Exploring the Process of Technology Socialization (TS) in the Family: ICT Adoption for Middle-aged Parents with the Influence of Adult Children

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Abstract

Family is an important socialization environment for adopting information and communication technologies (ICTs). However, while existing information systems research focuses on individual factors that influence digital inequity, it tends to ignore the influence of relational/collective factors on individuals' ICT adoption. Drawing on technology adoption, socialization, and social identity theories, this study focuses on the process of technology socialization of ICT adoption for middle-aged parents with the influence of their adult children in Chinese families. Through in-depth interviews with thematic analysis, we identify three mechanisms in the family, including creating a family shared environment, negotiating a family ICT identity and interplay, and generating digital differentiation. These findings contribute to a technology socialization framework, addressing how individuals can become digitally savvy with the influence of the socialization agents in the family. The findings have implications for ICT firms and policy makers to promote the family shared environment as a vehicle for achieving social wellbeing and digital upskilling of middle-aged adults.

Keywords IS/ICT adoption · Technology socialization · Family shared environment · Family ICT identity · Digital differentiation · Digital divide

1 Introduction

Now we have this consciousness. That is to say, with the rapid development of the era and knowledge explosiveness in various aspects, we are constantly learning things. There is a gap between us, not only in age but in knowledge. […] You are embedded in the new (digital) society, but we must learn it, adapt to the society, and understand cutting-edge things as much as possible. We are learning.

The above statement illustrates a middle-aged parent's feeling about the relationship between self-identity and the

rapidly changing Chinese society, mainly because of the growing development and use of information communication technology (ICT). This type of experience has been linked with digital divide between generations (Loh & Chib, 2022) and is widely discussed in the digital society and technology adoption literature. However, its impact and how to boost social inclusion remain unknown.

Consumers' willingness to try new ideas can boost a country's innovation economy globally (Tharp, 2021). In particular, the digital economy has increased technology adoption and has influenced people's everyday lives through the use of ICT products and services (Pal et al., 2020; Yan & Schroeder, 2020). For example, in China, the internet has reached more than half the total population. This includes users' access to the internet on mobile devices and tablets, such as apps including WeChat (a multimedia mobile instant messaging service), mobile banking, mobile shopping, ride-sharing, group buying, and service bookings (Wu et al., 2022). Additionally, there is a significantly growing adoption rate for online shopping, social media, and internet TV, which influence various aspects of daily life in developing areas in China (Deng et al., 2022).

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Globally, however, gaps have been identified between different groups' use of ICTs/IS, such as between younger and older generations (e.g., Elena-Bucea et al., 2021; Mahroof et al., 2018; Vimalkumar et al., 2021). Particularly, people's barriers to accessing and using technology are defined as the digital divide (Loh & Chib, 2022), leading to negative impacts. For example, during the COVID-19 pandemic, older generations experienced digital anxiety (Meng et al., 2022) and had trouble using ICT to maintain their daily activities (e.g., ordering food online or seeking healthcare support) or receive their adult children's tangible (e.g., food delivery) and intangible (e.g., emotional communication) support during lockdowns.

The family has been identified as an important environment that can provide informational and emotional support (Xiong & Zuo, 2019). Specifically, middle-aged adults are one of the largest population groups in Chinese society; particularly in urban areas, where they have a potential influence on the ICT adoption rate and have relatively stable and affluent household disposable incomes (Thomala, 2021). However, less attention has been given to middle-aged adults, particularly Baby Boomers and early Generation X, with regard to their level of innovation, involvement in, and their needs and demands for ICT adoption. For instance, they do not lag far behind society. Due to the relatively early retirement scheme (with an average retirement age of 54), a large group of middle-aged adults in China are entering retired or semi-retired life (Feng et al., 2019). After leaving the former workplaces, how do they spend their retirement over their extended lifespan in relation to economic developments and their social wellbeing? In this situation, ICT adoption by this group is as important as that of many other groups.

Drawing on the theories of technology adoption (Davis, 1989), socialization (Frønes, 2016), and social identity (Brown, 2000) we adopt a sociological perspective and propose the concept of technology socialization (TS), which explores the process by which people acquire technological knowledge, information, skills, attitudes and values from a socialization agent. Specifically, this study aims to explore the TS of middle-aged parents' ICT adoption with the influence of their adult children. In particular, the influence of a socialization agent, such as adult children, positively influences older people's ICT experiences (e.g., informational and emotional support) (Xiong & Zuo, 2019). Moreover, psychological factors, such as IT identity and perceived risk, are associated with ICT access and use (e.g., Benson et al., 2019). In this qualitative and interpretive study (Goulding, 1999), our findings develop three mechanisms of TS, including creating a family shared environment, negotiating family ICT identity and interplay, and generating digital differentiation. The findings contribute to the information systems literature by explaining the process of TS from relational and collective perspectives

in the family context. This can help to explain the formation of digital inclusion and/or divide in the family environment and provide recommendations to bridge the gap of digital divide.

2 Conceptual Background

2.1 ICT Adoption and User/Customer Engagement

Adoption of information communication technologies (ICTs) have long been studied using information system related theories such as the technology acceptance model (TAM), theory of planned behavior (TPB), innovation resistance theory (IRT) and theory of reasoned action (TRA). These theories were developed under the technology adoption framework, which focuses on understanding an individual's degree of technology engagement in terms of usage, skills, social support and self-perception, and the relationship between these factors (Seifert et al., 2018). In the recent information systems (IS) literature, two research streams have investigated the ICT adoption and user/customer engagement/wellbeing, which will be reviewed in the following sections.

2.1.1 ICT Wellbeing and Influencing Factors

The literature defines ICTs with the characteristics of "place-less connectivity," with the "anywhere, anytime" approach intensifying their adoption (Webster, 2014). Wellbeing through ICT adoption enhances quality of life (Ghahramani & Wang, 2020), particularly influencing user/customer (e.g., physical and psychological) engagement in ICT adoption (e.g., user acceptance and actual use). For example, IS scholars have identified positive psychological feelings, such as the enjoyment of watching TV on a mobile phone (Shin et al., 2021) and playing video games with family members (parents and young children) (Bassiouni et al., 2019).

ICT adoption can also facilitate information learning in the community (e.g., the use of e-health services by elderly individuals) (Meng et al., 2022), information sharing and knowledge transfer, such as through the use of mobile phones (Canevez et al., 2022), and information selection in decision-making, such as new mothers processing online information resources to make decisions regarding baby products (Mahony et al., 2022) and online group buying (OGB) (Hossain & Rahman, 2021). In addition, ICT adoption helps individuals solve problems with more engagement, such as using tablets for problem-solving, concentration, and control by improving the experience through the tablet's interface design (e.g., navigation and visual appearance) (Wu et al., 2022). Moreover, ICT adoption can share (cultural or social) identities with groups, such as taking and sharing selfies with groups (Dey et al., 2018), boosting

collective behavior and a sense of belonging (Canevez et al., 2022). These factors help individuals develop the use of technology habits (Jia et al., 2022) and positive performance expectancy, which refers to "*the degree to which using technology will provide benefits to consumers in performing certain activities*" (Venkatesh et al., 2012, p. 159).

However, the IS literature has also discussed adverse effects; for example, psychological stress can be involved in the use of ICTs, and/or addiction to social media for networking (Dang, 2020). In addition, customers who perceive high risks in online transactions and shopping via social platforms tend to be negatively influenced in their purchasing decisions (Benson et al., 2019). There is also a perceived risk in the influence of people's mobile technology adoption (Daghfous et al., 2018). For example, technology anxiety can negatively impact individuals, such as the elderly, in terms of their continued intention to use eHealth services, depending on their level of cognitive awareness and effective trust (Meng et al., 2022). Notably, it has been reported that the older generation (e.g., 41 years old and older) tends to experience more barriers to IS adoption than the younger generation (e.g., age 20 to 40), such as mobile technology adoption in life insurance products/services (Naicker & Merwe, 2018). As a result, the literature has also discussed disparities in adults' ICT adoption.

