Security Practices for Households Bank Customers in the Kingdom of Saudi Arabia

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ABSTRACT

Banking security is an instance of a socio-technical system, where technology and customers' practices need to work in harmony for the overall system to achieve its intended aims. While the technology of banking security is of interest, our study focuses on exploring the specific practices of household bank customers in the Kingdom of Saudi Arabia (KSA). The findings describe some practices of household customers and reveal some of the reasons behind them. Contrary to banking policy, sharing bank authentication credentials appears to be a common practice for our participants, and a number of different reasons are presented: trust, driving restrictions, the esteem placed in parents, and the 'need to know' this information. On the other hand, some participants consider credentials to be private information and do not share, although other participants view this as a sign of distrust. Implications of such practices on the Saudi banking system are outlined and discussed.

1. INTRODUCTION

A banking system is a socio-technical system which operates on a technical base and is used by people every day [59]. To achieve the aims of a secure and effective banking system, it is necessary for every aspect of a socio-technical system to work in harmony towards these goals, including hardware (PCs, hubs, routers), software (applications, programmes, codes), users and their practices, system procedures and regulations, data flow and structure. Crucially, users' security practices constitute "a vital variable" affecting the effectiveness of a system's security, according to Weirich and Sasse [58]. They found, for example, that colleagues in a workplace will commonly disclose passwords to one another as a sign of trust, to the extent that not participating in this practice can be seen as hiding something, even though this practice offers a clear opportunity for hackers and industrial spies to use social engineering techniques.

Different studies have considered the user as an employee in an organizational context [25] [37] [27] [42] [58]. For instance, Inglesant and Sasse [27] carried out a study among the staff of two organizations to explore the use of passwords in the workplace and found that it affected their productivity and ultimately that of the organisation.

However, the study of users' practices in the household context is a relatively underexplored area. The household context, compared to the organizational one, is interesting for a number of reasons: first, users spend longer hours and conduct a broader variety of different activities at home than they usually do in the workplace. Second, the organizational context typically contains only employees, while the household context may include wider groups of employed and unemployed users such as housewives, househusbands, students, pensioners and others. Third, households interact with a variety of different services – each offering different forms of security components, configuration options, and advice – however the responsibility for security in most households is not held by an experienced security practitioner. While organisations face similar challenges, they can devote greater resources to staffing, formulating security policies, and educating their employees in matters of security.

Two studies of computer users in a household context have explored the impact of users' family relationships on their interactions with computer applications. The VOME project [19], which studied users' privacy and how they used ICT within family settings across the UK. Coles-Kemp and Ashenden held a number of family workshops which recruited pairs of granddaughters and their grandmothers, some of whom were great-grandmothers. Meanwhile, Singh [48] [49] and Singh et al. [52] [50] [51] investigated the financial and banking practices of Australian households by interviewing couples, or individual members of couples in some cases. Despite providing valuable insights into the role of familial relationships in computer users' practices, more detail is needed to understand the different cultural and familial factors that affect security interactions in the home.

Our study focuses on the security practices of household bank customers in the Kingdom of Saudi Arabia (KSA), where modern banking technology has been adopted widely, but where very little work has as yet been done to explore the security practices of household customers. The KSA poses interesting cultural, technical, and security characteristics that have been under explored to date. Kaspersky [29] report that in 2009,

Saudi networks suffered the seventh highest incidence of information security attacks in the world. With only 0.007% of the Internet users in the world, Saudis were subjected to 1.81% of such attacks – a significantly higher rate than average. Symantec Intelligence reports rated the KSA as the most spammed country in 2012 and 2013, with a spam rate of 79.0% and 82.7% respectively [53, 54]. And in 2013, the KSA had the highest risk (10.78%) of privacy exposure among its Android users and the third highest volume (7.19%) of malicious Android app downloads [57]. Alarifi et al [5] suggest that this is due to the low levels of information security awareness among computer users in the KSA and according to Alkaabi et al [8] one of the information security awareness issues that needs to be dealt with is credential sharing with co-workers and family members. Algarni [7] observed that Saudi governmental organisations appeared unready to confront and control information security problems, citing the influence of religion and culture, which prevented government representatives from taking certain security approaches such as online monitoring.

Our paper offers two main contributions: i) a brief methodological review and research method design that respects Saudi cultural norms in order to allow us to ii) elicit and explore sensitive security practices and perceptions of household bank customers in KSA.

2. BACKGROUND

To support our analysis of household bank customers' security practices in the KSA, this section provides a brief overview of the history of the KSA, and an introduction to its banking system.

2.1 The Kingdom of Saudi Arabia

The KSA was founded in September 1932 by King Abdul-Aziz Al-Saud. It is one of the largest countries in the Middle East, with an area of over 2,000,000 square kilometres (772,204 square miles). Saudi cultural roots are a mixture of values originating from traditions and Islamic principles where social and religious practices and traditions are thoroughly intertwined. In the KSA, 97% of the population are Muslims [38] and religion plays an important role in Saudi life and politics, as Islam is considered a defining element of Saudi identity [36]. The system of tribes also has a great influence on Saudi life and practices. Before 1932 these tribes were hostile to each other, a situation which changed dramatically when King Abdul-Aziz united them into one country [13] [14]. Another major change came as a result of the oil boom of the 1970s, when the urban population of the KSA jumped from 16% of the total population in 1950 to 49% in 1970 and 80% in 1990 [31], while the nomadic tribal population fell from being the majority early in the twentieth century to between 5% and 25% of the population by 1993 [18]. Tribes still exist today in KSA but with less impact than before.

