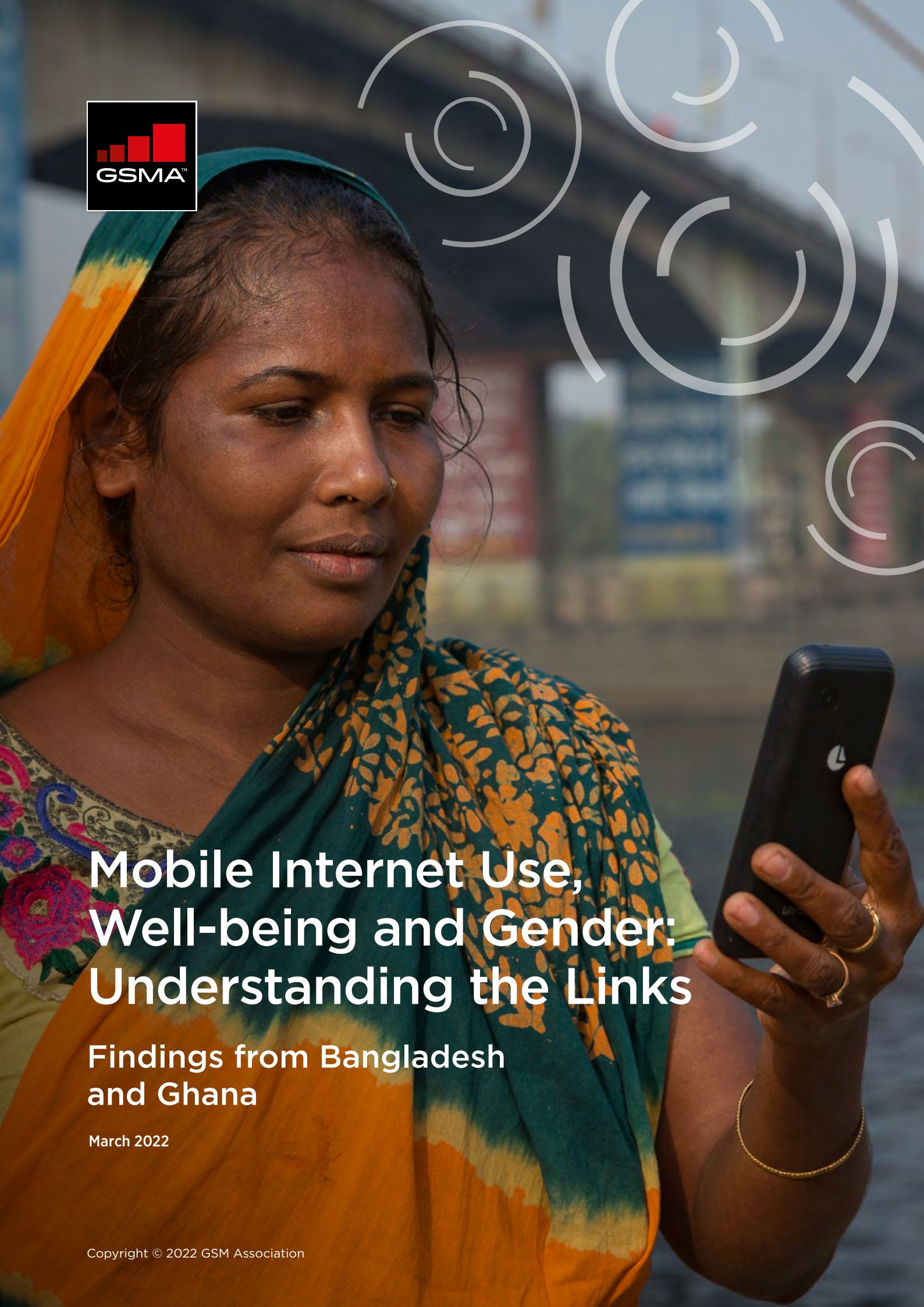

Mobile Internet Use, Well-being and Gender: Understanding the Links

Findings from Bangladesh and Ghana

March 2022

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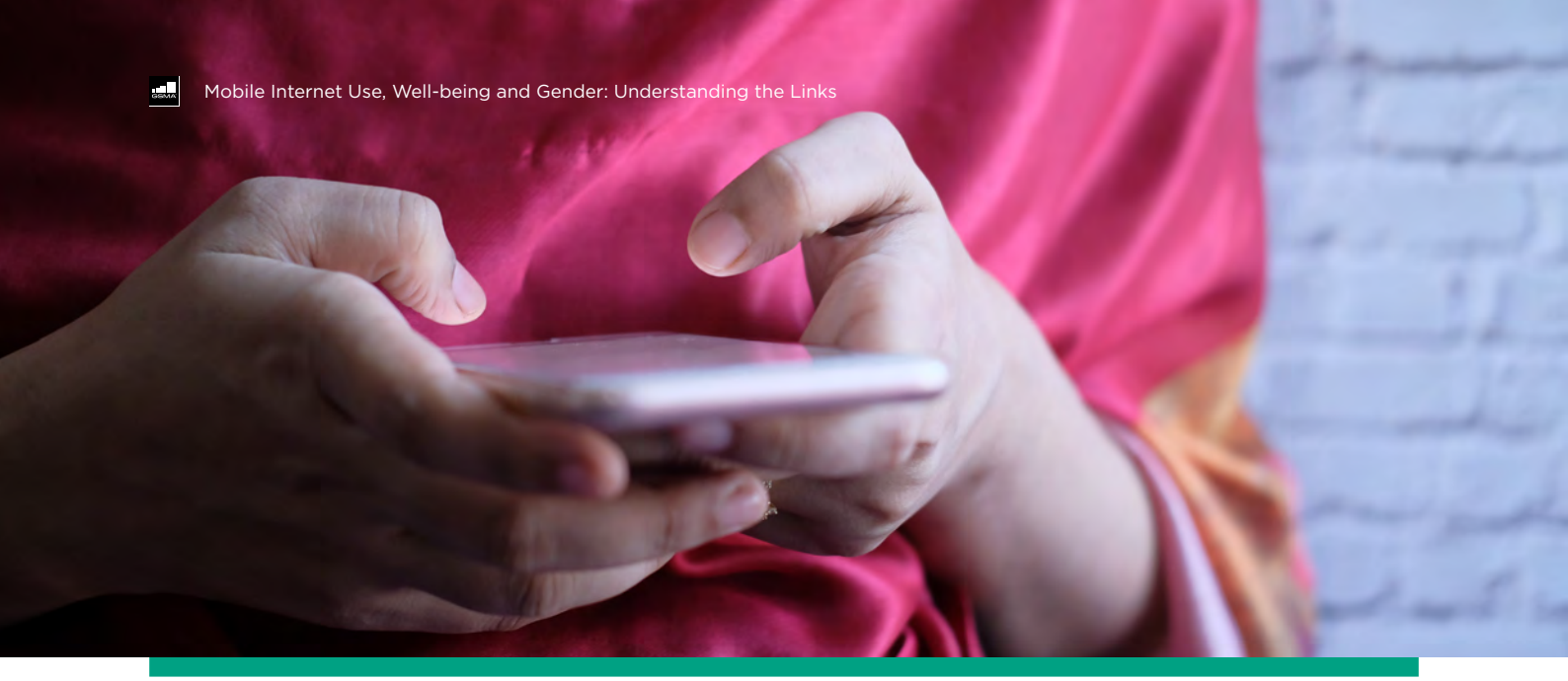


Introduction

Across low- and middle-income countries (LMICs), the use of mobile and mobile internet has increased substantially as societies digitise and digital solutions become more relevant to people's daily lives. With half the world's population now using mobile internet,[1] stakeholders have a growing interest in understanding the extent to which it affects the well-being of men and women in LMICs.

While macroeconomic and household-level studies have demonstrated the positive contribution that mobile internet can have on broader socio-economic outcomes,[2] there is little research on the impact at the individual level.[3] This study is among the first to apply a multidimensional "well-being index" to assess the link between mobile internet use and well-being for men and women in two countries: Bangladesh and Ghana.

With funding from the UK Foreign, Commonwealth & Development Office (FCDO) and the Swedish International Development Cooperation Agency (Sida), and in partnership with the University of Pennsylvania, the GSMA Connected Women team developed a well-being index to examine the link between mobile internet use and well-being among men and women in Bangladesh and Ghana. The multidimensional index draws on the OECD Framework for Measuring Well-Being and Progress.[4]

The study was based on both qualitative and quantitative face-to-face research in Ghana and Bangladesh. The qualitative research, conducted in November 2020, consisted of in-depth interviews with 35 mobile internet users in each country and included both men and women, and rural and urban residents. The interviews explored their experiences with using mobile internet, what they use it for, including specific apps, and how others perceive their mobile internet use. The quantitative research surveyed more than 5,000 respondents in each country, including mobile internet users, non-users, men, women and those living in rural and urban areas. A list of the sample can be found in Appendix 1. The survey research was conducted between December 2020 and February 2021. It is worth noting that the COVID-19 pandemic, related stay-at-home restrictions and the knock-on effects on employment, education, social interactions and the wider economy, may have influenced the results.

This report provides information on the well-being index we developed for this research, as well as insights from its application. It summarises the main research findings, providing evidence that using mobile internet does indeed have a positive correlation with well-being, but to a different extent in different contexts and among different demographic groups.

1. GSMA. (2021). *The State of Mobile Internet Connectivity Report*.
2. World Bank and GSMA. (2020). *The Welfare Effects of Mobile Broadband Internet: Evidence from Nigeria*; World Bank and GSMA. (2021). *Mobile Broadband Internet, Poverty and Labor Outcomes in Tanzania. Policy Research Working Paper*; World Bank. (2020). *Does the Internet Reduce Gender Gaps? The Case of Jordan*.
3. For example, see: GSMA and Gallup. (2018). *The Impact of Mobile on People's Happiness and Well-Being: Technical Report*.
4. *OECD Framework for Measuring Well-Being and Progress* and Boarini, R., Kolev, A. and McGregor, A. (2014). *Measuring Well-Being and Progress in Countries at Different Stages of Development: Towards a More Universal Conceptual Framework*.

