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An Investigation of The Vulnerability of Information Technology Governance (ITG) Models And Multi-Stakeholder Security Governance Scaling (MSGS) Correlates that Supports Decision-Makers Scalability Mechanism for the Successful Implementation of ITG Within UK's SME Aviation

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ABSTRACT

Primarily, our focus on secondary data obtainable from journal articles and a futurelearn.com study platform will be used to collect data on SME decision-makers. Data will also be raised on stakeholder views considering the obstacles to the implementation of ITG by SMEs. Such an opportunity will provide a basis for future research on why SMEs are becoming involved in the application of ITG models. Further information on how such could help in the successful implementation of ITG by SMEs will be explored/evaluated. Subsequently, this includes theorising scaling in ITG to determine the correlation between ITG and MSGS. Similarly, a fuller insight becomes achievable by the researcher on the implementable ITG; whereby the strategy is compared to the theory in practice. The findings remain a contribution to knowledge. This section – Research Methods will give the subtleties of the optional information procedure embraced to address the examination issues recognised above, together with the methods for gathering information for the investigation, including the interpretation and the examination of the data received. The paper concludes by highlighting the constraints with the choice of secondary data strategy and its usage.

Keywords: Investigation, Vulnerability, Information Technology Governance (ITG) Models, Multi-Stakeholder Security Governance Scaling (MSGS), Decision-Makers Scalability Mechanism, UK, SME Aviation

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1. INTRODUCTION

Research practitioners over the years sum up the use of research strategies as what makes a difference is not the mark that is joined to a specific system, however, whether it is suitable for particular research (Saunders et al., 2007; Silverman, 2016; O'Sullivan et al., 2017). Objective 3 of this study sets out to 'investigate how the vulnerability of ITG models and MSGS correlate to supporting decision-makers', and this will be implemented through the discussion and analysis of secondary data. Similarly, objective 5 will be implemented via secondary data analysis of a survey appended to an academic programme delivered via the futurelearn.com platform. The question then arises, what research strategy ought to be adopted to meet objectives 3 and 5?

The exploratory research in this study centres on investigating practitioners' stakeholder view regarding objective 3, and to discuss decision-makers' stakeholder perception concerning implementable cyber policy in SMEs taken the Aviation industry as a strategy. Such strategy, in essence, is primarily qualitative, not quantitative, where the arrangement exists to demonstrate that in satisfying objectives 3 and 5, qualitative identifies with exploring things in their typical setting, endeavouring to understand or decipher, marvels as far as the implications individuals bring to them (Denzin and Lincoln, 2011; Silverman, 2016). Consequently, the utilisation of existing data for research of this nature should be sufficient to achieve the objective. Johnston (2017) asserts that while secondary analysis is adaptable, it can be used in a few different ways. It is likewise a practical exercise, and a deliberate technique with procedural and evaluative advances liken to the empirical gathering and assessing of essential information.

De Haes and Grembergen (2008) noted that research in the domain of ITG implementations and its relationship with different organisational element and alignment is in its early stages. The associated theoretical models are rarely accessible if not scarcely available (Scheepers et al., 2014; Song et al., 2018). The examination idea is exploratory instead of using hypothesis testing. Apparently, this deviates from a natural science investigation where the study of natural phenomena prevails, using methods such as laboratory experiments and mathematical modelling. In some circumstances, researchers could use quantitative research to employ survey techniques within social settings and in conjunction with qualitative methods (Dwivedi et al., 2015; Myers, 1997).

Indeed, the concept of ITG, and the current ideology, only emerged in the late nineties (De Haes and Grembergen, 2009; Gregory et al., 2018; Asgarkhani et al., 2018); therefore, limited research material exists from which the researcher can build their research. The latter is not only true because it is a new research domain. Some researchers in ITG have been less successful than their colleagues in other disciplines in developing a cumulative research tradition (Benbasat and Zmud, 1999; Puklavec, Oliveira and Popovič, 2018). Since Benbasat and Zmud work in the late nineties, the assertion significantly remains. Without such combined outcomes, the challenges remain certainly feasible if solid hypothetical models are oblique.