Women in KSA: Islamic principles stated in the Qur'an and the Prophet's Hadith[1] grants women and men equal but not identical rights in personal, civil, social and political life aspects. None of these principles prevent women from participating in public life but the Qur'an does warn against the mixing of the sexes which could lead to "seduction and the 'evil consequences' that might follow" [11]. In KSA, jurists have interpreted this warning by tightly restricting any type of interaction between a woman and a non-mahram[2] [22], and gender segregation is fundamental to Saudi society [20, 35]. Culturally, gender separation is the rule in almost all aspects of private and public life in the KSA [4] [16]. In higher education for example females study in separate campuses and are taught face-to-face by women, or by men via closed-circuit television (CCTV) [10] which provide one-way video where female students can see their male teacher and two-way audio, from teacher to students and vice versa [9]. According to Deif [21], Saudi Islamic scholars maintain this norm with the social-religious justification that "loose interaction across gender lines is one of the major causes of fornication, which disintegrates society and destroys its moral values and all sense of propriety" (p. 13). Another aspect of this interpretation is that women in the KSA are forbidden from driving and those who defy this ban risk jail; therefore, women must use vehicles driven by a chauffeur or a mahram [60]. Moreover, the idea of walking even for a short distance is culturally quite restricted [4]. Saudi cities rarely have reliable public transport networks and where there are buses, women must use a separate entrance at the back and occupy designated seating [28] . A woman is expected to be accompanied with a mahram when she "ventures into the public sphere" [32].

Households in KSA: A household in the KSA usually consists of a married couple and their unmarried children of either sex; it is against the rules of Islam and culture for an unmarried couple to live together or to have children. Each household is headed by a male, while the role and position of each individual in this type of structure is defined according to sex and age [2]. Some features of households in the KSA, such as size and economic characteristics, have changed over time. The average household size fell from 6.08 persons per house in 1992 to 5.84 in 2010 [6]. In general, the economic level of households in the KSA has improved, especially since the oil boom. Today, the KSA is the top country in the world in terms of density of ultra-wealthy households (18 per 100,000), due to the strong national economy [55].

2.2 Banks in KSA

The history of banks and bank systems in the KSA started in 1926 with a few foreign-based trading houses (including Netherlands Trading Society) and money changers, which provided most of the finance services whose main role was to serve pilgrims and the trading community [47]. After that, foreign banks started gradually entering the market. The Saudi Arabian Monetary Agency (SAMA) was created in October 1952 by the government with the main purpose of achieving a stable monetary mechanism and ensuring currency stability. In 1966 a new Banking Control Law was approved, giving SAMA more supervisory powers [3]. With the approval of the Minister of Finance, the Banking Control Law also permitted SAMA to

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[1] The Hadith is a collection of traditions containing sayings of the prophet Muhammad which, with accounts of his daily practice (the Sunna), constitute the major source of guidance for Muslims apart from the Qur'an – Oxford English Dictionary.

[2] A mahram is a woman's husband or a man to whom she cannot be married, either because of a blood relationship, such as her father, brother, grandfather, son, uncle or nephew, or because of a marriage relationship, such as her father-in-law, son-in-law, stepfather or stepson.

recommend institutions for new licenses, issue rules and regulations, and take action against any violators of the Law and therefore banks expanded rapidly covering the entire country [43]. Since the 1980s SAMA continued to introduce new tools and systems to improve and strengthen the Saudi financial markets and to compel all Saudi banks to invest in technology and to improve their back and front office operations. Significant changes were made to modernise the system, starting with the introducing of a national Automated Teller Machine (ATM) system which permitted customers access to their accounts from any machine, followed by the introducing of debit, credit and charge cards and the linking of Saudi banks with the SWIFT payment network, banks also shared the benefits of a point of sales system and an advanced electronic share trading and settlement system, which enabled same-day settlement [43]. Today, bank customers can reach their account and use bank services via different channels: bank branches, online banking, phone banking, ATMs, sales point and online shopping. The security mechanisms can differ for each channel and from bank to bank: for instance some banks use hardware tokens to produce one-time PIN for online authentication while other banks send it to the mobile phone of the account holder. One security mechanism used very widely is an SMS notification where the account holder will receive an SMS for every transaction carried out in their account, e.g. money transfer, deposit, withdrawal, and online access.

SAMA regulations: SAMA has published its regulations for Electronic Banking (clause 3-3 Bank Obligations). One notable extract is that "banks are responsible for providing secure and safe systems and services for their customers unless the customer fails to safeguard their account user number or password and divulges it to a third party" [45]. Interestingly, this appears not to be the case for credit and debit cards, where a client may choose to authorize another to use their card. SAMA's Regulations for the Issuance and Operation of Credit and Charge Cards (clause 7-1) state: "The client (i.e. the cardholder) is not liable for any non-authorized transactions made with his card after it has been reported lost or stolen if the following conditions have been satisfied" and the third condition is: "The client must exercise every care and vigilance in safeguarding his card from loss or theft or unauthorized use." The document defines unauthorized use as "The use of a credit card or debit card by anyone other than the client (card holder) who does not have actual or implied authorization"[44]. SAMA regulations have emphasized more than once that banks must use different channels such as bank websites, promotional publications and others to educate their customers about different regulations for using bank services, protect online credentials (username and password), protect their card and its PIN, using secure passwords and changing them regularly, complaint procedures and others ([45] p. 11,[46] p 6-23). Specifically, the Consumer Protection Principles [46] (clause 11-5) state that the bank should inform the customer officially and clearly about his responsibilities when opening a bank account and the consequences of sharing the account credentials with a third party.

Saudi banks and women: The Saudi banking sector now consists of 12 banks supervised by SAMA. Under the religious and cultural constraints mentioned above, these all have so-called ladies-only branches, access to which is limited to female employees and customers. Before these were established,

women had access to bank branches and bank services such as opening accounts and transferring money, but as all of the employees were males this was inconvenient and violated female customers' privacy, because they would normally have to be accompanied by a mahram. The opening of ladies-only branches was thus an important step in the provision of services for women in the KSA. This development was introduced gradually, with the Al Rajhi bank opening its first ladies' branch in 1979 [1], while the Bank of Holland did not do so until 1999 [47]. The participation of women in the Saudi banking sector has continued to grow: women now account for 18% of the banking workforce and women have recently been appointed to more senior positions in several banks [56].

