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The Office at Home: Information Technology and Work-Life Balance among Women in Developing Countries

Research in Progress

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Abstract

The use of information technology (IT) has increased in developing countries, especially during the COVID-19 pandemic era, since many have been forced to stay indoors to stop the spread of the virus. IT use means the acquisition and use of smart devices and Apps that make work and communication from home efficient. Women in developing countries who also have to work from home have challenges of acquiring IT. They must solely care for the family as it is the norm. This potentially increases burnout. This study, therefore, seeks to understand how women in developing countries appropriate IT for work-life balance during COVID-19. This study employs qualitative autoethnography methodology and theoretical lens of technology appropriation to recount how female academics appropriate IT in Ghana during the COVID-19 pandemic. We present an analysis and discussion of the empirical finding through the three levels of the technology appropriation process that support Work-Life balance.

Keywords: Information Technology, Work-life Balance, Technology Appropriation, Autoethnography, Developing Country, Ghana

Introduction

Many governments decided to adopt strict measures to reduce the spread of the novel COVID-19 . In Ghana, a complete lock-down of most businesses came into force in March, 2020. The lockdown forced many people to work from home and affected many in different ways (Pan et al., 2020). Many who did not have an interest in information technology (IT) were forced to adapt and use technology. The period resulted in virtual platforms for online interactions in place of physical, face-to-face contacts (Kodama, 2020). Work styles have been transformed with increased demand for collaborative platforms and video conferencing tools to keep many still working (Davison, 2020; Kodama, 2020).

Use of IT has become essential for the daily operations of organisations and service delivery during and after the lockdowns, as social and physical distancing become enforced (De et al., 2020; Richter, 2020). IT solutions originally developed for organisations including education, shopping, and healthcare, has begun to attract information systems (IS) research (Barnes, 2020; Doyle & Conboy, 2020; Fletcher & Griffiths, 2020). However, not much is known about women using these technologies to handle work-life balance in their respective economies, especially in a developing country context where digital infrastructure remains limited.

Following the gaps stated above, this study seeks to understand how academic women in developing countries appropriate information technology for work-life balance during COVID-19 era. The accompanying research question is: *how do academic women in developing countries utilise information technology for work-life balance?*

In addressing the question, this study employs qualitative autoethnography methodology and the theoretical lens of technology appropriation to recount how female academics appropriated information technology in Ghana (a developing country) during the COVID-19 pandemic.

First a literature review on information technology is provided. Second the technology appropriation model as the theoretical framework for analysing the reflexive data is explained. Third the methodology, followed by empirical findings is given.

Literature Review

Information Technology

During the Covid-19 pandemic, information technology was the bedrock for tackling the pandemic. Though issues are medical related, information technology was used for real communications, gathering of data for research, etc.(Chen et al., 2020; Zhou et al., 2020).

This study would encompass three significant items.

- Computers and smart mobile devices (Thoreau, 2010; Abu-elenin, 2020).
- The Apps that are necessary for our use and make us effective and efficient (Hussain et al. 2020; Li et al. 2020).
- Accessibility to seamless and affordable internet in a developing country (Gong, 2020; Reddick et al., 2020). The minimum threshold of internet access is described in the table below, Source: A4AI (2020).

Minimum threshold	Proportion of internet access	Opinion
Daily use	Regular internet use – Internet is not cheap and not accessible	– Internet is not cheap and not accessible
Access to a smart device	An appropriate device – Smart devices are expensive	– Smart devices are expensive
An unlimited broadband/ wireless connection at home	Enough data - Internet is expensive. Not affordable	- Internet is expensive. Not affordable
4G mobile connectivity	A fast connection – Connectivity is a big issue. Not accessible	– Connectivity is a big issue. Not accessible

Table 1. **Four proportions of meaningful connectivity**

Work-Life balance (WLB)

Work-life balance is the state of equilibrium in which the demands for both a person's job (paid activities) and personal life are equal (AlHazemi & Ali, 2016). WLB was coined when roles at home and at work became blurred (Lockwood, 2003). In order to clear this anomaly, Friedman & Greenhaus, (2011) stated that the adult worker have a support network at home, work and live in the society. Kanwar et al. (2009), showed that men placed more premium on work than family while women rated work and family equally. Women experience burnout when there is an imbalance between work and family life. Further, Kanwar et al. (2009) study showed that job satisfaction is enabled by work-life balance but stalled by burnout. Hence the need to maintain a work-life balance for health and job performance (Ezzedeen & Zikic, 2017).

