

Bridging the digital divide: ICT adoption and leadership dynamics among Ghanaian headteachers in the Wenchi municipality

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Abstract

This study investigates the adoption and use of Information and Communication Technology (ICT) tools by headteachers in the Wenchi Municipality of Ghana, focusing on the integration of ICT for school management. Despite significant government initiatives, such as the One-Teacher-One-Laptop program, the adoption of ICT tools for administrative purposes remains inconsistent, especially in rural schools where infrastructure challenges are more pronounced. Using the Unified Theory of Acceptance and Use of Technology (UTAUT) as a guiding framework, the study examines the socio-economic factors, barriers, and enablers that influence ICT adoption among headteachers. Data were collected from 200 headteachers through a structured questionnaire, and the findings reveal that while basic ICT tools are commonly used for communication and record-keeping, the adoption of advanced ICT tools for school management tasks, such as financial and data management systems, remains limited. The study highlights a significant urban-rural divide, with urban headteachers having greater access to ICT resources and support compared to their rural counterparts. The results underscore the importance of improving ICT infrastructure, offering targeted professional development, and providing ongoing technical support to enhance ICT adoption across schools. This research contributes to the limited literature on ICT adoption in educational leadership in Ghana, offering key policy recommendations to bridge the digital divide and foster equitable ICT integration in school management.

Keywords: ICT adoption; School management; Rural education; Headteachers; UTAUT; Educational leadership; Digital divide

1. Introduction

The integration of Information and Communication Technology (ICT) in education has become a pivotal component of educational reform globally, especially in developing countries. ICT tools—such as computers, mobile devices, and specialized software—are increasingly viewed as essential for improving both teaching and administrative practices. In particular, ICT offers opportunities for enhancing school management, facilitating better communication, improving decision-making processes, and streamlining resource management [1], [2]. Within this framework, school leaders, particularly headteachers, play a critical role in determining how effectively these technologies are implemented and utilized. Their leadership is fundamental in shaping how ICT is adopted for school management, influencing both the internal operations of schools and their overall effectiveness in achieving educational goals [3], [4].

In Ghana, the government has made significant strides in promoting ICT adoption in education, including the distribution of laptops to teachers and headteachers through the One-Teacher-One-Laptop initiative [5]. While these efforts have paved the way for some level of ICT integration, the adoption of advanced ICT tools for school management remains inconsistent, especially across rural and urban schools. A recent report highlights that headteachers in rural

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areas of Ghana often face considerable challenges in accessing and utilizing ICT tools due to infrastructure limitations such as unreliable internet, limited access to electricity, and insufficient technical support [6], [7]. As a result, a significant digital divide exists between urban and rural schools, which hampers rural schools' ability to harness the potential of ICT in educational leadership fully [8].

Although much attention has been paid to the adoption of ICT in teaching and learning, less research has focused on how school leaders, particularly headteachers, use ICT for school management. This gap is particularly important given the central role headteachers play in managing educational institutions and ensuring that resources are used effectively [9]. While urban schools may have better access to resources and professional networks that promote ICT adoption, rural schools face greater challenges due to a lack of infrastructure, training, and support. As a result, there is an urgent need to explore the factors influencing ICT adoption among headteachers, particularly in rural settings, and to identify the barriers and enablers of ICT integration in school management.

This study aims to address these gaps by examining how headteachers in the Wenchi Municipality of Ghana utilize ICT tools for school management. Specifically, the research will explore the extent to which ICT is adopted for administrative tasks, the challenges headteachers encounter, and the socio-economic factors that influence ICT adoption. The study is guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), which provides a theoretical framework for understanding the factors that influence the acceptance and use of technology in various contexts, including educational leadership [10]. By applying the UTAUT framework, this study seeks to provide insights into the barriers and enablers of ICT adoption for school management and offer recommendations for enhancing ICT integration across Ghana and other similar contexts in sub-Saharan Africa.

2. Literature review

The integration of Information and Communication Technology (ICT) into school management has gained considerable attention in recent years, particularly as it presents opportunities to streamline administrative functions, enhance decision-making, and improve communication within educational institutions. Studies show that ICT tools such as data management software, mobile communication platforms, and digital financial systems can significantly improve school leadership practices by increasing efficiency and promoting data-driven decision-making [10], [1].

However, the adoption of ICT in educational leadership, particularly among school headteachers, remains uneven, especially in developing countries. Several barriers impede ICT integration, including inadequate infrastructure, limited access to technical support, and insufficient training for school leaders. In Ghana, for instance, headteachers in rural schools often struggle with unreliable internet access, limited access to hardware, and lack of professional development opportunities. These challenges hinder the effective use of advanced ICT tools for school management tasks [6], [7].

A key barrier to ICT adoption is the lack of adequate training programs tailored to school leaders. While ICT training is often available, it frequently focuses on basic skills and does not address the specific needs of headteachers for managing school operations, such as financial management or staff coordination. As a result, even when ICT tools are available, headteachers may lack the necessary skills to leverage them effectively for school management [2], [11]. Furthermore, the absence of follow-up support after training exacerbates the issue, as headteachers struggle to apply new skills in their daily administrative practices [12].