3. METHODOLOGY

The context in which this study is attempting to elicit information about users' practices was methodologically challenging from the outset. Previous work in this area has aimed to elicit security practices from home users as for example Kaye [30] who reports on a Facebook and Twitter survey about password sharing practices. Whilst providing interesting insights into self-reported password sharing, this approach was reported to have experienced problems in recruiting participants due to the sensitive nature of the topic. For our study, given that we were not sure of the issues and topics of interest in the domain, and that the security of banking is indeed a sensitive area, we did not feel a survey was likely to suit our particular research problem. Mathiasen et al. [34] discuss the use of exploratory workshops to discuss in depth a number of concepts and findings.. However this approach requires a certain amount of foreknowledge about the problem domain and we did not feel we had enough information to adopt this method.

The purpose of this research is to elicit and investigate the security practices and perceptions of household bank customers in the Kingdom of Saudi Arabia and consequently, the methodology has to accommodate several features. First, this is a new area of research for which we have little pre-existing knowledge. Second, this investigation aims to gather empirical, qualitative data. Third, the data concerns both the practices and perceptions of these customers.

Based on these requirements, we chose Grounded Theory which is a methodology for *generating* a theory, instead of testing one [26], and a means of understanding a problem that has not yet been explored deeply. Grounded theory originates from the work of Glaser and Strauss [26] and requires the researcher to undertake the iterative process of data collection, coding (assigning meaning to elements of the data), and thematic analysis (relating codes to one another) to provide an overall theory explaining the qualitative data.

Our study was ethically reviewed and approved by the Social Sciences and Humanities Inter-divisional Research Ethics Committee at the University of Oxford. There were two rounds of data collection: an initial telephone interview with six household bank customers (preliminary findings presented in [24]), and a series of four focus groups covering husbands, wives, sons and daughters in the KSA. The first round helped us identify practices and concepts related to the research topic which we wanted to explore in more detail. This informed the direction we took the discussion between the participants in the

second round. Each round had to be carefully designed to take into account: the sensitivity of discussing bank credentials, the intimate nature of the household context, and the cultural and religious constraints in the KSA. We present an overview of the research methods used in each round in the following sections.

3.1 First Round of Data Collection

Telephone interviews were conducted with six household bank customers. Telephone interviews were preferred as offering an appropriate method to elicit and discuss customers' practices whilst being sensitive to the practices of Saudi culture. This method was more suitable than face-to-face interviews for both the researcher and bank customers, in particular for male customers as the researcher is a female. First, the gender segregation practiced in the KSA (mentioned previously) extends to the provision of separate areas for males and females. Conducting interviews at home with a stranger is unusual in the Saudi culture even if both participant and researcher are of the same gender. The interviews were semi-structured where the interviewer directs the interviewee to the research topic but does not guide the answers to match their own expectations. All six bank customers were married Saudi citizens, three males and three females. Some had been married for only two years and some for more than ten. Two were married to each other but were interviewed separately. The participants were from various cities across the KSA and all were employed except one, who was the partner of an employee. Each interview lasted 35 to 50 minutes, carried out and transcribed in Arabic. The transcripts were translated into English then analysed using the ATLAS.ti computer-aided qualitative data analysis software (CAQDAS) package.

3.2 Second Round of Data Collection

After the first round of telephone interviews, focus groups were used to explore in more detail the participants' practices and attitudes that emerged from the telephone interviews. Focus group sessions are gatherings, usually of 6-8 participants [17], which encourage interaction amongst the participants to develop opinions and thoughts, as in real-world situations [33]. Four focus groups were conducted with household bank customers: husbands, wives, sons, and daughters. These sessions were segregated by gender, with a female researcher running sessions for groups of female household customers (wives and daughters), and a male moderator running groups of male household customers (husbands and sons). This arrangement was necessary for two reasons: firstly, to conform to the gender segregation that is fundamental to Saudi society; secondly, to explore the impact of different roles within households as factors influencing participants' practices. The daughters' focus group had six members, whose main selection criteria were that each must be unmarried and still living in her parents' house, to reflect the daughter's role. The sons' group comprised five participants, none of who were married and all of whom were still living with their parents, reflecting the son's role. There were six participants in the wives' focus group, four of whom were employed and two were housewives. The main selection criterion was for the participating women to be married, and some participants had children while others did not, to reflect the opinions of wives in both situations. Finally, the husbands' group also had six members, five of them employed and one who had retired. As with the wives, all were married to reflect the husband's role and not all had children.

We encountered significant challenges in running focus groups in the KSA, the first being one of recruitment. In order to recruit sufficient participants it was necessary to invite up to 40 people to join each group via social and professional networks. This difficulty arose mainly because focus groups are not common in the KSA compared to other methods such as questionnaires. The principle and operation of the focus groups therefore had to be described carefully to potential participants in the invitation letter. It was noticed that it was easier to recruit younger participants, for the daughters' and sons' groups, than older ones, for the wives' and husbands' groups. It happened many times that a recruit thought that she might convince one or more of her parents to participate in the study but failed.

Another challenge was finding a place to conduct the sessions. This might not be a problem in other countries, but the researcher spent a great amount of time and effort on this issue. Given the cultural norms arising from the religious and cultural constraints referred to above, it was necessary to find public places to conduct the sessions, as the use of private premises, such as the researcher's home, would not have been acceptable. This was particularly difficult because there are no neighbourhood community centres in KSA, and hiring a meeting room in a hotel would be both expensive and require approval from the City Council which can take up to three months to arrange. We finally resolved this through a closed meeting room in a restaurant, although such facilities are not common in KSA. The room was suitable because it was affordable, accessible to the public but could be closed for the sessions, quiet enough for clear recordings to be made and,no official approval was required. Participants were contacted via WhatsApp (a cross-platform mobile messaging app) to schedule and reschedule the sessions. Each session lasted an hour and a half, and as in the first round, each session was carried out and transcribed in Arabic. The transcripts were then translated into English and analysed using the ATLAS.ti.