2.1.2 ICT and the Digital Divide

The most common term to describe these ICT disparities is the "digital divide". This term refers to "*the gap between individuals, households, business and geographic areas at different socio-economic levels regarding their opportunities to access information and communication technologies (ICTs)*" (OECD, 2001). This definition indicates different levels of the behavior divide (e.g., access, use and appropriation) (Ghahramani & Wang, 2020), the demographic divide (e.g., individual, family, age, and gender groups), and the activity divide (e.g., education, employment, and daily functions) (e.g., Loh & Chib, 2022) in ICT adoption. In particular, ICT adoption among older consumers (above age 65) has been researched. Notably, age has been identified as an influencing factor regarding cognitive barriers (e.g., age-related issues such as poor eyesight, hearing, and memory), cost, complexity, ergonomic impediments, and lack of interest or trust (e.g., Carpenter & Buday, 2007; Choudrie et al., 2018; Knowles & Hanson, 2018). In addition, IS literature has identified an intergenerational gap in ICT adoption. For example, although adopting smartphones can increase the likelihood that individuals will seek and track health information, these behaviors are more likely to occur in the younger generation than in the older generation (Ghahramani & Wang, 2020).

Moreover, social influence factors such as shared social identity (Bailey & Ngwenyama, 2010), social support (Xiong & Zuo, 2019), social interaction (e.g., family bonding) (Deng et al., 2022), subjective norms (e.g., perceived risk and trust) (Wong et al., 2022), and motivation (e.g., intrinsic motivation) (Bassiouni et al., 2019) influence ICT adoption decisions. For example, Jiao and Wei (2020) found that adult children's informational and emotional support tends to increase their parents' brand association with technology products. Moreover, interpersonal communication and skills influence mobile phone technology adoption across their lifespan (Bailey & Ngwenyama, 2010; Magsamen-Conrad & Dillon, 2020), such as in the learning transfer process (Jia et al., 2022) and perceptions of the role ICTs play. For example, parents from South Asia perceive mobile technology as a disruptive agent due to its frequent adoption by their children, which influences the level of their children's dependency on them, thus influencing intergenerational relationships (Mahroof et al., 2018). This view is partly supported by the study of Vimalkumar et al. (2021). Furthermore, Bailey and Ngwenyama (2010) argue that intergenerational interaction is a critical issue in the analysis of ICT adoption behavior and the success of IS adoption in society.

Overall, the IS literature has discussed wellbeing in relation to different ICT products/services, influencing factors, and results (i.e., the digital divide). In particular, the family is a critical environment that involves different levels of the digital divide (e.g., intergenerational gap, gender difference, and level of access, usage and appropriation) and interactions (e.g., Vimalkumar et al., 2021). However, this area is still under-researched in the IS literature, especially from a qualitative perspective (Jiao & Wei, 2020; Xiong & Zuo, 2019). This study incorporates the technology adoption theory with the socialization theory, particularly reverse socialization, to study the dynamic intergenerational interactions in ICT adoption.

2.2 Technology Socialization (TS) in the Family Context

In sociology, the socialization theory was developed to understand how people acquire knowledge, skills and beliefs from socialization agents (e.g., parents, peers, schools and the mass media) to develop their social behavior and interactions (Frønes, 2016; Mortimer, 1978). There are two stages of socialization, including primary (childhood) and secondary socialization (adulthood) (cf. Frønes, 2016). Researchers argue that socialization is a lifelong process (Moschis, 2019). Specifically, people acquire learning from different socialization agents at different lifecycle stages, such as learning and using ICT products/services for social interaction and daily functions in adulthood (Perez et al., 2019).

Existing literature has discussed the family as an essential environment for diffusing technology and has investigated children's influence on their parents for ICT adoption from a reverse socialization perspective, such as informing parents about smartphone usage (Perez et al., 2019). This study adopts a relational and collective viewpoint and uses the term "reverse socialization", referring to the influence of the younger generation on the older generation's consumer values, knowledge, attitudes, and skills (Ekström, 2007), to investigate the intergenerational relationships and interactions between middle-aged parents and their adult children.

This study proposes the concept of technology socialization (TS) to explore how individuals learn technology-based knowledge, skills, values and attitudes from socialization agents in the use of various ICT products/services. Notably, this study approaches the process from a reverse perspective, i.e., from adult children to their middle-aged parents. In contrast, most research thus far has focused on families with young children (e.g., Belch et al., 2005; Correa, 2014) and/or older groups (above 65) (e.g., Knowles & Hanson, 2018; Seifert et al., 2018). However, there is a lack of IS research on the impact of TS on middle-aged people's wellbeing. Due to an aging society, the middle-aged group (between 45 and 60) will soon contribute to and be the target segment for technology adoption (e.g., mobile health services) (Meng et al., 2022). However, a low adoption rate persists (Magsamen-Conrad & Dillon, 2020). Although the family is an important environment to investigate technology diffusion through emotional and informational support (e.g., Xiong & Zuo, 2019), little attention has been given to exploring the interactions and the ICT identity of family members.

2.3 ICT Identity in Technology Socialization

Prior IS research has applied identity theory to analyze individuals' self-perception and relationship with ICT adoption in social interaction. Social identity theory studies intergroup relations and attitudes in a social group and identifies group identification, in-group bias, and self-esteem (Brown, 2000). For example, drawing on a female lens, Hino and Cunha (2021) developed different IT identities of female users, including connection and confidence, detachment, indifference to technology (although this unconsciously intensified adoption), acceptance (despite concern about use), and selective adoption (only for work). These IT identities reflect the different levels of self-efficacy in IT adoption. Linking to the TAM model, we refer to self-efficacy as a level of confidence and capability in the access, usage, and appropriation of technology adoption. For example, Canevez et al. (2022) found that IT self-efficacy (e.g., mobile phone usage) in urban areas positively relates to the sense of belonging in the community.

On the other hand, the social identity theory has been applied to IS studies in the family context. For example, in a study of South Asian communities, independent and interdependent self-construal determined how parents interpreted their children's technology use (Mahroof et al., 2018). Self-construal typically defines how an individual sees the self as related to others (Agrawal & Maheswaran, 2005). In the context of IS literature, self-construal is often defined as the extent to which an individual perceives himself/herself as an individual entity and/or is related to others in technology adoption (Mahroof et al., 2018). Indeed, the evolving nature of digital media has altered parent/child dynamics such that parents are perceived as "digital immigrants", while children are superior "digital natives" (Autry & Berge, 2011). This shift in the socialization relationship of parents with their children in technology adoption make parents feel insecuried and not acquainted or sufficiently technically literate to educate their children, who tend to hold more advanced skills and attitudes with regard to ICT adoption (Mahroof et al., 2018).

In addition, prior IS studies have applied personality traits to investigate adults' ICT adoption behavior (e.g., Bansal et al., 2016; Barnett et al., 2015). Personality traits refer to a pattern of behavioral characteristics of an individual that affects cognitive, affective and behavior reactions to determine the individual's beliefs, attitudes, and behavior (Venkatesh et al., 2003). Particularly, the five-factor model (FFM) of personality identifies five individual personality traits: extroversion, agreeableness, openness, conscientiousness, and neuroticism (McCrae & John, 1992). Specifically, personality traits impact IS success. For example, Hossain and Rahman (2021) applied the FFM to investigate the influence of personality traits on customers' online group buying (OGB) in China. The findings showed that customers with personalities demonstrating extroversion, agreeableness and conscientiousness were more comfortable using the internet, and therefore were more likely to purchase from OGB sites with the interaction of online group members. Although IS scholars (e.g., Devaraj et al., 2008; Hossain & Rahman, 2021) have urged the investigation of the role of personality in established IS theories explaining technology acceptance; it is unclear how individuals' personality traits influence their ICT adoption in the family, which is a significant physical and social environment influencing the information/innovation diffusion. This is particularly applicable in most collective cultures where individuals view themselves with a high relationship to family members. Taken together, this study aims to explore the interactions of middle-aged parents' ICT adoption with the influence of their adult children.