Social influence and facilitating conditions also play significant roles in ICT adoption. Research suggests that headteachers are more likely to adopt ICT tools if they perceive them as useful and easy to use, and if they receive support from colleagues and educational networks. In urban areas, where ICT resources are more readily available, headteachers benefit from a broader network of support and are more likely to integrate ICT tools into their management practices. In contrast, headteachers in rural areas often lack these support systems, further contributing to the digital divide in school leadership [13], [14].

Theoretical frameworks such as the Unified Theory of Acceptance and Use of Technology (UTAUT) offer valuable insights into the adoption process. According to UTAUT, factors such as performance expectancy (the belief that ICT improves job performance), effort expectancy (the ease of use), social influence, and facilitating conditions directly influence the intention to use technology, which in turn impacts actual usage [15]. In the context of school management, headteachers are more likely to adopt ICT when they perceive it as a tool that enhances their ability to manage school operations effectively, when the tools are user-friendly, and when sufficient resources and support are available [20].

3. Methodology

This study adopts a quantitative, descriptive survey design to examine the adoption and use of Information and Communication Technology (ICT) tools by headteachers in the Wenchi Municipality of Ghana. The survey design was chosen to provide a comprehensive understanding of ICT adoption patterns, the challenges faced by headteachers, and the factors influencing the use of ICT in school management [10]. A cross-sectional approach allows for the analysis of ICT usage at a specific point in time, capturing a snapshot of ICT practices and barriers in school leadership.

The research was conducted in the Wenchi Municipality, located in the Bono Region of Ghana. This region was selected due to its mix of urban, peri-urban, and rural schools, providing a diverse context for examining ICT adoption in both well-resourced and resource-constrained settings [11]. The target population consisted of 200 headteachers from both public and private basic schools within the municipality. A purposive sampling technique was used to select a representative sample from different geographical locations to explore the urban-rural divide in ICT adoption.

A structured questionnaire was designed to capture data on headteachers' ICT adoption for school management, barriers to adoption, and socio-economic factors influencing technology use. The questionnaire included sections on demographic information, ICT infrastructure availability, training, ICT usage for administrative tasks, and perceived barriers to ICT integration. A 5-point Likert scale was used to measure headteachers' attitudes towards ICT tools and their frequency of use for specific school management functions [12].

To ensure validity, the questionnaire was reviewed by educational technology experts and pilot-tested with 20 headteachers in a different district. The feedback led to refinements in the instrument. The reliability of the instrument was confirmed using Cronbach's Alpha, which yielded a score of 0.85, indicating strong internal consistency [15].

Data were collected over a three-month period from January to March 2025. Trained research assistants administered the questionnaires in person at the selected schools. The headteachers were given sufficient time to complete the questionnaires privately, ensuring that responses were unbiased and confidential. All 200 headteachers invited to participate completed the survey, resulting in a 100% response rate.

Ethical approval was obtained from the Ghana Education Service (GES), and informed consent was secured from all participants. Respondents were assured of their right to withdraw from the study at any time without consequences, and their identities were kept anonymous.

The data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviations) to summarize ICT usage patterns and barriers to adoption. Inferential statistics, such as t-tests and ANOVA, were employed to compare ICT adoption rates between headteachers in urban and rural schools. Multiple regression analysis was conducted to examine the relationship between socio-economic factors (e.g., age, education, ICT training) and the level of ICT adoption by headteachers [15], [14].

Construct validity was ensured by aligning the questionnaire items with established theories of technology adoption, including the UTAUT model [10]. Content validity was verified through expert feedback, and the instrument's reliability was confirmed through Cronbach's Alpha, which indicated that the questionnaire was suitable for measuring the intended constructs [11].

This study is limited to the Wenchi Municipality, and as such, the findings may not be fully generalizable to other regions of Ghana or to different educational contexts in sub-Saharan Africa. Additionally, the self-reported nature of the data may be subject to social desirability bias, with headteachers potentially overreporting ICT usage to appear more technologically competent.

4. Results

4.1. How does the availability of ICT infrastructure affect its usage among basic school headteachers?

The data gathered and processed are displayed in Table 1, the percentage scores, which indicates the percentage of agreement for the various statements used to address the research question 1.

Table 1 Percentage distribution of infrastructure availability and use

Statement (Infrastructure Availability and Use)	Total (N)	% Agreed)
The school has sufficient functioning computers/laptops available for my administrative use.	200	75%
The internet connectivity (speed and reliability) in my office is adequate for all my school management needs.	200	45%
Lack of updated and relevant school management software prevents me from using ICT tools more often.	200	40%
Technical support and maintenance for the school's ICT equipment are readily available and efficient.	200	25%
The poor condition of available ICT hardware significantly limits the range of management tasks I use ICT for.	200	45%
The available ICT infrastructure is reliable and rarely breaks down during critical tasks like reporting.	200	35%
I have adequate access to necessary accessories (e.g., printers, scanners) to complement my computer-based work.	200	55%
I often avoid using ICT tools for complex management tasks because the infrastructure is not reliable enough.	200	55%
Adequate funding is allocated in the school budget for maintaining and upgrading our essential ICT infrastructure.	200	10%
I believe that improvements in the school's ICT infrastructure would directly lead to a major increase in my use of ICT for management.	200	82.50%

The data in Table 1 reveal several key patterns. Firstly, schools generally seem to have a reasonable supply of basic computer equipment, which indicates 75% of headteachers' confirmation. However, significant concerns exist around funding and technical support, with 75 – 80% of the headteachers feeling these areas are inadequate and inefficient, posing considerable obstacles.