4. SHARING CREDENTIALS

Our analysis of security practices highlighted that sharing of authentication credentials for household bank customers in KSA is an important topic and follows two main themes (see Figure 1): **has shared**, where an account holder shares their credentials with family members, and **has not shared**, where the account holder prefers to keep this information secret and not share it with anyone.

The authentication information that was shared most between family members was the card PIN. This was the case for 25 of the participants while only four participants did not share such information – one female participant in the first round and one participant from each group of husbands, daughters and sons.

Only fourteen participants used online banking and five of them shared their online credentials – username/password: three participants in the first round of the data collection and two participants from the sons focus group shared with their brothers only. The two main categories, **has shared** and **has not shared**, can be divided to nine categories (see Figure 1): *Female account holders*, *Male account holders*, *Parents*, *Father's successor*, *Couples*, *Safe*, *Need to know*, *Having two accounts,* and *temporary divorce*. We explore these in more detail below:
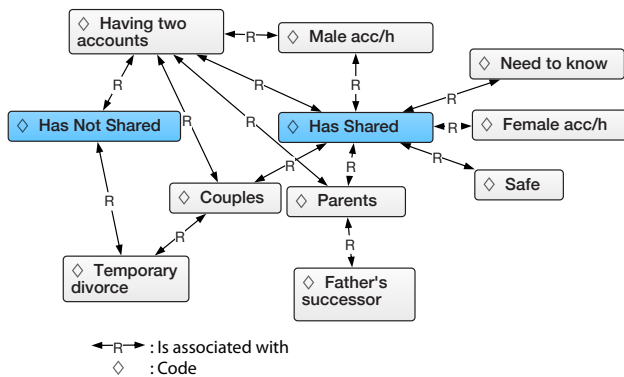
Figure 1: Sharing practices for household bank customers.

4.1 Has Shared

The following are a detailed discussion of the factors affecting credential sharing practices between family members based on familial relationships:

4.1.1 Female account holders

Most of the female participants appeared to see sharing as a *blessing*, because it solves a major problem: withdrawing cash from their account. If a woman needs to withdraw money from her account then she either goes to a bank branch or uses an ATM. In both cases, however, and given the movement limitation mentioned above, she must use vehicles driven by a chauffeur or a mahram. If the vehicle is driven by a chauffeur then she can withdraw money by herself from either a branch or ATM, but if the vehicle is driven by her mahram then she may find that the ATM is on the driver's side; she will then feel obliged to hand the driver her card so that he can operate the ATM, because asking him to pull over so that she could walk to the ATM and withdraw the money in private would be inappropriate and unacceptable. A member of the wives' focus group said:

Sometimes I am with my husband in the car and he withdraws the cash for me because the machine is on his side of the car. [P6, F]

An alternative scenario is when she needs to ask her mahram to take her card and bring her the cash when she cannot (e.g. because it is too late) or does not want to accompany him. A participant in the daughters' focus group said:

A girl shares her PIN with her brother to ask him to get cash for her from her account when she can't get out or she doesn't want to, but the brother doesn't need to share such information because he goes out by himself. [P3, F]

In addition, *'laziness'* or *'making life comfortable'* were stated reasons for sharing among females when the female account holder might prefer to stay at home and ask a female member of her family to draw some cash on her behalf. A participating wife stated:

When I am lazy and I don't want to go to make a withdrawal. If for example I am at my family's house and my little sister is going out, I ask her to get me cash. [P12, F]

In this scenario, the wife is taking advantage of the fact that her little sister is already going out accompanied by a chauffeur or a mahram in order to avoid the effort of having to arrange this for herself.

Female participants saw trust as the main reason for sharing; only if trust existed would any other factors be considered, as explained by this focus group member:

If you don't trust your family, would you give them your card? Even if you are lazy or there is a transport problem, you'd say 'No, I'll do it myself, even if I am tired'. If you didn't have this feeling of trust you would overcome your laziness and even the transport problem, you'd force yourself one way or another to go. I think that the first reason is that amount of trust between us, an excellent trust that makes me comfortable, and if I don't want to go it is easy to ask my brother to do it as long as there is no transport. [P15, F]

It is worth mentioning here that if movement limitation did not exist, female participants stated that they would still share for other reasons such as to make life more comfortable, albeit not as much as they did now.

The lifestyle in Saudi Arabia generally forces me to share my credentials with my husband or one of my brothers ... I can't drive here and there is no public transport ... and even if this situation changed, there would be much less need for sharing, nevertheless I would still do it sometimes, to simplify my life. [P1, F]

4.1.2 Male account holders

"Laziness", or *"to make life more comfortable and easier"* were also reasons given by some male participants for sharing their credentials with others, whether female or male. A member of the husbands' focus group said:

Sharing is a way of supporting each other ... a kind of solidarity where we help each other to make our lives easier. [P17, M]

However, it has been noticed that some male account holders **have two accounts** (see section 4.2.1). The man shares credentials for only one of them with his family, allowing them to use it whenever they need to, but his family have no idea about his second account. This practice will be discussed in more details in Section 4.2.1.

4.1.3 Parents

As mentioned above, KSA is a religious country and Islam is the dominant religion. The rules and principles of Islam emphasise the high value of parents which is reflected in Saudi culture as one of the factors influencing participants' practices.

For example, when the participants in focus groups asked about sharing bank credentials with fathers, all of the participants replied that it was the father's right to take his child's money, regardless of gender, and that he or she most likely could not be refused such a request. Thus, a member of the wives' focus group said:

It is hard to refuse such a request even if I want to ... I can't say no or I will lose my father ... he will say 'I spent all my life supporting you and bringing you up and now you don't want me to have an authorization on your account'. ... Even if he takes

all the money ... you and your wealth belong to your father. [P11, F].