Information Technology and Work-Life Balance

While some researchers were of the view that mobile technology was used to exploit employees by companies after working hours (Edley, 2001), other were of the view that, this gave flexibility (Wajcman et al., 2008, 2010) and hence a positive effect on work-life balance. In all, there is an overlapping engagement between IT and work-life balance. For women, there are additional complications

Blair-Loy (2003) stated that most women are faced with a strong cultural expectation of caring and managing the home, even if their roles at work are managerial. Finding the balance is important (Edley, 2001). Nagy (2020) reiterate the ubiquitous nature of IT that is helping women manage their lives better.

Contribution of Information Technology to Women's WLB in developing countries

There is a wide range of published research works on the contribution of IT in developing countries (Avgerou & Walsham, 2017; Chege & Wang, 2020; Leonow et al., 2019). Research on IT and women empowerment is an emergent field of research (Graf, 2020). Abubaker & Bagley (2016) found out that major WBL policies were not available in developing countries especially those that take care of female employees. Mushfiqur et al., (2018) recommended policies to manage WLB as institutional frameworks in Nigeria did not support WLB among female doctors.

Theoretical Framework – Technology Appropriation

We draw on the Model of Technology Appropriation developed by Carroll et al. (2002) as a philosophical and reflexive lens to understand how academic women in developing countries transform technology from its original design into technology as is being used for work-life balance (Carroll et al., 2001). Technology appropriation refers to the process through which users evaluate a particular technology, select and adopt some of its attributes, to meet their needs (Carroll et al., 2002; Herodotou et al., 2012; Mendoza et al., 2010; Plumb & Kautz, 2015). The model describes how users transform technology from its original use as intended by the designer into technology that provides benefit to the user through complementing practices, enabling new and beneficial methods, or possibly eliminating ineffective practices (Carroll & Fidock, 2011; Fidock & Carroll, 2006). Three levels are identified with the technology appropriation process (Rahim et al., 2010).

In Level 1, users first encounter technology and can either be unenthused about it, leading to non-appropriation or attraction to it, in which case the user decides to adopt it, leading to the initiation of the appropriation process.

Level 2 entails users' more in-depth evaluation of the technology through use; based-on their expectations of the technology, they can either continue evaluating it through use or reject it.

Level 3 focuses on users' persistent act to continue using the technology, as it is now considered stable.

Since users' needs may change over time, there is the need for continual reinforcement of the technology (Carroll et al., 2002; Reimer & Jonson, 2015). Thus, appropriation is not restricted to the IT in question. At times, users have to appropriate their roles, the design of the technology, and social norms for a successful outcome (Leonardi et al., 2016).

The technology appropriation model has been employed in several IS studies (Alam & Campbell, 2014; Carroll et al., 2001; Leonardi et al., 2016). As technology is increasingly blurring the boundaries between work and home life (Nagy, 2020), we find technology appropriation model particularly suited for understanding how academic women in developing countries' adopt, adapt, and utilize information technology to facilitate work-life balance. These afford them the ability to evaluate a particular technology, select and adopt some of its attributes, take possession of its capabilities to meet their needs and eventually incorporate it into their daily practices.

Research Method

We employ autoethnography, a qualitative method that aims to produce and analyse data from highly personalised accounts of authors' experiences and reflections about a topic of interest within their social context (Ghita, 2019). Unlike ethnography, which uses participants' observation and interviews to gain a deeper understanding of a phenomenon, autoethnography provides a unique opportunity for authors to provide their personal perspectives and relate experiences gathered on a phenomenon over time (Jewels et al., 2009). Autoethnography acknowledges the researcher's unavoidable entanglement in the production and analysis of data. We chose this method because we deem it appropriate for understanding digitally mediated experiences in everyday activities within a cultural setting (Riordan, 2014). Autoethnography is widely recognised as an in-depth research method but it is rarely used owing to the assertion that there is a lack of clarity about evaluation criteria (Riordan, 2014). To address this methodological gap, we present sincere narratives of our experiences and reflections as academics in very ordinary episodes involving the use of digital technologies to carry out work activities while juggling home, family, and social lives in the COVID-19 pandemic era.

