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RESEARCH

Online Safety and Academic Scholarship: Exploring Researchers' Concerns from Ghana

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INTRODUCTION This paper investigates factors, including fears of cybercrime, that may affect researchers' willingness to share research in institutional repositories in Ghana. **METHODS** Qualitative research was conducted to understand more about the experiences of Ghanaian researchers when sharing research in institutional repositories. Interviews were conducted with 25 participants, documents related to policy and infrastructure in Ghana were examined, and observations were held in meetings of information technology committees. **FINDINGS** The findings indicate that researchers are specifically concerned about three areas when sharing research online: fraud, plagiarism, and identity theft. **DISCUSSION** This paper adds to research that examines barriers toward using institutional repositories, and highlights the lack of basic preventative strategies in Ghana—such as training, security, and infrastructure—that are commonplace in developed countries. **CONCLUSION** This study draws on findings from Bossaller and Atiso (2015) that identified fears of cybercrime as one of the major barriers to sharing research online for Ghanaian researchers. While several other studies have found that fear of identity theft or plagiarism are barriers toward sharing work in the institutional repository, this is the first study that looks specifically at the experiences researchers have had with cybercrime to understand this barrier more fully.

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IMPLICATIONS FOR PRACTICE

1. While developed countries have secure systems for scholarly communication, researchers in developing countries, such as Ghana, may face societal factors that impact the scholarly communication process.
2. This study demonstrates that societal factors play a significant role in research productivity that is often overlooked in literature. Researchers who work in countries or institutions without access to reliable, secure information and communications technology (ICT) systems may find that using such systems to share research is far from ideal.
3. Societal factors like cybercrime can affect research practices when stable ICT systems are not in place.

INTRODUCTION

Low deposit rates in institutional repositories (IRs) are a common problem for librarians who wish to build a robust information system for sharing and archiving institutional work (Ferreira, Rodrigues, Baptista, & Saraiva, 2008). The IR is a tool that provides equitable access to research materials, while also archiving institutional research output (Burns, Lana, & Budd, 2013); however, researchers are often reluctant to adopt these systems as part of their own scholarly communication process due to lack of understanding of their perceived value (Giesecke, 2011).

In developing countries with financial constraints, an IR can have a significant impact on the scholarly communication process among researchers by providing open access to original research or data that may not have been available digitally before. In Ghana, a developing economy, an initiative was created to develop an IR for use within the Council for Scientific and Industrial Research (CSIR) community to increase access to research among scientists. While an IR may not solve all access problems, developers hoped this was a good initiative that could alleviate challenges in accessing academic scholarship.

Prior to the implementation of the IR, researchers in Ghana faced challenges in the scholarly communication process. One problem was that they often duplicated research that had already been conducted and were unable to build on previous research studies that existed but were not accessible. In developed countries, researchers have access to a vast number of subscription databases to retrieve research. For researchers in Ghana without institutions to pay for these subscriptions, research was hampered (Atiso, 2017).

Even though the IR was implemented in Ghana to help researchers overcome these barriers, its adoption rate is still low. It is well documented in the literature that researchers are reluctant to place their work in an IR (Larson 2017; Kim, 2011; Ferriera et al., 2008) for various reasons, including copyright concerns and the additional time it takes to submit work to the repository (Kim, 2011). However, Bossaller and Atiso (2015) discovered that Ghanaian scientists had specific, unique concerns that affected their use of the IR. In Ghana, researchers work in an environment fraught with cybercrime and identity theft, with little cyber infrastructure to protect them (Asamoah & Ahenkorah, 2017). For Ghanaian research scientists, the IR is an online tool that was vulnerable to cyberattack, and this simple fact contributed to the low patronage of the IR.

This paper examines the fears of Ghanaian research scientists, librarians, and administrators in the CSIR related to sharing work in online environments to improve scholarly communication. It is an extension of the work completed by Bossaller and Atiso (2015) and Atiso (2017) that focuses specifically on researcher perceptions of the IR in Ghana. For those in developed countries whose institutional data is protected by secure information technology systems with personnel trained in cybersecurity, it may be hard to imagine that fears of online fraud, plagiarism, or extortion could prevent one from publishing research in open access platforms like the IR. This qualitative study asked 25 participants (researchers, librarians, and administrators) in Ghana to elaborate on their experiences of cybercrime to discover how those experiences relate to scholarly communication.