3 Research Method

3.1 Research Setting

This qualitative, interpretive study (Goulding, 1999) chose Chinese families to be involved as the research context, as technology adoption rates have been increasing in recent decades in China (e.g., surpassing one billion mobile phone internet users in 2021) (Thomala, 2021). Since the 1950s, a relatively low retirement age scheme[1] has been implemented by the Chinese government, compared with other countries, such as the UK (Feng et al., 2019). However, there is still a lack of understanding of the ICT adoption behavior of middle-aged groups, although they are becoming a growing segment in the technology market, with a potentially huge demand for ICT adoption (Xiong & Zuo, 2019). In addition, due to the close family ties manifested by the cultural belief of filial piety, older parents tend to put high expectations on their adult children for emotional and physical support (Xiong & Zuo, 2019). Such family ties are a tradition and a dominant phenomenon in Chinese society and provide a natural context to explore parent-adult child interactions for parents' ICT adoption and consumption in TS.

3.2 Data Collection and Sample Characteristics

This field study (five months) with data collection, adopted an in-depth interview approach. Informants were recruited via personal contact with families of adults and children who lived in Beijing, Dalian, and Ulanhot (Inner Mongolia). A purposeful and snowball sampling approach (Gummesson, 2005) was applied to recruit informants who had experience of learning about ICT products/services from their adult children. Before data collection, ethical approval was received from the first author's university. A pilot study was conducted before data collection with mothers from two families, who were recruited and interviewed on WeChat audio (between 40 to 60 min) to test and improve the interview questions. Email and WeChat message invitations were sent, and sixteen families were recruited that included middle-aged parents (father and/or mother) and their adult children (N = 40). The family profiles are anonymously summarized in Table 1. The sample included parents who were Baby Boomers (born between 1954 and 1964) and early Generation X (born between 1965 and 1979) with their adult children who were Millennials (born between 1981 and 1996).

After informed consent was received, the researcher conducted in-depth, semi structured interviews in Mandarin with all the families. The rationale for using in-depth interviews was that they enabled us to collect thick data to understand family members' interactions with and attitudes towards IS/ICT adoption by asking "what," "how," and "why" questions (Cairns & Cox, 2008). Thirty-four interviews were completed with sixteen families and were digitally recorded. Most of the families were interviewed at the informants' homes; two families were interviewed at restaurants, and four individual interviews (the second visit) were conducted via WeChat audios due to the informants' time schedules. An interview guide was used to achieve a rapport with the informants and to promote further questions during the interviews. Family groups and individual interviews were conducted to collect in-depth and comprehensive descriptions and to avoid conflict (Geertz, 2008). Each interview lasted at least one hour.

Notably, this study used a retrospective interview approach (Nicolson, 2003) that allowed informants to remember their thoughts and emotions regarding TS experiences of ICT adoption with the influence of their adult children. Retrospective data (Metts et al., 1991) were then collected. Specifically, the questions began by asking about family background, residence, relationships, and family roles in consumption decision-making. This was followed by questions focused on the experiences of teaching and learning ICT from their adult children, including the products/services, occasions, processes, results, and impacts. The researcher adopted the informant-led approach (Goulding, 1999) and proposed follow-up questions according to the informants' descriptions, with opportunities to collect thick descriptions related to the topic. The interactions and relationships of family members in the TS and their characteristics in ICT adoption were captured. After the interviews, each family was given a gift (e.g., a Topshop soap) to show appreciation for their participation.

Each of the interviews was transcribed verbatim and served as a dataset. Thematic analysis (Braun & Clarke, 2006) was employed because it was helpful to explore the informants' lived experiences of ICT adoption, perspectives, behavior and practices, factors and social process, and relationships with socialization agents. The detailed steps are presented in the next section. Translation and back-translation between Chinese and English were applied to achieve validity and credibility (Douglas & Craig, 2007) by inviting two bilingual colleagues from the researcher's university to undertake the task.

3.3 Data Coding and Analysis

This study followed the guide of thematic analysis in a reflexive manner (Braun & Clarke, 2019) in three steps to perform coding. First, the lead author read and reread the family transcripts to gain familiarity with the data,

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[1] The current retirement ages in China are "60 for men, 55 for female professionals/cadres (including teachers, medical personnel, other professionals and administrators), and 50 for the rest of the female workers" (Feng et al., 2019). In contrast, the second-stage pension age in the UK is 66 (GOV.UK, 2022).

Table 1 Family profile*

#	Type of family residence	City	Family role	Age	Occupation	Number of family interviews (Group and/or individual)
1	Live separately with parents	Beijing	Mother	55	Accountant	3
			Father	55	Retired	
			Daughter	28	Hi-tech project manager	
2	Co-residence with parents	Dalian	Mother	51	Retired	3
			Father	54	Factory project leader	
			Daughter	28	Financial project manager	
3	Live separately with parents	Dalian	Mother	51	Retired	3
			Father	53	Lawyer	
			Son	26	Software designer	
4	Live separately with parents	Dalian	Mother	50	Accountant	2
			Father	51	Retired	
			Son	24	Software designer	
5	Live separately with parents	Ulanhot	Mother	48	Housewife	3
			Father	47	Self-employed	
			Son	20	College student	
6	Co-residence with parents	Ulanhot	Mother	50	Beauty salon owner	3
			Father	53	Forestry bureau staff	
			Son	23	IT programmer	
7	Co-residence with parents	Ulanhot	Mother	55	Retired	4
			Father	55	Forestry worker	
			Son	30	Restaurant manager	
8	Live separately with parents	Ulanhot	Mother	57	Insurance seller	3
			Father	58	Heating station manager	
			Daughter	31	Self-employed	
9	Co-residence with parents	Ulanhot	Mother	50	Retired	2
			Father	51	Local government taff	
			Daughter	26	Civil servant	
10	Live separately, different cities	Beijing	Daughter	27	Consultant	1
11	Live separately, different cities	Beijing	Son	25	Engineer	2
			Father	53	Engineer	
12	Live separately, different cities	Beijing	Daughter	24	IT programmer	1
13	Co-residence	Beijing	Daughter	27	Administration staff	1
14	Live separately, different cities	Ulanhot and Xiamen	Son	28	Doctoral student	1
15	Live separately	Ulanhot	Father	59	Retired	1
			Mother	60	Accountant	
			Daughter	33	Manager	
16	Live separately	Ulanot	Father	59	Retired	1
			Mother	58	Restaurant owner	
			Son	34	Firefighter	
			Daughter-in-law	28	Shop owner	

*Only informants who joined the interviews were included in the family profile

noting initial ideas related to family ICT adoption. Each family was treated as a unique case to understand their story about parent-adult child interactions in ICT adoption (Ayres et al., 2003). Then, the initial codes were generated on each of the transcripts by systematically identifying related features of the data across family cases (e.g., elements influencing/leading to parents' ICT adoption, including acceptance and actual use). Secondly, the codes were collated into the potential subthemes that emerged (e.g., the mechanisms of ICT adoption in the