The participant here was quoting a Hadith which states: "You and your wealth belong to your father." This Hadith was mentioned by many participants, in all four focus groups.

Both daughters and sons are included in this Hadith, but culturally the focus is more on daughters when one of the participants in daughters' focus group said "*A daughter is always under her father's wing*". This describes the relationship between a father and his daughter, asserting that she must always be under his supervision. When a father asks his daughter to share her bank credentials with him or to give him control of her bank account, all the focus group participants (with one notable exception in the daughter's group – see below for more details) declared that they could not refuse such a request as it would be a sign of disrespect and ingratitude.

Most of the participants felt that any such request would be made in the best interests of the daughter. For example, two wives and two daughters declared that a father could ask to supervise his "extravagant" daughter and monitor her expenditure as a way of "teaching her to not spend all her money". While other participants said that this arrangement can be a "safeguard" to protect the daughter from others, such as a "greedy husband". However, when one member of the daughters' focus group declared that she would refuse such a request because she considered her account and its information to be private, all of the other members in the group disapproved of this declaration despite her asserting many times that her father was an open-minded man who would accept this refusal from his daughter and respect her privacy.

However, participants also identified some cases where a daughter could refuse her father's request for sharing or delegation and such a refusal would be acceptable, such as where the father had a reputation for using money unwisely or treating his wife badly. A husband said:

She can say no, but will she say it? She has to express the reason why she doesn't want him to have control over her account. Are the reasons expressible? If her father is an exploitative man, unnatural or maybe a tyrant, or a man who has previous history of exploiting family members' individual money, then it is acceptable to say no …. In such a case she might be afraid that he will use that delegation badly by getting a loan, or withdrawing money from the account without her permission. [P24, M]

In refusing a father's request to share details,, boys were seen as different to girls in that a son could refuse such a request and, in this case, the father would accept the refusal and consider it a sign of maturity in his son. This difference seems more cultural than religious, and there was some disagreement among participants. Some said that even boys would not refuse sharing or delegating authority to their father as a sign of respect. Others recognised that there was a difference but believed it to be based on other factors. A member of the husbands' focus group said:

There is a difference, but it's based on caring and sympathy, that a father cares more for his daughter than for his son. This means that she might not be able to go to the governmental departments but the boy can come and go, so the father can be delegated control over his daughter's account to see to her needs. The father is always kind to his children, but the boy can

look after himself, as he will carry more responsibility than the girl in life. [P22, M]

Regarding sharing credentials with mothers or delegating authority to them, then an instance of this was raised as a security measure to protect the daughter and her money. A participant in the daughter focus group mentioned that her friend had delegated control of her account to her widowed mother in order to protect her (paternal) inheritance from her husband. The husband had repeatedly tried to convince his wife to give him part of her inheritance so that he could use it to expand his business. To avoid direct conflict with him and to protect her money, the wife passed control of the account to her mother. The husband now recognized that his mother-in-law was supervising her daughter's account and monitoring every transaction which stopped him from attempting to convince his wife.

Participants were then asked whether a male account holder would be likely to share his account information equally with his wife and his mother. Some replied that a man would trust his mother more than his wife and that this would be reflected in his sharing all of his information with his mother but not necessarily with his wife, because of the high value of mothers in Islam. One said:

The mother has a higher status ... A man would share his credentials more willingly with his mother than his wife. [P10, F]

Conversely, some participants said that while there was no difference between a mother and a wife in the sense that a man would trust them both equally, his wife would be more likely to know his card PIN than his mother would, because the mother would not know how to use an ATM, or because she would not need to know this information as she lived in another house. A member of the husbands' focus group explained:

There is a difference… I think a husband is more likely to share such information with his wife than his mother… not by preference, but because she is healthier so she can come and go, she can serve me and serve my mother. I can tell her to withdraw money from my account and give it to my mother so I won't tell my mother to go herself… The trust is there for both of them, but the sharing depends on other reasons. [P29, M]

In addition, when a parent shared his/her bank credentials with his children, the main reason was to help the parent and to make life easier. One mother also admitted that she gave her card to her son not just to help her, but also as a way to control her expenditure.

4.1.4 Father's successor

In Saudi families, it is common for a son to be raised with the idea that he is his father's successor and that when the time comes he will be the one who manages the family's affairs. This son is normally the eldest son, but this is not always the case. In some families he may be the most trusted son, or the closest to his siblings, instead of the eldest. One of the participants explained this in these terms:

It is common in Saudi Arabia… but it isn't always the eldest brother… It can be any of the brothers. I see it as a characteristic of Saudi society that a family always embraces all its members… and the father is the base. If he is lost, they will cling to any straw, meaning the family will find someone who is dependable and capable of looking after everybody's interests…

They count on him, so it is assumed to be the eldest son who is raised on that idea and is seen as his father's successor, but it isn't mandatory. Any brother might play this role whether he is old or young…. The eldest might be sick, for example. [P7, F]

As noted above, most participants felt that a woman could not refuse her father in taking control of her bank account, but the situation was seen as quite different in the case of a brother acting as their father's successor, when a sister could refuse her brother's request for delegation. All the participants in the husbands and wives focus groups declared that a sister had the right to refuse her brother's request for delegation while all the participants in the daughters' focus group declared that she can't and there was disagreement between the participants in the sons' focus group. The consequences of this refusal were also discussed and how this might affect her relationship with her brother and with the rest of the family.