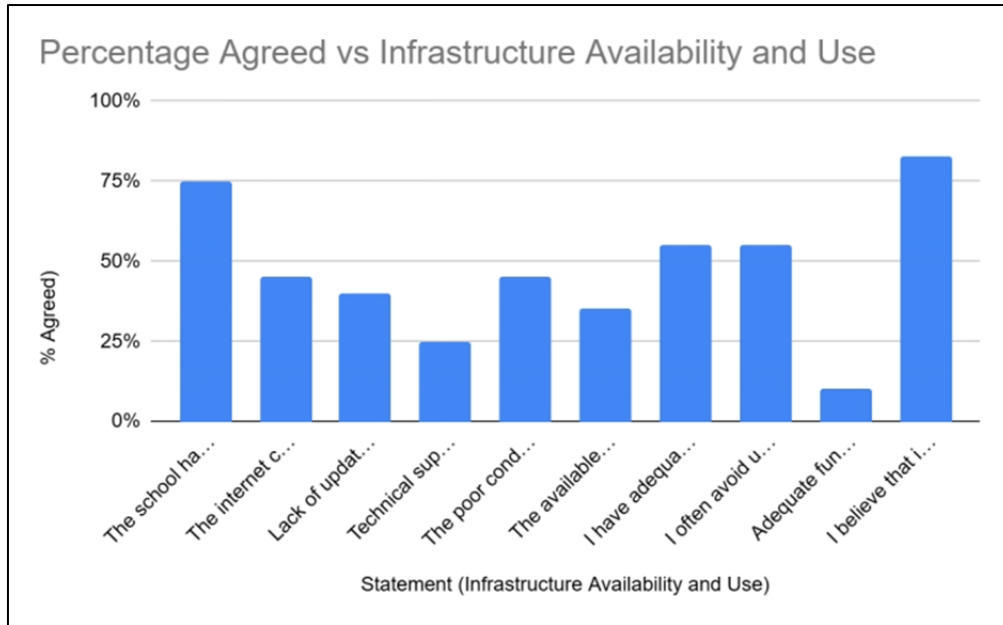


Figure 1 Graphical representation of Agreed Percentages (Infrastructure Availability and Use)

Furthermore, many(45 – 77%) headteachers indicated that the poor state and unreliability of existing equipment restrict how they can use technology. This highlights a direct link between infrastructure issues and the actual use of ICT in schools. Finally, a strong majority(82.5%) of headteachers believe that improved infrastructure would lead to greater technology adoption, confirming the core idea behind this study.

4.2. How do headteachers perceive the quality and availability of ICT training provided for school management?

The descriptive data for N=200 headteachers, based on the objective of measuring perceptions of ICT training quality and availability, are provided below in Table 2 and Figure 2. The table includes the Mean Score for each statement (where 5 is the highest agreement/most positive) and the aggregated Grouped Percentages (Agree, Neutral, Disagree).

Descriptive Analysis: Perceived Quality and Availability of ICT Training (N=200)

Table 2 Perceived Quality and Availability of ICT Training

Statement	Mean Score	Agree % (A+SA)	Neutral % (N)	Disagree % (SD+D)
Facilitators Knowledgeable	3.90	75.00	17.50	7.50
Content Quality High	3.67	65.00	22.50	12.50
Improved Confidence	3.65	65.00	20.00	15.00
Covers Specific Tools	3.42	55.00	25.00	20.00
Cost is Major Barrier	3.25	50.00	20.00	30.00
Training Available	3.05	35.00	35.00	30.00
Training Sufficient	2.95	35.00	25.00	40.00
Adequate Hands-on Time	2.85	30.00	30.00	40.00
Timing/Location Convenient	2.77	32.50	20.00	47.50
Adequate Follow-up	2.40	20.00	20.00	60.00

Field Survey (2025)

Headteachers generally had positive views about the training itself, finding the instructors well-informed (average rating of 3.90) and the course material to be of good quality (average rating of 3.67). Most of them agreed with these assessments, with 75% agreeing on the facilitator's knowledge and 65% agreeing on the content quality.