Fig. 1 Thematic map of technology socialization
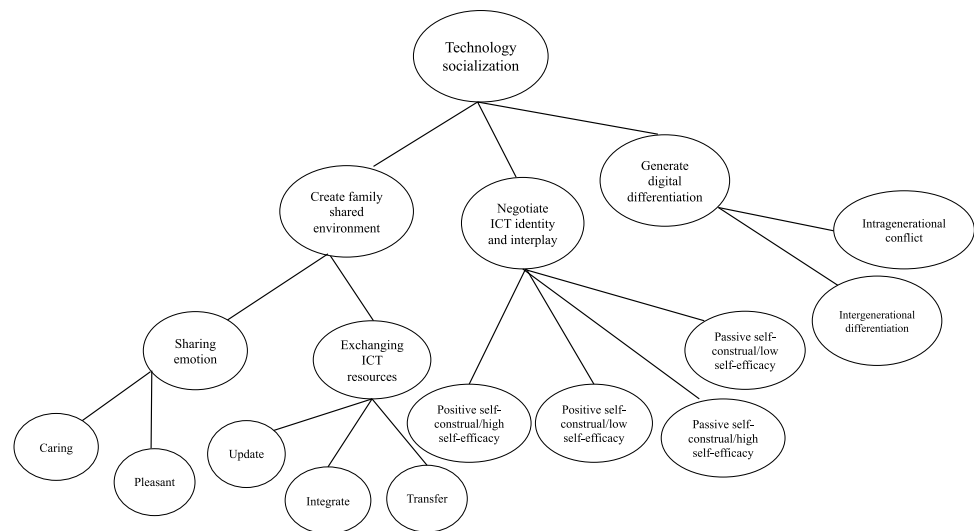
family). The process continued by reviewing the themes by checking the relationships of the codes within and across the themes (e.g., the process of TS). Three main themes were identified, and a thematic map was subsequently developed (see Fig. 1) and discussed with the research team, including names and clear definitions. Finally, a story of the overall themes of ICT adoption in TS was created, which will be presented in the next section, with examples and interpretations.

4 Findings

This study developed three mechanisms of ICT adoption performed between parents and their adult children, with details presented in the following sections and more examples in Table 2. Particularly, family participants reflected technology/ICT products/services, including PCs/laptops and tablets, smart devices (e.g., smartphones and internet TV) and mobile apps (e.g., for taxis and cooking), social media (e.g., WeChat and QQ), online/TV shopping, group buying, mobile payments (e.g., Alipay) and mobile POS (portable point of sale), and other online services (e.g., visa applications, and bookings for flights and hotels). Accordingly, the values and attitudes shaped in TS were derived from the adoption of the above categories.

4.1 Create Family Shared Environment—Timeless, Spaceless and Placeless

Family members can provide a relatively supportive environment *sharing emotions* and *exchanging ICT resources,* free from time, space, and place restraints. As a result, these behaviors provided family members with opportunities to use new ICTs and form digital inclusion (Bailey & Ngwenyama, 2010).

4.1.1 Sharing Emotions

This element focuses on family members enjoying ICT application results and sharing the same values through the emotional support of their adult children. On the one hand, shared emotions can result from the individual learning outcome of ICTs in TS; for example, a mother (Family 3) shared her pride in having her daughter support a quick learning skill, such as sending *hongbao* (Red Packet)[2] to her friends on WeChat for entertainment.

> *"I remember my daughter used to teach me how to send hongbao on WeChat when my friends sent theirs, and I wanted to join them. She told me once, and I quickly learned to send mine. My friends in group chat said, 'You have learned quickly!' 'Because I got a teacher just next to me!' I thought.'"*

This instant support from her daughter helped the mother achieve the goal of social interaction through ICT with a shared social identity (Bailey & Ngwenyama, 2010). Furthermore, this action by the daughter strengthened the mother's hedonic value (Bassiouni et al., 2019) and motivation (Migliore et al., 2022) for WeChat adoption, which facilitated the parent's actual use.

On the other hand, sharing emotion also helps parents increase engagement in technology adoption, such as acceptance in use through collective goal accomplishment. For example, a mother (Family 4) described how her daughter would buy gifts online for the family, and the daughter reflected on the convenience of engaging in her family's shopping activities in this way.

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[2] A Chinese tradition of giving money to family and friends. An app is installed on WeChat where money can be deposited into a user's WeChat pay account and used to make purchases.

Table 2 Themes: Three mechanisms of ICT adoption in family TS

Themes&descriptions	Sub-themes	Illustrative quotes –individual, relational, and collective goals	IS literature—Individual goal
Create shared environment Resource exchange in terms of emotion, information, and skills in family ICT adoption	Sharing emotion	"He does not quite like to chat with us. Whenever he returns home from school (college), he would stay in his room [...], but if we ask him about the use of technology products, such as laptops or smartphones, he will leave his own stuff behind and help us, so then we could have a brief conversation." (Father, Family 1)	Emotional support for parents' smartphone usage, feeling confident and enjoyment (Jiao & Wei, 2020)
	Updating ICT learning	"This is a popular social media (WeChat). They (parents) had also found other people started to use and felt curious (about that). So, I told them how to use it and hoped that my parents could keep their social style updated and adapt to the mainstream." (Son, Family 14)	IT information learning with cognitive/informational support (Meng et al., 2022; Xiong & Zuo, 2019)
	Integrating ICT resource	"My mother wanted to buy a new TV [...] I checked some product information with her and recommended the internet TV, while my father was in another city. I sent information to my father, such as the price and the product pictures. He then visited the local department store to check the new ones taking my advice. He also shared his information. [...] Finally, we decided to buy this one." (Daughter, Family 3)	ICT information sharing and knowledge transfer, such as with the usage of mobile phones in the community (Canevez et al., 2022) Individual information selection in decision making, such as processing online information resources (Mahony et al., 2022)
	Learning transfer	"I bought the same brand smartphone for my parents (my mother and then my father later) because it can save my effort to teach them twice. I taught my mother how to set the functions and WeChat. Later she shared the usage with my father." (Daughter, Family 10)	IT knowledge transfer and intergenerational knowledge transfer (Bailey & Ngwenyama, 2010; Jia et al., 2022)

Table 2 (continued)

Themes&descriptions	Sub-themes	Illustrative quotes –individual, relational, and collective goals	IS literature—Individual goal
Negotiate ICT identity and interplay Formed by family members' perceptions of self-construal and self-efficacy	Positive self-construal/high self-efficacy	*"My father can accept and learn new things quickly (according to my teaching experience), such as WeChat and smartphones. Maybe because of his work requirement, he needed to use WeChat to send group messages and shared documents."* (Son, Family 7)	Connected and confident in IT adoption (Hino & Cunha, 2021)
	Positive self-construal/low self-efficacy	*"My parents can accept technology products and services quickly, but on a surface level, such as using WeChat to chat, share information, and view products online. However, for the advanced skills, such as sending emails, mobile shopping and book services, they may not feel interested, and it will be hard to take over immediately."* (Daughter, Family 13)	Technology is important, although afraid of using and is motived by circumstances (Hino & Cunha, 2021)
	Passive self-construal /high self-efficacy	*"My father is not quite following the new technology. However, he can learn things well if they need to, such as WeChat. Now he uses WeChat as a routine (after my instruction) to chat with his siblings after work."* (Daughter, Family 8)	Indifferent to technology, but intensified adoption without notice (Hino & Cunha, 2021)
	Passive self-construal /low self-efficacy	*"My mother does not care about or use technology products or services as my father does. Perhaps because they are not related to her life at her age (retired), she has more interests in healthcare and gardening. She can also rely on me if she needs anything to purchase online."* (Son, Family 11)	Detached IT identity (Hino & Cunha, 2021)
Generate digital differentiation Differentiated interactions between intergenerational and intragenerational groups in using ICT	Intergenerational differentiation	*"I have not thought about that (continuing to teach WeChat to his father as he taught his mother, following his father's resistance). I think there needs to be a person like my father in my family who is not addicted to social media. Otherwise, everyone plays on the phone, and there is no talking at the dinner."* (Son, Family 5)	Intergenerational gap in ICT adoption influencing intergenerational relationships (Mahroof et al., 2018)
	Intragenerational differentiation	*"She is keen on reading online novels on her smartphone (taught by our son). During weekends, she would read all day until dinner was ready. [….]. Sometimes I wonder what is so attractive about this."* (Father, Family 6)	Addiction to social media for networking (Dang, 2020) Gender difference in mobile technology use (Vimalkumar et al., 2021)

