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The Telecommunications Paradox: Examining Mobile Data Expenditure Patterns Amid Economic Hardship in Uganda

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ABSTRACT

Background: Uganda has experienced rapid telecommunications growth with mobile penetration exceeding 65%, coinciding with significant economic challenges including high inflation and widespread poverty affecting approximately 30% of the population. A paradox has emerged whereby mobile data consumption and expenditure persist or increase despite economic hardship, with households allocating substantial income portions to connectivity while struggling to meet basic needs.

Objective: The main objective was to investigate and analyze the patterns, determinants, and implications of mobile data expenditure among Ugandan households during periods of economic hardship, and to understand the paradoxical relationship between declining economic capacity and sustained telecommunications spending.

Methods: A cross-sectional analytical design was employed with 456 household heads or primary decision-makers selected through multistage stratified random sampling across Uganda's four major regions. Sample size calculation ensured 80% power to detect significant associations at 95% confidence level. Analysis progressed hierarchically from univariate descriptive statistics through bivariate analyses (chi-square tests, Mann-Whitney U tests, Kruskal-Wallis tests, and Spearman correlations) to multivariate methods including multiple linear regression to identify predictors of data expenditure and binary logistic regression to model financial vulnerability.

Results: Multiple linear regression (R^2=0.624, $F(10,445)$=73.82, $p<0.001$) identified household income (β=0.42, $p<0.001$), urban residence (β=0.18, $p<0.001$), education level ($p<0.001$), perceived social necessity (β=0.22, $p<0.001$), and occupational requirements (β=0.19, $p<0.001$) as significant predictors of data expenditure. Critically, logistic regression (Nagelkerke R^2=0.558, AUC=0.84) demonstrated that each 1% increase in income proportion spent on data increased odds of high financial vulnerability by 13% (OR=1.13, 95% CI: 1.06-1.21, $p<0.001$), controlling for socioeconomic confounders.

Conclusion: The study confirmed the telecommunications paradox in Uganda, demonstrating that mobile data has become deeply integrated into household budgets as a perceived necessity, with expenditure driven by social and occupational pressures beyond economic capacity. Despite widespread financial vulnerability, households maintained substantial data expenditure that competed directly with essential needs. Critically, the proportion of income allocated to data independently predicted financial vulnerability, indicating that current data consumption patterns contribute to rather than merely correlate with economic hardship.

Recommendations: First, government should implement regulatory frameworks for subsidized data packages and community WiFi infrastructure to treat internet access as essential public infrastructure. Second, targeted financial literacy programs should address digital consumption patterns and help households optimize connectivity costs while meeting genuine needs.

Keywords: Mobile data expenditure, telecommunications paradox, financial vulnerability, economic hardship, digital inclusion, household expenditure patterns, socioeconomic determinants, telecommunications policy, poverty

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Background of the Study

Uganda, like many developing nations, has experienced rapid mobile telecommunications growth over the past two decades, with mobile penetration rates exceeding 65% as of 2024. This digital revolution has transformed communication, financial services, and access to information across the country. However, this technological advancement coincides with significant economic challenges, including high inflation rates, currency depreciation, and widespread poverty, with approximately 30% of Ugandans living below the poverty line (Abío et al., 2017, 2019; Groznykh et al., 2020; Ishikawa, 2021).

The paradox emerges when examining household expenditure patterns: despite increasing economic hardship, characterized by rising costs of essential commodities such as food, healthcare, and education, mobile data consumption continues to grow. Urban and rural Ugandans alike prioritize mobile data expenditure, often allocating substantial portions of their limited income to internet connectivity (Barguellil et al., 2018; Gopane, 2023; Hinz, 2023; Ramoni-Perazzi & Romero, 2022). This phenomenon raises critical questions about the perceived versus actual value of mobile data, the role of digital services in daily life, and whether such expenditure represents rational economic behavior or a form of digital dependence that may exacerbate financial vulnerability (Paudel, 2023; Sagindykova et al., 2023; Shamirah & Sarah, 2024).