The choice for exploratory is not unprecedented. Researchers in the past published similar titles in a reputable peer-reviewed journal. Mahmood and Mann (1993) investigated the relationship between investments in IT and economic performance; see also Khallaf, Omran and Zakaria, 2017. Similarly, De Haes and Grembergen (2008) analysed the relationship between ITG and business/IT alignment maturity. Recently, Laurenza et al. (2018) published about the effect of digital technologies adoption in the healthcare industry: a case-based analysis. Currently, high-level scholar and practitioner agenda in many organisations in the research domain of ITG and MSGS is trending. Theoretical models were rarely available; the option for exploratory research exists to build a basis for future study.

Exploratory research often builds on secondary research and or a case study. With methodologies, the contextual analysis gives a stage to comprehend the adoption of inductive approach - top to bottom. Further, in its unique setting and situation, the choice of SME Aviation in this study is more of a strategy than a method (Meyer, 2015; Bulmer, 2017). Understanding the criticisms of this approach (e.g. Alhaj, 2006; Bell, 2005; Edelman, 2016; Howlett, 2018; Thompson and Nesci, 2016), the challenges remain with making generalisations considering just a case study (Edelman, 2016; Scoones et al., 2018). Nonetheless, Alkhoraif (2018) asserted that there had not been extensive research conducted in SMEs based on the espouse of lean implementation (LI) or scaling technique to achieve more. Alkhoraif's review of available literature attempts to bridge this gap but mainly applicable in operation research approach. Cunha and Alves (2014) accentuated a similar approach in mechanical engineering and quality management to support policy decision-makers.

The same method should be available to cyber policy researchers or analysts. Decision-makers in SMEs should engage with perspectives of identifying the main challenges to cyber policymaking that lean on MSGS for bridging the gap that might exist. With the available ITG frameworks, variants ought to be accessible as the best fit to espouse by SME Aviation. The perspective on cyber policy could provide possible exploration on genuine multi-stakeholder commitment amid identified challenges to convey ITG ventures (Mysore, Elmualim and Kirytopoulos, 2019). The approach could interest cyber policy decision-makers, analysts and educators (Flyvbjerg, 2016; Banham and He, 2010; Mysore et al., 2019). Additionally, planning helps in safeguarding and grasp the wholeness and solidarity of the case (Pascal et al. 2018). The research method and strategy concurrently will afford the pathway to describe the phases under the critical findings section in meeting objective 6 that centres on the appropriate formulation of recommendations.

2. DATA COLLECTION

Adopting a case study strategy is generally considered to be qualitative research. Organisations such as universities, national and regional government and statistical institutions also collect, release and disseminate secondary data (Johnston, 2017; Hox and Boeije, 2005; Walliman, 2017). Walliman (2017) states that researchers are embracing a qualitative view usually concerned to comprehend people's impression of the world. The focus leans towards seeking insights rather than the statistical interpretation of the context. Objectives 3 and 5 of this study centres on such attainment. To understand and find explanations to such scenarios require an in-depth insight much more than merely the collection of facts and figures (Biggam, 2015; Bloomberg and Volpe, 2018). In such a process, an attempt at collecting quantitative data will suffice in the transcription. For examples, the number of SMEs decision-makers in Aviation, the number of ITG professionals involved, type and amounts of Cybersecurity awareness programme involved, number of ITG models involved, number of data breaches an organisation might have suffered, and so on.

It is essential to discuss the subject of the convenience of collection of the secondary data for this study. The method leans on the possibility to use the data collected in earlier research — earlier researchers who investigated works that differed in objectives (Hox and Boeije, 2005). The accentuation remains on the finding of useful secondary data with the appropriate search strategy. The researcher found this process convenient due to the availability of secondary data to researchers on futurelearn.com. As the information on the platform is vast and internet-driven, sources look disorganised. For accessibility, the researcher formulated a search strategy with appropriate keywords derived from objective 3 and 5 and the related questions.

However, such a strategy comes with featured problems. Hox and Boeije (2005) assert that to use secondary data, the challenges of the location, retrieval and evaluation of the secondary data are characteristically problematic for researchers. Notably, the review of how well the data meet the requirements of the current research and the methodological criteria of sound research practice. The study of relevant literature established that implementation of ITG models is an area of increasing interest. Particularly to the broader community of UK's SME Aviation's cyber policy decision-makers. Undoubtedly, the outcome of this investigation will bear some significance with those pondering similar decision-making issues. The selection of the UK's SME Aviation in this study presents an ideal opportunity in the discussion of issues that surround the vulnerability of ITG models and decision-makers adoption of an implementable cyber policy in light of MSGS. Given that the objectives 3 and 5 of this research centres on gaining an understanding of the relationship that might exist between ITG and MSGS, and that UK's SME Aviation decision-makers have discovered the needs for implementable cybersecurity policy as a resilience approach to understanding Cyber Security, the selection becomes a strategy than a methodology.