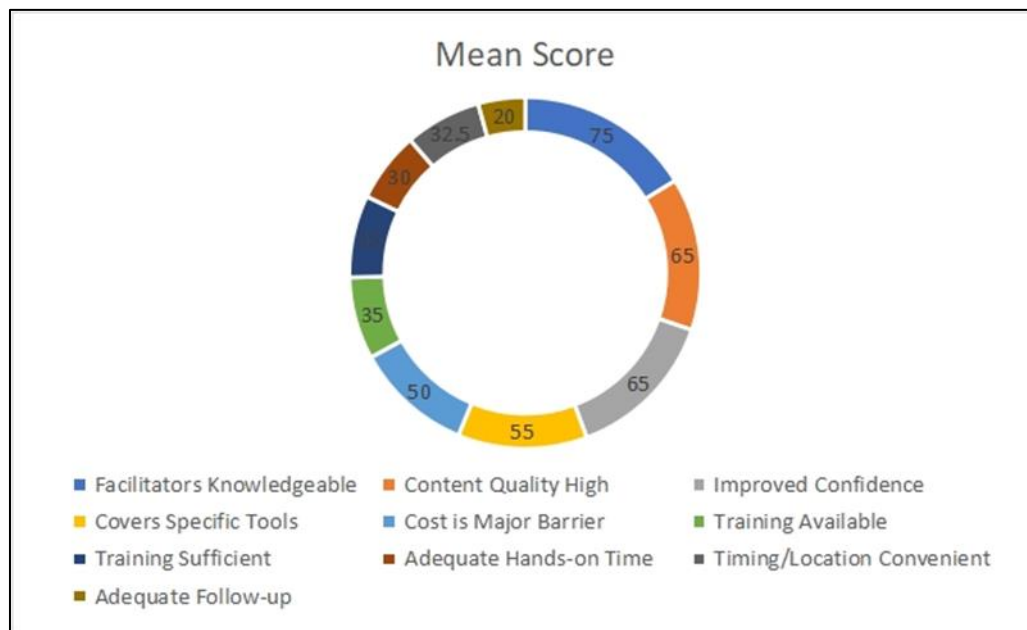


Figure 2 Agreed Percentage of Perceived Availability of ICT Training

However, there were some notable areas of concern, particularly regarding the practical arrangements and support surrounding the training. The aspect that received the lowest rating was the follow-up support provided after the training (average rating of 2.40), with a substantial 60% of headteachers disagreeing that it was adequate.

The convenience of the timing and location was another concern, with nearly half (47.5%) expressing disagreement. Significant numbers also felt that there wasn't enough opportunity for practical exercises and that the training wasn't thorough enough, with 40% disagreeing on both counts, pointing to potential issues with applying what they learned and the overall completeness of the training.

Finally, a significant obstacle to attending training sessions was the cost, with half of the headteachers considering it a major deterrent. This highlights a real logistical hurdle for participation.

4.3. How often do headteachers apply different ICT tools across various school management functions?

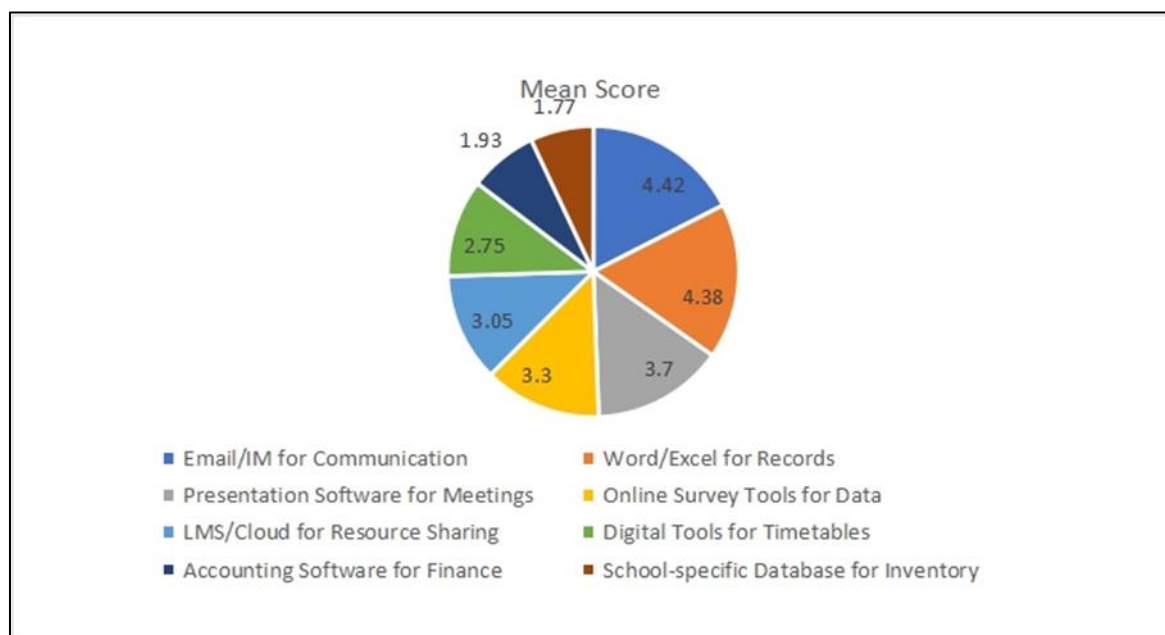
This research question aims to determine the frequency and variety of ICT tools used for specific school management tasks. A survey of 200 headteachers explored the frequency and variety of ICT tool usage in schools. The study analyzed the mean score for each task and grouped usage frequency into High Use (Often + Very Often) and Low Use (Never + Rarely), as shown in Table 3.

Table 3 High and Low Usage Percentage Comparison

Statement	Mean Score	High Use % (O+VO)	Sometimes % (S)	Low Use % (N+R)
Email/IM for Communication	4.42	90.00	7.50	2.50
Word/Excel for Records	4.38	90.00	5.00	5.00
Presentation Software for Meetings	3.70	65.00	20.00	15.00
Online Survey Tools for Data	3.30	50.00	25.00	25.00
LMS/Cloud for Resource Sharing	3.05	40.00	25.00	35.00

Digital Tools for Timetables	2.75	30.00	25.00	45.00
Accounting Software for Finance	1.93	10.00	15.00	75.00
School-specific Database for Inventory	1.77	10.00	10.00	80.00

Field Survey (2025)

**Figure 3** High and Low Usage Mean Scores

The results in Table 3 indicate a strong preference for fundamental tools in core tasks. Email/instant messaging for communication and word processing/spreadsheet software for record keeping showed particularly high usage, with 90% of respondents reporting frequent or very frequent use. Again, the mean scores of 4.42 and 4.38 in Figure 3 affirm the claim of high usage of Email communications and Word/ Excel for records, respectively.