Key findings

- **Mobile internet use is positively correlated with well-being for many users**. Mobile internet use was either positively correlated with key dimensions of well-being used in this study or had no link with well-being. Across Ghana and Bangladesh, there were no statistically significant negative correlations with the various dimensions of well-being, indicating that mobile internet use is not associated with lower levels of well-being against the dimensions measured.

- **The degree of correlation between mobile internet use and well-being differs substantially by both country and demographic, highlighting that local context matters**. In both Ghana and Bangladesh, important demographic factors included gender, location, family size and level of income and education.

- **In Bangladesh, mobile internet use is positively correlated with overall well-being**. This positive correlation was consistent across all six dimensions of well-being (social connection, health, income,[5] physical vulnerability, economic vulnerability, life evaluation and feelings). On average, mobile internet users had a three per cent higher overall well-being score than non-users. These results were even stronger for mobile internet users who had at least primary education. For certain demographic groups, the positive correlation with well-being is observed only for female mobile internet users. Compared to all other groups, female users in low-income groups have six per cent higher levels of well-being, and those under the age of 40 have four per cent higher levels of well-being.

- **In Ghana, mobile internet use is positively correlated with three of the six dimensions of well-being**. These were health, income and economic vulnerability. For the other three dimensions, there was no link between mobile internet use and well-being. The result is that, at the aggregated overall well-being level, there was no statistically significant positive correlation between mobile internet use and well-being.

- **Certain mobile internet activities are positively correlated with overall well-being**. For women in Bangladesh, this was the use of video calls and online purchasing. For men in Bangladesh, it was entertainment, and there was a positive correlation with religious apps for both men and women. In Ghana, the use of mobile internet for education was positively correlated with well-being, especially for women.

- **For women, the type of handset used and how frequently mobile internet is accessed has an impact on the link between mobile internet use and well-being**. For example, women in Ghana who accessed mobile internet via a smartphone reported higher levels of well-being than women who accessed it via a feature phone, as did women in Bangladesh who accessed mobile internet at least once a day compared with women who accessed it less frequently.

5. Measured as self-reported monthly expenditure on a basket of household goods and satisfaction with personal finances.

Measuring well-being

Well-being is a broad concept, generally measured through a combination of objective socio-economic focused questions and self-assessed measures of life satisfaction. For this research, we developed an index with six dimensions[6] (Box 1) based on the OECD Framework for Measuring Well-Being and Progress. A multidimensional index such as this allows for more nuanced analysis of the impact of mobile internet on different aspects of well-being.

Each of the six dimensions was measured for mobile internet users and non-users through a quantitative survey, drawing on standardised, tried-and-tested questions from existing national surveys.[7] For each dimension, an additional self-perception question enabled us to measure life satisfaction on a scale of 0 to 10.[8] This generated a score to measure well-being for the individual dimensions, which was then aggregated into an overall well-being score.[9]

The results were used to measure the correlation between mobile internet use and overall well-being, as well as for each of the six dimensions of well-being. That is, whether well-being was positively correlated with mobile internet use or not. Levels of well-being reported by the respondents were disaggregated by demographic characteristics, such as gender, age, location, education, employment, number of children and income groupings, to identify whether mobile internet users reported higher levels of well-being than non-users within the same demographic groups.

This analysis was also applied to mobile internet use cases to identify which, if any of the use cases reported by mobile internet users, were positively correlated with well-being. Other factors, such as how frequently they used mobile internet and how long they had owned an internet-enabled device, were also analysed.

6. The well-being index for this research was developed by the University of Pennsylvania. The selected dimensions are adapted from the OECD Framework for Measuring Well-Being and Progress.
7. See Appendix 1 for a list of national surveys used.
8. For example, "Overall how satisfied do you feel with your personal financial situation right now?"
9. Further details on the methodology can be found in Appendix 1.

BOX 1
Six dimensions of well-being

Social connection
Measures an individual's connectedness to family, relatives and friends

Physical vulnerability
Measures an individual's physical safety and security

Income
Measures an individual's expenditure as a proxy for income

Health
Measures an individual's health status

Economic vulnerability
Measures an individual's vulnerability to economic shocks

Life evaluation and feelings
Measures an individual's assessment of their life satisfaction and feelings

Qualitative research was conducted first to identify the relevant use cases to include in the quantitative survey. This also helped us better understand how mobile internet use, including specific use cases, was linked to reported levels of well-being, in addition to whether and how it was influenced by social norms.

Three factors were instrumental in uncovering insights from the research. First, using a multidimensional index, rather than just a single score for overall well-being, enabled us to identify significant results for each of the dimensions and differences between men and women in both countries. Using only an overall well-being score would have masked important differences by dimension. Second, disaggregating by key demographic factors was critical to unpacking the different experiences of users, both within countries and by gender. Women are not a homogeneous group, and the correlation between mobile internet use and well-being differed substantially by demographic subgroup, such as age and location. Finally, including qualitative research deepened our understanding through rich descriptions of men's and women's lived experiences using mobile internet.

The well-being index for mobile internet use developed for this study could be replicated in other countries. However, three important factors should be considered when applying the index. First, analyse both overall well-being and well-being by dimension to ensure important nuances are not lost in aggregation.[10] Second, disaggregate results by demographic factors, such as gender, age, education, location and employment, to understand differences in well-being between mobile internet users and non-users. Finally, complement the survey with qualitative research to gain a deeper understanding of the context and how men's and women's experiences using mobile internet differ, especially in terms of social norms.

10. Aggregation for the overall well-being score must be performed carefully and thoughtfully, rather than using simple sums and averages. The novel aggregation method created by the University of Pennsylvania can be replicated for this purpose.

Mobile internet use and overall well-being

Mobile internet use is positively correlated with overall well-being for many, and for some more than others

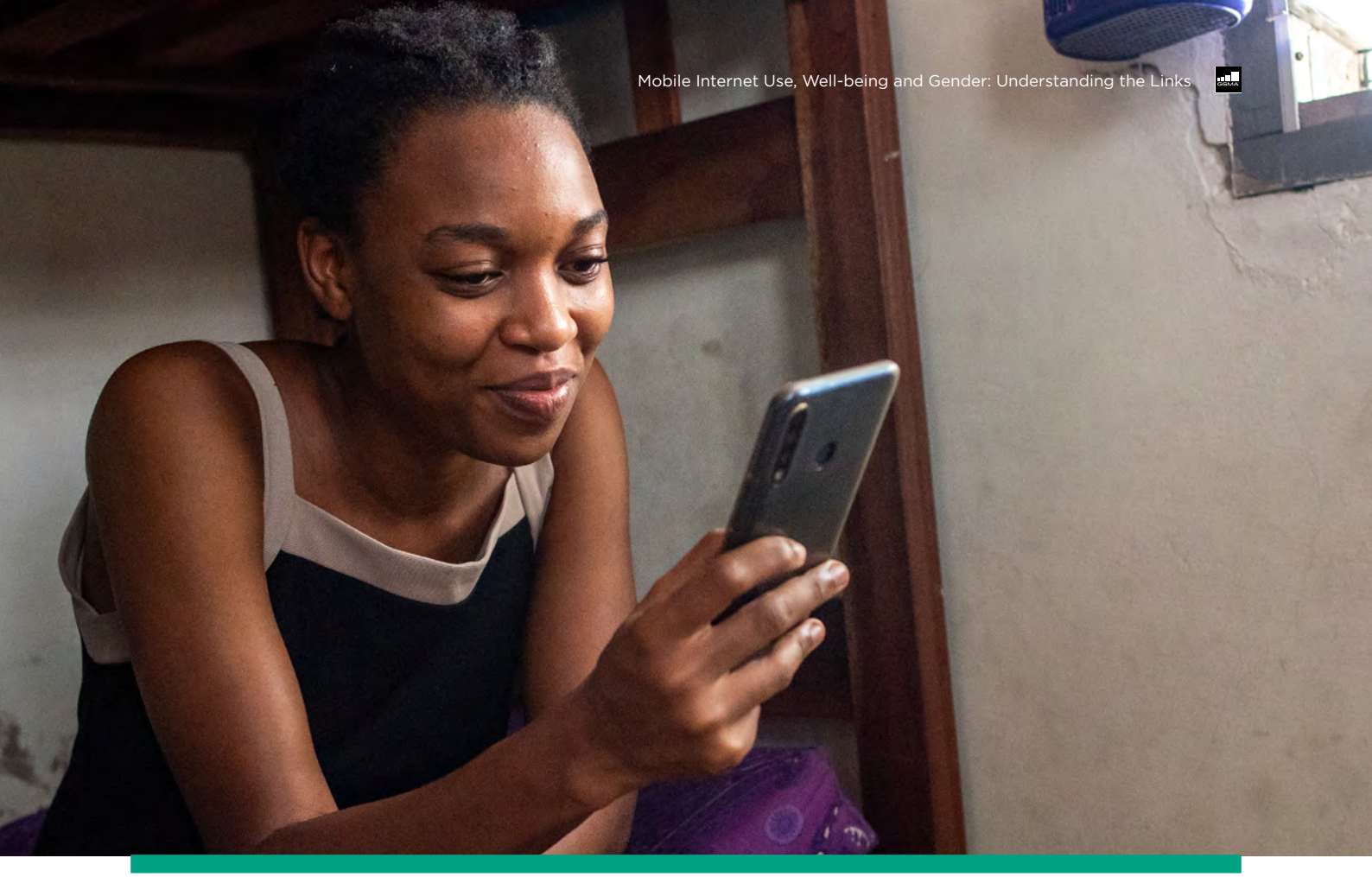
After controlling for key demographic factors, such as education, age and income, mobile internet use is positively correlated with the overall well-being of respondents in Bangladesh, but not in Ghana.[11] In Bangladesh, mobile internet users have three per cent higher overall well-being scores than non-users, and these findings were robust for both men and women.