In a way, such selection is not a pretence that UK's SME Aviation is representative of other industrial sections but as a theoretical framework that what could happen in its context, or will happen, elsewhere as determinants of cyber readiness (Makridis and Smeets, 2019). Instead, it is a relational approach to be of interest to other SME's industrial sectors. With such an initiative, combining both quantitative and qualitative methods might assist in the understanding of the developing issues within the Literature Review. Nonetheless, the fundamental focus of this research strategy is the collection of secondary qualitative data. The approach will triangulate between multiple different research methods: literature research, a matter of SME Aviation, and benchmarking in research. Such triangulation could enable the researcher to obtain a more precious insight into reality as diverse methods that focus on various aspects of reality. In this way, the consolidation of a few techniques becomes a single bit of research or research aspiration (Hassan et al., 2018; Pascal et al., 2018). The opportunity to explore the relationship that exists between ITG and the problems that arise with MSGS for decision-makers in the SME Aviation digital world in the UK is intriguing.

Secondary data exploratory research in ITG tends to take place via the mechanism of respondents to questionnaires. For example, Alreemy et al., 2016; Clarke and Cossette, 2016; Harding, 2018; Khan et al., 2019; Lowry et al., 2016 adopted such an approach. With regards to quantitative data, this approach could espouse MSGS appropriately (Harding, 2018; Khan et al., 2019); for instance, '58 % of the considerable number of respondents stated they had a cybersecurity policy in their organisations' instead of testing qualitative data. It is expected that the result of reanalysing of the secondary qualitative data forms an essential input to the outcome of this study (see Table 3.1). The reader of the formulated recommendations of this study will picture the relationship between the ITG implementation and MSGS. Additionally, they will relate to the tapestry of knowledge that is developing around the field of Cyber policy - the implementable cyber policy.

There are three reasons for choosing the UK's SME Aviation. First, the six objectives in the UK Aviation Strategy 2017, to be achievable, ITG must correctly be an essential inclusion. For instance, the assertion of suitability in SMEs revealed that practitioners and scholars could recall the impact of theoretical frameworks. And as such, possibly propose alternatives that are cost-effective and specifically implementable in organisations with MSGS possibilities (Banham and He 2010; Bergeron et al. 2015; Silva, da Silva and Pereira 2018). The selection of SME Aviation allows the researcher to use secondary data. It helps in the reuse of primary data of the past research on how decision-makers are preparing for the challenge of achieving the implementable cyber policy from a different SMEs' security culture.

Secondly, the bi- and multi-lateral requests for the implementation of the right industrial cyber strategy and how the plan could contribute to the robustness of multi-stakeholder governance approach remain a global issue (Aggarwal and Reddie, 2018; Bartlett, 2018; Timmers, 2018). The EU, UK's MOD, US's DOD are successful players promoting such an initiative even till date. GreenPope et al. (2010) argue that such an approach "requires tightly choreographed activities across organisations in diverse locations." The strategy accentuates the responsibilities of Airport Commissions, Department of Transport, Ministry of Defense (MOD) and other Aviation security organisations, adopting such a synergy. Thirdly, the continued role of businesses, governments, other critical stakeholders in the emergence of industrial policy remain an opportunity. When this couple with the emerging escalation of the geopolitical context in cyber policy content of both UK, US, and other world power, it provides a strategic competition within the market space. Revealing evidence for the social inclusion of implementable cyber policy within the industrial policy strategy remains trending. The Literature Review section seems to support both the second and third assertions, with the anchor that widespread the use of the internet as a global venue for international cybercrime (Ademola, 2019).

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In the achievement of the overall aim of this exploratory study, decision-makers involved with the deployment of ITG models in the SMEs take the essential role (Banham and He, 2010). The central aim is to increase a rich, three-dimensional picture of implementable cyber policy. Such an approach centre on multi-stakeholder. Further, there is a need to ascertain the view of SME decision-makers in the determination of the relationship that may exist between variables. The relationship that exists could help variously. All suffice to uncover a further vulnerability in ITG models and support decision-making; primarily to determine the impact of cyber-attacks on UK's SME Aviation in terms of risks and costs (Asgarkhani et al., 2018; Gregory et al., 2018).