"She (daughter) would buy us clothes online for special days, like Mother's Day or Father's Day, and send them to our home, which I feel sweet. The products (e.g., quality) were not that bad as we thought. […] We (the couple) used to worry about online payment fraud, therefore, whenever shopping, we prefer to add the products to the basket, and she will complete the transaction." (Mother, Family 4)

"It is convenient to shop online as we do not have too many choices in the shops where we live, and I do not have much time to shop physically due to my childcare duty and pregnancy (a pregnant mother with a 3-year-old son)." (Adult daughter, Family 4)

Specifically, the online shopping process included choosing/checking products, making transactions/payments, chatting with customer service, and arranging delivery. The parents had previously lacked sufficient knowledge to make online transactions, particularly in the early stage when online shopping had just become popular in China, with perceived risks such as financial risks and value barriers (Migliore et al., 2022), which can discourage motivation to user acceptance and actual use. Consequently, the daughter's sharing emotions through buying gifts online increased the parent's positive performance expectancy towards the online shopping approach, reducing the aforementioned perceived risks, free from time, space, and place.

4.1.2 Exchanging ICT Resources

This theme demonstrates the exchange behavior in using ICT resources in the family to facilitate technology acceptance and use being free from time, space, and place restrictions. Specifically, this resource exchange can be achieved by *updating, integrating* and *transferring* tangible (e.g., smartphone, PC/laptop) and intangible (e.g., online booking services, IT knowledge, and skills) resources. Such an exchange resource enables technology habit formation and social interaction within and outside the family context, building social networks and relationships in the digital environment.

Updating ICT Resources This element shows that family members can update ICT resources for each other to adapt to ICT adoption and keep their daily activities functioning well. For example, the family (Family 1) shared the experience of receiving technological information from the adult son.

"The internet TV is trendy now. I explained this to my mother and recommended replacing our cable TV with the internet one so that they can watch with more choices. Additionally, the payment is only for

the network fee. […] So now we have this new one." (Adult son, Family 1)

"I enjoy watching the internet TV he recommended. I can watch many programs without worrying about missing the time slot." (Mother, Family 1)

"As long as the things that we use are technologically related (e.g., if the internet TV or PC has a problem), he will take charge of them because he likes to do the research and knows more than us." (Father, Family 1)

From this, we can perceive that the son's persuasion was successful because the parents perceived their son as technology savvy with expert power influence (c.f. Raven, 2008). Therefore, the parents were willing to accept the son's suggestions and enjoyed the TS outcome with new learning and forming a new technology habit.

Integrating ICT Resources This element focuses on family members collaborating using multiple ICT resources to fulfil individual, relational and/or collective goals. For example, a daughter (Family 2) shared an experience of making US visa applications for her parents, who traveled abroad for her graduation ceremony.

"First, I helped them (parents) prepare the visa application documents online and filled out the information on their behalf. Then, I returned the forms to them via WeChat so that they could complete the rest of the sections. After that, they submitted the documents online to book an appointment. […] On Skype, we had a video chat (I taught them before studying abroad) and shared with them the places we could travel."

On the other hand, family members can integrate ICT sources to experience the result of IS adoption. For example, a son (Family 7) used online group buying (OGB) for the family to make reservations for dining out.

"Every once a while I find some set meals on a group buying website with a good deal. […] Then, I will book online and take my parents to eat out." (Son, Family 7)

"We (the couple) do not eat out very often and did not feel like knowing this (OGB) before […] But it was cost-effective and an excellent way of eating outside (after we tried)." (Mother, Family 7)

It can be observed that both families integrated multiple ICT resources, which supported the parents' consumption decision-makings with new user experience. Therefore, the adult children played the role of initiators, creating values which helped the parents reduce the value

and function barrier of ICT adoption (Migliore et al., 2022).

Transferring ICT Resources This element focuses on family members transferring ICT learning outcomes (e.g., IS user information, values, and skills) to others within and outside the family, thus forming a shared environment. For example, a mother and a son (Family 9) described the knowledge transfer experience (e.g., adult son–mother-peer group) regarding the problem of the WeChat account block.

> "*A couple of days ago, I helped my mother resolve the WeChat account block issue. […] It took me a while to work out, and she observed the steps next to me.*" (Son, Family 9)

> "*I learned the steps from him. After that, I shared this solution with my friends who had the same issue.*" (Mother, Family 9)

Specifically, our findings indicate that intergenerational transfers can also benefit the community outside the family, forming a social network for technology diffusion. Notably, this finding supports the view that intergenerational knowledge transfer can be seen as a partnership that can promote social inclusion (Bailey & Ngwenyama, 2010). On the other hand, parents are also willing to share their ICT learning outcomes with family members to create a shared environment. For example, a son (Family 1) and a daughter (Family 10) reflected on their family sharing experiences.

> "*My mother shared with my father about the usage when I was not at home. [...] I remember she also told me how to share the moments on WeChat she perhaps learned by herself or from her friends.*" (Son, Family 1)
> "*My mother would very often share with me some news that she read from some WeChat official accounts (after I taught her how to use WeChat) and felt helpful, such as healthcare information.*" (Daughter, Family 10)

Specifically, the findings reveal an intergenerational and intragenerational transfer that shows that parents can be the influencers shaping a sharing environment. Taken together, these different reciprocal ICT knowledge transfers (within and outside families) can facilitate access and develop technology habits, thus enhancing social inclusion (Jia et al., 2022).

4.2 Negotiate Family ICT Identity and Interplay

Different family ICT identities are developed and interact within TS which are shaped by self-construal and self-efficacy. In particular, family members' self-construal incorporates individual and others' perceptions of ICT adoption (e.g.,

regarding values and skills) (Chen et al., 2020; Hossain & Rahman, 2021; Mahroof et al., 2018). According to families' descriptions, this study generally identified two types of parents' self-construal in ICT adoption, including positive self-construal (e.g., being inventive/curious and willing to engage with others in using ICT) and passive self-construal (e.g., being consistent/cautious and unwilling to engage with others in using ICT). These thus shape different levels of technology user acceptance. Meanwhile, family members also reflected on parental capability of actual use in technology. We refer to capability as different levels of self-efficacy, meaning the belief about parents' general level of technical aptitude and confidence in ICT adoption (Benson et al., 2019). As a result, we developed four types of ICT identities of parents leading to different levels of customer engagement (Hollebeek & Belk, 2021) in technology adoption.

Positive Self-Construal/High Self-Efficacy Parents tended to demonstrate an open mind, with positive self-construal and high self-efficacy when learning new ICTs. For example, a mother (Family 1) expressed her feeling about technology adoption: "*I was the first who used WeChat in my family.*" This ICT identity leads to frequent communication and ICT resource exchanges with family members; this was confirmed by her son and is a critical factor for the success of ICT diffusion in TS.