When my aunt and her husband died, her eldest son became guardian of his brothers and sisters… They used to have a good relationship, then suddenly he disagreed with one of the sisters and she refused to delegate control of her bank account. Instead, she asked the next brother to be the one who was authorised… Initially, the rest of the family refused and told her that because he was the eldest his word must be obeyed, but she insisted. At first, he was upset and the rest of the family was upset, but afterwards they accepted that and it became normal. [P9, F]

4.1.5 Couples

Focusing on sharing practices in couples, all six participants in the first round of the data collection agreed that sharing card PINs was a sign of trust between the husband and wife. For example, one participant said:

It's all about trust between wife and husband … and this is more important than just a bank account … In our culture and with our priorities, this is much more important than materialistic belongings … and in our marriage, I have given her things more important than a bank account. [P20, M]

For this participant, trust between him and his wife was more important than their bank accounts and he referred to the cultural norms which defined his priorities. It is worth mentioning that according to Saudi cultural norms, most marriages are family arrangements. The groom's mother chooses the girl who she thinks will be most suitable for her son, then, usually after six to 12 months of engagement, they are married. According to the participants, trust and sharing arise during the first months of the relationship which means that couples begin to share sensitive banking information when they have known each other for only a very short period of time.

Another participant declared that he trusted his wife and decided to share such information with her from the fifth month of their engagement, even before they were married. It is noteworthy here that couples usually started sharing before having children, although having children increased the propensity to do so. Thus, a female participant said:

Sharing between me and my husband happened before we had kids. But if I want to be honest, I would say that having kids puts a big emphasis on the need for sharing. For instance, when I want to buy something for them and I don't want to go out, I just send them with their father and give him my card to use. [P5, F]

Similarly, another participant stated that she had shared her credentials with her husband from the first month of their marriage:

First of all, mutual trust between us is natural; also, I used to see my father and his wife exchanging their passwords … and there were no problems. [P8, F]

Thus, this participant saw mutual trust as natural because she was used to seeing a sharing relationship between her father and stepmother. One explanation is that marriage creates the expectation of mutual trust between husband and wife, which in turn creates the expectation that banking information will be shared; making sharing a consequence of marriage.

Regarding online banking, four participants declared that they never shared their passwords with their partners, while the other two said that they did share them. Those who did not share explained that because they used their ATM cards more than online banking, the need to share online passwords had not arisen and each was responsible for his or her own online banking, a situation unaffected by sharing the same device to access online accounts. A participant said:

I need to give him my card to get cash but I do not need him to access my account online ... But if we needed to I wouldn't mind giving it to him. [P4, F]

As to the two participants who did share their online banking passwords, they explained that the partner with more IT experience in each of their couples was responsible for the online banking for his or her spouse. In one case the wife was responsible and in the other it was the husband.

4.1.6 It is safe

The majority of the participants shared their bank credentials and saw no risk in doing so because the account holder is informed by SMS of any operation on the account, such as transfers, withdrawals or online access. Most participants considered that this service would protect the account from any fraudulent transaction by allowing the account holder to monitor the account. A member of the wives' focus group said, for example:

My husband has my card. When I ask him to do something then he does it. He doesn't withdraw until I ask him to do so, as I receive an SMS on my mobile. I didn't do it due to a lack of trust. It was just a good new service.[P2, F]

SMS are also used by some banks to protect their online banking: the account holder receives a one-time PIN by mobile phone when they request access to their account online; again, this service protects bank customers as well as allowing them to monitor access requests to their accounts.

In addition, some participants claimed that sharing a card and its PIN was relatively safe because the card would be kept by the account holder at all times and no one would have access to the account without the card, even if he knew the card PIN a member of the daughters' focus group said:

Why would I stop this sharing? He doesn't have the card with him all the time… and if he has the card, he just makes the withdrawal and brings it back to me. He doesn't take anything.[P13, F]

Moreover, *sharing is safe* because according to the participants permission must be obtained for every transaction.

Even if my wife's card is with me all the time, it is unacceptable to use it without her permission... In Islam even if she is rich the man has not got the right to take from his wife money without her permission. [P26, M]

4.1.7 Need to know

Some participants saw sharing as a necessity in order to have a backup of their credentials given the perceived importance of this information. Many in the daughters', wives' and husbands' focus groups expressed the view that a wife would need to know about her husband's assets and obligations, in order to avoid any unpleasant surprises if he should die suddenly. A participant in the daughter focus group said that her father had gathered the family together before he died and told them everything about his money and his bank accounts, because he used to help certain people with donations and wanted to be sure that this help would not stop after his death. A related reason for sharing this information was to avoid problems with the family of an account holder who had died, as illustrated by the personal experience of a member of the wives' focus group:

Actually, it is important that the wife asks frankly about those things, given what I have learned from the situation I went through after the death of my husband. I didn't know anything, not even his card PIN, and all those things had to be taken care of by his brother and there were a lot of problems. I couldn't do anything and I couldn't get out as I was in mourning, so the wife should know these things. [P14, F]

Participants also mentioned the importance of needing to share the credentials for cases such as the account holder's illness or travel.

Once I had some heart troubles and I got sick. During that time, my family needed to spend money and I trusted my wife who was careful – thank God – so although I stayed at the hospital for more than a month, my financial situation was fine thank God. [P18, M]

My sister shared her credentials with me because she is sick, she can't get out frequently as she suffers of arthritis, sometimes she needs things and she can't do it. For example the last transaction I did for her two weeks ago was to pay her daughter's school fees. [P12, F]

I share my credentials with my wife because sometimes I travel abroad so I couldn't be there if she needed money to transfer to someone or to pay for electricity or something of the sort. [P23, M]

4.2 Has Not Shared

Not sharing practices between family members can be divided into:

4.2.1 Having two accounts

Some male account holders may have more than one account: one to share with family members, and another private or secret account. This practice was mentioned by two participants in the wives focus group, two participants in the first round, and a participant in the sons' focus group. A participant in the wives' focus group claimed that this was done for control rather than distrust:

The problem is not lack of trust between them, but for instance he might want to build a new house or expand his business and

if his wife knew how much he had in the bank she'd ask him to buy new furniture for their home or something else… and in fact that's what we actually do.[P6, F]

