The Digital Divide: Immobility and Vulnerability of Marginalized Groups in Urban Areas in China

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Abstract:

The research report delves into the formation and impact paradigm of the digital divide in urban marginalized areas, with a particular attention of how digital divides affect the daily lives of urban marginalized groups. While existing analysis of digital divide in China have predominantly focus on differences between urban and rural areas or eastern and western area, this study centres its attention on the community of Junyuan, Qiaokou District, Wuhan, Hubei Province. Herein lies an research of how the digital divide generated and its ramifications for urban life within a community primarily inhabited by low-income residents, elderly individuals, and migrant workers. Survey results are compared with international research findings related to the digital divide. This comparison leads to a proposed influence paradigm tailored for urban fringe communities based on age and education level. Furthermore, a governance approach is recommended that places emphasis on cultivating user willingness and fostering trust in ICT technology as part of efforts to alleviate the adverse effects of the DD experienced by marginalized groups within cities.

Keywords: Digital divides; urban marginalized groups; China.

1. Introduction

The heightened scrutiny of digital inequality has been precipitated by the repercussions of the pandemic, with a particular emphasis on telecommuting, health information dissemination, and online educational pursuits. However, the prevailing digital divide theory has been subject to substantial critique for its ignoring of intersectionality and complexity [1-3]. Conventional research on the digital divide tends to oversimplify by focusing solely on access to electronic devices support and technical training while neglecting intricate support needs influenced by gender, race, class, and other structural constraints [1]. Heeks' Global South digital inequality model established in 2022 illustrates that digital inequality stems from multifaceted and interactive factors [2].

In China, the current research of digital inequality issues is primarily associated with geographical disparities wherein remote rural areas serve as focal points for intervention and policy support [4-6]. Nevertheless, the nuanced structural differences within urban locales often evade attention. This study is centred around exploring urban residents' experiences of digital inequality within Wuhan's Junyuan community in Gutian Street, Qiaokou District. The research specifically targets marginalized groups such as low-income migrant workers and left-behind elderly individuals. Through extensive social surveys conducted within this fringe area of Wuhan City, this study visually demonstrates the significant challenges faced by groups affected by urban digital inequality. By addressing intra-city issues rather than urban-rural differences issues, this research aims to develop more effective solutions for intra-city problems.

2. Methodology and Survey Designs

The earliest definition of the digital divide is found by Toffler, he defines it as inequality stemming from disparities in information and electronic technology usage [7]. Building on Toffler's theory, initial research on the digital divide categorized individuals into those proficient in information technology or computer use and those lacking access to relevant technologies with low inclination to utilize them [7]. Subsequent studies have expanded this concept to encompass autonomous willingness to engage with technology, social and cultural backgrounds, diverse purposes of use, varying levels of engagement, and the influence of social support [8-10]. Long-term investigations have revealed that different groups accessing distinct services through the Internet experience varied impacts and changes. This evidence supports a three-stage model for understanding the digital divide: access, technical proficiency utilization, and the result of using internet [11,12].

This survey employs two approaches to examine how digital inequality affects marginalized urban groups. It seeks to comprehensively explore the impact paradigm of digital inequality issues on marginalized communities in China. The first part primarily involves data collection through a questionnaire administered to 500 representative community residents; 432 valid responses were received.

To better understand which factors predominantly affect urban marginalized groups according to the three stages of digital divide theory. The results are differentiated based on these stages. The first differentiation considers whether respondents have stable Internet access. However, all households surveyed had internet access conditions rendering this classification irrelevant.

Recent studies indicate that second- and third-order effects are more significant due mainly to structural objective differences [13,14], leading us to classify results based on interviewees' objective conditions such as gender income level education level – considered key criteria for distinguishing interviewee groups [13] – confirming their knowledge of information technology and structural conditions for using internet services. To ensure relatively objective data sampling was conducted according to original proportion structure within each community resulting in differentiation shown in Table 1, 2, and 3.

