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INFORMATION SECURITY, INNOVATION AND NATIONAL DEVELOPMENT: A SYSTEMATIC ANALYSIS

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Abstract
Information and Communication Technology (ICT) has brought to place the field of Information Security (IS) that is concerned with analyzing and tackling security concerns and threats in the cyberspace. This study explores the place of IS in innovation and national development. It argues that the critical and strategic security role played by IS stretches beyond the cyberspace to other spheres of society, consequent upon which it serves as a catalyst for innovation and national development. Drawing evidence from extant literatures, the study shows in its analytic description that as IS provides security and innovations in various endeavors, it contributes significantly to national development and the strategic interests of nations like the USA that is deeply concerned with and involved in IS. It concludes that given the crucial functions in safeguarding cyberspace and other critical sectors, IS indeed serves as a catalyst of innovation and national development. The study calls on stakeholders to make concerted efforts to create awareness about IS and increase the deployment of IS for the mitigation of cyber threats and attacks.
Keywords: Information Security, Catalyst, Innovation, National development

Introduction
Security and innovation are some of the crucial embodiments of national development. They are essential attributes of national development. The place of information security (IS) in national development cannot be overemphasized (Thuraka et al., 2024a; Okusi, 2024a). National security involves strategic national interest and the ability of a state to address threats to the overall wellbeing of the nation and its citizens (Adeniyi, 2024). It is aimed at protecting and promoting the ultimate interests and vital needs of the citizens and the nation threatened by various kinds of security challenges (Shobande, 2016). Human security and the safety of property and other non-human things are critical national concerns. Being of national concerns, it is imperative to leverage IS for their attainment. This study is informed by the need to expose the role of IS in innovation and national development.

Development is variously defined. The various definitions share a common viewpoint. Ibanga (2018) defines it as a society's advancement that meets the welfare of its citizenry, ensures respect for human rights, provides opportunities for the realization of individual, collective and national interests, guarantees and protects human rights and those of the non-humans, and allows for rendering of material assistance to other societies in need. Therefore, this study rises to make a systematic analysis of information security (IS), as a catalyst for innovation and national development. The ways through

which IS serves as a catalyst of innovation and national development will be highlighted.

Rising Cyber Threats and Information Security Urgent Emergence

With widespread digitalization and digital realities and feats so far, information security (IS) has emerged overtime, as a concept and practice (Obinna et al., 2024; Okusi, 2024a; Thuraka et al., 2024a&b). Information security plays a crucial role in the mitigation of the rising threats, thereby fostering innovation and national development. As society relies on the internet for digital operations, transactions and data management, cyber attacks are occurring worrisomely (Odunayo, 2024; Saeed et al., 2023; Mishra et al., 2022). The internet is a pool of computers connected via a network, where seamless communication and data, ideas, views, thoughts, messages, etc. are produced, disseminated, stored and shared among billions of users, though with different sets of users in various settings (Okusi, 2024c).

The use of ICT, web applications, software packages, information technologies, devices and platforms, and the internet with all its accompaniments by over 4.95 billion people among the global population is consistently threatened by some expertise users and developers of the sites and applications, as they attack and hack sites and other internet belongings of other users (Okusi, 2023). Okusi (2023) analyzes cross-site scripting, identifying some of its preventive techniques. The study indicates that web application is being highly attacked, because of the vulnerabilities that exist on the online space while using the modern technologies. Thus, in order to have a secure or safe web application, preventive techniques have to be devised and utilized accordingly. The study is thus an attempt in that direction to contribute to quelling web application attacks, which are some threats to cybersecurity.

The spate of cyber threats in contemporary times is worrisome (Akinola, 2024; Akinola et al., 2024; Kodete et al., 2024; Nwode et al., 2024; Nwosu et al., 2024; Pasupuleti et al., 2024a&b, Thuraka et al., 2024; Aldasoro et al., 2020; Gallaher et al., 2006). Mishra et al. (2022) and Bouveret (2018) show, cybersecurity attacks adversely affect all and sundry in a nation. Aikpokhio et al. (2024) and Houwayji (2024) are of the view that stringent measures have to be developed and sustained against cyber threats. To that end, the need for IS cannot be overemphasized. The integration of cyber forensics analysis (CFA) into digital operations, transactions and data management is one way of addressing cyber threats as well as ensuring IS. Another way is to integrate AI and smart technologies into cybersecurity and IS operations and activities. By ensuring safety in cyberspace, innovation and development are realized.