> "*My mother is more willing to accept new things (i.e., technology-related products) than my father. For example, my mother was the first in my family to buy a cell phone when I was little. Since then, she has always followed new technology trends, such as WeChat […] Therefore, if I have some new information about technology products, I prefer to talk to my mother first.*" (Son, Family 1)

Therefore, a smaller intergenerational gap was perceived between the parent and the adult child with a relatively similar ICT relational identity. This result minimizes the perception of parents as "digital immigrants" and children as "digital natives" (e.g., Mahroof et al., 2018), thus demonstrating the parent's high level of acceptance in use and behavioral engagement (e.g., actual use) (Hollebeek & Belk, 2021).

Positive Self-Construal/Low Self-Efficacy Parents can also be open-minded with and curious about technology adoption, seeking outward connection but with low self-efficacy. For example, a mother (Family 4) reflected on her learning experience from her daughter, with high self-motivation to learn and use ICT, but with the passive assistance of her adult daughter.

"I am not a laggard. Although I am nearly 60, I want to learn what others are using (WeChat, QQ, iPhone, etc.) […] and get my daughter to teach me (until I can do it myself). However, she is too busy and always impatient with teaching. I have to wait for her to resolve problems, such as the usage problem of my smartphone. I almost feel like giving up on learning sometimes and just receive the ready-made support." (Mother, Family 4)

Consequently, the adult child's delayed teaching or ignorance of the parent's ICT adoption demand could negatively impact the parent, with the potential of passively becoming a digital divide. This shows that poor family communication with insufficient informational/cognitive and emotional support can discourage parents' motivation for ICT adoption (e.g., actual use). Therefore, it can be perceived that an adult child (e.g., his/her teaching attitude) can have a moderate effect on the attitude of the parent towards ICT adoption (e.g., ease of use and actual use), particularly in a collective social culture where family bond plays a crucial role in family decision making in consumption.

Passive Self-Construal/High Self-Efficacy Parents also demonstrated passive self-construal when they lacked interest and were cautious about new technology. For example, a daughter (Family 3) described her perception of her father's rational attitudes towards and results of ICT adoption.

"My father is not the type who blindly follows a trend. You have to give him a reason to convince him. For example, he used to resist using the iPhone I gave him as he had no interest and found it complex. However, he can now accept using the iPhone and the apps like a pro (with my encouragement and support)." (Daughter, Family 3)

From this we can perceive that the daughter plays the role of an agent in increasing the father's perceived trust in ICT adoption, reducing his ICT adoption value and function barriers, and thus fostering the father's technology habits. Specifically, the findings reveal that the parent can become highly self-efficient after tackling the two levels of the digital divide (with the assistance of the adult child): (1) lack of information and access (with motivation), and (2) capability in use (Vimalkumar et al., 2021).

Passive self-construal/low self-efficacy The last type of interaction demonstrates parents' innovation resistance when they lack knowledge and interest or have low motivation for technology adoption, along with low self-efficacy. For example, family members (Family 9) described an unsuccessful

teaching and learning experience with the father regarding using a smartphone in the family interview.

"I used to try to teach my father how to use a smartphone before, but I gave up. I started by teaching him some basic functions, but he said it was too annoying, and then he gave up […] Not much I can do about it." (Son, Family 9)

"I am almost 60 years old…so I am not good at learning these new technologies. These technologies are not quite related to my life, and I will not use them." (Father, Family 9)

Their reflections particularly reveal that parents can play the "age card" (Knowles & Hanson, 2018) to conceal their unwillingness to learn and access ICTs, therefore psychologically resisting learning (e.g., innovation resistance, Migliore et al., 2022). The unwillingness is due to the fear of change (Perez et al., 2019), which may disrupt their current routine and psychological comfort zone, causing them to resist change. Compared with positive self-construal/low self-efficacy parents, this family's father opted out of technology socialization when he perceived barriers, which led to a digital divide in the family environment.

4.3 Generate Digital Differentiation

The findings focus on the reflection of family relationships in ICT adoption, that is, how family members perceive changes to their relationships due to TS in ICT adoption generating negative technology-based consumer wellbeing. Notably, we reveal *intergenerational differentiation* and *intragenerational differentiation* regarding values, attitudes, habits and beliefs shaped by ICT adoption as a result.

4.3.1 Intergenerational Differentiation

By comparing the interactions of adult children with their parents, this study reveals that adult children can differentiate their interactions with parents in ITC adoption, thus leading to intergenerational alliance and differentiation. For example, the parents (Family 4) reflected on their relationship with the daughter in teaching and learning, highlighting the differentiated behavior of their daughter in teaching. As a result, the differentiated behavior can influence parents' acceptance in use and actual use.

"If I asked her more, such as about smartphones, she would feel annoyed, which irritated me. We both ended up having bad attitudes toward each other." (Mother, Family 4)

"When she started feeling impatient (about teaching me smartphone use), you could tell from how she moved. However, she would not show her frustration to me (and perform the steps until the problem is solved) because I think she felt it was inappropriate for the father-daughter relationship." (Father, Family 4)

Echoing the above descriptions, adult children's perceptions of parents' self-construal and levels of self-efficacy influenced their teaching attitudes toward parents. For example, their daughter (Family 4) reflected on her parents' difference in ICT adoption.

"My father has very good hands-on skill. He can learn well after I tell him once. However, my mother needs to be reminded of the solution repeatedly, which makes me feel frustrated sometimes when I am busy." (Daughter, Family 4)

Specifically, she perceived her father as having passive self-construal/high self-efficacy, and her mother as having positive self-construal/low self-efficacy, in ICT adoption. By comparing their learning capabilities, we perceive that the daughter could have saved more effort teaching her father, rather than her mother. These different relationships can therefore influence the quality of teaching and learning, potentially leading to intergenerational digital inclusion or inequity.

4.3.2 Intragenerational Differentiation

The findings also show digital divide between parents due to the differentiated behavior of ICT adoption in TS. For example, the couple (Family 5) reflected on the tension felt in the family when using WeChat, due to different attitudes towards and habits when using WeChat.

"They (the mother and the son) use WeChat very often. He (the son) also taught me before, but I felt no interest, and it was hard to use. [...] She (the mother) chats on WeChat daily and does not talk to me. She would even play this at midnight with lights on the annoying screen." (Father, Family 5)
"I think his father is very old-fashioned. [...] He should also learn this and join us on WeChat. Otherwise, he may feel too lonely." (Mother, Family 5)

Notably, previous IS literature argues that existing habits promote inertia or resistance when an innovation conflicts with an existing habit (Jia et al., 2022). Specifically, our findings show that one parent's addiction to social media can raise tension levels within a couple. This is particularly due to parents' different perceptions of each other regarding their self-construal and self-efficacy in their ICT adoption (e.g., acceptance and use) (Vimalkumar et al., 2021). In particular,

the mother in family 5 demonstrated positive self-construal/ high self-efficacy, whereas the father demonstrated passive self-construal/low self-efficacy in WeChat use. Such different ICT identities may affect technology diffusion in the family and lead to digital differentiation with intragenerational disruption.

Overall, Table 2 presents the thematic analysis result with examples, the comparisons to existing literature demonstrating the formation of the TS process in the family environment. This shows the impact of relational/collective relationships in ICT adoption, thus achieving individual, relational, and collective goals in family consumption.

5 Discussion

This study explores the mechanisms of middle-aged parents' ICT adoption through the interactions with their adult children in TS, drawing from technology adoption, (reverse) socialization and social identity theories. To the best of our knowledge, this study is the first to propose a concept of technology socialization to explain how individuals acquire technology-based information, skills, and attitudes from socialization agents. Through interpretive analysis of the retrospective data, this study identified three mechanisms in family TS, including creating a family shared environment, negotiating family ICT identities and interplay, and generating digital differentiation along with the elements attributed to them. These findings demonstrate the process of TS (e.g., the flow of knowledge and information from socialization agent, such as adult children, to parents within the three mechanisms) that influence parents' technology acceptance and actual use.