Table 1. Respondents' age classification

Age	Male	Female
18-25	30	21
25-35	21	22
35-45	49	69
45-60	36	36
60+	75	73

Table 2. Respondents' income

Income(household)	Respondent Numbers
Low income (lower than ¥50,000)	117
Middle income (¥50,000-¥100,000)	216
Ordinary (¥100,000-¥200,000)	72
High income (Above ¥200,000)	27

Table 3. Respondents' education levels

Education	Respondent Numbers
Illiteracy (compulsory education not completed)	52
Junior school education level	37
Secondary school/high school education level	87
College/undergraduate education	226
Postgraduate students or above	30

The third distinction is based on Dutton's categorization into five perceptions of Internet culture, which combined with objective conditions examining subjective willingness among different marginalized groups towards internet usage [15]. Accordingly, an "Attitude towards Internet" module was added into questionnaires confirming respondents' subjective willingness toward accessing internet.

In-depth interviews constitute the second approach in this research. During epidemic periods, inequalities intensified concerns across China about unequal internet service use intensifying concerns over Digital Divide [16]. Five representative figures were interviewed during this phase communicating deeply about restrictions brought by data inequality within their urban lives aiming at obtaining

intuitive feelings experiences ensuring integrity beyond what mere data surveys can reveal.

3. Result Analysis

"In urban areas, the lack of access to Internet and electronic devices due to financial constraints has become exceedingly rare. According to Tang, secretary of the Junyuan Community, "The utilization of electronic gadgets and Internet services has permeated every aspect of city life, with even economically disadvantaged households owning smartphones capable of accessing online resources. This trend is also facilitating the migration of numerous community services to digital platforms."

According to the survey data, among 432 respondents, only two reported inadequate financial resources and material conditions as impediments to Internet access. In their detailed responses, one individual cited difficulty in utilizing smartphones due to advanced age and reliance on a non-Internet-capable mobile phone designed for elderly users. Another respondent expressed concerns about exorbitant mobile internet charges, resulting in limited internet usage exclusively through Wi-Fi. This indicates that among respondents there are no affordability issues with basic internet services in peri-urban. Therefore, this study focuses on users' ability and willingness to utilize internet resources rather than financial constraints.

"The primary issue lies in the fact that, despite the Internet's facilitation of our lives, we have not been adequately instructed on its proper usage." According to 76-year-old Xiao, in today's urban environment, internet usage has permeated nearly every facet of life, and electronic transactions have become fundamental to societal functioning. Nevertheless, many of his elderly acquaintances struggle to adapt to the intricate operational procedures, often needlessly complicating what should be straightforward tasks.

Respondents generally expressed that the procedural steps involved in online shopping are overly complex, requiring them to re-engage with banking processes for the purpose of ensuring secure online payments. However, the 'convenience' of online payment has inadvertently added to their burden. "What was once done with cash now needs to be conducted through the Internet." Ms. Yan, 76, found it unfeasible. The migration of previously offline businesses to an online platform has made it challenging for them to manage the associated fees. Tang, the secretary of Junyuan Community, has verified their assertion that the majority of essential services previously managed within the community have now transitioned to an online platform. However, this shift has presented a few additional challenges. For instance, the annual retirement audit, which formerly necessitated residents to simply present their certificates for staff assistance, must now be conducted online. Regrettably, the community lacks access to view the outcomes of these transactions, resulting in an increased number of residents seeking aid from the senior department and subsequently generating a heavier workload than before.

According survey participants, 107 people of total 432 citing inability in utilizing internet services based on their comments. Four analytical frameworks were constructed based on various determinants, with education and age emerging as predominant influencers. Notably, 87.64% of participants with an educational background below middle school expressed insufficient internet usage capability, while elderly individuals aged over 60 constituted 57.43%. It is noteworthy that income appears to only impact individuals at the higher end of the income spectrum. The percentages of people who perceive themselves as lacking proficiency in computer usage are 29.91%, 25.93%, and 18.06% across all income brackets, indicating that income may not be the primary determinant of residents' ability to utilize electronic devices in urban marginalized groups.