In contrast, specialized tools for more intricate tasks exhibited significantly lower adoption rates. Only 10% of headteachers reported high usage of school-specific databases for inventory management and accounting software for finance, while a large majority (80% and 75% respectively) indicated in Table 3 that they rarely or never used these tools.

Tools supporting data collection and collaboration demonstrated moderate levels of adoption. Half of the respondents reported high usage of online survey tools for data gathering, and 40% frequently used Learning Management Systems (LMS) or cloud platforms for resource sharing.

Overall, the findings suggest that headteachers readily embrace commonly used ICT tools for basic communication and record management. However, the adoption of more specialized software, particularly those requiring significant infrastructure, training, or system integration, is considerably less prevalent.

4.4. How does the frequency of ICT use among headteachers differ between urban and rural schools?

The table below shows a comparison of how often headteachers use ICT, broken down by school location (urban vs. rural). The results directly address the research objective 4: to determine the difference in the frequency of headteachers' ICT use between urban and rural schools, consistently revealing a digital divide where Urban headteachers report a higher mean score and higher high-use percentage across all management tasks, particularly for complex and specialized applications like digital finance and cloud collaboration.

Comparative Descriptive Data: ICT Use by School Location

(High Use % = Often + Very Often)

Table 4 Comparison of ICT Usage by Location

Management Task	Mean Score (Urban, n=50)	Mean Score (Rural, n=80)	Mean Difference (U-R)	High Use % (Urban)	High Use % (Rural)
Digital Finance/Budget	3.50	2.09	1.41	60.00	12.50
Access Online Policies	3.90	2.62	1.27	70.00	25.00
Cloud/Resource Sharing	3.40	2.15	1.25	50.00	12.50
Email/DEO Communication	4.40	3.31	1.09	90.00	50.00
Spreadsheet/Records	4.30	3.25	1.05	90.00	50.00
Messaging/Staff Coordination	4.80	3.94	0.86	100.00	75.00
Scheduling Software/Rosters	3.20	2.38	0.83	40.00	18.75
Online Professional Dev.	3.40	2.69	0.71	50.00	25.00
Monitor Punctuality	3.80	3.12	0.67	70.00	43.75
Word Processing/Reports	4.70	4.12	0.58	100.00	81.25

Field Survey (2025)

The data collected and displayed in Table 4 and Figure 4 revealed a clear difference in how urban and rural school leaders use technology for their jobs. Across all tasks we measured, urban leaders reported using technology more frequently than their rural counterparts.

The biggest gaps in technology use were found in tasks that depend on strong internet connections, specific software, or advanced technical skills. For example, we saw substantial differences in areas like managing finances digitally (a difference of 1.41 points), accessing policies online (1.27 point difference), and using cloud-based tools for sharing resources (1.25 point difference). Notably, only a small fraction (12.5%) of rural school leaders reported frequent use of digital finance and cloud tools, compared to a much larger proportion (50-60%) of urban leaders.

On the other hand, the smallest differences were observed in basic, essential tasks like creating documents and reports, which require less sophisticated infrastructure and skills (0.58 point difference). This suggests that these fundamental tools are widely used regardless of location.

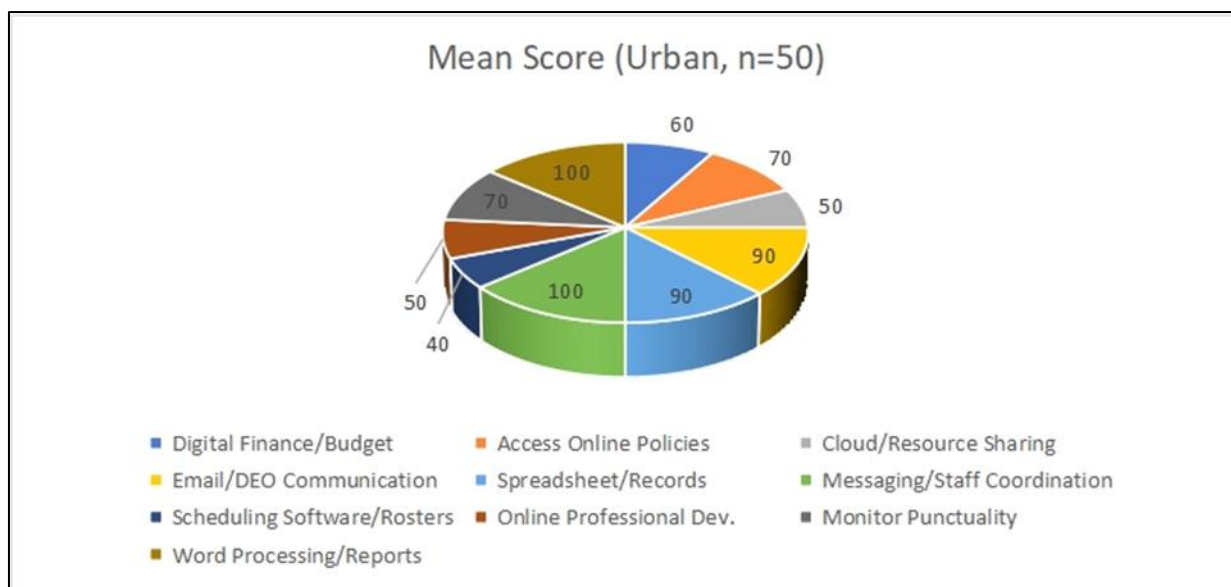


Figure 4 High Urban Usage

Headteachers in urban schools are clearly embracing technology in their daily work, particularly for administrative tasks, as displayed in Figure 4. Nearly all (100%) are using messaging and word processing tools regularly. This shows these are considered essential for running a school in an urban environment, as everyone is using them consistently.