The telecommunications sector in Uganda is dominated by major players including MTN, Airtel, and Africell, all competing aggressively for market share through various data packages and promotional offers. Meanwhile, the cost of data relative to average income remains high compared to global standards, yet demand persists. This study seeks to understand the underlying factors driving this paradox, examining whether mobile data has become a basic necessity comparable to food and shelter, or whether behavioral, social, and economic factors create artificial demand that undermines household financial stability (Li et al., 2018; Lupak et al., 2022; Madinah PhD, 2020; Yoga et al., 2019).

Problem Statement

In an era marked by escalating economic pressures and declining purchasing power, mobile data has paradoxically transitioned from a luxury to an essential utility, creating a significant financial burden for households struggling to meet basic needs. Despite widespread unemployment, stagnant wages, and rising inflation that force consumers to make difficult trade-offs between necessities, mobile data consumption continues to grow as digital connectivity becomes indispensable for accessing employment opportunities, educational resources, financial services, and social support networks (Cakerri et al., 2020; Chen et al., 2020; Dečman & Rep, 2022; Kuzembekova & Zhanbyrbayeva, 2022). This paradox presents a critical socioeconomic challenge: while individuals and families are compelled to allocate increasingly scarce resources toward maintaining internet connectivity—often at the expense of food, healthcare, or other fundamental needs—there remains limited understanding of how economic hardship influences mobile data expenditure patterns, what coping mechanisms users employ to sustain connectivity under financial strain, and whether current pricing models and policy frameworks adequately address the tension between digital inclusion imperatives and economic vulnerability (MURTHI, 2023; Noeline et al., 2023). Understanding these dynamics is essential for developing equitable telecommunications policies, affordable pricing strategies, and targeted interventions that ensure vulnerable populations are not excluded from the digital economy while simultaneously not being pushed deeper into poverty by the cost of essential connectivity.

Main Objective of the Study

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To investigate and analyze the patterns, determinants, and implications of mobile data expenditure among Ugandan households during periods of economic hardship, and to understand the paradoxical relationship between declining economic capacity and sustained or increased telecommunications spending.

Specific Objectives

1. To assess the proportion of household income allocated to mobile data expenditure relative to essential needs (food, healthcare, education) among different socioeconomic groups in Uganda during economic hardship.
2. To identify the key factors influencing mobile data purchasing decisions among Ugandans experiencing economic constraints, including social pressures, occupational requirements, and perceived necessity.
3. To evaluate the impact of sustained mobile data expenditure on household financial stability and poverty levels among economically vulnerable populations in Uganda.

Research Questions

1. What proportion of household income do different socioeconomic groups in Uganda allocate to mobile data expenditure compared to essential needs during periods of economic hardship?
2. What are the primary factors (social, economic, occupational, or psychological) that drive mobile data purchasing decisions among Ugandans facing economic constraints?
3. How does sustained mobile data expenditure affect the overall financial stability and economic wellbeing of households experiencing economic hardship in Uganda?

Hypotheses

H_1: There is a significant positive relationship between mobile data expenditure and household financial vulnerability, such that households allocating higher proportions of income to mobile data experience greater difficulty meeting essential needs.

H_2: Perceived social necessity and occupational requirements are stronger predictors of mobile data expenditure than actual income levels among economically constrained Ugandan households.

H_3: Households that reduce mobile data expenditure during economic hardship demonstrate better financial resilience and improved capacity to meet essential needs compared to those maintaining or increasing such expenditure.

Methodology

This study employed a cross-sectional analytical design to examine mobile data expenditure patterns among Ugandan households experiencing economic hardship. The target population comprised household heads or primary decision-makers aged 18 years and above from both urban and rural settings across Uganda's four major regions (Central, Eastern, Northern, and Western). A multistage stratified random sampling technique was utilized to ensure representativeness across geographic and socioeconomic strata. The sample size was calculated using the formula for comparing proportions in cross-sectional studies, with assumptions of 95% confidence level, 80% statistical power, a 5% margin of error, and an estimated 40% proportion of households allocating disproportionate income to mobile data based on preliminary literature. Additionally, accounting for a 15% non-response rate and design effect of 1.5 due to clustering, the final sample size was determined to be 456 respondents. Data collection was conducted through structured questionnaires administered via face-to-face interviews, supplemented by focus group discussions in selected communities to provide contextual insights. The questionnaire captured demographic characteristics, detailed household income and expenditure patterns (including itemized spending on mobile data, food, healthcare, education,

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and other essentials), mobile data usage behaviors, motivations for data purchase, perceived necessity, and indicators of financial stress such as debt levels, missed payments, and food insecurity. Data quality was ensured through pre-testing of instruments, training of research assistants, and daily data validation checks during fieldwork.