Among a total of 107 individuals who perceive themselves as lacking the capability to utilize the Internet, an analysis of their primary comments regarding the issues stemming from these limitations reveals the following key influences of their urban life (see Table 4).

Table 4. Influence of digital divides

Influence	Respondent Numbers
The medical system is complex to navigate and lacks adequate support.	63
Online shopping	42
Inconvenient transportation	31
Use of health codes during the pandemic	25
Online utilities and online administrative business handling	21

Few sources of information	18

"The process of accessing medical care has become increasingly complex," Xiao noted, During the interview, numerous elder participants expressed that the process of seeking medical care at a hospital is so intricate that they must rely on their children to navigate through the entire clinic visit. Furthermore, obtaining prescribed medications online requires presenting various electronic consultation certificates and does not offer any benefits associated with online transactions. Moreover, insufficient guidance information from hospitals makes it more challenging for them to receive a diagnosis in an outpatient setting.

The survey findings align with the limited inclination of elderly Chinese individuals to engage with digital health systems, primarily due to challenges in embracing widespread adoption of WITMED stemming from the digital divide [17]. This issue was not only acknowledged by older adults in the survey but also highlighted by young participants during interviews. For example, as a representative of migrant workers, Yu stated in the interview as follows:

We have not experienced significant direct impact. However, in the elderly care sector where I work, accompanying elderly individuals to the hospital often proves challenging. They are frequently uncooperative, particularly when providing necessary information, displaying heightened vigilance. Furthermore, hospital staff impatience exacerbates feelings of disrespect among the elderly, imposing both practical and psychological burdens on their lives.

In addition to the challenges within the healthcare system, the transportation infrastructure presents significant issues as well. During interviews, multiple participants highlighted that the widespread implementation of intelligent transportation systems has led to an increasing demand for electronic device usage. Accessing transportation reservation software and electronic maps has become essential for navigation.

"Currently, navigating traffic routes is consistently challenging," lamented 54-year-old Wang. The survey feedback indicated that transportation issues were mentioned less frequently than those related to the medical system. Based on interviews and analysis of the survey results, several key problems were identified: unclear signage at stations and subways, difficulty in identifying accurate road directions, limited advertising of newly built roads in traditional media but availability on digital navigation maps only, leading to potential navigation challenges for those without access to these tools. Additionally, online taxi booking is essential in the city, particularly during peak traffic hours when securing a seat can be challenging. Telephone reservations are underutilized and often unanswered. Maintenance issues have affected cash ticket machines at public rail transit stations, with only a limited number of machines still able to process cash transactions at many stations. This poses additional challenges for individuals who do not use electronic payment methods.

The pandemic has also brought attention to various difficulties. Secretary Tang noted during the interview that due to inadequate utilization of health QR codes among elderly individuals throughout the pandemic period, most have opted out of venturing outdoors altogether or have resorted to obtaining paper health certificates from local communities when necessary – a cumbersome process according to many seniors who report that daily detours for certificate issuance consume valuable time.

The results of the survey on willingness to go online are also concerning. According to Dutton's model, there are five distinct attitudes towards the Internet [15]. The survey indicates that people in urban fringe areas generally exhibit varying levels of willingness to use the Internet (see Fig. 1). A simple interpretation of the survey reveals that out of 117 individuals experiencing difficulty using the Internet, 115 show no active interest in learning Internet technology. Among those with no subjective intention