LITERATURE REVIEW

Information and Communications Technology (ICT) in Ghana

The United Nations (2014) considers Ghana to be a country with a “developing economy.” This means that Ghana has lower degrees of industrialization than countries with “developed economies,” as well as a lower standard of living based on the size of the population. The effect of this status on research quality cannot be underestimated. In addition to Ghanaian researchers not having access to modern computer equipment, the infrastructure for their telecommunications is not as developed. The Ghanaian government invested heavily in the technological infrastructure in the 1990s to improve support for research and development within the country. However, even with those improvements, researchers in Ghana have indicated that a lack of reliable access to electricity is a significant impediment to their work (Atiso, 2017; Baylon & Antwi-Boasiako, 2016). Improved infrastructure indeed boosted the research community, as networks became available that would enable scholarly communication in electronic formats. But it is important to note that while such improvements were achieved, Internet access and speed in Ghana are still far less advanced than in

a developed country like the United States. It is also important to note that this weak ICT infrastructure makes it vulnerable to cybercrime.

Cybercrime as a Societal Factor

In Ghana, the term *sakawa* describes criminal activities that occur in an online environment (also referred to as *cybercrime* in this paper). Boateng, Longe, Isabalija, and Budu (2011) used the exploratory case study method to examine the different forms of cybercrime in Ghana. They found that cybercrime is often financially motivated and conducted by young people who monitor online activities, or attempt fraud with banks. They also found that the police mostly deal with cybercrime related to fraudulent gold deals (where the victim is asked to send money in exchange for gold), inheritance (where the victim is falsely told they have inherited money and asked to move money out of Ghana), marriage deals (where the victim believes they are sending money to someone they met on a dating site), and other scams that attempt to glean money from their victims. Yar (2005) describes forms of cybercrime that go beyond seeking money, including cybertrespassing (for example, hacking), cyberdeceptions (for example, identity theft), cyberpornography (for example, victims are asked to pay a ransom or else have their nude photos shared online), and cyberviolence (for example, hate speech, harassment, online bullying, etc).

Sakawa has escalated in recent years, becoming a major concern in many different areas of business and government, including research organizations. In a recent report on cybercrime in Ghana, researchers found that people working in government agencies in Ghana generally felt that the country lacked laws, infrastructure, and personnel to limit (or prevent) cybercrime from happening, and even referred to the West African region as a “gold field with wide open systems” (3T Solutions, 2017, p. 74). In Ghana, cybercrime is a rampant problem that has been difficult to control. After many years of Ghana’s rates of cybercrime being among the highest in the world, the Ghanaian government made efforts to fight it by increasing funding to create a cybersecurity infrastructure (Asamoah & Ahenkorah, 2017). Prior to this initiative in 2017, most cybercrime went unpunished and the combination of corruption, high use of mobile devices, high poverty levels, theft, and electricity shortages made it easy for cybercrime to occur in Ghana (Baylon & Antwi-Boasiako, 2016). In fact, rates of cybercrime in Ghana are among the highest of all African countries (Warner, 2011; Boateng et al., 2011). Danquah and Longe (2011) suggest that cybercrime is more common in Ghana because of outdated criminal laws that do not account sufficiently for electronic crimes.

Access to Research in Ghana

Ghana has only a few national journals, which means that researchers must often look to

journals outside the country for publication and reference (Larson, 2017). Scholarly databases are often available at universities, but societal constraints like slow Internet speed, confusing authentication methods, and old computer systems hinder usage. Dadzie (2005) and Larson (2017) both found that while faculty were aware of the scholarly databases provided by the university, they were rarely used due to constraints that made them hard to access, such as not being available off campus, or faculty not having passwords to access them. Several efforts have been made in Ghana to provide more access to scholarly resources. The International Network for the Availability of Scientific Publications and the Programme for the Enhancement of Research Institutions (PERI) both provided access temporarily to scholarly databases in Ghana for a short period in the early to mid-2000s (Larson, 2017).