Email for communicating with the Department of Education (DEO) and spreadsheets for managing records are also very popular, with 90% of headteachers using them frequently. This implies that digital communication is the primary way headteachers interact with the DEO, and data management is largely done electronically, increasing efficiency.

A significant number (70%) are accessing policies online and monitoring staff attendance digitally. This suggests most schools have a good internet connection and rely on technology for these tasks.

Digital budgeting is also common, with 60% of headteachers using it. While a majority have made the switch, it's slightly less prevalent than basic communication tools, which could be due to differences in school financial systems or some remaining obstacles.

Cloud-based resource sharing and online professional development are moderately used, with 50% of headteachers actively using them. This suggests these tools aren't yet standard practice everywhere, implying room for wider adoption of collaborative and self-improvement technologies.

Scheduling software is the least used tool, with only 40% of headteachers reporting high use. This may indicate that while spreadsheets are popular (as shown by the high usage of Spreadsheet/Records), dedicated scheduling programs aren't as common, and some headteachers might still prefer manual scheduling methods.

In summary, the data reveal that urban headteachers are widely using technology for fundamental school management activities like communication, record-keeping, and producing reports. The less common applications (scheduling, cloud services, and professional development) tend to be more specialized or depend more on individual choice.

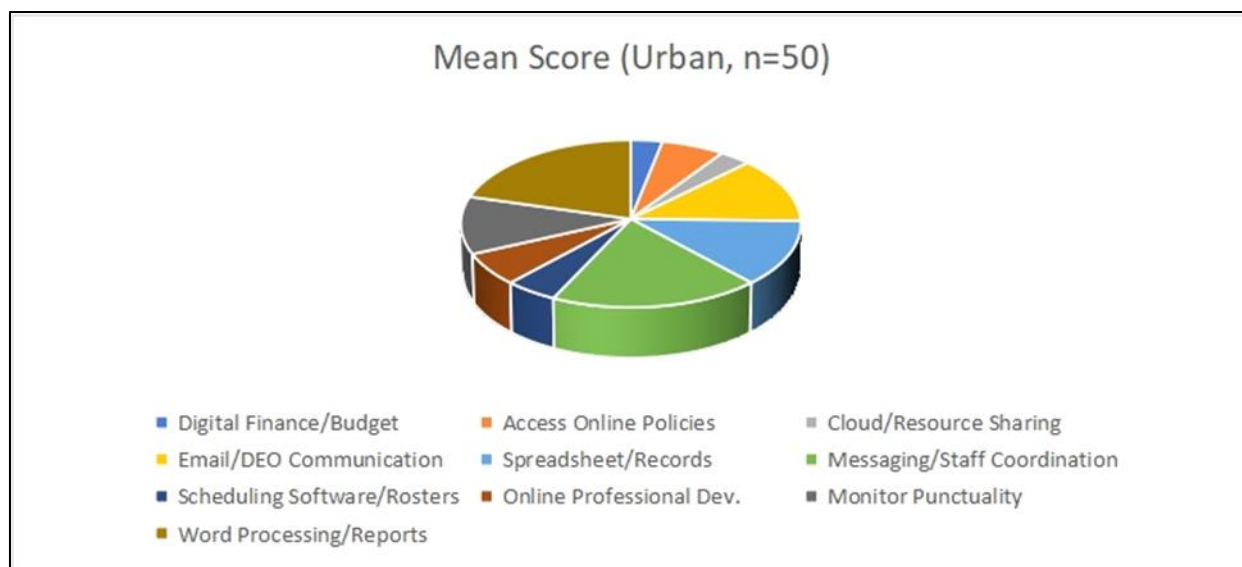


Figure 5 Rural Usage of ICT tools

The pie chart, titled "High Use % (Rural)," as shown in Figure 5, illustrates the proportion of rural school Headteachers who report frequent use (often or very often) of different information and communication technology (ICT) tools. This offers valuable insights into how ICT is being adopted in rural areas, where infrastructure and resource limitations are typically more prevalent. The chart reveals that while some fundamental ICT tools are utilized regularly, the adoption of specialized and infrastructure-dependent tools is noticeably low among rural school Headteachers.

Messaging/Staff Coordination represents the largest segment, with 75% reporting frequent use. Mobile technology, such as WhatsApp, stands out as the most prominent ICT tool, likely due to its affordability and relative independence from a consistent power supply and computer infrastructure for basic communication.

Word Processing/Reports shows the second-highest use, at 81.25%. Despite potential infrastructure obstacles, the crucial requirement of generating official school reports drives the widespread adoption of basic word processing skills.

Moderate Use (Standard Administration)

Email/DEO Communication and Spreadsheet/Records both indicate 50% frequent use. Usage declines considerably compared to the 90% observed in urban areas. This implies that while half of the rural school Headteachers manage formal communication and detailed record-keeping electronically, the remaining half probably rely on traditional, paper-based, or less frequent methods due to limited internet access or hardware.