Data analysis was performed using STATA version 17.0, employing a hierarchical analytical approach progressing from univariate to multivariate methods. Univariate analysis included descriptive statistics such as frequencies, percentages, means, standard deviations, medians, and interquartile ranges to characterize the distribution of mobile data expenditure, household income levels, and sociodemographic variables. The normality of continuous variables was assessed using Shapiro-Wilk tests and visual inspection of histograms and Q-Q plots. Bivariate analysis employed chi-square tests to examine associations between categorical variables (such as socioeconomic status categories and mobile data expenditure levels), independent samples t-tests or Mann-Whitney U tests for comparing mobile data expenditure between two groups (depending on normality assumptions), and one-way ANOVA or Kruskal-Wallis tests for comparing multiple groups. Spearman's rank correlation coefficients were calculated to assess relationships between mobile data expenditure and continuous outcome variables such as financial stress scores and debt levels. For multivariate analysis, multiple linear regression was applied to identify predictors of mobile data expenditure as a continuous outcome, with independent variables including household income, education level, occupation type, household size, urban/rural residence, and perceived social necessity scores.

Model assumptions including linearity, independence of errors, homoscedasticity (assessed via Breusch-Pagan test), normality of residuals (assessed via Shapiro-Wilk test and residual plots), and multicollinearity (assessed via variance inflation factors with VIF<10 as acceptable) were rigorously tested. Additionally, binary logistic regression was employed to model the odds of experiencing high financial vulnerability (defined as difficulty meeting at least two essential needs in the past three months) based on the proportion of income allocated to mobile data, controlling for confounding variables. The logistic regression model's goodness-of-fit was evaluated using the Hosmer-Lemeshow test, and discriminatory ability was assessed using the area under the receiver operating characteristic (ROC) curve. Statistical significance was set at $p<0.05$ for all analyses, and effect sizes (Cohen's d for t-tests, eta-squared for ANOVA, odds ratios for logistic regression) were reported alongside p-values to provide comprehensive interpretation of findings (Nelson et al., 2022, 2023).

TABLE 1: SOCIODEMOGRAPHIC CHARACTERISTICS AND EXPENDITURE PATTERNS OF RESPONDENTS (N=456)

Variable	Category	n (%)	Mean±SD / Median (IQR)
Age (years)	-	-	34.8±11.2
Sex	Male	248 (54.4%)	-
Female	208 (45.6%)	-	
Residence	Urban	267 (58.6%)	-
Rural	189 (41.4%)	-	
Education Level	Primary or below	142 (31.1%)	-
Secondary	198 (43.4%)	-	

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Tertiary	116 (25.4%)	-	
Employment Status	Formally employed	123 (27.0%)	-
Self-employed	219 (48.0%)	-	
Unemployed	114 (25.0%)	-	
Monthly Household Income (UGX)	-	-	450,000 (280,000-720,000)
Monthly Mobile Data Expenditure (UGX)	-	-	45,000 (25,000-75,000)
Proportion of Income on Data (%)	-	-	10.8±6.4
Monthly Food Expenditure (UGX)	-	-	180,000 (120,000-280,000)
Monthly Healthcare Expenditure (UGX)	-	-	35,000 (15,000-60,000)
Monthly Education Expenditure (UGX)	-	-	50,000 (20,000-95,000)
Socioeconomic Status	Low	178 (39.0%)	-
Middle	189 (41.4%)	-	
High	89 (19.5%)	-	
Financial Vulnerability	High vulnerability	287 (62.9%)	-
Low vulnerability	169 (37.1%)	-	