to use, individuals over 60 years old account for 53.30%, while those over 45 years old make up 32.99%. Additionally, women demonstrate a higher overall willingness to use Internet technology compared to men, and 67.00% of respondents with a high school education or below express reluctance to actively learn Internet technology.
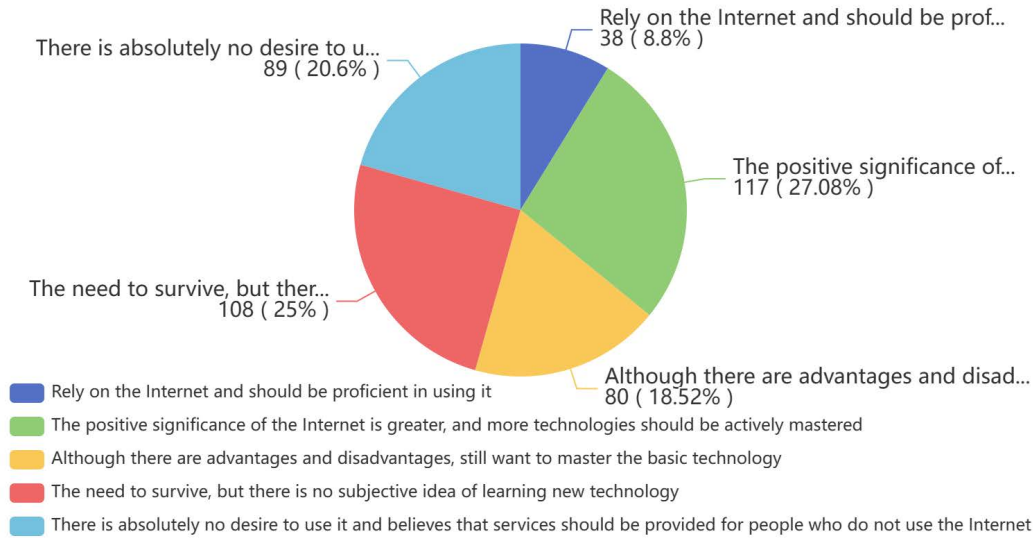
Willingness to use

Fig 1. Attitude to Internet

Different comments have identified key concerns and reasons among individuals who are less willing to use the internet (see Table 5). "It is always challenging for us to discern online promotions," Yu stated. "We lack a high level of proficiency, and even with the use of anti-fraud applications, our ability to safeguard our rights in cases of online fraud is limited. Recovering losses from minor fraudulent activities proves to be quite arduous." Concerns regarding online fraud have been widely reported among users, with the majority expressing the belief that their limited proficiency in ICT usage renders them potentially vulnerable parties in Internet transactions.

Table 5. The influence of attitude

Influence	Respondent Numbers
Property safety	92
Privacy information security	37
Fake information	49
Freedom of expression	26

The elderly are often the target of deception. They lack reliable means to discern the authenticity of information and often fall victim to misinformation. Misinformation leads them to make unnecessary purchases. In addition, among the elderly and low-education groups, it is widely believed that there may be information leakage problems when using electronic payment methods, passwords and facial recognition technology.

"Although we try to explain to them that the risk is low, they still have this concern." Mr. Li said. Lack of trust in the use of ICT has become an important reason for lowering people's willingness to use ICT. The majority of respondents believe that the Internet poses a major information security risk. In addition to property threats, the potential exposure of personal information and online speech are concerned. This has made respondents wary of using any platform that requires real-name information. "It makes us feel a lot of mental pressure." Ms. Yan said.

Through comprehensive surveys and interviews, a discernible trend emerges: within urban marginalized communities, education level and age are identified as primary determinants contributing to digital division. It becomes

evident that access to internet connectivity does not represent a fundamental issue, rather crucial are individuals' capacity for utilizing technology along with their subjective inclination towards doing so. Insufficient technological literacy engenders skepticism and impedes effective utilization of online services—most notably prevalent among older adults or those with limited educational backgrounds. In contrast to findings from urban-rural assessments, income exerts minimal influence, indeed, lower-income demographics alongside migrant laborers typically exhibit proficient internet usage within outlying city regions.