The level of overall well-being differed quite substantially, not only between the two countries, but also within countries by gender and other demographic factors. In Bangladesh, mobile internet users with at least primary education had five per cent higher levels of well-being than non-users. This finding did not vary significantly by gender. However, for certain demographic groups in Bangladesh, the positive correlation of mobile internet use on well-being is observed only for female users. Compared to all other groups, female users in low-income groups have six per cent higher levels of well-being, and those under the age of 40 have four per cent higher levels of well-being. Interestingly, female mobile internet users with two or fewer children also reported four per cent higher levels of well-being than other demographic groups.

In Ghana, mobile internet use has no correlation with overall well-being, and this is consistent across the different demographic groups. Although mobile internet use is positively correlated with three of the six dimensions of well-being (see next section), this significance was lost at the aggregated overall well-being level.

This suggests that the ways in which different demographic subgroups commonly use mobile internet, and the extent to which mobile internet meets their daily needs, differ substantially. This, in turn, affects the dimensions of well-being and overall well-being in distinct ways. It underscores that men and women are not homogeneous groups and that other factors affect their ability to use mobile internet and benefit from using it. It also highlights the importance of disaggregating by key demographic factors in analysis and conducting qualitative research to better understand why certain groups benefit from using mobile internet more than others.

11. Without demographic controls, mobile internet also had a significant impact on overall well-being in Ghana. However, once demographic variables are added, there is no statistically significant impact, suggesting that the impact could be related to another demographic factor and not mobile internet use.



Mobile internet use and the dimensions of well-being

Mobile internet use is positively correlated with three well-being dimensions in Ghana and all six in Bangladesh

The multidimensional index allowed us to examine each of the six dimensions individually, revealing different insights for both countries. Each dimension was measured using a subset of indicators linked to questions in the quantitative survey. These indicators revealed further nuances in the correlation of well-being with mobile internet use by country and by gender.

Mobile internet use is positively correlated with all six dimensions of well-being in Bangladesh and three in Ghana (health, income and economic vulnerability). Further research is required to understand the reasons for these differences between the two countries. There is also no negative correlation between mobile internet use and any of the dimensions or indicators of well-being.

In this section, we highlight some of the key results for the dimension indicators of well-being. The following tables show whether mobile internet use was correlated with each dimension of well-being, and each indicator, in both countries. Green indicates a positive correlation and white indicates no correlation. Lighter shades are used to indicate a weaker correlation and dark shades a stronger correlation.

Table 1

Social connection

Indicators	Bangladesh	Ghana
Satisfaction with personal relationships		
Social networks		
Social support		
Social isolation		
OVERALL SCORE		

Positive correlation No correlation Negative correlation

The social connection dimension of well-being measures an individual's connectedness to family, relatives and friends. It is measured by four indicators: satisfaction with personal relationships, the number of people in their social network, social support and social isolation.[12] In Bangladesh, positive well-being scores were correlated with mobile internet use for two of the four indicators. Overall, mobile internet users experience eight per cent greater social support than non-users and had more people in their social network. However, men in Bangladesh had, on average, two more people in their social network than non-users, while women had only an additional 0.5 people in their network, suggesting that male mobile internet users may experience more of the benefits of expanding their social networks online. In Ghana, however, no correlation was detected between mobile internet use and the social connection indicators.

Table 2

Income

Indicators	Bangladesh	Ghana
Satisfaction with financial situation		
Consumption		
OVERALL SCORE		

Positive correlation No correlation Negative correlation

This dimension measures an individual's expenditure as a proxy for income and is measured by two indicators: satisfaction with financial situation and consumption. In Bangladesh, mobile internet users are six per cent more satisfied with their financial situation compared to non-users. For women, the results are even more robust: female users are 11 per cent more satisfied with their financial situation than non-users. However, results for Ghana on satisfaction with financial situation were not significant. As income is difficult to measure accurately, consumption was chosen as a proxy, using average monthly household expenditure on a basket of goods, such as food and cooking fuel. In both Bangladesh and Ghana, mobile internet users estimate their average monthly expenditures to be higher than non-users, by 11 per cent in Bangladesh and 25 per cent in Ghana, with little difference in either country by gender.

12. Full details of these composite measures can be found in Appendix 1.

Table 3

Economic vulnerability

Indicators	Bangladesh	Ghana
Self-reported stability of economic situation		
Coping with the most recent economic shock		
Recovery from a past economic shock		
Expected recovery from a future economic shock		
OVERALL SCORE		

Positive correlation No correlation Negative correlation

This dimension measures an individual's economic vulnerability using four indicators: self-reported stability of economic situation; coping with the most recent economic shock; recovery from a past economic shock; and expected recovery from a future economic shock. In Bangladesh, mobile internet users report 18 per cent higher stability in their personal financial situation than non-users, that they recovered 12 per cent sooner from a recent economic shock and expected to recover nine per cent sooner from the next shock, compared to non-users. In Ghana, the results were not as robust, affecting only the self-reported stability of their economic situation, which was five per cent higher for mobile internet users than non-users. There were no significant differences by gender in either country.

Table 4

Physical vulnerability

Indicators	Bangladesh	Ghana
Perceived level of safety in their neighbourhood		
Household items stolen		
Assault without weapon		
Assault with weapon		
Victim of other crime		
OVERALL SCORE		

Positive correlation No correlation Negative correlation

This dimension measures an individual's physical vulnerability. It is measured by five indicators: perceived level of safety in their neighbourhood; experience with crime, including having household items stolen; being assaulted with or without a weapon; and being the victim of another crime. Experience with crime was a retrospective measure and, as such, responses may or may not overlap with mobile internet use. The positive correlation with mobile internet use was only significant for female users in Bangladesh and not male users.

Mobile internet use had no correlation with people feeling safer in their neighbourhood in either country or with their experience with other crimes. It is possible that the result in Ghana could be explained, in part, by existing community initiatives, such as Community-Based Action Teams (COMBAT) to address physical violence in the community.[13]

13. Addo-Lartey, A.A. et al. (2019). "Rural response system to prevent violence against women: methodology for a community randomised controlled trial in the central region of Ghana." *Global Health Action*, 12(1).

Table 5

Health

Indicators	Bangladesh	Ghana
Health literacy		
Access to health care[14]		
Health behaviour and service use[15]		
OVERALL SCORE		

Positive correlation No correlation Negative correlation

This dimension measures an individual's health status using three indicators: health literacy; access to health care; and health behaviours and service use. Positive correlations were noted in both countries, but these differed by country and by gender across the various sub-indicators. For example, in Bangladesh, mobile internet use was positively correlated with not postponing medical care due to loss of working hours, but primarily for male users. Not postponing medical care due to the price of the service was only significant for female users in Bangladesh, but was not robust at the country level.

Meanwhile, in Ghana, mobile internet use was positively correlated with not drinking alcohol, but mainly for men; and with not being admitted to hospital, but this was significant only for women and not at the country level. These varied findings make it difficult to draw specific conclusions. However, the most conclusive result was a statistically significant positive correlation between mobile internet use and health literacy in both countries. This was 11 per cent higher for mobile internet users in Bangladesh and three per cent higher in Ghana, but with little difference between men and women.

14. Only one of the five subindicators was positively correlated in Bangladesh: not postponing medical care due to fear of losing working hours. None in Ghana.
15. Only one of the four subindicators was positively correlated in Ghana: not drinking alcohol. None in Bangladesh. Note that this subindicator on alcohol was not measured in Bangladesh due to religious and cultural norms.

Table 6

Life evaluation and feelings

Indicators	Bangladesh	Ghana
Emotional well-being		
Life satisfaction		
OVERALL SCORE		

Positive correlation No correlation Negative correlation

This dimension was measured by two indicators: emotional well-being, which is a composite score of feelings experienced over the last day; and evaluative well-being, which uses a ladder as a scale to rank life satisfaction.[16] Mobile internet use is positively correlated with life satisfaction and feelings of emotional well-being for respondents in Bangladesh, but not in Ghana. This result is robust for both indicators in Bangladesh with no significant differences between men and women. The qualitative findings provide some useful illustrations. Although respondents were not asked how using mobile internet made them feel, in Bangladesh 20 of the 35 qualitative interviewees described how using mobile internet made life feel good:

One female respondent described how reconnecting with her group of friends makes life beautiful:

"This is wonderful. We are reminiscing 10 years back; that is an amazing feeling."
Bangladesh, urban female

A male respondent mentioned how much he enjoyed talking to friends and family through video calls and playing online games together during the COVID-19 pandemic.

"We send messages during the game, react to each other, discuss about who would be the winner. Everything is enjoyable."
Bangladesh, urban male

16. Cantrill's Ladder, Cantril, H. (1965). Pattern of human concerns. See Appendix 1 for further details.

Mobile internet use cases and well-being

Certain uses of mobile internet are associated with well-being

A key question in the research was whether the ways in which a person chooses to use mobile internet have an influence on their well-being. Are there certain use cases that are positively or negatively correlated with well-being? This section looks at both correlations between specific mobile internet use cases and overall well-being and with each of the six dimensions of well-being. For example, the use of mobile internet for entertainment was strongly and positively correlated with overall well-being for male users in Bangladesh.

These findings do not necessarily suggest that a specific app or use case *causes* an increase or decrease in well-being, rather, it indicates there is a positive correlation between the use case and well-being. It may be that a particular use case has affected an individual's well-being (e.g. use of video calls may improve their sense of social connection) or it may be the other way around and their life situation has shaped their need to use mobile internet in a specific way (e.g. a job loss or economic vulnerability may drive the use of job search apps or to register for government welfare payments). While it is not possible to understand the reason for these correlations without further research, the results are still interesting to note, particularly how they differ by country, gender and other demographic factors. A full table of use cases and correlations with overall well-being and by dimension can be found in Appendix 2.