3.1 Data Collection Methods

The selection means to collect secondary data is correspondingly essential to the choice of research strategy and its justification. The study's interest centred around collecting secondary qualitative data. As such, it relied on data compiled and analysed from previous research. The researcher's desire for detailed input from UK's SME Aviation decision-makers need to avoid apparent difficulties. For instance, complexity related to compare findings from the literature review. A recommendation in terms of advice or strategy on the way forward would help to prepare decision-makers in some way. Implementing cyber policy will appreciably weaken if secondary qualitative data are not available from the applicable industrial sector.

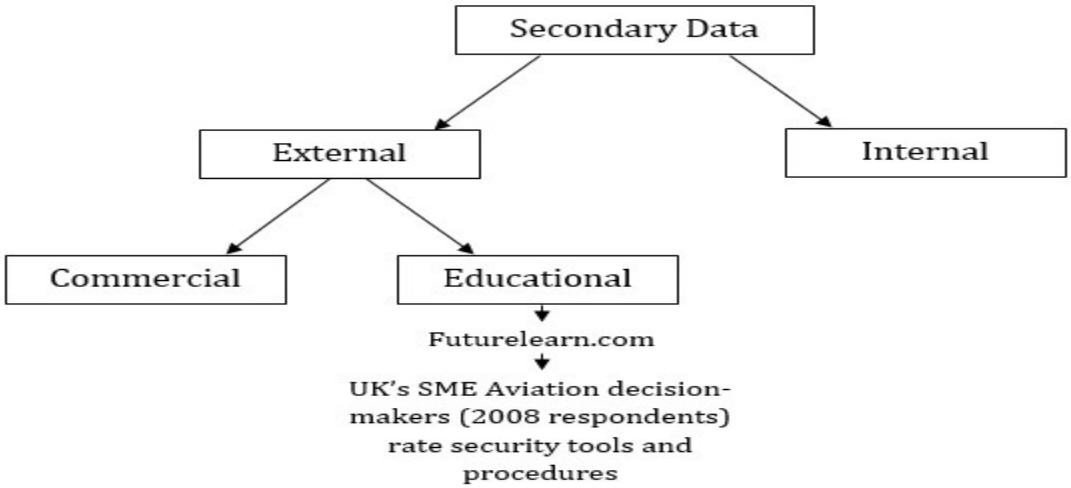

Figure 3.1 Data Collection Techniques: Secondary Qualitative Data

The data collection techniques are obtained from the survey located in futurelearn.com (see Figure 3.1) and the transcription of the collected data shown in Table 3.1. The method provides appropriate means of collecting secondary qualitative data, and commonly applied to such a strategy (Palinkas et al., 2015; Johnston, 2017; Bishop and Kuula-Luumi, 2017). The technique provides a non-time-consuming path to raising questions the researcher would have asked in a structured interview scenario or that of any survey in a primary data collection technique. The technique would ease the application of Principal Component (PCA) and the Link Analysis (LA) to help the researcher in the reanalysis of the data to meet objectives 3 and 5. The methodology, albeit advantageous, gives the chance to obtain secondary qualitative data with the benefit of providing an immediate inquiry system substantially. The inquiries remain as significant to the exploration issues. On balance, they will traction. The use of secondary qualitative data, coupled with the findings from the literature review (Ademola, 2019) is, therefore, appropriate to this study. Such a method allows for insightful and critical discussion with pertinent multi-stakeholder synergy in a dedicated framework.

3. FRAMEWORK FOR ANALYSIS

In terms of reflecting the objectives of this study, the ease of reanalysing the secondary qualitative data, the survey questions are limited to six open items according to themes. These themes reflect the overall aim and objectives, echoing core areas that arise from the review of the literature. Linkages between ITG and MSGS, Scaling and Scalability mechanisms, scaling as a Security Strategy and, to formulate recommendations and conclude, reflections and future directions. The themes are interrelated. And as such, all the topics could relate mostly to 'Awareness of implementable cyber policy in UK's SMEs'. For instance, questions on some critical systems, the experience of a cyber-attack relate specifically to scaling and scalability mechanisms — the vulnerability of ITG models, which could drive decision-makers to implement cyber policy. The themes are helpful in terms of focus and the reanalysis of the transcribed data (See Table 3.1).

