privacy

Theme	Sub-Themes	Quotations
Technical privacy	Data protection	"Can we know where the selfies go? Is there any confidentiality?" "I want to know, did you view all the selfies people captured in the app?"
		"I hope human rights organizations and advocates assume their responsibilities regarding violations of the right to privacy and taking selfies in the Shlonik app, as they ask for selfies several times a day as if we are in a police state."
		"Where is the Shlonik app database saved? Which government agency [is responsible]?"
	Location and tracing	"Shlonik app, I am not convinced by it, they say you will be exposed to them for 24 hours, where you went and who you visited, and all your movements are monitored, meaning it is like they are installing a tracking device on you. Honestly, I consider it a breach of privacy. I only recommend it for quarantined people."
		"The app that they force you to use is one of the worst apps... It penetrates people's privacy and reveals their movements... Now the situation has become more heinous, with close censorship and spying on the smallest details of our lives! ... Do people understand the situation we have reached or what... No more comment:("
		"This is the second time I have asked, I need to know and understand, how Shlonik can know who has Corona around me. I need to know how this works! It is incredible that the privacy of people is breached!!!"

CONCLUSION

This study investigated lived experiences and perspectives on the success of the contact tracing application Shlonik in Kuwait through users' posts on Twitter (now X). We collected and analyzed approximately 2,450 tweets using Delone and Mclean's information system success theory. We found that the app is easy to use but proves a nuisance to users due to its feature of repeated selfie check-ins throughout the day. It is also not adaptable based on users' status and location. Users also lose trust in the application's credibility after a short time of required use. These factors negatively affect users' experience with the app since they are obligated to use it even though they are not convinced of its quality. Users positively assessed service quality from a medical standpoint due to doctors' good responses to patients' questions; however, they assessed the app poorly from a technical standpoint, complaining about IT support services, for example. Again, the combination of obligatory and insufficient technical support puts users under pressure and causes frustration.

More themes emerged beyond the theoretical lens, representing novel findings within the contact tracing literature on social privacy. The system feature of multiple selfie check-ins impacted users' privacy in terms of time, and female users complained a lot on Twitter about this issue. The repeated requests affected users' private time, and female users were unsure who viewed their pictures and thus expressed concern about their privacy. The studied application was imported from foreign countries with different cultures, thus rendering it incompatible with Kuwaiti users. This, in turn, reflects users' data protection, which is mentioned frequently in the literature, albeit from a different angle than in Kuwait. The technical privacy themes of data protection and location tracing also emerged. Again, data protection in Kuwait was related more closely to selfies and pictures; location tracing was also mentioned but less often than data protection.

The general lessons to be learned for future digitization initiatives and m-government services include the need for more culturally sensitive and user-centered design. Cultural norms and practices should be considered in the initial design phase and open to ongoing revision based on user feedback. The shift to new technologies must be gradual, and awareness of the benefits, consequences, and drawbacks must be spread through diverse media channels. Protecting users' privacy and security must also be a priority, and transparency must be evident when these tools are presented to users. For instance, the declaration of data protection strategies is a user's right. It might have been more fruitful if the service had been managed by one party and a special staff dedicated to online services. Finally, the Ministry of Health and other government bodies should not ignore cultural considerations when designing future apps to improve system quality. This is especially true since post-COVID health informatics may continue with e-government services.

The limitation of this study involves its sole reliance on social media data sources. Accordingly, it cannot represent all citizens as some may have elected not to participate in active hashtags on Twitter. Also, Twitter users' demographics might not be representative of Kuwait's broader population. We collected the tweets within a specific time frame; users' perspectives might have changed with app updates or as users became more familiar with the app. Moreover, external factors we did not consider might have affected users, such as media coverage or global events. Also, a detailed sentiment analysis of the tweets might enrich the study results.

Future research might consider other social media platforms or data sources, such as interviews, for a more comprehensive understanding. Also, tweets might be analyzed over an extended period to observe users' changing perspectives and opinions. Future research can consider the privacy concerns of female users, examine their unique challenges, and find solutions tailored to their needs. The data also reflect only the users' point of view. Future research can include the opinions and experiences of other stakeholders, such as the Ministry of Health and app designers. It might also include cross-cultural views from countries similar to Kuwait in terms of culture and norms, such as other Arab Gulf countries, or Western countries that are different than Kuwait.

This research has highlighted the necessity of placing technology, public health demands, and governance challenges within appropriate cultural settings. Contact tracing apps were designed and implemented at speed and under pressure. Any future iterations of such technology should consider findings such as those provided by this research and work to offer more nuanced and socially contextualized apps.

COMPETING INTERESTS

The authors of this publication declare there are no competing interests.

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