Bangladesh

In Bangladesh, three use cases had a strong correlation with overall well-being for both men and women. Mobile internet users who used video calls had 10 per cent higher levels of well-being than those who did not use mobile internet. Those using mobile internet for entertainment had 10 per cent higher levels of well-being and for religious uses it was six per cent higher. This association was most evident among populations who were rural, unemployed, younger or had at least primary education. It is interesting to note that all three use cases are more social in nature, highlighting the important connection between leisure and well-being.

Several substantial differences were noted for female users specifically. For instance, overall well-being scores for Bangladeshi women who use mobile internet for video calls was 15 per cent higher than for non-users, and women who use mobile internet for online purchases had 11 per cent higher well-being scores than non-users. For men, well-being was positively correlated with using mobile internet for entertainment purposes (nine per cent), but there was no significant correlation for women.

Those over 40 years old who reported higher levels of overall well-being were more likely to use mobile internet for health-related use cases, which could be linked to managing health risks and needs for older populations or to support other family members' health needs. Those in higher income groups who reported higher levels of overall well-being were more likely to use mobile internet for safety and location-related use cases, which may be linked to the need to travel for business or social commitments.

"[My] husband lives abroad, with video calls I can always see him."
Bangladesh, rural female

"You can't find every trendy thing in Cumilla, so I order what I like from different pages on Facebook. So, I can always wear the trendy dresses, hijabs. And I don't even go to Dhaka for shopping."
Bangladesh, rural female

Ghana

In Ghana, the use of mobile internet for education was positively correlated with well-being for a wide range of demographic groups. This included respondents who were female or lived in rural areas or had at least primary education, or higher income, or had no children or who were unemployed. Concerns over the declining quality of education in Ghana[17] may have driven increased online education opportunities, which have a positive link to well-being.

Differences were noted between demographic groups and use cases. For example, those living in urban areas who reported higher levels of overall well-being were more likely to use mobile internet for safety and location-related use cases. Similarly, overall well-being was correlated with online purchases for those with more than primary education. Conversely, using mobile internet to apply for jobs and to use government services was negatively correlated with well-being. However, it is likely that those who are unemployed or underemployed would report lower levels of well-being irrespective of mobile internet use, as might those who need to apply for government support services or welfare.

"[With mobile internet] I learned how to improve my typing and writing skills."
Ghana, urban female

"[WhatsApp] helps to send messages to a loved one close by when I sense danger. It helps eradicate fear."
Ghana, urban female

17. Ghana Statistical Service (2018). Poverty trends in Ghana (2005-2017). Ghana Living Standards Survey Round 7.

Other mobile-related factors and well-being

The type of handset a woman uses to access mobile internet, and how frequently, are linked to well-being

The research also examined other factors that influenced the connection between mobile internet use and well-being for women specifically. Two additional factors were found to be positively correlated:

Type of handset: In Ghana, women who access mobile internet via a smartphone have nine per cent higher levels of well-being than women who access it via a basic or feature phone. This was not significant for female users Bangladesh.

Frequency: In Bangladesh, women who use mobile internet at least once a day have six per cent higher levels of well-being than those who use it less frequently. This was not significant for female users in Ghana.

There was a small but statistically significant correlation between having a larger number of mobile internet use cases and well-being, but the length of time respondents spent online had little impact on their well-being, either positively or negatively.

Possible reasons the two countries differ

The correlation between mobile internet use and well-being differs substantially between Ghana and Bangladesh.[18] Mobile internet use is correlated with positive well-being for more dimensions in Bangladesh than in Ghana and, in several cases, female users in Bangladesh in particular report higher levels of well-being. What people use mobile internet for in Ghana and Bangladesh also differs, which is likely to influence their self-reported well-being across the various dimensions. In our sample in Ghana, men and women reported equal numbers of business-related mobile internet use cases (25 per cent of respondents), but in Bangladesh only two per cent of women and 11 per cent of men reported this use case. The only use case reported more by women than men in both countries was searching for cooking recipes.

It is important to consider the differences between Bangladesh and Ghana in terms of socio-economic context and mobile internet connectivity, both of which are likely to have an influence on mobile internet use and the well-being results. This includes the lack of a common language in Ghana[19] and the greater social norms in Bangladesh that impact women, including their relatively low labour force participation and limited ability to travel independently.[20] In addition, Bangladesh benefits from higher levels of 4G mobile broadband coverage,[21] as well as more affordable data, compared to Ghana.[22] These factors may help explain why video calls are relatively more common in Bangladesh,[23] which are strongly linked to well-being for women, but not in Ghana where text communications are more common.[24] A common language makes it easier to engage with internet services and to create content that is widely understood, including entertainment and religious content. This may also help explain why education use cases are more positively correlated with well-being for educated individuals in Ghana as they are likely to share the common language of English.

18. The differences in demographic distributions, such as age and employment, varied between Bangladesh and Ghana, and this should be noted when making any comparisons between the countries.
19. Ghana has 80 spoken languages and 11 official languages, while 98 per cent of Bangladeshis speak Bangla. See: Lewis, M.P., Simons, G.F. and Fennig, C.D. (2010). *Ethnologue: languages of the world*, 12(12). Dallas, Texas: SIL International.
20. See, for example, Heintz, J., Kabeer, N. and Mahmud, S. (2017). "Cultural norms, economic incentives and women's labour market behaviour: empirical insights from Bangladesh". Oxford Development Studies, 46(2); and Solotaroff, J. et al. (2019). *Voices to Choices: Bangladesh's Journey in Women's Economic Empowerment*.
21. At the end of 2020, 4G networks covered 97 per cent of the population in Bangladesh compared to 72 per cent in Ghana. Source: GSMA Intelligence.
22. The median cost of 1GB as a percentage of monthly GDP per capita for Ghana is 0.9 per cent and 0.3 per cent for Bangladesh. For 5GB of data, the figures are 2.1 per cent for Ghana and 1.3 per cent for Bangladesh. Source: GSMA Intelligence, 2021.
23. Video calls were reported by 97 per cent of male and female mobile internet users in Bangladesh, and by 87 per cent of male and 86 per cent of female users in Ghana.
24. Pew Research (Silver et al., 2017) shows that text messaging (e.g. via WhatsApp) is one of the most popular uses of the internet in Ghana.

Social norms

In Ghana, relatively high levels of female labour force participation[25] may provide women with a higher level of independent mobility and autonomy. This means that for women in Ghana earning an income outside the home, getting jobs done and seeing friends "offline" is more common. Conversely, in Bangladesh, social norms play a significant role in keeping women closer to or within the home.[26] In this context, where physical mobility may be limited without male accompaniment, mobile internet provides an important means for women to get things done, access information and connect with others without leaving home. Furthermore, statistics on sexual harassment of women in Bangladesh, particularly on public transport,[27] point to the tangible benefit of being able to complete tasks via mobile internet. The following quotes from women in Bangladesh highlight the value of connecting to mobile internet from home:

"I can pay gas-electricity-water bills from home. This way of paying bills seems amazing to me, and I enjoy it."
Bangladesh, urban female

"With bKash, there is no need to leave the home anymore, money transactions are possible from home, now I shop staying at home."
Bangladesh, urban female

"You do not have to go out to earn money. I have become [financially] supportive while sitting at home."
Bangladesh, urban female

Other drivers of mobile internet use in Bangladesh

The high number of Bangladeshis working overseas[28] may also drive people to use mobile internet to connect with friends and family. Most respondents in the qualitative research conducted in Bangladesh reported that communicating via mobile internet is much cheaper and easier, especially for calling abroad, and 21 of 35 participants mentioned video calling as a means to connect with friends and family who live or work abroad. In Ghana, only eight of 37 participants mentioned this.

The perceived social benefits of mobile internet differ by country and gender

The qualitative research also highlighted the social and emotional benefits of mobile internet, particularly for women in Bangladesh, who described using mobile internet to create chat groups, online games or make video calls. These use cases were not reported in the sample in Ghana. It is worth noting that the pandemic may have influenced the responses in Bangladesh. For example, respondents mentioned playing Ludo online with friends or family and attending virtual birthday celebrations during lockdowns. In the qualitative research in Bangladesh, men reported using social media more, while women reported using private online spaces for social connection more, such as closed groups for friends and family and one-to-one instant messaging or video calls.

"Messenger is a lifeline, like my oxygen. It's my breathing space."
Bangladesh, urban female

"The most interesting side is that I never feel lonely, rather I feel that someone is always with me, I get this strength from using social media."
Bangladesh, urban female

"I also use Facebook, Messenger or imo like my urban friends. I like to think of myself as the equivalent of city friends."
Bangladesh, rural male

These factors may go some way to explain why mobile internet has a greater impact on well-being in Bangladesh than Ghana, particularly for women across many dimensions.

25. 64 per cent in Ghana and 36 per cent in Bangladesh. Source: World Bank. (2019). "Percentage of female population 15+ participating in labour force".
26. See also GSMA. (2017). *Triggering mobile internet use among men and women in South Asia*.
27. In 2018, a BRAC study revealed that 94 per cent of female users of public transportation in Dhaka have experienced verbal, physical or other forms of sexual harassment. Moreover, 20.5 per cent of women have stopped using public transportation due to sexual harassment (Daily Star, 2020).
28. The International Labour Organisation (ILO) estimates that over 400,000 workers leave Bangladesh every year for overseas employment.

Conclusion

This study provides unique insights into the impact of mobile internet use on the well-being of men and women in two countries. Further research is needed to better understand the correlations between the dimensions of well-being explored with our index and mobile internet use, and how this relationship evolves over time. This will be even more pertinent in a more digitised, post-pandemic world. For example, to understand how mobile internet is having an impact on the different dimensions of well-being during the recovery phase of the pandemic and which use cases are driving this. In addition, applying the well-being index in other countries would provide valuable new data points to understand how mobile internet is linked to well-being in different contexts.