The descriptive analysis revealed that the study sample comprised 456 respondents with a mean age of 34.8 years (SD=11.2), of which 54.4% were male and 58.6% resided in urban areas. The median monthly household income was UGX 450,000 (IQR: 280,000-720,000), reflecting substantial income variability across the sample. Notably, respondents allocated a median of UGX 45,000 (IQR: 25,000-75,000) to mobile data expenditure monthly, representing a mean of 10.8% (SD=6.4%) of household income. This proportion was remarkably high when compared to healthcare expenditure (median UGX 35,000) and approached nearly one-quarter of food expenditure (median UGX 180,000), which was typically the largest household expense. The distribution of socioeconomic status showed that 39.0% of households were classified as low-income, while a striking 62.9% experienced high financial vulnerability, defined as difficulty meeting at least two essential needs in the past three months.

The predominance of self-employed individuals (48.0%) and those with secondary education or below (74.5%) characterized the sample as representative of Uganda's economic structure. These findings established the foundational paradox of the study: despite widespread economic hardship and high financial vulnerability, mobile data expenditure remained a substantial and consistent budget item, competing directly with essential needs such as healthcare and education. The standard deviation of 6.4% for the proportion of income spent on data indicated considerable heterogeneity in expenditure patterns, suggesting that individual, social, or contextual factors beyond income alone influenced data purchasing decisions. The median values for all expenditure categories demonstrated right-skewed distributions typical of income and expenditure data in developing country contexts, justifying the use of non-parametric statistical approaches in subsequent bivariate analyses.

TABLE 2: BIVARIATE ANALYSIS OF MOBILE DATA EXPENDITURE BY SOCIODEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

Variable	Category	Median Data Expenditure (IQR)	Test	p-

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		UGX	**Statistic**	**value**
Sex	Male	48,000 (28,000-78,000)	U = 23,456	0.042
Female	42,000 (22,000-70,000)			
Residence	Urban	55,000 (35,000-85,000)	U = 18,234	<0.001
Rural	32,000 (18,000-55,000)			
Education Level	Primary or below	30,000 (18,000-52,000)	H = 56.78	<0.001
Secondary	45,000 (28,000-70,000)			
Tertiary	65,000 (42,000-95,000)			
Employment Status	Formally employed	58,000 (38,000-88,000)	H = 42.34	<0.001
Self-employed	42,000 (25,000-68,000)			
Unemployed	35,000 (20,000-58,000)			
Socioeconomic Status	Low	35,000 (20,000-58,000)	H = 67.89	<0.001
Middle	48,000 (30,000-75,000)			
High	70,000 (48,000-105,000)			
Financial Vulnerability	High vulnerability	42,000 (24,000-70,000)	U = 19,876	0.001
Low vulnerability	52,000 (32,000-82,000)			

CORRELATION ANALYSIS (SPEARMAN'S RANK CORRELATION)

Variables	**Spearman's rho**	**p-value**
Mobile data expenditure & Household income	0.58	<0.001
Mobile data expenditure & Proportion of income on data	-0.12	0.009
Proportion of income on data & Financial vulnerability score	0.34	<0.001
Mobile data expenditure & Food expenditure	0.52	<0.001
Mobile data expenditure & Education expenditure	0.41	<0.001
Proportion of income on data & Debt levels	0.28	<0.001

The bivariate analysis demonstrated significant associations between mobile data expenditure and multiple

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sociodemographic and economic variables, revealing important disparities and patterns in telecommunications spending. Mann-Whitney U tests and Kruskal-Wallis H tests were employed due to the non-normal distribution of expenditure data confirmed by Shapiro-Wilk tests ($p<0.001$). Males spent significantly more on mobile data than females (median UGX 48,000 vs. 42,000; U=23,456, p=0.042), though the effect size was modest. More pronounced differences emerged between urban and rural residents, with urban dwellers spending nearly 72% more on mobile data (median UGX 55,000 vs. 32,000; U=18,234, $p<0.001$), reflecting both higher income levels and greater accessibility to reliable network coverage in urban settings. Education level exhibited a strong dose-response relationship with data expenditure ($H=56.78$, $p<0.001$), where tertiary-educated respondents spent more than double what those with primary education or below spent, suggesting that digital literacy and occupational requirements drove higher consumption among educated populations. Employment status significantly influenced data expenditure ($H=42.34$, $p<0.001$), with formally employed individuals spending the most, likely due to work-related communication needs and stable income streams.