Having a secret account was seen as quite common and many wives accepted it, although not all did so. A member of the wives' focus group said:

Normal? I don't see it as normal. I do not consider it normal to have two accounts, because Sharia says that he has to pay for my expenses. This is … a religious obligation … and I don't permit anything except what our religion permits. [P9, F]

But another member of the same group thought that it was a matter of privacy for her husband, who had the right to keep his balance secret:

If he insists then it is his personal freedom. I shouldn't interfere. If he insists this is his affair, he can say: 'You have your needs and I fulfil them and you don't have to know my stuff. You can't interfere'. [P3, F]

4.2.2 Temporary divorce

Four participants felt that withholding banking information from a spouse would be a sign of distrust:

If she does not like to share such information with me, then she might have a trust problem … definitely there is a trust problem. [P16, M]

It's natural for couples to share everything … Otherwise, there will definitely be a trust problem. [P7, F]

Interestingly, one participant admitted distrusting her husband, stating that they used to share banking information until she felt that she could no longer trust him, after they had been temporarily divorced.[3] Although the couple had decided to re-unite she could not trust her husband again, so she decided not to share sensitive information with him. He, however, still shared his credentials with her:

I used to trust him and tell him everything about my account and how much I had. But after the first divorce, I became afraid; then after the second divorce, I got really afraid. Therefore, I think that divorce is the main reason why I am hiding everything, not just my money. … I know his card password; he always tells me everything about his account and he is really honest with me about money and all his financial stuff. I know that even if he gave some money to his parents, he would tell me about it. Therefore, you can say that he trusts me more than I trust him. [P13, F]

5. SECURITY ANALYSIS

5.1 Summary statistics

- In total, 29 household bank customers participated in this study, 15 being female and 14 male.

- All participants had bank accounts and some had more than one, but it was noted that the use of joint accounts and savings accounts was rare. None of the participants had a

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[3] In Islam, couples may obtain a temporary divorce for three months. If they are able to fix their problems during this period, they can come back to each other and continue their married life. If not, this temporary divorce becomes permanent. This process can be used only twice during the life of a marriage.

savings account, although some said that they might use their current accounts for savings. Similarly, joint accounts were not popular: only one couple in the study claimed to use one.

- Twelve (85.7%) of the male customers shared their cards PIN with family members and two did not.

- Thirteen (86.7%) female customers shared their cards PIN with family members and two did not, one also shared her card PIN with friends.

- Only three (20%) female participants used online banking one of them only shared her online credentials – username/password.

- Eleven (78.6%) male participants used online banking four of them shared their online credentials – username/password- with their family.

- Thirteen (86.7%) female and all male participants reported using sales points.

- Only two of each gender (13.3% female, 14.3% male) said that they used online shopping.

5.2 Credential Sharing

Is it safe? 86% of the participants in this study share their bank credentials for various reasons. One of these reasons is that they believe that sharing is safe, and also that they use different methods to ensure the security of their accounts (mostly through SMS notifications). However, the possibility of misusing the shared credentials (e.g. someone uses this information without permission to gain access to another person's account, or to use the money in that account) still exists. By discussing this issue, all the participants in the first round of data collection declared their belief that their own partners, siblings or parents would never do this, for reasons of religion and culture. First, the participants described their partners, siblings and parents as religious believers for whom doing such things would be against their religion. Thus, a participant was sure that her husband

... would not get any money out of my accounts without telling me first, and also because I know this from past experience ... how he dealt with his father's inheritance when he was responsible for it. He divided it equally between himself and his siblings. He had a religious deterrent. [P5, F]

Secondly, they considered such practices alien to Saudi culture. A participant, for example, said that he did not expect his wife or siblings to steal money from his account in any circumstances, because

this is unusual here in our culture . . . I am sure this does not happen here. [P21, M]

In contrast to this widely mentioned belief, one of the participants reported that she had twice suffered misuse of sharing by her husband:

He used the money in my account without my permission twice because he thought I wouldn't mind ... The first time he took less than two thousands riyals ($540), and around ten thousand ($2700) the second time. After the first time I complained in an indirect way and I thought this was enough. But the second time I got really upset and discussed this with him clearly and he stopped. [P11, F]

Despite these two incidences of misuse of sharing by her husband this participant stated that she still shared her card PIN with him. When asked why, she replied that the misuse had happened four years ago and she did not think it would happen again.

Another case appeared when a participant in the daughters' focus group mentioned what happened to her sister when she delegated her husband over her account and he misused this by taking a loan of half million riyals ($133,300) by using her account and because of that she is now paying the instalments for five years.

Accountability and misuse: Despite the belief that sharing credentials is safe, and that family members will not abuse the trust placed in them, there are clear risks associated with this widespread practice.

First, the banking regulations presented in section 2.2 clearly state that "banks are responsible for providing secure and safe systems and services for their customers **unless the customer fails to safeguard their account user number or password and divulges it to a third party**" [45] (emphasis added). This can mean that banks are free to disclaim any responsibility for cases of fraudulent access to the accounts of people who have shared their credentials – even if the fraud did not happen because of this practice.

Second, accountability for actions undertaken in a given bank account are strongly undermined when different people share the same authentication credentials. In the case of a dispute requiring an investigation into who authorised a given transaction, the habit of sharing credentials can significantly undermine the principle of non-repudiation, allowing an account holder to deny having authorised the transaction.

While the reasons behind this practice have been explored in section 4, mitigating the risks associated with it is a challenge. One of our key findings is that many of the reasons for sharing stem from a sense of pre-existing trust (or a need to appear trustworthy), and also as a means of solving the practical problem of accessing funds (particularly for females). These are different problems which lend themselves to different solutions.