Data Collection

The use of information technology as academics in the IS discipline to carry out work activities is not new. We first recall events, experiences, feelings, and interpretations of our use of IT to maintain work-life balance before the COVID-19 lockdown period. These retrospective accounts were conducted from memory with the help of old emails and jotted down notes where applicable. Next, we conducted reflections on the go as we used digital technologies every day to do our jobs by noting down experiences immediately or as soon as we could. This second part of data collection occurred between July 2020 and November 2020.

Data Analysis

The analysis was carried out using the three main levels of the technology appropriation model identified, through deep introspection as frequent challenges, change in attitudes, and major concerns. The use of appropriation of digital technologies in new everyday routines is to maintain a work-life balance.

Empirical Findings

Auto-ethnography One

When my University announced its intention to continue teaching and learning activities using the Google Classroom (GC) platform, I considered it an advantage. I could combine my weekend and weekday classes, thus reducing my workload and deliver lecture from the comfort of my home. I've had experience using alternative learning management systems and being IT savvy, adapting to the GC didn't seem to be much

of a problem. Nonetheless, online classes via GC were saddled with many difficulties ranging from lack of verbal communication feature, high cost of internet, time constraint, poor internet connectivity and my students' inexperience of the GC platform. To address the verbal problem, I initially resorted to the use of WhatsApp voice notes to further explain concepts in the lesson. I eventually adopted Google Meet (GM) to enable share on my computer screen to demonstrate sections of the lesson. However, I was met with the challenge of network interruptions, which caused breaks or loss of footage in the video sessions. Occasionally, the network's interruption was as a result of a phone call coming through to my smartphone which doubled as an internet provider through hotspot to my laptop.

After a thorough search, I found a relatively faster and cheaper internet data plan. However, the offer was only available from 12:01 am to 5:00 am. To take advantage of this fast and cheap offer, I would stay up late to get my lecture videos ready and/or work on my Ph.D. thesis. I devoted the quiet hours of some days to making pre-recorded lecture videos, editing and compressing them for students' easy download and use.

Being a young woman, living alone with my parents, there's an inherent expectation of me to perform household duties early in the day. Obviously, staying up late and spending the larger part of my day in online meetings impacted other aspects of my life and my overall performance and productivity.

Thus, I invested a sizable portion of my income in a more effective internet router. This ensured that I had a good internet speed to work with any time of the day. I could also perform my other duties as a young woman in my home. I also learned to perform several activities simultaneously to enable me keep a good balance between work and life.

Auto-ethnography Two

The anxiety of being part of a history in which a pandemic took place was high. In March 2020, I made sure my family (husband, children, and my ageing parents) went on lockdown several days before the president pronounced a strict lockdown in major cities in Ghana. As a mother, an early career researcher, and a full-time Ph.D. student, I took drastic decisions and actions to keep my family safe and up to date with news worldwide. These decisions included acquiring an extra computer, a tablet and a router for wireless internet service of up to ten devices. I searched for Apps that could meet our needs, and help in making me work efficiently. The idea was to select the appropriate IT tools. Communication and Collaboration tools such as *Zoom*, *Microsoft teams*, *Google teams*, and *Google classrooms* were studied and used to aid teaching and learning online. These decisions meant very high financial commitments that were unplanned for.

It was essential to keep an eye on the children throughout the day, since primary schools had been closed. My regular daily activities involved multitasking during the day. At night, with the use of the Learning Management System (UPSA Virtual), I designed my lesson notes and created lecture videos to be linked to the Learning Management System. This was done at night because it was much quieter with less distractions. Initially it was a joy to be home with the family. After two weeks, it became tiring to taking care of the children. It was evident that working from home had its advantages and disadvantages.