Lamprey and Corleley (2011) presented the IR as one of many possible solutions to making research available to the Ghanaian community. IRs provide an electronic platform for researchers to share their findings with the research community, who can use the data to improve local conditions. Modern-day IRs include research components like completed journal articles, drafts of research, and raw data from the research study (Atiso, 2017, Kim, 2011). Adu and Ngulube (2016) also described how Ghana has made improvements but is still lagging behind in technological infrastructure—cloud computing is nonexistent, and most archival practices rely on local repositories that are seldom used. In other parts of the world, the IR has shown promise as a tool that can improve the scholarly communication process. IRs provide a platform for sharing research components as well as for digitizing work for long-term preservation. They are easy to search and retrieve, while also allowing an institution to manage its digital assets. Many research institutions choose to use IRs for sharing and disseminating work among their own academic communities. Works like published articles, unpublished work, conference presentations or papers, raw data, and teaching materials can be shared in an IR for others to access. However, researchers will be reluctant to add any of these materials if it means that their work will be plagiarized or used inappropriately, or if it will make them vulnerable to cybercrime.

Researchers in Ghana are also experience a high degree of solicitation from predatory journals (i.e., counterfeit journals posing as legitimate journals). Butler (2013) described how several authentic scientific journals became victims of cybercrime when their sites were duplicated. Researchers submitted work and publication fees to a fake site thinking they were submitting to the official publication. Falling prey to such schemes can be a concern for academics who are judged by the quality of the journal they publish in. Karanu (2017) describes how falling victim to predatory journals can leave a “black mark” on a researcher’s record, while defrauding them at the same time.

Researchers must also protect the ownership of their original work, particularly when self-

archiving their own research. For one, researchers may worry about copyright infringement, particularly if the work has already been published in a journal (Abrizah, 2009). Additionally, researchers may see the job of self-archiving their work in an IR as time-consuming and tedious. Some fear that they are making their work vulnerable to plagiarism if the work is deposited in a repository before it is published.

Not every researcher is comfortable sharing research in unpublished environments. Kim (2007) found that when researchers didn't share their research in the IR, it was often because they didn't trust the readers to use the research properly. Some also felt that their field was too competitive to make research public unless it was published in a journal. Davis and Connolly (2007) also found that researchers within their institution had little motivation to use the IR to share their work due to lack of incentives and competitive environments. Some of these reasons were also related to trust. Their researchers feared that sharing their research in an IR would lead to "redundancy with other modes of disseminating information, a learning curve, confusion with copyright, fear of plagiarism and having one's work scooped, associating one's work with inconsistent quality, and whether posting a manuscript constitutes 'publishing'" (Davis & Connolly, 2007, p. 1).

METHODS

Ghana's commitment to research and development (R&D) dates far back. After attaining political independence from Great Britain in 1957, the government attempted to incorporate R&D to contribute to national development. Besides universities (public and private), there are research organizations whose aim is to carry out R&D in various sectors of the economy. The CSIR is the foremost national science and technology institution in Ghana. This state-owned organization was created to cater to the research needs of different communities based on the resources available on the ground. It has 13 research institutes scattered across the country, each with a different specialization required for national development. These institutes include the Animal Research Institute in Accra, the Building and Road Research Institute in Kumasi, the Crops Research Institute in Kumasi, the Food Research Institute in Accra, the Forestry Research Institute of Ghana in Kumasi, the Institute of Industrial Research in Accra, the Institute for Scientific and Technological Information in Accra, the Oil Palm Research Institute in Kusi, the Plant Genetic Resources Center in Bunso, the Savanna Agricultural Research Institute in Nyankpala and Tamale, the Science and Technology Policy Research Institute in Accra, the Soil Research Institute in Kwadaso and Kumasi, and the Water Research Institute in Accra (Council of Scientific and Industrial Research, 2017).

This study examines scholarly communication at four research centers in the CSIR: the

Animal Research Institute, the Water Research Institute, the Food Research Institute, and the Institute for Industrial Research. These were selected for purposes of proximity to the authors' location. Sampling in qualitative studies is normally smaller than in quantitative ones due to the in-depth input expected from participants (Hill et al., 2005). It is recommended that qualitative studies include eight to 15 participants, a range that should be reduced if multiple interview sessions are expected. For each of the four research institutes in this study, one librarian, one administrator, and four research scientists were interviewed (n=24). In addition, a technology expert who works outside of these institutes was also interviewed to add an external perspective. A total of 25 participants were sampled.