Further, the ease of transcription is an indication for refocusing the research. Over 30% of the 2008 decision-makers respondents are UK's SME Aviation cyber policymakers. They answered six open questions to rate security tools and procedures in their respective SME. The items could be more closed and structured for the appropriate mix in case alternative research method adopted. Such a thematic approach to data analysis is useful to show the pattern and informed by grounded theory (Bryman et al., 2009). The secondary data are in probing to establish culture when grouped into themes. Such provides a path to possible reflection on decision-makers' view on the implementable cyber policy and the security culture of the industrial sector. The researcher will adopt PCA and LA to reanalyse the secondary data. Both approaches based on the iterative process of description, analysis and interpretation remain useful in the extracting and supplementing the evolving themes and their understanding (Bernauer, 2015). The flow representation of the process shown in Figure 3.2. Nonetheless, the non-linear approach to analysing qualitative data requires an iterative process to capture, transcribe, and understand themes and patterns (Pascal et al. 2018; Silverman, 2016).

The question may arise, why transcription? It is used to consider that an interview did not take place, recording on tape did not occur, but the researcher did a collation of the analysed primary data. In fulfilling an essential part of this research, a process to show all-the-encompassing reflection path suffices. Figure 3.3 provides a link to the results of the findings in the review of the literature. The use of PCA will help in fulfilling objectives 3, 5 as the various components indicated by the relationships identified via the data set. Also, the use of LA will help to accentuate the non-linear approach to discuss the study findings. However, the reanalysis will overall, underscore the results of fulfilling objectives 3 and 5 and, enable critical discussion about the relevant literature review findings. The essence is to connect with the accepted practice in dealing with exploratory secondary data research (Bishop and Kuula-Luumi, 2017). Such as working with data to discover that significantly is prevailing to learning and decision-making within the UK's SME Aviation (Manville et al., 2019).

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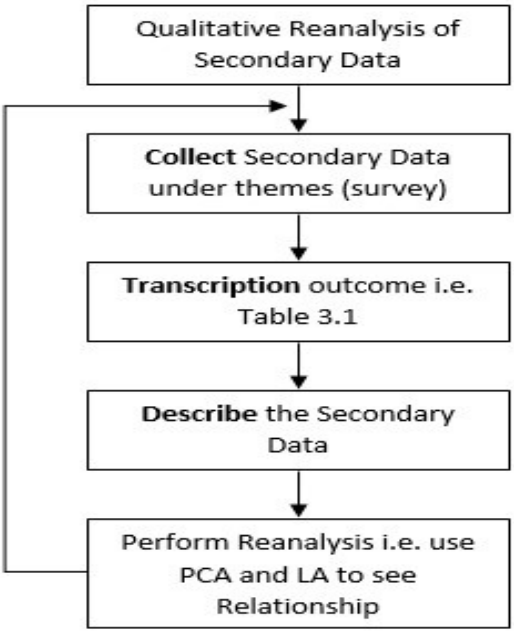