Analysis and Discussion

This study sought to understand how women in developing countries appropriate information technology for work-life balance during the COVID-19 pandemic. This section, presents an analysis and discussion of the empirical finding through the three levels of the technology appropriation process developed by Carroll et al. (2002).

Level 1 – Evaluation for Acceptance or Rejection

Technology appropriation examines the process by which users interact with technology, adapt to it so that the technology becomes beneficial to the user. The benefit to the users in this study is achieving work-life balance. From the narrative accounts of both authors', IT tools were evaluated for adoption to facilitate online teaching and learning. The literature on technology appropriation has been widely asserted to afford

users the options of adoption or non-appropriation after initial evaluation of a technology (Carroll & Fidock, 2011). The present study does not support this assertion. The account from autoethnography one (aeth1) revealed that the GC platform, lacked appeal after an initial evaluation. It lacked a voice feature that could facilitate real-time discussion. The user had no option of non-appropriation despite knowledge and acquaintance with other alternative technologies.

Level 2 – Deeper Evaluation for Mutual Adaptation

Through use, user continuously evaluated the technologies adopted and devised means of adapting to it. The adaptation process changed both the ways the technology was appropriated and the users' roles and attitude to the technology so that it becomes beneficial to the user (Carroll et al., 2002; Mendoza et al., 2010; Overdijk & Van Diggelen, 2006; Riemer & Johnston, 2015). For instance, aeth1, used appropriation to create and edit videos to overcome the contextual challenges of poor network infrastructure. Consequently, the social norm of having a good night's rest to wake up early the following morning to attend to other duties was also appropriated since the author sought to take advantage of the cheap and fast midnight internet plan to ensure the successful appropriation of technology for online teaching and learning. Similarly, aeth2, committed financial resources to acquire complementing equipment and tools in the appropriation process to facilitate efficient online working. At night, the author appropriated her role as a wife working at night explore technology appropriation for work-life balance. The present findings resonate with Leonardi et al.'s (2016) assertion that technology appropriation is not restricted to the technology in question.

Level 3 – User's Persistent Act for Continuous Use

The two narratives portray how deliberate actions promoted appropriation of IT to balance work and life. The author in aeth1, committed resources to acquire a wireless router, to ensure that regular work-life is not disrupted. She consciously maintained a good balance between work and life. The same is true for the author in aeth2, who combined her home and work activities to ensure that a balance was achieved. This third level of technology appropriation is crucial to the stability of the technology if it is to be beneficial to users.

Conclusion

This study set out to understand how academic women in developing countries appropriate information technology for work-life balance. It is inferred from a 3-level technology appropriation analysis of the narrative, that users may lack the option to adopt or reject a given technology within a certain context. The uniqueness of this paper lies in the call for more autoethnography studies within the IS discipline (Riordan, 2014), thus contributing to a perspective. Moreover, the focus was on an issue gap of the appropriation of IT by women in developing countries. The study is limited as it examines two women working in academia in the Ghana. Perhaps the findings will be different if a similar study was conducted among women in other professions and a different cultural context. Also, the application of different technology acceptance theory for data analysis could yield different findings. We advocate for a comparative study of other professional working women from different cultural contexts.