In the summer of 2017, the first author of this paper interviewed 25 participants who were involved in the adoption of IR use for scholarly research. These participants were recruited through the various institutions' listservs and represent three professional groups: researchers, librarians, and administrators. All interviews were held in the research institutes, all of which are based in Accra, the capital of Ghana. Researchers at these institutes conduct research and advise the government on new technologies and innovations. Librarians are responsible for collecting, managing, disseminating, and providing literature to the scientists. Administrators lead the institutions where the research scientists and the librarians work. Administrators also make resource and policy decisions for the institutions.

To ensure participant privacy, ethical procedures were followed at two levels because of the international nature of the study. The authors were based at the University of Missouri and sought and received ethical clearance at the University of Missouri Institutional Review Board (IRB). Authors also received approval from the human subjects committee in Ghana. Several policies were reviewed to determine the current state of technology in Ghana. Two national policies, the National Telecommunications Policy (NTP) and the Ghana ICT for Accelerated Development (ICT4AD), have a large impact on research and development in Ghana. These policies also served as a starting point for guiding the interview questions. Beyond the national policies, institutional documentation was consulted (i.e., annual reports, minutes) and reviewed for context at each of the four selected CSIR institutes.

The authors in this study conducted observations within CSIR Information and Communications Technology committee meetings related to technology issues. Selected participants—administrators, librarians, and research scientists—attended these quarterly meetings, where the committees reviewed all technology-related matters affecting the institutes. Semistructured interviews with 25 individuals were conducted in this study: research scientists (n=16), librarians (n=4), administrators (n=4), and an external participant (n=1). All sessions were recorded and took place in the workspace of the participants. Interviews were designed with open-ended questions and continued until saturation was reached, as recom-

mended by Corbin and Strauss (1990). A saturation point is reached when successive interview participants start repeating the same ideas as the participants before them. This style of interviewing allowed participants to explain their thoughts and feelings in relationship to their experiences with sharing scholarly work in IRs. Researchers were asked questions that ranged from questions about security (including emerging issues such as experience with predatory journals) to their use and feelings about the IR. Given that researchers, librarians, and administrators had different expertise, they were given different sets of questions (with the exception of demographic questions, which were the same for all groups). For instance, administrators were asked to describe their challenges with access and lack of regulation. Librarians, on the other hand, as the custodians of all scholarly works, were asked questions that revolved around technologies needed to make their libraries capable of providing research information to users.

Interviews were transcribed, documents reviewed, and observations combined and coded for themes. Using Creswell's (2002) approach to finding meaning, data was analyzed by first coding, then generating themes from the codes. The themes were then explored for their descriptive meaning and interpretation. The three types of data sources (interviews, observation, and policy analysis) were examined for similarities and differences.

Several methods were used to ensure the quality of this research. First, the three types of data sources (interviews, policy analysis, and observation) were triangulated to determine validity between them, while also comparing the accounts between the participants (researchers, librarians, and administrators) (Greene, Caracelli, & Graham, 1989). Also, a peer debriefing process provided an opportunity to establish credibility between researchers on the findings. Lincoln and Guba (1985, p. 308) define peer debriefing as "the process of exposing oneself to a disinterested peer in a manner paralleling an analytic session and for the purpose of exploring aspects of the inquiry that might otherwise remain only implicit within the inquirer's mind." Finally, each participant was given an opportunity to validate their own interview transcript through a member-checking process.

RESULTS

The data set was coded and interpreted to generate appropriate themes. Analysis of the interviews, observation, and document review indicate that societal fears of cybercrime have made researchers more cautious when sharing their work in IRs as well. Researchers are not necessarily afraid of using the IR specifically, but lack trust in the ICT system and are afraid to share their work online for fear of losing control of their work. Several themes emerged about which specific factors scared them the most (Table 1). In addition, while researchers may be aware of the difference between an open system and a closed system (like the IR),

training researchers on the use of IR (as compared with other types of online publishing) did not alleviate their concerns. Specifically, the participants in this study feared fraud, plagiarism, and lack of protection (vulnerability) should they be attacked (Table 2). Policy analysis and observations indicated that these fears were well founded: there is indeed minimal structure to protect researchers.