Understanding the impact of mobile internet use on the well-being of men and women is both important and timely to achieve digital inclusion for all, and in a way that maximises the social and economic benefits.

Appendix 1: Methodology

Selection of dimensions of well-being

Well-being is a multidimensional concept. A range of well-being dimensions can be found in the literature, with some measurable at the household level and others at an individual level. The index we developed focuses on dimensions measurable at the individual level only. The OECD Framework for Measuring Well-Being and Progress provided the most useful framework for our index. We selected six of the 11 OECD well-being dimensions that are measurable at the individual level, that concern adults and are applicable in the local context (Ghana and Bangladesh). The six dimensions of well-being selected for this report were social connection, health, income, physical vulnerability, economic vulnerability and life evaluation and feelings. Indicators for each dimension were drawn from the literature and refined for the local context in discussion with local partners. The selected indicators for each dimension are presented in Table 7.

Table 7

Selected well-being dimensions and indicators

Well-being dimensions	Brief description and summary of selected indicators
Social connection	Measures an individual's connectedness to family, relatives and friends. Indicators are overall satisfaction, frequency of interactions, social support and social isolation.
Health	Measures an individual's health status. Indicators are access to health care, health behaviour, health service use and health literacy.
Income	Measures an individual's expenditure as a proxy for income. Indicators are financial situation (measure) and expenditure based on selected basket items. We also included work.
Physical vulnerability	Measures an individual's physical vulnerability (also classified as physical safety and security). Indicators are safety perception and crime victimisation.
Economic vulnerability	Measures an individual's economic vulnerability. Indicators are economic status perception and economic shocks/vulnerability.
Life evaluation and feelings	Evaluative well-being focuses on an individual's assessment of their life satisfaction based on the Cantril's Ladder.[29] Experiential well-being focuses on an individual's recall of emotions, both positive and negative.

An individual's responses to questions within a dimension are used to assess their well-being in that particular dimension. To determine an individual's overall well-being, we systematically combined responses across the dimensions. We achieved this by developing an index of well-being using weights.

29. Cantril, H. (1965). Pattern of human concerns.

Qualitative analysis

In-depth interviews with individuals

Qualitative interviews were conducted to explore the mechanisms of mobile internet use among men and women, in both urban and rural areas. In addition, the research aimed to understand the extent to which social norms influence how mobile internet use affects men and women. The qualitative instrument included questions on mobile internet use across five dimensions – social connection, economic activity, work, health and physical safety – as well as questions about social norms. The data collection was conducted in-person by a local partner in November 2020.

Sampling

A stratified sampling approach was used to recruit mobile internet users in both countries. The interview participants were randomly selected from three predetermined districts to represent different regions of each country in relation to the overall population. The sample selection was restricted to mobile internet users between the ages of 18 and 49 years. Table 8 below outlines the sample selection by country, gender and location.

Table 8

Demographics of qualitative research respondents

	Bangladesh		Ghana	
	Rural	Urban	Rural	Urban
Female	12	9	12	9
Male	8	6	8	8
TOTAL	**20**	**15**	**20**	**17**

Analysis

Data were analysed using thematic analysis, by reading through the transcripts carefully and allowing codes to develop within each dimension. For example, within social connection, codes included video calling, text, sharing posts and photos. These were then grouped into broader categories. This was repeated for each dimension and social norms. Two researchers coded the data, developed a codebook and ensured intercoder reliability. The analysis also took into consideration gender and location.

Descriptive statistics

Of the 21 female participants in Bangladesh, 76 per cent had post-secondary education and 86 per cent were under 35 years old. In addition, 24 per cent were employed and 52 per cent were married. In terms of mobile phone ownership, 38 per cent shared their mobile phone with someone else. Of the 14 male participants, 93 per cent had attained post-secondary education and 93 per cent were under 35 years old. Also, 79 per cent reported being employed and 29 per cent married. In terms of mobile phone ownership, 36 per cent shared their mobile phone with someone else.

Of the 21 female participants in Ghana, 86 per cent had post-secondary education and 95 per cent were under 35 years old. In addition, 62 per cent were employed and 43 per cent were married. In terms of mobile phone ownership, 24 per cent shared their mobile phone with someone else. Of the 17 male participants, 75 per cent had post-secondary education and 81 per cent were under 35 years old. Also, 75 per cent reported being employed and 50 per cent married. In terms of mobile phone ownership, 19 per cent shared their mobile phone with someone else. A summary of the demographic details of respondents is presented in Table 9.

Table 9

Demographics of qualitative research respondents

	Total female		Total male		Rural female		Rural male		Urban female		Urban male	
	Bangladesh	Ghana	Bangladesh	Ghana	Bangladesh	Ghana	Bangladesh	Ghana	Bangladesh	Ghana	Bangladesh	Ghana
Post-secondary education	16/21 76%	18/21 86%	13/14 94%	12/16 75%	8/12 67%	11/12 92%	7/8 88%	7/8 88%	8/9 89%	7/9 78%	6/6 100%	5/8 63%
Under 35	18/21 86%	20/21 95%	13/14 94%	13/16 81%	10/12 83%	12/12 100%	8/8 100%	7/8 87%	8/9 89%	8/9 89%	5/6 83%	6/8 75%
Employed	5/21 24%	13/21 62%	11/14 79%	12/16 75%	3/12 25%	9/12 75%	5/8 62%	7/8 87%	2/9 22%	4/9 44%	6/6 100%	5/8 62%
Married	11/21 52%	9/21 43%	4/14 29%	8/16 50%	9/12 75%	6/12 50%	2/8 25%	4/8 50%	2/9 22%	3/9 33%	2/6 33%	4/8 50%
Sharing mobile phone	8/21 38%	5/21 24%	5/14 36%	3/16 19%	6/12 50%	2/12 16%	3/8 37%	2/8 25%	2/9 22%	3/9 33%	2/6 33%	1/8 13%

Potential biases and risks

There were a few potential biases in the qualitative sample. These should be considered when interpreting the results.

1. The samples in both countries were more educated than the country average. Existing reports show that education is positively associated with internet use. In Bangladesh, 76 per cent of the female participants and 93 per cent of male participants had post-secondary education, while World Bank data[30] for Bangladesh indicates that only 27 per cent of females and 36 per cent of males have completed upper secondary education. In Ghana, 86 per cent of the female participants and 75 per cent of male participants had post-secondary education, while World Bank data for Ghana indicates that only 15 per cent of females and 27 per cent of males have completed upper secondary education.
2. Rural and urban male participants in Bangladesh had higher employment levels than the country average. Existing research shows that economic status is positively associated with internet use. In our sample, 79 per cent of the rural male participants and 100 per cent of the urban male participants were employed. Higher education and economic levels together might have biased the findings.
3. The qualitative data from Ghana was not as comprehensive and does not have the same depth as the Bangladesh data. The findings should be evaluated with this quality difference in mind.
4. The study was conducted during the COVID-19 pandemic. Some of the use cases that emerged from the data might be a unique consequence of the lockdown and social distancing measures, rather than a general trend in both countries.

30. World Bank data. (2020).

Quantitative analysis

Survey design

We used both evaluative and experiential measures to analyse the impact of mobile internet on each dimension of well-being. Each dimension has an evaluative measure question (self-assessed) to capture how satisfied a respondent is with a certain aspect of their life. Each dimension also includes multiple experiential measure questions to capture behaviours and expectations of respondents as an indication of how well they are doing in that same aspect of their life. The evaluative question is always asked before the experiential questions.

Outcome measures were developed based on existing validated methodologies/scales drawn from the literature for each of the six dimensions of well-being. The list of validated scales/ surveys/research used to develop the outcome measures is shown in Table 10.

Table 10

Data sources used to develop survey questions for each dimension of well-being

Well-being dimension	Section of the survey	Source
Social connection	Satisfaction with personal relationships	EU-SILC Questionnaire 2015
	Number of people in social network	Social Network Index 1997
	Social support	Oslo-3 Social Support Scale
	Social isolation	3-item UCLA Loneliness Scale
Health	Satisfaction with physical health	Yoo, C. et al (2021)[31]
	Access to health care	Amoah, P.A. (2018). Social participation, health literacy, and health and well-being: A cross-sectional study in Ghana
	Health behaviour and health service use	
	Health literacy	Short-short version of HLS-EU-Q6
Income	Satisfaction with personal finances	Yoo, C. et al (2021)[32]
	Consumption	Bangladesh Integrated Household Survey 2015 Ghana Living Standards Survey 2017
Physical vulnerability	Perceived level of safety in their neighbourhood	Yoo, C. et al (2021)[33]
	Crime victimisation	Kenya Life Panel Survey 2016
Economic vulnerability	Stability of economic situation	Yoo, C. et al (2021)[34]
	Economic vulnerability	PEPFAR USAID Household Economic Vulnerability Tool Indicator Guide 2017
Life evaluation and feelings	Evaluative well-being	World Happiness Report 2020
	Emotional well-being	GSMA Impact of Mobile on People's Happiness and Well-Being Report 2018

To determine which mobile internet use cases to study, the survey adapted the use cases from the 2017 Pew Internet Research Global Attitudes and Trends Spring Survey.[35] This survey has been conducted in 11 LMICs. Additional use cases from the GSMA Consumer Survey research augmented the list. The use cases on cooking recipes and videos were added based on the findings of the qualitative research.

31. Yoo, C.S. et al. (2021). Investigating the Impact of Mobile Internet Uptake and Use by Women. Unpublished report. University of Pennsylvania.
32. Ibid
33. Ibid
34. Ibid
35. https://www.pewresearch.org/global/dataset/spring-2017-survey-data/

Sampling

Data was collected in Bangladesh and Ghana in January and February 2021. Mobile internet non-users were oversampled to align with initial power calculations, which indicated a need for approximately 4,500 non-users and 500 users. A two-stage sampling approach was applied in both countries using the latest population census to identify enumeration areas.[36]

In Bangladesh, a two-stage cluster sampling approach was used. A total of 16 districts were selected, four from the two largest divisions, Dhaka and Chattogram, and two districts selected from the remaining six divisions. Also, 32 Upazilas (subdistricts) were selected randomly from these districts, two per district. Respondents were selected from each subdistrict level while maintaining a nationally representative distribution in the sample by gender (1:1 ratio) and urban-rural (1:3 ratio).