Sharing for trust: While joint accounts do not appear to be common in the KSA, they provide a simple means for different parties to have access to the same account. This does not address the issue, however, of allowing access to a personal account as a demonstration of trust. Another option would be for banks to provide account holders with the means of explicitly delegating access to their personal accounts to other individuals, without having to divulge the authentication credentials. By introducing such a mechanism, the principle of accountability would be easier to achieve, and the possibility of revoking access would also be available to account holders. While such a system might still be undermined by the principle that people share in order to demonstrate trust, it would at least provide a means for trust to be shown without undermining banking accountability.

Access to funds: Convenience and the logistical problem of women gaining access to cash, seems to be another key factor in the need to share credit cards and PINs with others. By doing this, however, the card holder relinquishes authority over the account: leading to the possibility of someone behaving other than intended, or at a later date taking the card and misusing their access. One possible solution to this problem would be to

enable account holders to authorise an individual to withdraw a specified sum of money from an ATM on a one-off (or even recurring) basis without requiring either the card or the PIN. A possible high-level design for such a system would be to allow account holders to send an authenticated instruction to the bank to dispense a specific sum of money. The bank would reply with a one-use access code that could be given to the trusted person, who would then use this code in an ATM to withdraw the specified sum of money without having to have the card or know the PIN.

5.3 Future Work

We have identified a number of themes which we would like to highlight for further research.

Bank regulation knowledge: As mentioned in Section 2.2, SAMA regulations state that it is the bank's responsibility to educate customers about the regulations, specifically, the consequences of unauthorized use of an account by sharing of the account credentials with a third party. However, all the participants indicated that their knowledge of bank regulations was both limited and very general. A participant said:

I have four accounts in four different banks and it has not happened at any time that a banker has told me anything about bank regulations or how to protect my credentials. [P25, M]

Some participants mentioned that the only warning given by the banks was when a customer used a card device to register the PIN and was told not to disclose the PIN to bank employees. This lack of awareness about the regulations among bank customers can be considered as one of the reasons behind commonly sharing credentials for 25 (86%) participants especially if this sharing seems safe and solving problems, and without consequences. By focusing more on educating customers about the regulations and the consequences of breaches, it would possibly reduce the chances of sharing.

Online banking use: According to female customers, online banking use was not prevalent among females (only 20%), despite providing convenient access to an account which might be seen as a helping to mitigate the issues of constraints on movement. By asking about the reasons behind this, a female customer claimed that she was determined to learn how to use online banking but she could not, because when she asked her bank for help with this service she was told that she must do it by herself while other participants declared that they tried activating online services but they failed and did not try again.

The Internet was introduced in KSA for public use in 1999 [12] and since then Saudi women have used it for socialising, decreasing social pressures, running businesses, all while remaining anonymous in the home with no obligation to meet men in person [23, 39]. Statistics taken from the Asbar Centre for Studies, Research and Communication [15] indicate that 55% of Internet users are men and 45% women, however, the proportion of female users is predicted to increase as the Internet can be seen as a solution for those who are isolated and/or lacking mobility [40, 41].

As a result, IT literacy does not seem to be a likely reason for the lack of online banking use in females. Further exploration of the process for registering and activating online banking services for different Saudi banks has found that this process requires the use of an ATM. As mentioned above, female access to an ATM depends on the availability of vehicle driven by a chauffeur or a

mahram, and can be problematic. One possible solution would be to modify the process of activating online banking to use security mechanisms which do not require physical mobility (e.g. telephone authentication, or wholly online authentication).

Sale points: Card payments at sale points was also discussed as a means of alleviating the problem of accessing money for women. Two women did not use this service, explaining that they had experienced problems with the service before: in one case, a transaction was incorrectly duplicated and led to two debits to her account, requiring her to go to her bank to claim a refund. According to her, this was very inconvenient, especially given the constraints on movement.

P15 [F]: (...) as for the using of the card to buy things, those are very rare occasions. It happened twice or three times only that I went to buy something and I didn't have the full amount so I had to use my card to pay. But it is very rare.

Q: why?

P2: Frankly I don't trust the Saudi bank network... I don't like to use the card. It happened before that the transaction was duplicated and to solve this problem I went to the bank branch to claim a refund. So for me this service created more problems.

The second woman stated that a transaction was seemingly successful, but had not in fact resulted in the correct debit, fuelling her distrust of the system. Given the limited evidence surrounding this, it is not clear how this problem arose, or indeed how widespread it is.

P1 [F]: I don't use sale points because I don't trust this service. It happened to my brother in law, who is a cashier in a shop: when a customer bought things and used her card to pay, the transaction finished smoothly and successfully but then he was informed by the bank that this transaction had not completed and the money was not credited from the customer's account. When he contacted the customer to pay for the goods because the transaction failed and the money was not credited from her account, she refused saying it is not her fault and the receipt showed that the transaction was successful and because of that he had to pay for the goods.

Online shopping: According to the statistics, the use of online shopping is very limited between the participants. When asked why they did not shop online, many participants said that it was because they did not have credit cards which could be used for online shopping; their bank cards could be used only in ATMs and at sales points. Saudi banks often routinely issue ATM/sales-point cards to customers who open an account, but provide credit cards only if the customer requests one. Participants also said that they were wary of trying online shopping without guidance or help from the bank. As an alternative, many customers reported using the services of an intermediary with experience in online shopping. The customer would contact such a person by phone or email to request certain goods, then transfer the money to the account of the intermediary, who would purchase the goods online using his credit card and send them on to the customer.

6. CONCLUSION

Bank customers in the KSA give various reasons for sharing their credentials with their family members including mutual trust, simplifying life and laziness, movement limitation for females and the high esteem placed in parents. They perceive

little to no harm or risk from sharing, relying on being able to monitor their accounts by receiving an SMS for every transaction and keeping their banking card safe.

We have discussed the ways in which these practices can undermine good security principles, and proposed a number of solutions aimed at working with the factors that underpin these practices, however more needs to be done to further investigate the issues and assess the effectiveness of our proposals.

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