Data Source	Themes	Participants
Interview	Fraud	RS, LIS ADM) EXT ^a
	Plagiarism	RS LIS ADM EXT (2RS dissent)
	Vulnerability	RS LIS ADM, EXT
	ICT Infrastructure	RS LIS ADM, EXT
	Account takeovers	RS LIS ADM, EXT
	Poor cybersecurity	RSLIS ADM, EXT
	Poor funding	RS, LIS ADM EXT
Document Review	Electricity outages	RS, LIS ADM EXT
	ICT Infrastructure	
	Poor Internet access Internet security	
Observation	Fraud	RS LIS ADM, EXT
	Plagiarism	RS LIS ADM, EXT

Table 1. Emerging Themes from Various Data Sources

aRS - Research Scientists; LIS – Librarians; ADM - Administrators. All participants agree to the themes above in full, except for plagiarism, where two out of 16 research scientists dissented.

Fraud

Researchers indicated that they had been the victims of fraud multiple times. For them, fraud has included being scammed, hacked, or violated online so that a criminal could access their information. For example, a research scientist who has been scammed in the past stated,

My email (account) has been taken over in the past. Besides, my friends have had similar experiences. I have no problem publishing my articles online, but I am not sharing my important dataset in IRs. I will have to be convinced the platform is safe before sharing certain data online.

However, despite the concern researchers may have about using an online platform in Ghana, they also understand the benefit. One participant expressed the need to open up research to a wider community, as initiated by the European Union:

Just yesterday I read a news which stated that the Europeans leaders (European Union) have met and made a dramatic statement. They have called for immediate open access to all scientific papers by year 2020. For us in CSIR, one of our tough challenges has been access to current data; we need to start something of our own now.

While participants may have understood the value of putting research online, they were also quick to enumerate the factors preventing them from using a system like the IR. Online platforms require accounts, and it is not always easy to know which emails related to those accounts are authentic. As one respondent noted,

The number one concern in this region is cyber security. I am a victim of cyber fraud. My email was hacked. I received a mail to update my details, and when I did it, that was it. My email account was taken over and was used to perpetuate fraud. This has affected me a lot, anytime I do online transactions, I am overly conscious.

One researcher has been working for ten years, but fears cybercrime as the only thing standing between him and doing anything online: “A lot of people have fallen into this trap and . . . to be part of any online platform, I want to make sure it is pretty safe, [even if the platform is assumed safe] I will decide what kind of information to release therein.”

Because of the increase in cybercrime across the country, one researcher stated,

I have no trust in the cyber system any longer. This region [West Africa] is a hot bed for these fraudsters. This has prevented many people working online because you don't know when someone hacks into your account. If this [cybersecurity] is not corrected, the consequences could be dire.

Participants also described their fear of being swindled by owners of predatory journals. By putting research online, they felt like they had become more identifiable, making them a target. This fear translated to the IR and indicated that while researchers might be aware that the IR was a different type of system, they weren't willing to take the risk. Researchers claim they received numerous offers to publish in these journals; a few may have fallen prey to this scam. While this concern may not be specific to Ghana, the weak cybersecurity in the

region may have heightened researcher fears of any online environment. The rise in predatory journals has just made publishing research in open environments even more confusing. One researcher noted, “I have sent a paper to a predatory journal in the past, in fact I was misled. Their website was similar to ‘X’ [name withheld] journal.” Though an IR is different than a predatory journal, the two are similar in that they both appear to offer open access to researchers. Another concern related to predatory journals involves fraudulent researchers claiming other researchers’ work as their own. In the past, researchers have complained that their proposals were used without their knowledge, sometimes in different wording.

These fears have specific significance for librarians who want to encourage researchers to share work in the IR. For librarians who have been at the forefront of providing information for researchers, the digital age introduced positive opportunities such as open access but also risks that the scientific community could not handle. One recounts the many times he may have been swindled: “The scam in our region is impacting every aspect of our lives. Now researchers are apprehensive in what they do online, despite the training anymore and this is impacting their participation in IR activities.”