In particular, this study developed a conceptual framework for understanding the TS process (see Fig. 2). Specifically, this framework presents a multi-directional TS process, emphasizing the connections between the internal (i.e., cognitive and emotional) and external environment (i.e., interplay with the socialization agent) and the TS outcomes. (1) Various ICT identities and interplay lead to family shared environment creation/or digital differentiation; or (2) family shared environment/digital differentiation leads to diverse ICT identity formation and interplay. In connection to IS, the TS process with three mechanisms can demonstrate the IS success and problems in (parents') user behavior, such as in learning ("training"), acceptance, and use, from psychological and functional, and relational and collective perspectives in the social context (e.g., family).

Fig. 2 Technology socialization (TS) process in the family context
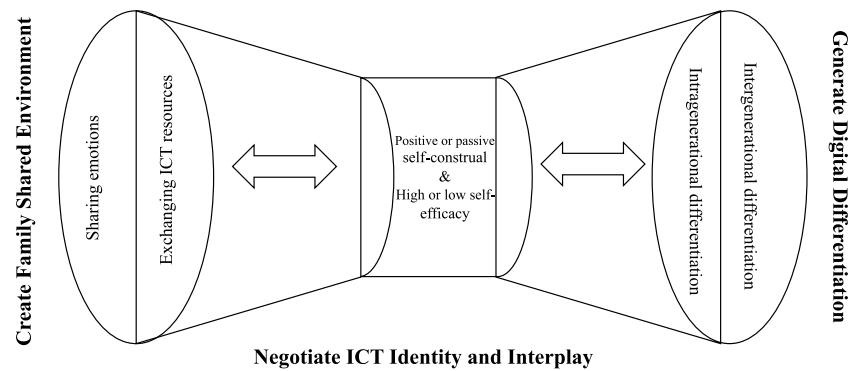
5.1 Creating a Shared Environment Free from Time, Space and Place

Previous IS studies have identified the intergenerational divide and the distant relationship between parents and children in ICT adoption (e.g., Mahroof et al., 2018). However, this study argues that adult children can play a gatekeeping role and create a shared environment with their middle-aged parents. First, with ICTs, adult children can *share emotions* with parents by using ICTs to express their care and/or make parents feel good about the learning outcomes, thus enhancing parents' positive performance expectancy (Venkatesh et al., 2012).

Second, adult children can *exchange resources* with their parents in ICT adoption. This finding provides a new understanding of how ICTs (e.g., information and related digital platform/device adoption) can be disseminated or diffused by adult children, demonstrating three elements in TS.

(1) Adult children can *update ICT resources* for parents by sharing information and teaching knowledge and skills, which supports the finding of cognitive support from adult children (Xiong & Zuo, 2019). Additionally, the findings demonstrate increased levels of access, usage, and appropriation for parents' technology adoption (e.g., parents learned about internet TV from an adult child, purchased one, and learned to use it).

(2) Adult children can *integrate resources,* including using multiple ICT resources to facilitate family decision-making (e.g., preparing online visa applications for parents) and enjoying ICT resources online/offline (e.g., eating out with an online group, or buying with a discount). In comparison with fulfilling the parents' individual goals (Jiao & Wei, 2020), our findings argue that adult children can use ICT resources to facilitate not only individual goals, but also relational and collective goals through TS, which enhances parents' acceptance and actual use of technology (Barnett et al., 2015).

(3) Family members can *transfer learning resources* to each other and outside social groups to form ICT adoption networks. This finding supports the view of individuals sharing ICT adoption (e.g., smartphone), therefore increasing a sense of belonging (Bailey & Ngwenyama, 2010; Canevez et al., 2022). In addition, our findings contribute to the IS literature by presenting the reciprocal socialization between generations (i.e., parents and adult children) and across peer groups (i.e., with the couple and their peer groups), which helps to increase ICT diffusion and adoption that are free from time, space, and place restrictions.

5.2 Revealing and Negotiating Family ICT Identity and Interplay

Previous IS studies developed individual differences based on social identity theory and applied personality traits to understand customer ICT adoption behavior (e.g., Hino & Cunha, 2021; Hossain & Rahman, 2021). However, this study identified four types of identity for parents derived from self-construal and self-efficacy in ICT adoption and form interplay with socialization agent (e.g., family members) with the following comparisons.

Positive self-construal/high self-efficacy parents demonstrate a high possibility of accessing and using ICT products/services (i.e., user acceptance and actual use) with fewer barriers. Parents are more likely to form a technology habit with the assistance of their adult children in a shared family environment.

Positive self-construal/low self-efficacy parents demonstrate a positive attitude toward ICT adoption. However, cognitive barriers hinder ICT habit formation. This finding supports the IT identity of being aware of the importance of usage, but lacking confidence and motivation (Hino & Cunha, 2021). At this point, adult children's informational and emotional support (e.g., patience) could help to relieve parents' technology anxiety (Meng et al., 2022) through forming a shared environment.

Passive self-construal/high self-efficacy parents demonstrate a relatively cautious attitude toward ICT products/services due to a perceived risk and/or lack of interest (e.g., Daghfous et al., 2018; Wong et al., 2022). However, parents can be highly self-efficient in learning if the first level of the digital divide issue (e.g., access) is addressed with motivation. This finding is partly consistent with the IT identity of an *"indifferent attitude toward technology but with intensified adoption"* (Hino & Cunha, 2021, p.1382). Notably, adult children's *sharing emotions* and *exchanging resources* (Section 4.1) are helpful, particularly for encouraging and increasing their parents' learning motivation by creating a shared environment.

Passive self-construal/low self-efficacy parents tend to distance themselves from ICT adoption in TS and use cognitive and psychological factors to justify their resistance to change (i.e., a reason for innovation resistance) (Migliore et al., 2022). In addition, this finding supports the detached characteristic of IT identity reported by Hino and Cunha (2021). Therefore, this *passive self-construal/low self-efficacy* ICT identity explains the formation of the digital divide with a cognitive and/or psychological barrier.

5.3 Generating a Family Multilevel Digital Divide

The third theme identified *intergenerational differentiation* and *intragenerational differentiation* in TS. Previous IS studies have identified the intergenerational gap (Ghahramani & Wang, 2020; Mahroof et al., 2018) and the gender gap (Vimalkumar et al., 2021) in ICT adoption. This theme supports and extends previous findings and further identifies the results of these different gaps. First, adult children can differentiate their interactions with parents in TS due to the different ICT identities of parents described in Section 4.2 and in parent-adult child relationships. Specifically, we find that a close relationship can foster a relatively relaxed/casual attitude of adult children in supporting parents (e.g., *positive self-construal/low self-efficacy*) due to their lack of tolerance of their parents' slow learning, which discourages parents' learning motivation. This interaction can be explained by the influence of the growing age of children (e.g., a more independent figure) and the increased power influence in technology adoption (Ekström, 2007). In contrast, a distant relationship tends to be helpful for middle-aged parents to gain support from their adult children regarding TS with relatively formal communication. Accordingly, intergenerational differentiation tends to form a digital divide between parents and their adult children.