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References

- Abu-elenin, M. M. (2020). Uses of Smart Device Technology in Medical Field among Clinical Physicians: Is It Important? *Egyptian Journal of Community Medicine*, 38(3).
- Abubaker, M., & Bagley, C. (2016). Work-life balance and the needs of female employees in the telecommunications industry in a developing country: A critical realist approach to issues in industrial and organizational social psychology. *Comprehensive Psychology*, 5, 2165222816648075.
- Alam, S., & Campbell, J. (2014). *Examining cultural volunteer crowdsourcing technology: An appropriation perspective*.
- AlHazemi, A. A., & Ali, W. (2016). The notion of work life balance, determining factors, antecedents and consequences: a comprehensive literature survey. *International Journal of Academic Research and Reflection*, 4(8), 74–85.
- Avgerou, C., & Walsham, G. (2017). *Information technology in context: Studies from the perspective of developing countries: Studies from the perspective of developing countries*. Routledge.
- Barnes, S. J. (2020). Information management research and practice in the post-COVID-19 world. *International Journal of Information Management*, June, 102175. <https://doi.org/10.1016/j.ijinfomgt.2020.102175>
- Blair-Loy, M. (2003). *Competing Devotions: Career and Family Among Women Executives*.
- Carroll, J., & Fidock, J. (2011). Beyond resistance to technology appropriation. *2011 44th Hawaii International Conference on System Sciences*, 1–9.
- Carroll, J., Howard, S., Peck, J., & Murphy, J. (2002). A field study of perceptions and use of mobile telephones by 16 to 22 year olds. *Journal of Information Technology Theory and Application (JITTA)*, 4(2), 6.
- Carroll, J., Howard, S., Vetere, F., Peck, J., & Murphy, J. (2001). *Identity, power and fragmentation in cyberspace: technology appropriation by young people*.
- Chege, S. M., & Wang, D. (2020). Information technology innovation and its impact on job creation by SMEs in developing countries: an analysis of the literature review. *Technology Analysis & Strategic Management*, 32(3), 256–271.
- Chen, E., Lerman, K., & Ferrara, E. (2020). COVID-19 : The first public coronavirus twitter dataset. *ArXiv Preprint ArXiv:2003.07372*.
- Davison, R. M. (2020). The transformative potential of disruptions: A viewpoint. *International Journal of Information Management*, 102149.
- De, R., Pandey, N., & Pal, A. (2020). Impact of digital surge during COVID-19 pandemic: A viewpoint on research and practice. *International Journal of Information Management*, June, 102171. <https://doi.org/10.1016/j.ijinfomgt.2020.102171>
- Doyle, R., & Conboy, K. (2020). The role of IS in the COVID-19 pandemic: A liquid-modern perspective. *International Journal of Information Management*, June, 102184. <https://doi.org/10.1016/j.ijinfomgt.2020.102184>
- Edley, P. P. (2001). Technology, employed mothers, and corporate colonization of the lifeworld: A gendered paradox of work and family balance. *Women and Language*, 24(2), 28.
- Ezzedeen, S. R., & Zikic, J. (2017). Finding balance amid boundarylessness: An interpretive study of entrepreneurial work--life balance and boundary management. *Journal of Family Issues*, 38(11), 1546–1576.
- Fidock, J., & Carroll, J. (2006). *The model of technology appropriation: A lens for understanding systems integration in a Defence context*.
- Fletcher, G., & Griffiths, M. (2020). Digital transformation during a lockdown. *International Journal of Information Management*, June, 102185. <https://doi.org/10.1016/j.ijinfomgt.2020.102185>