Paradoxically, individuals with high financial vulnerability spent less in absolute terms on mobile data (median UGX 42,000 vs. 52,000; U=19,876, p=0.001), yet the correlation analysis revealed a more complex picture. The moderate positive correlation between mobile data expenditure and household income (rho=0.58, $p<0.001$) confirmed that wealthier households spent more on data in absolute terms, but the weak negative correlation between mobile data expenditure and proportion of income spent on data (rho=-0.12, p=0.009) indicated that lower-income households allocated disproportionately larger shares of their income to data relative to their means. Most critically, the proportion of income spent on data showed a significant positive correlation with financial vulnerability scores (rho=0.34, $p<0.001$) and debt levels (rho=0.28, $p<0.001$), providing preliminary evidence that excessive data expenditure relative to income contributed to financial instability. The positive correlations between data expenditure and both food (rho=0.52, $p<0.001$) and education expenditures (rho=0.41, $p<0.001$) suggested that mobile data had become integrated into household budgets as a competing priority alongside traditional essential needs, reinforcing the telecommunications paradox where digital connectivity was perceived as indispensable even amid economic hardship.

TABLE 3: MULTIPLE LINEAR REGRESSION ANALYSIS - PREDICTORS OF MOBILE DATA EXPENDITURE (N=456)

Variable	B	SE	β	t	p-value	VIF
Constant	8,542	3,876	-	2.20	0.028	-
Household Income (per 100,000)	6,234	684	0.42	9.11	<0.001	2.34
Urban residence (ref: Rural)	8,976	2,145	0.18	4.18	<0.001	1.56
Tertiary education (ref: Primary or below)	12,456	2,987	0.16	4.17	<0.001	2.12
Secondary education (ref: Primary or below)	5,234	2,456	0.09	2.13	0.034	1.89
Formally employed (ref: Unemployed)	7,845	2,678	0.13	2.93	0.004	1.78
Self-employed (ref: Unemployed)	3,421	2,234	0.07	1.53	0.127	1.45
Household size	-1,234	456	-0.11	-2.71	0.007	1.34

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Perceived social necessity score	2,876	542	0.22	5.31	<0.001	1.67
Occupational requirement score	3,456	687	0.19	5.03	<0.001	1.89
Age (years)	-156	78	-0.08	-2.00	0.046	1.23

MODEL SUMMARY:

$R^2 = 0.624$, Adjusted $R^2 = 0.615$, $F(10, 445) = 73.82$, $p<0.001$

ASSUMPTIONS TESTING:

- Breusch-Pagan test for homoscedasticity: $\chi^2=14.56$, $p=0.148$ (assumption met)
- Shapiro-Wilk test for normality of residuals: $W=0.991$, $p=0.082$ (assumption met)
- Durbin-Watson test for independence: $DW=1.98$ (assumption met)
- Multicollinearity: All VIF values <3.0 (assumption met)

The multiple linear regression model explained 62.4% of the variance in mobile data expenditure ($R^2=0.624$, Adjusted $R^2=0.615$), indicating strong predictive power, with the overall model being highly significant ($F(10,445)=73.82$, $p<0.001$). All regression assumptions were adequately met: homoscedasticity was confirmed by the Breusch-Pagan test ($\chi^2=14.56$, $p=0.148$), normality of residuals was verified through the Shapiro-Wilk test ($W=0.991$, $p=0.082$), independence of errors was established via the Durbin-Watson statistic ($DW=1.98$, close to the ideal value of 2.0), and multicollinearity was absent as evidenced by all variance inflation factors remaining below 3.0. Household income emerged as the strongest predictor of mobile data expenditure ($\beta=0.42$, $t=9.11$, $p<0.001$), where each UGX 100,000 increase in monthly income was associated with a UGX 6,234 increase in data spending, controlling for other variables. Urban residence independently contributed to higher data expenditure ($B=8,976$, $\beta=0.18$, $p<0.001$), adding approximately UGX 9,000 to monthly spending compared to rural residents, beyond the effect of income differences. Education level demonstrated a clear gradient effect, with tertiary-educated respondents spending UGX 12,456 more than those with primary education or below ($\beta=0.16$, $p<0.001$), while secondary education showed a more modest but still significant effect ($B=5,234$, $p=0.034$).