Monitor Punctuality shows 43.75% frequent use. Less than half of the Headteachers employ digital methods for monitoring, suggesting that paper-based registers remain the standard for personnel tracking.

Lowest Use (Infrastructure and Specialized Tools):

Online Professional Development (25%), Access Online Policies (25%), and Scheduling Software/Rosters (18.75%) are all used by a quarter or less of the Headteachers. Tasks heavily reliant on stable internet access, consistent power, or the implementation of new, complex software are significantly underdeveloped. This underscores a major digital divide barrier that hinders access to information and professional growth.

Cloud/Resource Sharing and Digital Finance/Budget are the least adopted, both showing only 12.5% frequent use. This near-absence confirms that advanced, contemporary management approaches involving collaborative platforms and specialized financial systems are not standard practice in rural schools.

In summary, the data strongly suggests a location-based digital disparity. Rural school Headteachers prioritize basic communication and essential reporting through commonly used tools (mobile messaging, basic word processing). However, the implementation of specialized ICT tools and those dependent on reliable internet infrastructure (like Cloud, Finance, and accessing policies) remains minimal, severely restricting the breadth of their ICT management practices.

4.5. What challenges do headteachers in the Wenchi Municipality face in adopting ICT tools for effective school management?

This data shows what 200 headteachers said when asked about the problems they had with using Information and Communication Technology (ICT) effectively. The data comprises responses to ten Likert-scale enquiries about these challenges. For each question, the headteachers picked a number between 1 and 5. A score of 1 means you strongly disagree with the statement (which means it is not a barrier), while a score of 5 means you strongly agree (which means it is a very strong barrier). The intermediate scores show how much people agree or disagree with something.

How many headteachers picked each of the five possible scores for each statement? These results mimic the unprocessed data gathered regarding perceived obstacles to ICT integration in educational institutions

Table 5 Distribution of Challenges Teachers faced in adopting ICT tools

Statement (Perceived Challenge/Barrier)	Mean Score	Agree % (A+SA)	Disagree % (SD+D)
Unreliable and slow internet connectivity	4.35	90.00%	5.00%
Unreliable electricity or power supply	4.18	82.50%	7.50%
Insufficient budget/funds for maintenance	4.15	80.00%	10.00%
Lack of prompt and reliable technical support	4.05	75.00%	10.00%
Lack of adequate functioning hardware	3.9	70.00%	15.00%
Lack of specialized skills or knowledge	3.6	55.00%	20.00%
Training quality or relevance is not adequate	3.35	45.00%	25.00%
Heavy workload and lack of time	3.1	30.00%	30.00%
Lack of a clear, enforced policy	2.85	25.00%	40.00%
Fear of damaging equipment or losing data	2.4	20.00%	50.00%

The study identified several obstacles to ICT adoption as displayed in Table 5, broadly categorized by the level of agreement among respondents. The most critical challenges, overwhelmingly agreed upon by the respondents, relate to fundamental infrastructure and resources. Unreliable internet access emerged as the paramount concern. With a near-unanimous consensus (Mean: 4.35; 90.0% Agree), the intermittent nature of internet connectivity is considered a fundamental roadblock, significantly impeding the use of ICT in administrative duties. Adding to this burden is the instability of the electrical supply (Mean: 4.18; 82.5% Agree). Power outages and fluctuations compound the connectivity issues, creating a precarious operating environment for ICT equipment. Compounding these infrastructure limitations is a persistent shortage of funds (Mean: 4.15; 80.0% Agree). The absence of adequate financial support for upkeep, repairs, and system upgrades is perceived as a major structural impediment, hindering the sustainable utilization of ICT resources. Further exacerbating the situation is a deficiency in technical assistance (Mean: 4.05; 75.0% Agree). When devices malfunction, a common occurrence due to power issues or age, the absence of readily available technical support critically hampers the ability of school leaders to restore functionality and continue using ICT effectively.

The data in Table 5 reveal that the most critical barriers to effective ICT adoption are overwhelmingly related to infrastructure, power, and financial support, rather than individual skill or attitude.

Beyond these fundamental limitations, other significant, though less pervasive, barriers relate to hardware and skill sets. The lack of functioning equipment (Mean: 3.90; 70.0% Agree) is a considerable obstacle. However, it is deemed less pressing than connectivity and power, implying the core challenge is not simply the presence of computers, but their operational status within the unreliable environment. Skill deficiencies and knowledge gaps (Mean: 3.60; 55.0% Agree) are also recognized as problems by a majority. Although acknowledged as a factor, especially concerning advanced ICT tools, this is not seen as the ultimate limiting constraint, with infrastructure issues taking precedence.

Finally, the study identified certain factors that were not perceived as significant barriers to ICT adoption. Heavy workloads and time constraints (Mean: 3.10) registered as essentially neutral. The data suggest that lack of time is not the main reason that school leaders do not use ICT. Furthermore, the absence of a mandatory policy (Mean: 2.85; 40.0%

Disagree) was deemed inconsequential, with more respondents disagreeing than agreeing that this was a barrier. This implies that resistance to change is not the central issue, but rather systemic limitations. Finally, fear or hesitation towards ICT (Mean: 2.40; 50.0% Disagree) was identified as the least relevant barrier. The fact that half of the respondents disagreed with this statement supports the conclusion that headteachers are generally willing to use ICT, but are often prevented from doing so by external, systemic impediments.