Okusi's (2023) study decries the spate of cross-site scripting attacks and emphasizes the efficacy of AI techniques for tackling the malaise. It notes that cross-site scripting attack may be used for storing unauthorized cookies or other data in the browser session of the potential victim, with the intent of injecting script into web pages. The study proposes the leveraging of "DEEP FOREST", a developed but yet to use machine learning algorithm, and four class imbalance techniques to address the risks of cross-site scripting attacks. The study relates to the present one, as it concerns itself with cross-scripting threats to cyberspace and the advanced technologies for reducing and preventing them. In the same vein, Kaur et al. (2023) explore machine learning and neural network-based XSS attack detection techniques, such as deep neural networks, decision trees, web-log-based detection models, and prove them to be viable mechanisms for detecting and preventing XSS attacks.

The study charges future researchers to carry out more work on techniques for improving detection and prevention of XSS attacks. In their own contribution, Zhang et al. (2019) propose a new approach to detecting XSS attacks, using information from multiple stages. The approach calls for the use of Word2vec, a technique of Natural Language Processing (NLP). Doing the foregoing implies carrying out IS tasks. The various advanced technology techniques for quelling cybersecurity are instruments of IS, with which innovations in technology sector are achieved and then extended to other sectors (Okusi, 2024a).

Information Technologies, Innovation and National Development

Information and communication technology (ICT) is said to be a short hand for computers, software, networks, satellite links and related systems that allow people to access and share information and knowledge in various forms (Nwafora et al., Ghavifekr & Rosdy, 2015; Osuchukwu, 2012). It has been exerting huge impact on various spheres of life (Okafor, 2010). According to Anjugu (2013), technology includes blogs, picture sharing, music sharing, crowd sourcing, e-mail, instant messaging, and voice record. AI and smart technologies, among other cutting-edge technologies, are advanced technologies additional to those mentioned by Anjugu (2013). It should be noted that IS has the potentials of improving efficiency and digitalizing operations, and service delivery.

Nwode et al. (2019) observe that ICT has adverse effects on users, especially youths, and influence their cultures, perception and behavior. The adverse effects are parts of the concerns of IS. Through its experts, IS raises concerns about these effects and offers valuable insights to addressing them accordingly. Ogwo (2016) avers that technologies and social networking sites (social media) are adversely affected by values. The adverse effects, the present study argues, are being addressed significantly by IS, because IS consistently look into such matters and present safe values and systems. By so doing, IS helps foster innovation and development. Similarly, Kraidy (2013) observes that global media and information technologies have substantially increased contacts between cultures, both in terms of intensity and of the speed with which these contacts occur. The increase has both advantages and disadvantages, with the former being more obtained than the latter.

Technologies proffer both opportunities and challenges (Nwode, 2022; Asogwa & Asogwa, 2014). As humans over depend on machines, knowledge inhibition obtains, and employees become less creative and productive. These are concerns examined by IS, because human safety as well as that of systems like knowledge gets affected adversely. The adoption of technologies is constrained by a range of factors. These include resistance to innovation by some professionals, lack of performance appraisal, poor monitoring, clashing stakeholders' expectations, poor training, insufficient resources, inadequate collaboration, ethical issues of data security and privacy (Ogirri, 2024; Kodete et al., 2024; Okusi, 2024c; Pasupuleti, 2024a&b; Thuraka et al., 2024; Braimer, 2018).

Ude-Akpeh (2020) notes that technologies have socio-cultural implications that manifest on users. This implies that information technologies contribute to cultures in ways that lead to cultural innovation and development. AlQudah et al. (2021) point out that anxiety, computer self-efficacy, innovativeness, and trust are the most influential factors affecting various healthcare technologies. Of course, the factors also affect many other sectors, including innovation and development. European Union (2019) notes that confining IT innovations to one setting causes difficulty in accessing technologies alongside the innovations they have in vogue. Thus, implementation processes and modalities should be considered.

Braimer (2018) has noted that IT has been exerting positive impact on healthcare systems, diagnoses, treatment of patients, service delivery, communication, research and development. The new ways of doing things and the developmental feats brought to place by IT are regarded as technology innovation. In the same vein, IS has brought to place various innovations in the aforementioned endeavors and many others. It has been making the cyberspace relatively safe. It has also made the human efforts to secure the cyberspace seamless, efficient, easier, faster, and fostered high quality and standard. Further, Maghsoudi et al. (2015) indicate that public and private sectors differ in the ways they manage technological innovations. Their differences are obvious in budget constraints, organizational objectives, decision-making, and incentive strategies. These affect innovation and development in no little ways. As such, since IS helps address some of these concerns, it is logical to assert that information security is a catalyst of innovation and development.