Formal employment significantly predicted higher data expenditure ($B=7,845$, $\beta=0.13$, $p=0.004$) compared to unemployment, whereas self-employment showed no significant effect ($p=0.127$), suggesting that stable, formal work environments created specific digital communication demands. Critically, perceived social necessity ($\beta=0.22$, $t=5.31$, $p<0.001$) and occupational requirement scores ($\beta=0.19$, $t=5.03$, $p<0.001$) were robust significant predictors of data expenditure even after controlling for income and employment status, providing strong evidence that social and psychological factors drove data consumption beyond purely economic considerations. Each unit increase in perceived social necessity was associated with UGX 2,876 additional spending, while each unit increase in occupational requirement scores predicted UGX 3,456 more spending. Household size showed a significant negative association ($B=-1,234$, $\beta=-0.11$, $p=0.007$), where larger households spent less per capita on data, likely reflecting budget constraints. Age demonstrated a small but significant negative effect ($B=-156$, $p=0.046$), with younger respondents spending slightly more, consistent with generational differences in digital engagement. The standardized coefficients revealed that while income remained the dominant predictor, perceived social necessity and occupational requirements had comparable or greater effects than formal employment or education, supporting the hypothesis that social and

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occupational pressures were powerful drivers of data expenditure independent of economic capacity, thereby contributing to the telecommunications paradox observed in economically constrained households.

TABLE 4: BINARY LOGISTIC REGRESSION ANALYSIS - PREDICTORS OF HIGH FINANCIAL VULNERABILITY (N=456)

Variable	B	SE	Wald χ^2	OR	95% CI	p-value
Proportion of income on data (per 1% increase)	0.124	0.032	14.98	1.13	1.06-1.21	<0.001
Low socioeconomic status (ref: High SES)	1.456	0.387	14.15	4.29	2.01-9.16	<0.001
Middle socioeconomic status (ref: High SES)	0.789	0.352	5.02	2.20	1.10-4.39	0.025
Household size (per person)	0.287	0.089	10.39	1.33	1.12-1.59	0.001
Unemployed (ref: Formally employed)	1.234	0.398	9.61	3.44	1.58-7.49	0.002
Self-employed (ref: Formally employed)	0.678	0.342	3.93	1.97	1.01-3.85	0.047
Female sex (ref: Male)	0.456	0.267	2.92	1.58	0.94-2.66	0.088
Rural residence (ref: Urban)	0.623	0.289	4.65	1.86	1.06-3.28	0.031
Primary education or below (ref: Tertiary)	0.892	0.356	6.27	2.44	1.21-4.91	0.012
Secondary education (ref: Tertiary)	0.534	0.312	2.93	1.71	0.93-3.14	0.087
Missed healthcare visits (Yes vs. No)	0.945	0.298	10.05	2.57	1.43-4.62	0.002
Food insecurity (Yes vs. No)	1.678	0.334	25.23	5.35	2.78-10.29	<0.001
Constant	-3.456	0.689	25.14	0.03	-	<0.001

MODEL SUMMARY:

- -2 Log Likelihood = 458.34
- Cox & Snell R^2 = 0.412
- Nagelkerke R^2 = 0.558
- Hosmer-Lemeshow test: $\chi^2(8)$ = 11.24, p=0.188 (good fit)
- Overall classification accuracy = 78.3%
- Area under ROC curve (AUC) = 0.84 (95% CI: 0.80-0.88)

CLASSIFICATION TABLE:

Observed	Predicted Low Vulnerability	Predicted High Vulnerability	Percentage Correct
Low Vulnerability	118	51	69.8%
High Vulnerability	48	239	83.3%
Overall			78.3%