- Friedman, S. D., & Greenhaus, J. (2011). *Work and Family-Allies or Enemies?: What Happens When Business Professionals Confront Life Choices*. 1–288. <https://doi.org/10.1093/acprof:oso/9780195112757.001.0001>
- Ghita, C. (2019). In Defence of Subjectivity.: Autoethnography and studying technology non-use. *The 27th European Conference on Information Systems (ECIS)*.
- Gong, R. (2020). *Digital Inclusion: Assessing Meaningful Internet Connectivity in Malaysia*.
- Graf, V. (2020). Inclusiveness in a digitizing World-Investigating ICT and women's Empowerment. *ECIS*.
- Herodotou, C., Winters, N., & Kambouri, M. (2012). A Motivationally Oriented Approach to Understanding Game Appropriation. *International Journal of Human-Computer Interaction*, 28(1), 34–47. <https://doi.org/10.1080/10447318.2011.566108>
- Hussain, A., Mkpojiogu, E. O. C., Hussein, I., Muhi, O. M., & Yosri, M. H. H. (n.d.). *The Effectiveness, Efficiency and Reliability-in-Use of Daylio Mobile App*.
- Jewels, T., Ghanem, A., Mongeal, A., Nuaimi, E., Ajaaidi, A., Al-Kaf, A., & Nuaimi, A. (2009). eBusiness use in the United Arab Emirates: lessons for evolving markets. *AMCIS 2009 Proceedings*, 557.
- Kanwar, Y. P. S., Singh, A. K., & Kodwani, A. D. (2009). Work—life balance and burnout as predictors of job satisfaction in the IT-ITES industry. *Vision*, 13(2), 1–12.
- Kodama, M. (2020). Digitally transforming work styles in an era of infectious disease. *International Journal of Information Management*, 102172.
- Leonardi, P. M., Bailey, D. E., Diniz, E. H., Sholler, D., & Nardi, B. A. (2016). Multiplex Appropriation in Complex Systems Implementation: The Case of Brazil's Correspondent Banking System. *MIS Q.*, 40(2), 461–473.
- Leonow, A. I., Koniagina, M. N., Petrova, S. V., Grunt, E. V., Kerimkhulle, S. Y., & Shubaeva, V. G. (2019). Application of information technologies in marketing: experience of developing countries. *Revista Espacios*, 40(38).
- Li, X., Zhao, X., Pu, W., & others. (2020). Measuring ease of use of mobile applications in e-commerce retailing from the perspective of consumer online shopping behaviour patterns. *Journal of Retailing and Consumer Services*, 55, 102093.
- Lockwood, N. R. (2003). Work/life balance. *Challenges and Solutions, SHRM Research, USA*.
- Mendoza, A., Carroll, J., Stern, L., & others. (2010). Software appropriation over time: from adoption to stabilization and beyond. *Australasian Journal of Information Systems*, 16(2).
- Mushfiqur, R., Mordi, C., Oruh, E. S., Nwagbara, U., Mordi, T., & Turner, I. M. (2018). The impacts of work-life-balance (WLB) challenges on social sustainability. *Employee Relations*.
- Nagy, B. (2020). “Mummy is in a Call”: Digital Technology and Executive Women's Work--Life Balance. *Social Inclusion*, 8(4), 72–80.
- Overdijk, M., & Van Diggelen, W. (2006). Technology appropriation in face-to-face collaborative learning. *Innovative Approaches for Learning and Knowledge Sharing, EC-TEL 2006 Workshops Proceedings*, 89–96.
- Pan, S. L., Cui, M., & Qian, J. (2020). Information resource orchestration during the COVID-19 pandemic: A study of community lockdowns in China. *International Journal of Information Management*, 102143.
- Plumb, M., & Kautz, K. (2015). *Innovation determinants and barriers: A tri-perspective analysis of IT appropriation within an early childhood education and care organisation*.
- Rahim, N. Z. A., Alias, R. A., & Carroll, J. (2010). Multiple Perspectives Technology Appropriation: Analysis of Open Source Software Implementation Failure. *PACIS*, 110.
- Reddick, C. G., Enriquez, R., Harris, R. J., & Sharma, B. (2020). Determinants of broadband access and affordability: An analysis of a community survey on the digital divide. *Cities*, 106, 102904.

- Richter, A. (2020). Locked-down digital work. *International Journal of Information Management*, May, 102157. <https://doi.org/10.1016/j.ijinfomgt.2020.102157>
- Riemer, K., & Johnston, R. B. (2015). Organizational technology appropriation as actively accomplished" place-making. *7th International Symposium on Process Organization Studies*.
- Riordan, N. O. (2014). Autoethnography: Proposing a new method for information systems research. *Twenty Second European Conference on Information Systems*, 22, 1–14.
- Thoreau, F. (2010). *The 'interpretive flexibility' of nanotechnologies in context: The case of a leading R&D center in Flanders, Belgium*. University of Maastricht, Maastricht, Netherlands.
- Wajcman, J., Bittman, M., & Brown, J. (2008). Families Without Borders: Mobile Phones, Connectedness and Work-Home Divisions. *Sociology*, 42. <https://doi.org/10.1177/0038038508091620>
- Wajcman, J., Rose, E., Brown, J., & Bittman, M. (2010). Enacting Virtual Connections Between Work and Home. *Journal of Sociology*, 46. <https://doi.org/10.1177/1440783310365583>
- Zhou, C., Su, F., Pei, T., Zhang, A., Du, Y., Luo, B., Cao, Z., Wang, J., Yuan, W., Zhu, Y., & others. (2020). COVID-19 : Challenges to GIS with big data. *Geography and Sustainability*.