Figure 3.2. Qualitative Secondary Data Reanalysis Process for UK's SME Aviation

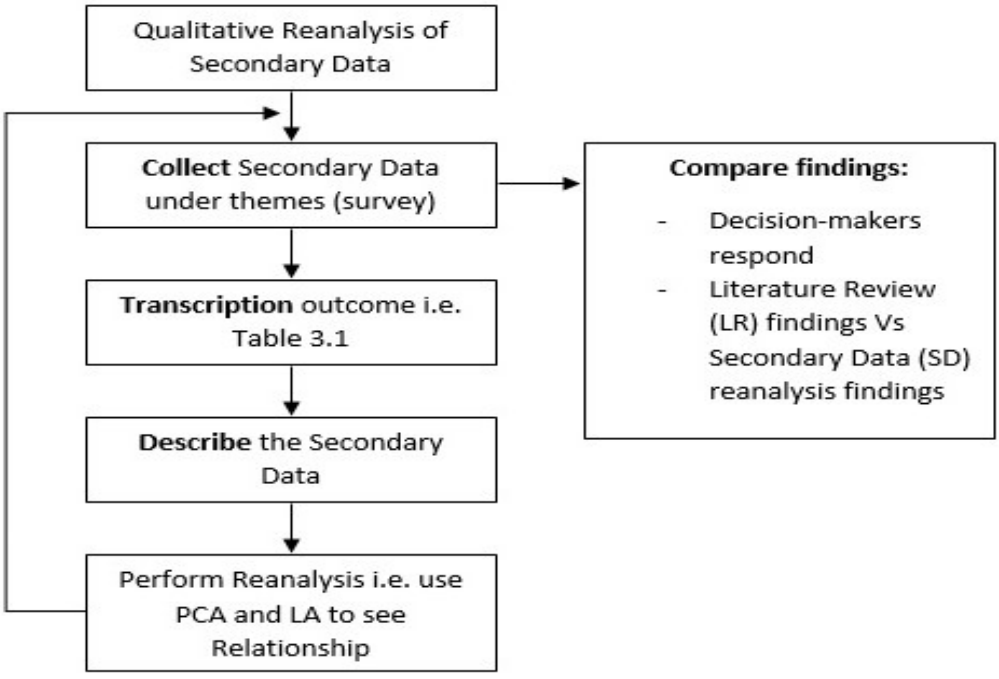

Figure 3.3. Expansion of Figure 3.2 showing links to the outcome of comparison

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Table 3.1 Transcription of the Reanalysed Data from the Futurelearn.com study units

Question	Available responses	Number of answered	Outcome
How many critical systems with sensitive information exist in your workplace?	4+ 3 2 1	All participants responded	(4+) – 42% (1) - 30% (2) - 17% (3) - 10%
Have you ever experienced a cyber-attack in your organisation before?	Yes No	All participants responded	(Yes) - 35% (No) - 64%
How would you handle a cyber-attack in your organisation, what is the first thing you would do?	Investigate internally (Ii) Call a 3rd party cyber investigator (3CI) Call the police (CTP) Ignore (IG)	All participants responded	(Ii) - 78% (3CI) – 14% (CTP) – 6% (IG) - 1%
Do you have any of the following tools/devices/methods in your workplace for security (that are maintained an up to date)?	Anti-virus (AV) Firewall (FW) Backups (BU) Encryption (EN)	All participants responded	(AV) - 92% (FW) - 89% (BU) - 84% (EN) – 55%
Do you have a cyber security policy in your organisation?	Yes No	All participants responded	(Yes) – 58% (No) – 41%
Have you had training, education or awareness campaigns in your workplace on cyber security threats to increase awareness?	Yes No	All participants responded	(Yes) – 55% (No) – 44%

4. LIMITATIONS AND POTENTIAL CHALLENGES

There are limitations to this exploratory study, considering the context of implementable cyber policy. The outcomes could fail the test of generalisability to the broader research community: although the secondary data mostly relates to the UK's SME Aviation. Indeed, the results of this study could appeal to other different SME industrial sectors. In preparing decision-makers for ITG and the adoption of scaling approach to doable cyber policy, the study of a different SME may not inherently provide the same result. With the use of a case study research, generalisability is usually unachievable (Silverman, 2016; Siebert, 2017). The researcher appeals to the concept of relatability rather than generalisability. Such a method could help to conceive the notion that incremental generalisability is doable over a period. Particularly with more empirical research conducted as well as to question the validity that centres on case study research. As such, this research sacrificing instant generalisability for an in-depth exploratory study.

The issue of reliability could suffice with the use of this strategy, especially when a survey is the means of data collection in exploratory secondary research. This study met the test of reliability by justifying the appropriateness of the research strategy, data collection techniques and the framework for data reanalysis. Transcription provides additional evidence of security as it fulfils the test of anonymisation if it existed at the time of data collection (Johnston, 2017). In this study, the existing data analysed to handle objectives 3 and 5, that are critical to this research. Indeed, it saves lots of time, money and other resources as the data are from an extensive sample survey to ensure quality and representativeness of the population. The secondary data and the corresponding analysis help to achieve conciseness.

Additionally, they help to avoid repetition of research and wastage of resources by a detailed exploration of existing research data. With minimal resources, scope and timing, this remains a valid approach. There are no ethical problems associated with the data collection as detailed earlier. The researcher declared in the proposal that there exists no conflict of interest. Indeed, this work discussed the rationale and functional elements of the research strategy adopted therein. Further, its highlighted limitations of the study and underscored the framework to minimise potential challenges.

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