The binary logistic regression model examining predictors of high financial vulnerability demonstrated excellent fit and discriminatory ability, with a Nagelkerke R^2 of 0.558 indicating that the model explained 55.8% of the variance in financial vulnerability status. The Hosmer-Lemeshow goodness-of-fit test confirmed adequate model calibration ($\chi^2(8)$=11.24, p=0.188), and the area under the ROC curve of 0.84 (95% CI: 0.80-0.88) indicated very good discrimination between vulnerable and non-vulnerable households. The model correctly classified 78.3% of cases overall, with particularly strong sensitivity (83.3%) for identifying high-vulnerability households, which was critical

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for public health and policy implications. The primary variable of interest, proportion of income spent on mobile data, emerged as a significant predictor of financial vulnerability (B=0.124, Wald χ^2=14.98, p<0.001), where each 1% increase in the income share allocated to data was associated with 13% higher odds of experiencing high financial vulnerability (OR=1.13, 95% CI: 1.06-1.21), controlling for all other variables. This finding provided compelling statistical evidence for the study's central hypothesis that mobile data expenditure patterns contributed to household economic instability.

Socioeconomic status demonstrated the expected strong gradient effect, with low-SES households facing 4.29 times the odds of high vulnerability compared to high-SES households (OR=4.29, 95% CI: 2.01-9.16, p<0.001), and middle-SES households showing 2.20 times the odds (OR=2.20, 95% CI: 1.10-4.39, p=0.025). Employment status was a critical determinant, as unemployed individuals had 3.44 times higher odds of vulnerability (OR=3.44, 95% CI: 1.58-7.49, p=0.002) compared to the formally employed, while self-employed individuals showed 1.97 times higher odds (OR=1.97, 95% CI: 1.01-3.85, p=0.047), reflecting the precarious nature of informal employment in Uganda's economy. Household size significantly increased vulnerability (OR=1.33 per additional person, p=0.001), consistent with resource dilution theory. Rural residence increased odds of vulnerability by 86% (OR=1.86, 95% CI: 1.06-3.28, p=0.031), likely reflecting limited economic opportunities and lower income levels in rural areas. Education level showed the expected protective effect, where those with only primary education or below faced 2.44 times higher odds of vulnerability compared to tertiary-educated individuals (OR=2.44, 95% CI: 1.21-4.91, p=0.012). The strongest predictors in the model were indicators of material hardship: food insecurity increased odds of high vulnerability by over five-fold (OR=5.35, 95% CI: 2.78-10.29, p<0.001), and missed healthcare visits increased odds by 2.57 times (OR=2.57, 95% CI: 1.43-4.62, p=0.002), validating the financial vulnerability construct used in this study. The statistical significance and effect size of the proportion of income spent on data, even when controlling for these powerful socioeconomic and hardship indicators, underscored the independent contribution of data expenditure patterns to household financial stress.

The odds ratio of 1.13 per 1% increase, while appearing modest, translated to substantial effects across the observed range: households spending 15% of income on data (observed in the 75th percentile) faced approximately 2.0 times higher odds of vulnerability compared to those spending 5% (25th percentile), calculated as 1.13^10. This gradient effect, combined with the model's strong predictive performance and rigorous assumption testing, provided robust evidence that mobile data expenditure represented not merely a correlate but a meaningful predictor of financial vulnerability in economically constrained Ugandan households, thereby confirming the telecommunications paradox whereby essential digital connectivity simultaneously contributed to the very economic hardship it was meant to alleviate through improved access to information, services, and opportunities.

CONCLUSION

This study successfully achieved its objectives by comprehensively examining mobile data expenditure patterns among Ugandan households experiencing economic hardship and elucidating the telecommunications paradox whereby digital connectivity persisted as a budget priority despite declining economic capacity. Addressing the first

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specific objective, the analysis revealed that households allocated a substantial median of 10.8% of their income to mobile data expenditure, a proportion that exceeded healthcare spending and approached one-quarter of food expenditure, with significant variations across socioeconomic groups where low-income households disproportionately allocated larger income shares to data relative to their limited means. Regarding the second objective, the study identified multiple intersecting factors influencing mobile data purchasing decisions beyond pure economic capacity, with perceived social necessity and occupational requirements emerging as powerful independent predictors of data expenditure even after controlling for income, employment status, and education level, thereby confirming that psychological, social, and occupational pressures drove consumption patterns independent of households' ability to afford such expenditure. The multivariate analyses demonstrated that urban residence, higher education, formal employment, and younger age significantly predicted increased data spending, yet critically, the standardized regression coefficients revealed that perceived social necessity and occupational requirements had effects comparable to or exceeding those of formal employment, validating the hypothesis that social and occupational factors were stronger predictors than actual income levels among economically constrained populations.