4. Discussion: Differences between City and Countryside in China and Policy Recommendations

In the general perception, particularly in the study of Western countries, gender, age, income, education, and geographic location have been recognized as significant factors for determining the presence of a digital divide [18-20]. However, based on this survey conducted in urban marginalized areas of Wuhan, the impact of gender and income level is notably diminished in these areas and geographical factors are unexplored.

In traditional studies of the digital divide, household economic income is often considered a significant metric of disparity. Higher levels of social income tend to correlate with reduced disparities in ICT usage levels [8,18]. However, recent research has gradually contested this assertion. The findings indicate that despite being classified as a third world country, Thailand demonstrates widespread Internet connectivity, and income can hardly be deemed a determining factor for proper utilization of Internet connectivity [21]. A similar pattern was observed in Indonesia where income and the use of traditional PC devices were found to have minimal impact on the digital divide [22,23]. This trend is also evident in China's overall development. While the urban-rural economic gap and east-west economic gap continue to influence China's digital divide, research indicates that there is no long-term linear relationship between economic growth and the level of digital divide. As the internal economic differences in urban areas gradually narrows, this effect has been significantly diminished [4,6,24]. This also corroborates the findings of the survey, indicating that income level should not be regarded as the exclusive determinant for urban marginalized groups. Even within these demographics, households with the lowest income exhibit adequate economic resources to maintain Internet access and the financial issues are consequently excluded from the study.

The gender gap in developing nations is widely acknowl-

edged as a significant contributing factor to the overall digital disparity [25]. However, research indicates that the impact of gender is primarily rooted in social and cultural contexts, particularly evident in societies with prevalent gender discrimination. In Rwanda, where such discrimination is pervasive, the gender-based discrepancy in access to digital resources becomes even more pronounced [26]. In certain regions with extreme gender disparities, such as Jordan, even well-educated college students predominantly hold views favouring restricted ICT access for women [27]. A common criticism that is always present when discussing gender issues in the digital divide is the tolerance of the online environment for "masculinity" and the perception that men have more access to the Internet [20,26,27]. Conversely, China presents a different scenario; here, men exhibit lower levels of general internet usage and willingness compared to women. Mr. Xiao noted during an interview that he believes China's online environment leans more towards catering to women's needs—especially given the widespread popularity of e-commerce and live streaming platforms—as well as the increasing presence of female netizens on social media. This aligns with recent studies indicating that internet use can help alleviate gender discrimination in China [28]. The open utilization of information networks and the sustained positive influence of the internet on reducing gender bias have heightened women's inclination towards using it while simultaneously narrowing the ICT access gap between genders.

Apart from these two possibly different research results, the cognition of the existence of digital divide in China's urban fringe areas is still in line with the world development trend. In the latest reports on the digital divide, the willingness of individuals to use it has become the main development trend of future research [8-12, 29,30]. Education and age are seen as factors that influence data inequality in general, and research into old age is also popular around the world. Older people who lack the impact of higher education are often identified as the group most widely affected by the digital divide [18,19,31]. This is consistent with the description of the research results, the elderly with lower education have a strong resistance to the Internet, and the use of technology is relatively backward. It should be noted that in international studies, the impact of education level on data divide is widely divided in different countries and regions [32].

However, in the survey of urban marginalized areas in China, education level and DD influence level show a very significant positive correlation. Personal willingness to use also has a significant impact on the existence of DD, and most people with low willingness to use are more affected by subjective willingness. However, it should be

noted that this subjective willingness is more influenced by religious belief, individual social identity and worldview in African and Western studies [18,30]. In China, such factors are relatively rare, and are more influenced by distrust caused by lack of ICT-related knowledge and awareness of privacy. In addition, it should be noted that although China's Internet services are influenced by the form of market dominance led by the United States, China's Internet services are mostly on domestically restricted platforms [33,34]. This means that China's Internet service system as a whole is different from other systems in the world [5,34]. Mainstream media and mainstream online services have limited access to some of the world's information [34]. This disparity is likely to be the source of the lack of awareness and distrust of ICTs among marginalized urban Chinese who have little access to other environments.