This study also identified a conflict between parents in ICT adoption, leading to intragenerational differentiation. Specifically, different parents' ICT use habits and the level of the digital divide (e.g., access, usage and appropriation) can generate conflict in parents' daily lives. In particular,

frequent use of ICT products/services tends to break the family routine (e.g., rest, entertainment, shopping, and communication). In contrast, a partner who lacks access to ICT resources has less power influence, leading to digital divide. Notably, a previous study found that marital status and gender differences could influence an individual's ICT adoption, such as mobile technology (Vimalkumar et al., 2021). In particular, women are less likely to use digital literature than men or unmarried women in Asian countries (Vimalkumar et al., 2021). However, this study did not find a significant difference between fathers and mothers, meaning that both parents tend to have equal opportunities to be digitally divided or digitally savvy. The reason for this may be the influence of parents' employment status, such as retired or (self) employed, and different ICT identities are developed in Section 4.2. Overall, the TS process can contribute to IS literature by understanding the IS development process, particularly training, acceptance, and use in the family environment (Baskerville & Myers, 2002) through learning IT/ICTs from the socialization agent from sociological and behavioral perspectives. Moreover, our findings against the argument of "one way" of the flow of knowledge and information on the aspects of both disciplinary development (Baskerville & Myers, 2002) (e.g., incorporating multiple theories from other fields rather than IS only) and IS development (e.g., information and knowledge flow extended from "device to user" to "user to user").

6 Practical Implications

This study provides several implications for practitioners. First, due to the nature of the family shared environment in ICT adoption, digital firms can design solutions that enhance family communications and ICT adoption from a relational and collective perspective, particularly considering the role adult children play in technology diffusion in the collective cultural context. For example, e-commerce firms (e.g., Taobao) and mobile payment app firms (e.g., Alipay or WeChat) can help design a sharing account for family members to register to and access. This would allow family members to choose products, make transactions and complete goods delivery arrangements, freeing time, place and space, especially for customers who are digitally divided in ICT adoption. In addition, online group buying firms can provide family discount offers, such as for dining out and ridesharing (Hou et al., 2021), which can encourage service use and potentially reduce the barriers for individuals who are digitally divided, to enjoy the convenience of use. Moreover, digital firms can create short, simplified video tutorials for using their ICT products/services. These can be distributed through popular channels accessed by younger and older generations, such as social

Table 3 Digital transformation framework for IT policy maker in ICT context

Technology socialization Bridge digital divide	ICT identity Transformation (Individual)	ICT identity interplay (Relational)	Shared or differentiated environment formation (Collective/generational)
Mindset/goals	Consider the impact of subjective age on aging people (Nunan & Di Domenico, 2019)- how people (psychologically) associate age with technology consumption (e.g., attachment or detachment)	Break the stereotype of older people and young people having a gap in technology consumption (Bae et al., 2021) and communication in the family context	Be aware of the importance of technology socialization with the influence of socialization agents, such as adult children, and their involvement (e.g., influence strategies in Section 4.1)
Resource support	Promote digital inclusion by collaborating with different service/product providers and demonstrating: • Data/privacy/information security (e.g., social media accounts and online fraud) • Responsible Financial Innovation Act • Knowledge access and learning opportunities • Entertainment • Self-service access	Design routes and promote ICT access and use through relational influence, such as focusing on family (cognitive and emotional) support for the senior digital divide	Ensure the ICT's function is to promote positive and inclusive emotion and behavior between intrageneration and intergeneration
Influence strategies	Provide support free from time, space, and place restraints: • Information/service customization • Multiple distribution channels in 24/7/365 and different regions • Sustainable cost of accessing and using	Improve self-construal and self-efficacy by designing ICT adoption (e.g., access and use) in different scenarios (e.g., shopping, information seeking, communication, entertainment, healthcare, and financial service) with social innovation (e.g., products or services), meeting the demand of senior digital divide, such as compatibility (Lee & Lyu, 2019), with considering four types of ICT identities and interplay with socialization agent (e.g., Section 4.2)	Design and develop responsible ICT principles and policies in an aging society (Pappas et al., 2023; Vassilakopoulou & Hustad, 2023) with the collaboration of socialization agents (e.g., adult children) to increase self-motivation, self-control (e.g., addiction), and perceived risk/conflict mitigation (e.g., Section 4.3)

media (e.g., Weibo, Douyin/TikTok, and Xiao Hong Shu) or mini programs on WeChat (Tang et al., 2022). Furthermore, firms and policy makers should create/improve their data protection policies, strengthen information system controls and create safe and reliable e-commerce environments/digital platforms.

Second, this study identified four types of ICT identity. Based on this finding, digital firms can conduct market research to design a measurement scale and identify the target segment(s). With this research, firms can identify brand personalities (Sung & Kim, 2010) associated with customer identity in ICT adoption, thus positioning their products/services effectively and resonating with users' or potential users' needs and demands. Accordingly, product/service design should consider the attributes that provide solutions for customers, such as balancing the level of novelty and complexity of use (e.g., Wong et al., 2022). For example, high-novelty and low-complexity ICT products/services may appeal to customers with *positive self-construal/low self-efficacy* in ICT adoption. In addition, firms can communicate with the public by promoting the positive effect of adult children providing support for their parents at different levels of digital divide to boost sustainable technology diffusion in society.

Finally, this study identified family digital differentiation and challenged family relationships due to different ICT use habits. Policy makers can share information through integrated communication channels (e.g., both online channels and offline print) at different times to ensure consistency in forming an information sharing environment in society. Additionally, they can provide regulations to promote a healthy lifestyle in ICT adoption and minimize the risk of addiction to ICT products/services. Furthermore, sustainable development and consumption have become a trend in transforming digitalized society (Pappas et al., 2023). Our findings show that family support is essential for sharing technology information and skill through TS for the senior digital divide. Table 3 aims to provide IT policymakers with suggestions on bridging the intergenerational and intragenerational digital divide to enhance social welfare.

In particular, IT policymakers should bridge digital divide by considering individual, relational, and collective goals of the senior digital divide with the influence of socialization agents in ICT adoption. Meanwhile, to improve technology diffusion, they should provide resource support and promote digital inclusion through collaboration with product and service providers popularizing the access and use of ICT in the family context, thus enhancing positive family (cognitive, emotional, and behavioral) wellbeing across generations (e.g., family harmony in ICT adoption). This can be achieved by developing influence strategies, including providing timeless, spaceless, and placeness support with sustainable cost, social innovation, and responsible ICT principles.

7 Limitations, Future Research, and Conclusions

This qualitative, interpretive study investigated the mechanisms of ICT adoption between middle-aged parents and their adult children in TS from a reverse influence perspective. Although the findings may not be generalizable due to the nature of the research method, we provide a theoretical framework to examine the TS process in the family. Future IS research can develop a quantitative study to examine this TS framework and factors influencing the process, such as demographic (age, gender, marital status, education, occupation, culture and region), behavioral (e.g., attitudes, life style and decision making roles) and psychological factors (e.g., personality). In addition, this study identified the power influence of adult children in TS but did not identify the level of influence. Therefore, future research can examine the level of involvement of adult children in their middle-aged or older parents' ICT adoption and the effect on parents' learning outcomes, such as ICT adoption in the healthcare sector (Heid et al., 2017). Specifically, studies can examine the (moderating) effect of the four types of parent ICT identity and family communications on the interactions in TS.

This study was conducted in a Chinese cultural context with (pre)retired parents and their adult children in an urban area. The policy of IS, retirement age, lifestyle, and popular ICT products/services can vary globally. Therefore, future research could investigate the TS of middle-aged parents in other social-cultural contexts, such as with the design of a cross-cultural study to compare the results.

Finally, this interpretive study used retrospective data for analysis (Metts et al., 1991), based on informants' memories of their recent and past experiences, which may be less likely to reflect the aftereffects. Future research can conduct a longitudinal study to observe the TS process and changes in the family in the ICT adoption of middle-aged parents with a life course paradigm (Moschis, 2019). For example, how do individuals' past experiences/life events influence the changes in contemporary ICT adoption?

Declarations

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