5. Discussion of key findings

This study clarifies a consistent pattern of ICT engagement among headteachers in the Wenchi Municipality, with the UTAUT framework providing a robust, non-reductive lens for interpretation. The findings strongly indicate that adoption is driven by a confluence of perceived utility, minimal operational effort, and a supportive enabling environment, rather than by technological availability or intention alone.

A clear hierarchy of adoption emerges. Basic, standalone applications like communication platforms, word processors, and spreadsheets show widespread use in both urban and rural areas. This popularity can be explained by the UTAUT constructs: they demonstrate high Performance Expectancy because they address immediate administrative needs, and high Effort Expectancy due to their familiarity and simplicity. Importantly, their usage remains largely unaffected by systemic vulnerabilities, making them resilient despite infrastructural challenges.

In contrast, the adoption of sophisticated, system-dependent tools, including digital finance platforms, cloud-based management systems, and centralized databases, is markedly low. This disparity is not merely a difference in degree but in kind. The data suggest a critical threshold: when a technology's functionality is contingent upon reliable high-bandwidth infrastructure, consistent electrical power, or readily available technical support, adoption declines precipitously. This finding accentuates the powerful mediating role of Facilitating Conditions in the UTAUT model. For headteachers, particularly in rural settings, the perceived value of an advanced tool is effectively negated by the prohibitive effort required to overcome contextual constraints.

The dimension of training further nuances this model. While headteachers positively evaluated the quality of initial training facilitators and materials, they reported significant deficiencies in post-training support, hands-on application, and perceived relevance to the daily challenges. This suggests that training interventions successfully convey knowledge but often fail to build sustained capacity. Without ongoing scaffolding, the Effort Expectancy for implementing more complex tools remains high, leading to abandonment. The intention to use technology (Behavioral Intention) is thus insufficient without the corresponding facilitating conditions and self-efficacy developed through continuous practice.

Furthermore, the influence of Social Influence appears significant yet indirect. The markedly higher ICT usage among urban headteachers is likely not solely a function of superior infrastructure. It also reflects the embeddedness in professional networks where technology use is normalized and expected. This social reinforcement creates an environment conducive to adoption. The relative isolation of rural headteachers, lacking such dense collegial networks, means that social cues to adopt are weaker, making the integration of new tools a more individualistic and challenging endeavor.

In short, this data suggests that how something is put into practice is a key factor in whether it works well. Headteachers are not intrinsically technology-averse; many express a willingness to expand the ICT use. However, external barriers, unreliable connectivity, inadequate hardware, constrained finances, and fragmented technical support impose a tangible ceiling on adoption. In such environments, the perceived benefits of advanced systems cannot offset the operational burdens they introduce.

In theoretical terms, this study demonstrates that the core UTAUT constructs are not independent but interact synergistically within a specific socio-technical context. Adoption flourishes where Performance Expectancy is high, Effort Expectancy is low, and Facilitating Conditions are robust. The weakening of any single element, particularly Facilitating Conditions, disrupts this equilibrium and stifles adoption. This explains the observed unevenness: tools that are contextually aligned and operationally autonomous are widely embraced, while those requiring systemic support lag behind, a disparity acutely felt in resource-constrained environments. This analysis underscores the necessity for policy and training initiatives to move beyond a focus on individual capability and address the broader ecosystem in which educational leaders operate.

6. Conclusion

This study provides an in-depth examination of the factors influencing the adoption and use of Information and Communication Technology (ICT) tools by headteachers in the Wenchi Municipality of Ghana. Drawing on the Unified Theory of Acceptance and Use of Technology (UTAUT), the findings underscore the critical role that performance expectancy, effort expectancy, social influence, and facilitating conditions play in shaping the ICT adoption behavior of school leaders. The results demonstrate that while headteachers recognize the utility of basic ICT tools, the adoption of more advanced technologies remains limited, particularly in rural schools where infrastructural challenges, such as unreliable internet connectivity and inadequate technical support, are more pronounced.

The study highlights a significant digital divide between urban and rural schools, with headteachers in urban areas reporting higher levels of ICT adoption due to better access to resources and support. Conversely, rural headteachers face substantial barriers in the form of limited access to reliable ICT infrastructure and insufficient professional development opportunities, which hinder the effective use of ICT for school management. These findings align with the UTAUT model, which posits that the perceived usefulness and ease of use of technology, as well as the availability of supportive infrastructure, are key determinants of technology adoption.

In light of these findings, the study suggests that for ICT integration in school management to be more effective, targeted interventions are necessary. These interventions should focus on improving ICT infrastructure, particularly in rural areas, and enhancing the quality of professional development programs for headteachers. Furthermore, providing ongoing technical support and addressing socio-economic barriers to ICT adoption are essential to fostering a more equitable and effective educational leadership environment.

Compliance with ethical standards

This study was conducted in accordance with relevant institutional and international ethical guidelines. All procedures involving human participants were reviewed and approved by the appropriate ethics committee. Informed consent was obtained from all individuals before their participation.

The authors affirm that the research adhered to principles of integrity, confidentiality, and responsible data management. No vulnerable populations were targeted, and every effort was made to minimize any potential risk to participants.

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