In the broader context, the impact of digital divide on urban marginalized groups in China diverges from the general digital divides paradigm and significantly differs from urban-rural disparities. The narrowing economic disparity and unique internet service provisions in China have contributed to the distinct challenges faced by marginalized groups in cities. Consequently, addressing the issue of data inequality among urban marginalized groups necessitates an approach that deviates from traditional structural methods.

While the proliferation of education is considered a pivotal strategy, findings from the survey reveal that the educational attainment among young cohorts generally surpasses university level. Consequently, the impact of education on elderly disengagement looms large, necessitating targeted interventions to address this issue specifically rather than broadly emphasizing ICT literacy promotion across the board.

As per Tang's findings, the Junyuan community has consistently provided technical training classes for the elderly; however, in practice, a majority of seniors seldom opt to partake in such programs. Consequently, addressing the issue of internet usage intention becomes particularly crucial in bridging the digital divides among urban marginalized groups. Here are several potential solutions to this scenario:

First, facilitate comprehensive manual support for the widespread utilization of network services, offering tailored assistance to the elderly and individuals with limited ICT proficiency to enhance their inclination towards ICT adoption. This approach aims to dispel the misconception that ubiquitous ICT usage leads to inconvenience in daily life. Second, strengthen oversight of online information and publicize efforts to combat internet-related crimes in order to bolster public trust in internet services. Dissem-

inate information on safe internet usage through traditional media channels such as TV news, newspapers, and publicity reports, thereby enhancing public awareness of ICT-related knowledge and improving their capacity to identify criminal activities and fraud. Third, streamline internet service processes as much as possible to alleviate the learning burden associated with ICT while making essential technologies more accessible to the general population. This strategy enables individuals without initial ICT proficiency to gradually acquire necessary skills over time. Finally, as a vital grassroots support sector in China, communities should establish a comprehensive ICT infrastructure to aid marginalized groups affected by digital divides.

4. Conclusion

This report shows a comprehensive analysis of the primary causes and impact paradigms of the digital divide among marginalized groups in urban areas of China. The following key findings are highlighted: Firstly, income level and gender do not emerge as the predominant determinants contributing to the DD in marginalized urban areas. Contrary to prevailing research, gender dynamics within marginalized urban settings reveal a higher likelihood for men to experience ICT deprivation. Furthermore, some men perceive Internet services as being more aligned with women. Secondly, education level and age are identified as pivotal factors shaping the digital divide. Research indicates that elderly residents with lower educational attainment face an increased risk of encountering a digital divide due to limited access to ICT resources. Additionally, individuals with lower levels of education and older residents exhibit greater resistance towards embracing ICT usage. Thirdly, the principal repercussions of the digital divide within China's urban marginalized areas manifest in restricted access to medical systems and electronic payment platforms. Those affected predominantly comprise individuals who struggle with mastering ICT tools, displaying relatively low subjective willingness overall to ameliorate their current circumstances. Finally, reluctance towards utilizing ICT primarily stems from distrust towards Internet services, largely stemming from a lack of knowledge about ICT-related matters leading to misconceptions about online risks, resulting in heightened vigilance for prevention.

It is important to emphasize that disparities between urban and rural areas do not extend into urban marginalized groups; migrant workers continue exhibiting relatively strong acceptance of using ICT within an urban context owing directly to improved educational opportunities and narrowing economic gaps between urban and rural

regions. The unique circumstances faced by marginalized communities in urban areas of China necessitate tailored interventions. It should be noted that this report is based on a study of a representative Junyuan community and offers valuable insights for addressing the digital divides in community work.

5. Acknowledgements

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