In Ghana, a similar two-stage stratified sampling approach was used. The sample consisted of 162 enumeration areas, randomly selected from 16 administrative regions, forming the primary sampling units (PSUs). The PSUs in Ghana were allocated into the 16 regions using stratified systematic probability proportional to size (PPS), taking into account the rural and urban distribution of the localities. This resulted in the selection of 73 urban and 89 rural enumeration areas, three per district on average. A nationally representative gender ratio of 1:1 was maintained in the second stage of the sampling. Sampling between rural and urban respondents was approximately even. The numbers can be seen in Table 11.

Table 11

Sampling distribution disaggregated by gender, user type and location

	Bangladesh			Ghana		
	Male	Female	**Total**	Male	Female	**Total**
Mobile internet user	308	308	**616**	288	283	**571**
Non-user	2,288	2,288	**4,576**	2,449	2,467	**4,916**
Total	**2,596**	**2,596**	**5,192**	**2,737**	**2,750**	**5,487**

	Bangladesh			Ghana		
	User	Non-user	**Total**	User	Non-user	**Total**
Urban	176	1,144	**1,320**	300	2,391	**2,691**
Rural	440	3,432	**3,872**	271	2,525	**2,796**
Total	**616**	**4,576**	**5,192**	**571**	**4,916**	**5,487**

	Bangladesh			Ghana		
	Urban	Rural	**Total**	Urban	Rural	**Total**
Male	660	1,936	**2,596**	1,329	1,408	**2,737**
Female	660	1,936	**2,596**	1,362	1,388	**2,750**
Total	**1,320**	**3,872**	**5,192**	**2,691**	**2,796**	**5,487**

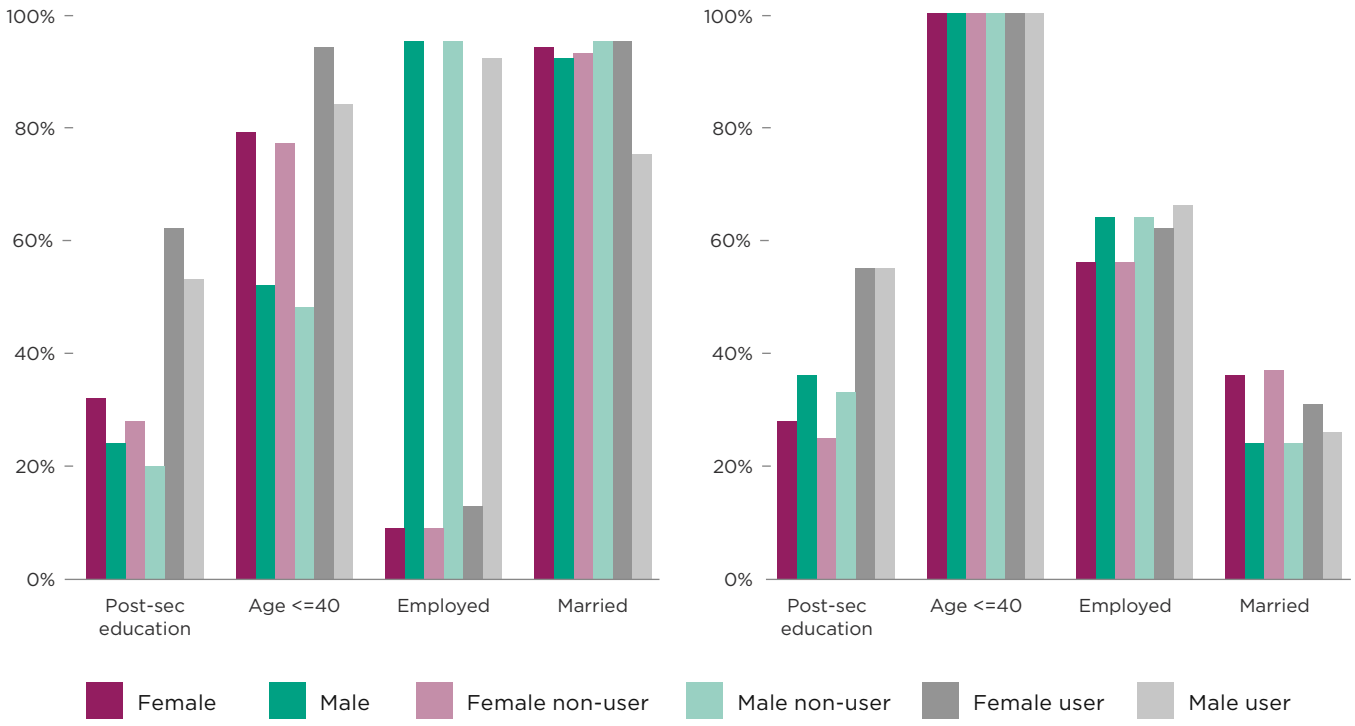
36. Bangladesh Bureau of Statistics (BBS) 2011 population and housing census and the Ghana Statistical Bureau 2010 population and housing census.

Descriptive statistics

The distribution for four key demographics is displayed for different subsections of respondents in Figure 1.

Figure 1

Descriptive statistics of demographics of respondents in Bangladesh[37] and Ghana[38]



The data in Figure 1 revealed the following insights:

1. **Education level:** Across both Bangladesh and Ghana, mobile internet users had much higher education levels compared to non-users. The difference was that, in Bangladesh, these levels skewed slightly towards females whereas in Ghana they skewed slightly towards males.

2. **Age:** There was a large difference in age distribution between the Bangladeshi and Ghanaian samples in the study. In Bangladesh, the sampled females were younger on average than the sampled males. In Bangladesh, almost 50 per cent of the male non-user population and 25 per cent of the female non-user population were above 40 years of age. In Ghana, no one in the sampled population, non-users or users, were above 40 years of age.[39]

3. **Employment status:** In Bangladesh, there was a large difference in the employment rates of men and women. This difference was consistent across mobile internet users and non-users. Almost 95 per cent of the Bangladeshi men in the sample said they were either employed full time, part time or self-employed whereas only nine per cent of the women said the same. In Ghana, the difference in employment rates between men and women was much smaller. However, on average, the employment rates were much lower for men in Ghana compared to Bangladesh and much higher for women in Ghana compared to women in Bangladesh. In Ghana, only 64 per cent of men reported being employed compared to 56 per cent of women.

37. n=5,192; Female=2,596; Male=2,596; Non-user female=2,288; Non-user male=2,288; User female=308; User male=308
38. n=5,487; Female=2,750; Male=2,737; Non-user female=2,467; Non-user male=2,449; User female=283; User male=288
39. While Ghana has a younger population than Bangladesh on average, a bigger reason for this sampling is that local partners in Ghana used the same age restrictions for both the qualitative study and the quantitative study, therefore, only individuals below the age of 49 were sampled.

4. **Marital status:** There was a large difference between the average rate of married individuals in the overall sample in Bangladesh and Ghana. In Bangladesh, 94 per cent of women and 92 per cent of men said they are married. For women, this was similar across the user and non-user population. However, for men, this was mainly the case for mobile internet non-users, with 95 per cent of non-users reporting they were married, but only 75 per cent of users were married. In Ghana, the percentage of married individuals in the sample was much lower compared to Bangladesh with 36 per cent of women and 24 per cent of men married. This skew for gender was similar for user type.

Potential biases and risks

There are a few potential biases in the quantitative sample that must be kept in mind when analysing the results from the Bangladesh and Ghana data. These include the following:

1. This study was not a randomised control trial. We could control for certain demographic variables in the analysis, but not for all confounding factors. In the absence of a completely randomised experimental design, we cannot make causal claims but only work in that direction. This should be kept in mind when interpreting the results from the regressions.

2. Differences in demographics across countries. Some demographic distributions, such as age and employment, were very different across Bangladesh and Ghana. This needs to be taken into account when analysing the disparities or similarities of results based on the analyses and data collected from these sampled respondents.

3. There was a difference in the sampling strategy used by local partners. Whereas in Bangladesh a two-stage cluster sampling approach was used, in Ghana, partners used a two-stage stratified sampling approach. The only concrete difference is that stratified sampling leads to some homogeneity within groups while cluster sampling leads to homogeneity between the groups that form the smallest selection unit. This might lead to small levels of bias in the result.

4. Translation into local languages could have caused some variations in the interpretation of certain questions. In Bangladesh, the common local language is Bangla, so all surveys were translated into the same language. However, in Ghana, there is no single common written language, so surveys were orally translated into the different local languages during the interviews conducted by the enumerators.

5. The study was conducted during the first quarter of 2021 while the world was still dealing with the global COVID-19 pandemic. The enumerators on the ground conducting the interviews followed all safety and regulatory protocols. However, responses in terms of satisfaction or certain events could be biased based on the special circumstances of this year.

Appendix 2: Well-being and mobile internet use cases

Correlation between mobile internet use cases and overall well-being by demographic group

The following tables show the correlation between the overall well-being scores of different demographic groups who use mobile internet and the mobile internet use cases reported. Green indicates a positive correlation, purple a negative correlation and blank indicates that there was no significant result.