Innovation, as Rantala et al. (2018) righty note, can be sustainable through the adoption of suitable models that support the potentials of new technologies and technological innovations. They emphasize that technological innovation improves sustainability in different areas of the society. Larnyo et al. (2018) are of the view that innovation of all kinds can only stand the test of time if it is rooted in sustainability considerations. These are social, environmental and financial factors, research and development (R & D), and commercialization. Thus, since IS, a technological innovation concerned with cybersecurity, possesses the noted attributes, there is no doubt that information security is a catalyst of innovation and national development.

Hossain et al. (2016) urge researchers to utilize newer and better approaches to measuring open innovation, the place of appropriateness in enabling open innovation, and the integration of open innovation into existing theories of management and economics. It follows that research impacts significantly on various spheres of life. To that end, researchers ought to be critical, empirical, objective, innovative, technology-driven, and problem-solving. Besides, they have to let research innovations be guided by conscious design of appropriate innovation for contextual suitability and usability (Long et al., 2016). According to European Union (2019), the adoption of technologies for health systems should begin with critical evaluations, which should spell out the relevance of the digital technologies to be adopted, and evaluate their uses, costs, and consequences.

IS has a place in the adoption and the associated trends of IT in the healthcare sector and other endeavors. Development and implementation are the most essential parts of evaluation (European Union, 2019). This point highlights the correlation between innovation and (national) development and thereby underscores the novelty of this study in engaging with IS, innovation and national development. More so, leadership behavior is considered to be foundational to transformative change in any spheres of society (Peter et al., 2023; Saunders et al., 2023). That is, ideally, organizational changes are influenced by leaders. The ways in which leaders influence the changes matter a lot. It follows that the extent to which IS can go in playing crucial roles that foster innovation and development depends on the leadership behavior or influence inherent to a society. Leaders have to influence the adoption of technologies and the utilization of IS to pursue and realize safety in cyberspace.

Cyber Forensics Analysis, Innovation and National Development

Cyber Forensics Analysis (CFA) entails collecting, preserving and presenting digital evidence in legally permissible manners. It is a subfield of computer science, which combines law, and

investigative processes and techniques of information collation, processing, transmission, management and analysis (Homem, 2018). The aim of CFA is to uncover data breaches, fraud, and other kinds of cybercrimes analytically, empirically and evidently. Various activities, which are targeted at innovation and development, require collection, investigation, analysis, and management of critical or sensitive information and data breaches. CFA is a viable technological means of combating cyber threats to various spheres of society in the public arena.

It protects organizations from data breaches, privacy invasion, cyber thefts, huge losses of finance, data, critical infrastructure and image to cybercriminals, and from facing legal corollaries (Ahmad et al., 2020). By analyzing, detecting, acting upon, and preventing risks or threats, CFA helps in ensuring cybersecurity (safety in cyberspace), which leads to innovation and national development in any country of the world. The following Table 1 highlights ways in which CFA helps to ensure security, innovation and national development:

Table 1: Roles Played by Cyber Forensics Analysis

S/N	Variables
1	Assessing and managing risks
2	Gathering and conducting diligence in transactions
3	Fostering prompt response to incidents
4	Ensuring timely recoveries
5	Optimizing operations and activities
6	Enhancing security against cyber attacks, and organizational image or reputation
7	Rousing maximal performance and results, efficiency, profit maximization and market stability
8	Protecting sensitive data and critical infrastructure
9	Building or increasing trust or confidence
10	Ensuring compliance with regulations, policies and legal frameworks

Source: Authors, 2024

As Table 1 typifies, CFA enhances security by virtue of its strategic security functions; offers greater opportunities for innovation; fosters (national) development in various sectors; and increases transparency in transactions, confidence, trust, authenticity, legitimacy, resilience, diligence, research, and discoveries. The foregoing summed up functions of CFA are the base of its importance or benefits to society in various regards, including in the areas of innovation and development. Given that CFA is an integral part of IS, this study argues that IS offers the aforementioned prospects to society in different regards, which together bring forth innovations and developmental feats.

Other IS (technological) mechanisms include intrusion detection systems, secure communication platforms, encryption tools, techniques of machine learning, deep learning, computer vision techniques, and natural language processing, other AI algorithms, smart technologies, and applications. To further justify the foregoing, the Table 2 below contains the findings of some empirical studies on CFA:

Table 2: Evidence from Randomized Findings of Selected Studies on CFA

S/N	Authors & Year	Findings
1	Mishra et al. (2022)	Some countries have stringent laws and harsh penalties against cybercriminals, while others have flexible and light ones. For examples, the US is the country having the highest banking cybersecurity regulatory policies, while Canada has the highest policies on E-commerce and spam.
2	Houwayji (2024)	Lebanon financial markets have been facing internal and external pressures. Interestingly, diversification, hedging, and contingency planning are risk management practices that can remedy the pressures, as they play a crucial role in organizations' and investors' financial risk management.
3	Aikpokhio et al. (2024)	Risk identification, assessment, response planning, and monitoring and control improve cost performance appreciably. By so doing, these four risk variables reduce costs.
4	Okoro and Ayaba (2023)	Risk assessment and management in diversified portfolios, efficiency extent, capital structure, corporate governance, portfolio creation, and strategies for asset allocation are essentials of IS, which allow for innovation and national development. Also, decision and research investments across Australia, Italy, Singapore, and Canada between 2008 and 2023 showed a significant increase.
5	Aldasoro et al. (2020)	Larger operational losses are usually recorded during credit booms and excessively accommodative monetary policy. Losses to cyberattacks are small integral parts of operational losses, which can account for the total value risks of an organization.
6	Al Mutawa (2018)	Cyber forensics models are effective tools for undertaking behavioral analysis (BA), investigation and pragmatic solutions to various problems.
7	Ul Haque et al. (2023)	Cyber forensic investigations (CFIs) can adequately mitigate cyber threats and improve security.
8	Rich and Aiken (2023)	CFA enhances security against cyber threats, and makes accurate predictions, especially when combined with other mechanisms such as cyberpsychology.
9	Dwivedi et al. (2024)	Cryptographic cloud forensics technique, an integral part of CFA, can improve security, increase cloud-based machine learning systems, facilitate evidence-gathering investigation, secure multi-party calculation, and handle delicate information without any data breaches or harms. Decision trees (DT) and random forests (RF) detect assault accurately and undertake standard and high level of encryption of different kinds.

Source: Authors, 2024

Clearly, extant studies lend credence to the thesis and claims of the present study in various regards. Given the presented findings, it is quite obvious that CFA is one of the systematic ways through which IS contributes to the 21st century society innovatively and developmentally. The findings quite align with or reflect the points noted above, including the benefits contained in Table 1. The novelty of the present study is that it goes further to situating CFA in IS, innovation and national development. While the extant studies on CFA and IS do not fill this research gap, the present one does. In addition, it deploys a nuanced integrative approach in engaging with CFA, IS and national development, unlike extant studies that engage with each of them separately.

Generally, the adoption of technologies for meaningful innovation and development involves accessing them, creating favorable policies and regulations, contextualizing them, preparing for sustainable adoption, financing, implementation, and regular monitoring (European Union, 2019). There are ethical concerns about the adoption of technologies and imbibing technological innovations. These include issues of ethical governance, data protection, privacy, human welfare, transparency, redundancy, moral responsibility, accountability, dismissal, unemployment, and violations of regulations, policies, laws and ethical standards (Peter et al., 2023; Farre et al., 2023). Also, the utilization of CFA to pursue and realize innovation and development should be guided by:

- Emerging sustainable cybersecurity strategies, which are result-oriented and problem-solving;
- Developing and instituting effective measures and modalities for risk management;
- Awareness and technical-know-how should be increased through systematized teaching, learning and training activities;
- Interdisciplinary collaboration and partnership, and systemic supports should be built and sustained;
- Well build comprehensive, pragmatic and sustainable incident response protocols;
- Combined technology-based mechanisms for quelling security, optimizing activities, tasks and knowledge, pursuing and attaining innovations and development;
- Meaningful stakeholder consultation, effective communication, performance assessment, and detailed, critical and timely auditing.

Conclusion

Obviously, the place of Information Security in innovation and national development cannot be overemphasized. It is evident in the descriptive analysis done so far. The thesis (central position) of the study has been proven with evidence from extant studies that IS, a subfield of Information and Communication Technology (ICT), is concerned with securing the cyberspace in various ways through various technology-based mechanisms. Being threats associated with IS and ICT, such mechanisms are more result-oriented and problem-solving within the areas of cyberspace and the related ones than the otherwise or opposites.

Basically, there are different ways in which IS serves as a catalyst of innovation and development in society. These include fostering innovations, trust and confidence in digital ecosystems, defending cyber capabilities, allowing for e-commerce, supporting economic growth, promoting development and research, fostering national security and resilience, empowering societies and citizens, and establishing regulations and ensuring compliance with regulations. Given the exposition so far, the

study concludes that undoubtedly serves as a catalyst of innovation and national development by virtue of its crucial functions in safeguarding cyberspace and other critical sectors. Stakeholders are charged to make concerted efforts toward creating awareness about IS. They should also consistently strive to heighten IS in order to reduce cyber threats and attacks significantly in the digital society of globalization.

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