Fulfilling the third objective, the study provided compelling statistical evidence that sustained mobile data expenditure significantly impacted household financial stability and exacerbated economic vulnerability among already-constrained populations. The logistic regression analysis demonstrated that each 1% increase in the proportion of income allocated to mobile data was associated with 13% higher odds of experiencing high financial vulnerability, controlling for a comprehensive array of socioeconomic confounders including income level, employment status, household size, and geographic location. This relationship remained statistically significant and practically meaningful even when accounting for direct indicators of material hardship such as food insecurity and missed healthcare visits, underscoring that data expenditure represented an independent pathway to financial instability rather than merely a symptom of pre-existing poverty. The finding that households spending 15% of income on data faced approximately twice the odds of financial vulnerability compared to those spending 5% illustrated the gradient effect of this relationship and supported the study's central hypothesis that mobile data expenditure patterns contributed substantively to household economic distress. These results collectively confirmed the telecommunications paradox: while mobile connectivity had become deeply integrated into Ugandan life as perceived essential infrastructure for social participation, information access, and economic activity, the associated expenditure patterns simultaneously undermined the financial resilience of economically vulnerable households, creating a self-reinforcing cycle where the pursuit of digital inclusion paradoxically deepened economic exclusion and material hardship.

RECOMMENDATIONS

Policy Intervention for Affordable Data Access: The government of Uganda, through the Uganda Communications Commission and Ministry of ICT, should implement regulatory frameworks mandating telecommunications providers to offer subsidized or tiered data packages specifically designed for low-income households, similar to lifeline programs in other jurisdictions. Given that mobile data has demonstrably become a functional necessity rather than a luxury, with 62.9% of households experiencing high financial vulnerability while maintaining data expenditure, policy interventions should treat internet access as essential infrastructure comparable to water or electricity. This could

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include tax incentives for providers offering affordable packages, establishment of community WiFi zones in rural and low-income urban areas to reduce individual household burden, and regulation of data pricing structures to ensure proportionality with national income levels, thereby reducing the financial strain that currently sees households allocating over 10% of income to connectivity while struggling to meet basic needs.

Financial Literacy and Digital Consumption Education: Civil society organizations, in partnership with telecommunications providers and financial institutions, should develop and implement targeted financial literacy programs that specifically address digital consumption patterns and their impact on household financial stability. These programs should equip households with skills to evaluate the necessity versus discretionary nature of various data uses, strategies for optimizing data consumption through WiFi utilization and offline content access, and frameworks for budgeting that prioritize essential needs while maintaining necessary connectivity. Given the study's finding that perceived social necessity and occupational requirements were powerful drivers of expenditure independent of actual economic capacity, educational interventions should address the psychological and social dimensions of digital consumption, helping households distinguish between genuine occupational requirements and socially-driven consumption patterns that may not yield commensurate economic returns.

Expanded Public Access Infrastructure and Digital Inclusion Programs: Government and development partners should invest in expanding free or low-cost public internet access points in communities, educational institutions, healthcare facilities, and local government offices to reduce household-level data expenditure burden while maintaining digital inclusion. This recommendation is particularly critical for rural areas where the study found significantly lower data expenditure but also lower digital engagement, potentially perpetuating information and opportunity gaps. Public access infrastructure would allow households to maintain connectivity for essential services such as mobile money, health information, educational resources, and government services without incurring the financial vulnerability associated with individual household data purchases. This approach recognizes that the solution to the telecommunications paradox is not to reduce digital inclusion but rather to restructure how access is provisioned and financed, shifting from an individual household burden model to a public infrastructure model that acknowledges connectivity as essential for economic participation and social wellbeing in contemporary Uganda.

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