Plagiarism

The findings show that plagiarism was a major concern for researchers. In the interviews, researchers recounted the number of times when they were “scammed” or read about fraud in the news. Participants stated that the ability of cybercriminals to steal personal identities online made it seem even more possible that their research materials could be stolen or plagiarized online. For example, someone could take unpublished work they found in the IR and submit it to a journal using their own name. This has affected their perception of sharing research data online anywhere, including the IR. Words such as *scam*, *swindle*, and *fraud* were repetitively used by participants throughout the data. A researcher who has been working for ten years states,

[Putting data in the IR] will be a good opportunity for fraudsters to plagiarize hard fought intellectual properties from scientists. I hear there are plagiarism checkers, but I wonder how good this would be. The same people who develop technologies are the same who sometimes do these things. It’s a scary situation.

Another researcher shares that he will be reluctant to put his research data online because he feels that posting it online in the IR is like giving it away for others to use:

All our lives are dependent on the data we generate, if I have to contribute my hard-earned data in a general pool and lose ownership of it, I have to be in

incentivized in one way or the other. This could be in the form of receiving points for promotion.

Though the researchers in this study generally agreed that plagiarism was something to worry about when putting research online, two researchers thought that the risk of plagiarism was not increased by sharing research online. One commented that regardless of the environment, plagiarism will occur and is a problem within the research community in general:

For plagiarism, it doesn't matter the platform, whether it's in books, online . . . I think that if people are made aware of what is going on, for instance if you read and you don't copy there should not be any course of alarm. Just a how the journals try to secure its content, a repository can adopt the same kind of style for security purposes.

Another researcher emphasized the legal recourse available to scholars should plagiarism occur, and argued that plagiarism is easier to detect in online materials:

I don't see why academics make noise about plagiarism. It is an age-old problem that will not vanish into thin air for nothing. . . . That is why we have copyright rules to follow. . . . One of the reasons we have copyright is to sue those who offend the law. . . . It is faster to notice plagiarism electronically than in the print media.

Vulnerability

Several researchers in this study indicated that the lack of protection for victims of cybercrime was of great concern to them. They expressed concerns that there were few protections in place to protect them if they were victimized, or to prevent cybercrime from happening in the first place. Most participants lamented the apparent lack of protection offered by the government. One researcher advocated for librarians taking a lead role in making the community aware of ways to detect and punish cybercrime:

I know there is so much cyber fraud and that it is a major issue in our region. However, I also think this is a golden opportunity for the LIS community to enlighten users that the same medium used to perpetuate the fraud could be used to arrest the fraudsters. There are technologies such as plagiarism software and many more that can help reduce the situation. It is now the responsibility of the LIS community to enlighten its users on this.

Low funding for research contributes to the problem. For administrators (whose main role is to provide funding for research activities), the inability to find necessary funding puts a lot of strain on research work. They think central government funding is woefully inadequate and contributes to the problem:

If your main source of funding comes from Government then it is likely you are going to be handicapped with getting equipment and other supplies for research. This is the situation we are in and the effect on research quality cannot be underestimated.

Administrators also expressed some satisfaction with the current IR system that finally allows researchers to share work between institutions, stating that things were better for research now than before. One administrator described how the IR made it so that access to research was more instantaneous and less tedious:

In the past researchers [had to] walk from one institute [research institute] to the other to know what kind of research was going on. Even then there was a lot of repetition of works [research] and I think the idea of a central platform will be great.

	Fraud	Plagiarism	Vulnerability
Librarian	"Our continuous training [on fraud] is few and far between."	"Plagiarism is scary for the research community in general."	"The library has a responsibility to protect user data."
Researcher	"My inbox is always inundated with invitations from predatory journals."	"Besides my published papers, I will not upload my documents online."	"How much can an institutional repository protect raw data?"
Administrator	"Many times users have complained of online fraud."	"We need commitment to more funding to fight these crimes."	"We lag behind in fighting crime in this country."

Table 2. Sample Quotations from Participants in Each Role Related to Themes

ICT Infrastructure

A running theme throughout all of the data was that the cyberinfrastructure in Ghana is still in development. Policy documents (Republic of Ghana, Ministry of Communications, 2004; Information and Communications Technology for Accelerated Development, 2003)

indicate that the Ghanaian government began to invest in the system to improve security and training, but funding remains an issue. Researchers repeatedly made comments about slow networks and computer systems that made it hard to get online, as well as problems with electricity. This difficulty is also corroborated by the literature, which indicated that features like single sign-on and authentication systems hinder the use of research databases (Dadzie, 2005). Administrators and librarians both indicated that they recognize that an IR would help to meet this need, but that lack of funding had an impact on getting the hardware necessary to run a robust system.