Table 12

Correlation between mobile internet use cases and overall well-being among users in Bangladesh

Use cases	All users	Females	Males	Urban	Rural	Edu (>=Pri)	Edu (<Pri)	Income (<High)	Income (High)	Child (>=3)	Child (<3)	Age (>40)	Age (<=40)
Video calls	+0.664	+0.938			+0.702	+0.877		+0.638			+0.732		
Entertainment	+0.374		+0.608										
Soc media													
Religious	+0.257				+0.291	+0.267		+0.432			+0.231		+0.236
News													
Cooking													
Education													
Health												+0.91	
Safety								+0.36					
Payment	+0.241				+0.34	+0.248					+0.259		+0.308
Apply jobs													
Gov services													
Purchases		+0.728											
Business													

Positive correlation No significant result Negative correlation

Note: For income, high is categorised as above 0.66 quantile

Table 13

Correlation between mobile internet use cases and overall well-being among users in Ghana

Use cases	All users	Females	Males	Urban	Rural	Edu (>=Pri)	Edu (<Pri)	Income (<High)	Income (High)	Has child	No child	Employ-ment	Unem-ployment
Video calls													
Entertainment													
Soc media							-0.735	-0.465		-0.809		-0.606	
Religious													
News													
Cooking								+0.425					
Education	+0.29	+0.421			+0.407	+0.332		+0.491			+0.404		+0.55
Health								-0.451					
Safety				+0.368									
Payment													
Apply jobs	-0.337		-0.396		-0.507	-0.323			-0.493				
Gov services		-0.611											
Purchases						+0.396							
Business													

Positive correlation No significant result Negative correlation

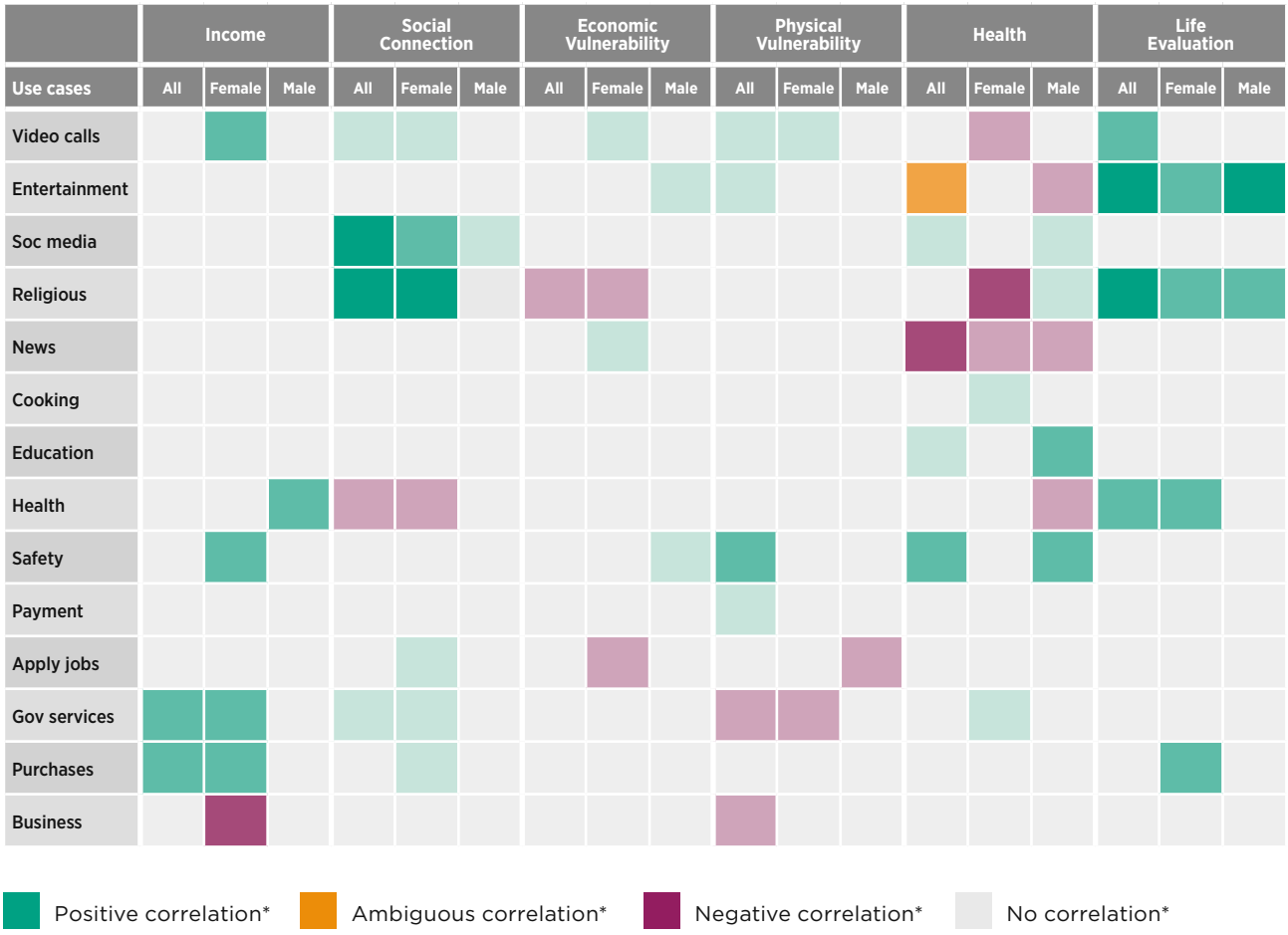
Note: For income, high is categorised as above 0.66 quantile

Correlation between mobile internet use cases and well-being dimensions, by gender

The following tables show the correlation between each of the six dimensions of well-being and mobile internet use cases, by gender. A dark colour indicates a strong result and a lighter shade indicates a weaker result, although still significant.

Table 14

Correlation between mobile internet use cases and well-being dimensions, by gender in Bangladesh

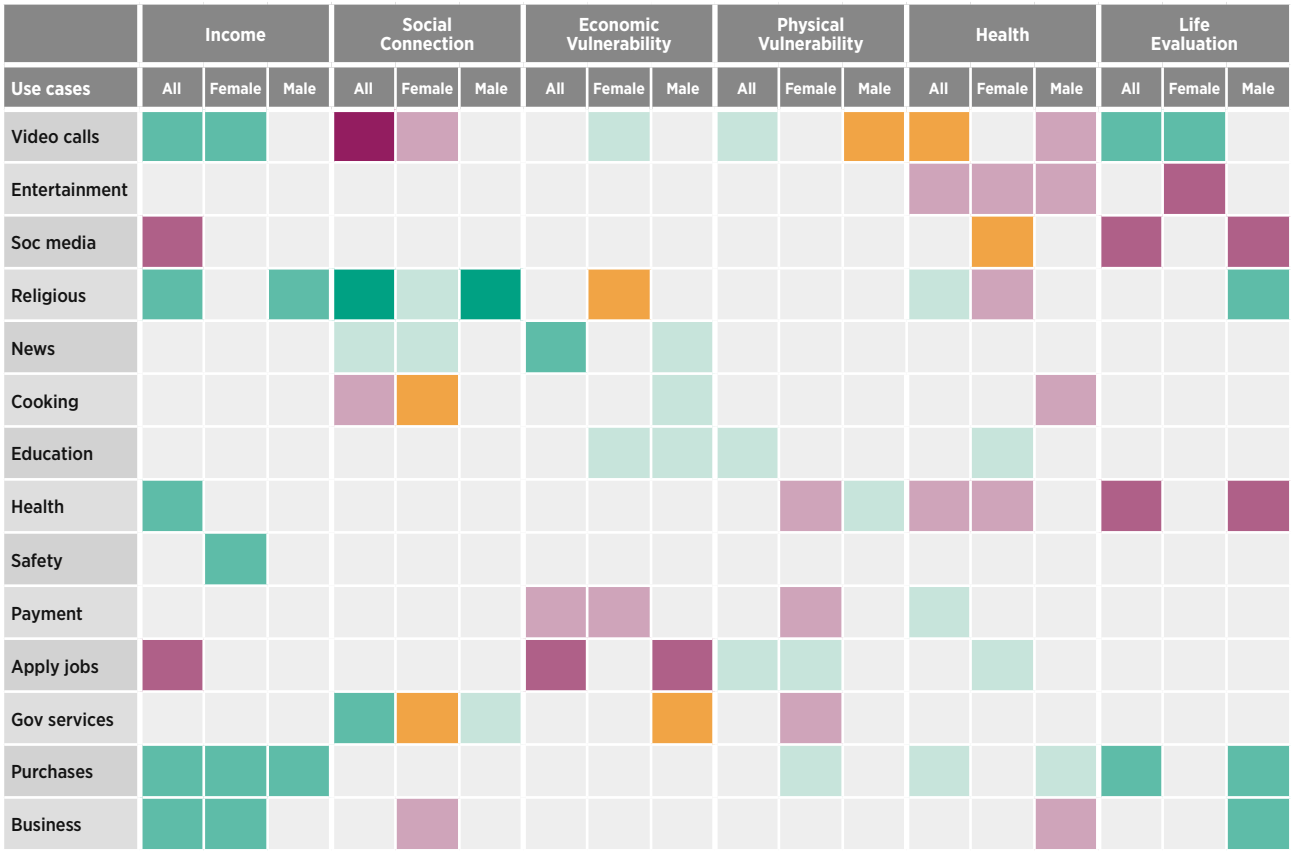


*Correlation significant at the 5% level or below

Note: The gradient of colour indicates how many measures of that dimension is the use case statistically significantly correlated for at the 5% level or less

Table 15

Correlation between mobile internet use cases and well-being dimensions, by gender in Ghana



*Correlation significant at the 5% level or below

Note: The gradient of colour indicates how many measures of that dimension is the use case statistically significantly correlated for at the 5% level or less

Appendix 3: Well-being index analysis

We selected six different dimensions of well-being as the constituent components of overall well-being based on the OECD framework discussed in Appendix 1. One approach to analyse the impact of mobile internet use on overall well-being is to analyse it against each of these dimensions separately. This highlights the dimensions of life in which people benefit from using mobile internet, the different benefits between dimensions and the magnitude of the differences.

However, a dimension-by-dimension methodology would miss key insights. We would not get a sense of the relative importance of these dimensions in measuring overall well-being. For example, if mobile internet has an impact on economic activity but not on health, the overall well-being of a user who values their finances more would be higher compared to a user who values and cares about their health more, either because they are older, financially very stable or other reason. Additionally, in the case of contrasting results, we would not have a conclusive way to measure the impact of mobile internet use on overall well-being in either country.