DISCUSSION

Many researchers in Ghana have personal experiences with cybercrime that make them fearful of using online environments where they might become victims again. Rather than fearing the act of sharing research or the IR specifically, they are wary of the online environment, and do not trust that the ICT is stable enough to protect them. While their experiences with cybercrime occurred on a personal basis (rather than at work), the reality of working in an insecure online environment transfers into the work life of these researchers. The findings also make it clear that researchers are very much aware that sharing research online is good for them, and for the field. However, fears of fraud, plagiarism, and susceptibility to cyberattacks trump such recognition and prevent them from sharing research online as often as they would like.

Librarians, researchers, and administrators seem to agree that cybercrime affects research activities negatively. Researchers feel that the cyber environment is rather fragile and unattractive for scholarly work, making them vulnerable to attack in an environment they have little trust in. However, one in particular thought that the library community could play a larger role in making it a safer environment. Librarians thought that the system lacked the regulations and training required for information professionals to manage modern academic scholarship. Administrators seemed to feel that there had been major improvements in infrastructure, and that the IR alone was a huge improvement to research. However, they also felt that a lack of funding affected the ability to protect researchers from cybercrime.

The researchers in this study had a great deal of personal experience with cybercrime. Many had personally experienced hacking, fraud, and solicitation, and some had heard about other researchers experiencing it. In particular, the participants in this study said that they experienced cybercrime directly, or knew colleagues who had experienced it. Predatory journals were one of the major concerns for researchers. Researchers confirm the importance of open access scholarship for academic work (Atiso, 2017), but worry they will be fooled by a predatory journal presenting itself as legitimate under the guise of open access. Recently,

the CSIR has sent a communique sharing Beall's List of Predatory Journals and Publishers (Council, 2017) and stating that any articles in predatory journals will not be counted toward promotion and tenure. While this is not directly related to cybercrime, it does make researchers more confused about where it is safe to publish and share scholarly work. Some worry that a predatory journal might even take work out of the IR to use inappropriately. The interviews with researchers indicate that librarians are in a prime position to advocate for computer systems and networks that can protect researchers from being spammed, solicited, or hacked in their work environment. In addition, offering more incentives for researchers to use the IR may make their presumed risk more worthwhile. This finding relates to research by Bartol and Srivastava (2002), which indicated that rewards systems are indirectly related to the development of trust in an organization and participation in knowledge-sharing systems.

CONCLUSION

The cultural implications of working with insecure computing systems are vast. Fears that come from personal experiences with online fraud Bartol and Srivastava (2002), which indicated that rewards systems are indirectly related to the deceit or deception may be brought into the work environment when they are so commonplace. While researchers in developed countries like the United States may also worry about things like plagiarism when using IRs (Davis & Connolly, 2007), they do not worry that the systems they are using within their institution are vulnerable to attack. In Ghana, researchers fear that the weak cyber-infrastructure in their institutions could lead to them losing control of their accounts, or that their work could be used for unscrupulous purposes. In other parts of the world, it is common for researchers to attend cybertraining that teaches them how to protect their data and passwords and learn strategies to identify when they are being scammed, phished, or exploited. In Ghana, this initiative seems to be lacking or happens at irregular intervals. Without secure systems and training, researchers feel more vulnerable.

This research also found that environmental factors related to using slow networks and outdated systems and hardware impeded researchers from using technology as much as they might otherwise. In addition, the high cost of subscription databases was a barrier for researchers seeking existing literature. This study found that an IR would help to disseminate research, if support could be built for its use. The impact of not having access to local research is that researchers in Ghana are less able to build on existing research. This means that less scholarly work comes from Ghana researchers.

Finally, this study found that processes that exist in developed countries, like security and training, might help alleviate researchers' fears about sharing work online in secure environ-

ments. This presents an opportunity for librarians and administrators to play a significant role in improving the barriers faced by researchers in Ghana. Librarians may be in an ideal position to provide digital literacy training related to staying safe online, as well as act as a liaison with information technology departments to improve protections. For administrators, securing funding for the purchase of new hardware and software, as well as advocating for better cyberinfrastructure, may play a positive role in research development in Ghana.

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