To prevent both these issues, we created an overall well-being index based on the self-reported perceptions of well-being under each of the dimensions, also called evaluative measures.

The evaluative measure of subjective well-being asks individuals about their overall evaluation of life satisfaction and where they stand in life on a scale of 0 to 10. We compared this measure against individual dimension measures, such as satisfaction with personal social relationships, physical health, personal financial situation, financial stability, perception of physical safety in their neighbourhood, physical health and emotional well-being. In the case of life evaluation and feelings, since we used the evaluative score as the main dependent variable in the regression to measure all other variables against, we used the experiential score as the independent measure of that dimension.

We conducted a linear regression as shown in Equation 1 to identify the relative importance of each of the dimensions to the overall well-being of individuals at an average population level in each country.

Equation 1

Linear regression to calculate the weights for creating the overall well-being index

$$(H.1_i) = \beta_o + \beta_1(C.1_i) + \beta_2(D.1_i) + \beta_3(E.1_i) + \beta_4(F.1_i) + \beta_5(G.1_i) + \beta_6(H.b_i) + \varepsilon_i$$

Where:

β_o: Constant

$\beta_1, \beta_2, \ldots \beta_6$: Coefficients of regression

$H.1$: Score from H.1

$C.1$: Score from question C.1 on overall satisfaction (Social connection)

$D.1$: Score from question D.1 on satisfaction with physical health status (Health)

$E.1$: Score from question E.1 on satisfaction with personal financial situation (Economic activity)

$F.1$: Score from question F.1 on perception of safety in neighbourhood (Physical vulnerability)

$G.1$: Score from question G.1 on perception of financial stability (Economic vulnerability)

$H.b$: Composite score from section on experiential well-being (Life evaluation and feelings)

ε: Error term

The coefficients of the regression were respectively assigned as common weights to calculate the weighted average overall well-being index score for each individual. The index score for each respondent was calculated using the weighted average formula shown in Equation 2.

Equation 2

Weighted average formula for the calculation of the overall well-being index score

$$INDEX_i = \frac{W_1(C.1_i) + W_2(D.1_i) + W_3(E.1_i) + W_4(F.1_i) + W_5(G.1_i) + W_6(H.b_i)}{W_1 + W_2 + W_3 + W_4 + W_5 + W_6}$$

We found some similarities and differences in the relative importance of dimensions for Bangladesh and Ghana after conducting the regression and assigning the coefficients as the common weights for the calculation of the overall well-being index. Economic activity emerges as the most important well-being dimension for both the countries. Health is the least important dimension in Ghana and not statistically significant.

The relative order of importance of dimensions in Bangladesh for the 5,190 respondents was (1) Economic activity, (2) Social connection, (3) Economic vulnerability, (4) Physical vulnerability, (5) Health and (6) Life evaluation/feelings, in that order. In Ghana, for the 5,469 respondents, the relative order was (1) Economic activity, (2) Economic vulnerability, (3) Life evaluation/feelings, (4) Physical vulnerability, (5) Social connection and (6) Health, in that order. The coefficients for Economic activity were much higher than for any other dimension. The value of the weights used to calculate the index and the relative ordering can be seen in Table 16.

Table 16

Regression coefficients used as weights while creating overall well-being index

	Bangladesh		Ghana	
Economic activity	0.442**	(0.013)	0.390**	(0.012)
Social connection	0.154**	(0.012)	0.220**	(0.015)
Economic vulnerability	0.088**	(0.009)	0.109**	(0.011)
Physical vulnerability	0.082**	(0.013)	0.053**	(0.013)
Health	0.071**	(0.012)	0.029*	(0.014)
Life evaluation/feelings	0.026**	(0.007)	-0.004	(0.015)
(Intercept)	1.005**	(0.024)	1.261**	(0.166)
n	5,190		5,469	
R^2	0.447		0.286	
Adjusted *R^2*	0.446		0.285	

Notes: **Significant at 1%, *Significant at 5%, • Significant at 10%

Analysis of overall well-being and mobile internet use

One of the two key research questions of this study was how mobile internet use impacts the socio-economic well-being of men and women in Bangladesh and Ghana. To answer this, we selected six dimensions of well-being as discussed in Appendix 1. However, to analyse the cumulative impact of mobile internet use, we calculated an overall well-being value for each respondent in the sample by creating an index based on the six dimensions of well-being, as discussed above.

Next, we calculated the impact of mobile internet use on overall well-being by deploying a linear regression as shown in Equation 3, with the well-being index as the dependent variable and mobile internet use as the independent variable, with relevant demographic control variables. Control variables enhanced the internal validity of the analysis by limiting the influence of confounding and other extraneous variables. They also helped establish a more accurate correlational or causal relationship between the variables of interest which, in this case, are mobile internet use and well-being.

We chose a linear regression model over an ordered probit model because the coefficients for linear regressions are easier to interpret and a growing body of literature suggests that the differences between the methods are minimal for well-being analyses.[40]

In a regression, there is an interaction effect when the effect of an independent variable on a dependent variable changes depending on the value(s) of one or more other independent variables. One of the focus areas of the study was understanding how the impact of mobile internet use on well-being varies by gender. Therefore, we used a *gender x* usage interaction term in the regression model to understand the additional impact that being a male or female mobile internet user had on well-being.

Equation 3

Linear regression equation to measure the impact of mobile internet use on the overall well-being of respondents

$$(Overall\ well\text{-}being\ index)_i = \beta_o + \beta_1 Usage_i + \beta_2 Gender_i \times Usage_j + \beta_3 Gender_i + \beta_4 Location_i + \beta_5 Employment_i + \beta_6 Age_i + \beta_7 Marital + \beta_8 HeadHousehold_i + \beta_9 Education_i + \beta_{10} Consumption_i + \beta_{11} Children_i + \varepsilon_i$$

Where:

β_o: Constant

$\beta_1, \beta_2, \ldots \beta_{11}$: Coefficients of regression

Usage: Mobile internet usage binary variable (User=1)

Gender: Gender binary variable (Female=1)

Gender x Usage: Gender usage interaction term (Female user=1)

Location: Urban/rural binary variable (Urban=1)

Employment: Employment status binary variable (Employed=1)

Age: Continuous variable about age of respondent

Marital: Marital status binary variable (Married=1)

Head of household: Relationship with head of household binary variable (Head of household=1)

Education: Discrete multilevel variable depicting various levels of education in the country

Consumption: Log of monthly per capita consumption as a continuous variable

Children: Number of children of the respondent as a continuous variable

ε: Error term

40. Ferrer-i-Carbonell, A., and Frijters, P. (2004). How important is methodology for the estimates of the determinants of happiness? *The economic journal, 114*(497), 641-659; Stevenson, B., and Wolfers, J. (2008). Economic growth and subjective wellbeing: Reassessing the Easterlin paradox (No. w14282). National Bureau of Economic Research

To prevent the issue of multicollinearity in the regression models, we measured the correlation between all the variables in the regression one at a time and calculated the variance inflation factor (VIF) for each regression. In this study, a very high correlation was found in Bangladesh between gender and employment status, as well as between gender and relationship with the head of household, but not in Ghana. Since gender is one of the key demographic variables of interest, we dropped the employment status and the relationship with head of household variables from all the Bangladeshi regressions in the study. However, we still used these demographic control variables when analysing the impact of mobile internet in Ghana.

For this study, we reported results that were statistically significant at the 5% level. Mobile internet use had a statistically significant positive impact on the well-being of respondents in Bangladesh, but not in Ghana. Mobile internet users in Bangladesh had +3%[41] higher levels of well-being, on average, compared to non-users. This means that on a scale of 0 to 10 of overall well-being, users scored 3% higher compared to the mean score of non-users. This impact was similar for both men and women in Bangladesh and did not vary significantly by gender.

Table 17 shows the regression coefficients from Equation 3 for each country, both with and without demographic controls. In the absence of demographic controls, mobile internet had a significant impact on well-being in Ghana. However, when we controlled for demographic variables, the statistically significant impact disappeared. This may be because that impact was due to another, confounding demographic variable and not mobile internet use. Therefore, it was important to control for other confounding variables in the analysis.

Table 17

Regression coefficients from Equation 3 (with and without demographic controls)

	Bangladesh				Ghana			
	All data		All data		All data		All data	
User type (User=1)	0.538**	(0.068)	0.195**	(0.068)	0.160*	(0.068)	0.009	(0.066)
Gender x User type (Female user=1)	0.225*	(0.098)	0.170•	(0.092)	0.105	(0.097)	0.043	(0.093)
Gender (Female=1)	0.048	(0.031)	0.0003	(0.034)	0.096**	(0.031)	0.203**	(0.033)
Location (Urban=1)			0.008	(0.034)			-0.085**	(0.030)
Employment (Employed=1)			Dropped				0.373**	(0.033)
Age			0.001	(0.002)			-0.003	(0.004)
Marital status (Married=1)			0.431**	(0.059)			0.027	(0.028)
Household status (Head=1)			Dropped				-0.024	(0.039)
Education level			0.054**	(0.004)			0.044**	(0.004)
Expenditure (log value)			0.699**	(0.037)			0.210**	(0.019)
Number of children			-0.083**	(0.013)			-0.017	(0.014)
(Intercept)	6.292**	(0.024)	3.416**	(0.146)	5.933**	(0.022)	4.566**	(0.016)
n	5,190		5,187		5,469		5,465	
R^2	0.035		0.178		0.006		0.083	
Adjusted *R^2*	0.034		0.176		0.005		0.082	

Notes: **Significant at 1%, *Significant at 5%, • Significant at 10%

41. +3% higher well-being was calculated by dividing the coefficient from the regression result (0.195) by the mean well-being score (i.e the mean index score) of non-users (male and female combined) which, in this case, was 6.3 on a scale of 0 to 10.

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