

Influence of Information Communication Technology (ICT) on Social Science Research in Nigeria

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ABSTRACT

The current trend in global research development in social sciences is as a result of the introduction of Information Communication and Technology. This study is based on observation approach in which ICT had effects on social science research in the following three ICT application areas: a) Pre-data analysis, b) Data analysis, and c) Post-data analysis. These three ICT application areas had improved a researcher's productivity in terms of speed, quantity, quality, complexity as well as cost perspective is also discussed. This paper also highlighted some challenges facing ICT development in social sciences research in Nigeria. Limitation, recommendation for future works and conclusion are also included.

Key words: ICT, Social Science, Research and Social Science Research

Introduction

The early 1990s witnessed series of developments, among which is the advent of Information Communication Technology (ICT) which came in to impact every aspect of human endeavor. Information and Communications Technology in a general term that englobes mostly communication devices or applications including radio, television, cellular phones, computers and its networks such as the internet, satellite system and many more services associated with them. In a more specific term, ICT refers to the combination of different technologies. These technologies include the creation, acquisition, storage, organization, dissemination, retrieval, processing, and interpretation, transmission of information to accumulate knowledge and expedite communication (Chan, 2002).

According to Esharenana and Emperor (2010), information and communication technologies (ICT) are electronic technologies used for information storage and retrieval.

With advances in ICT, electronic information resources such as electronic books, electronic journals, CD-ROM databases, online databases and the internet have launched the world into an information age. No institution or organization can still rely on only traditional printed information resources to perform effectively and efficiently. To researchers, ICT is a significant development that provides tools for managing the avalanche of information generated by this modern technology. ICT enables researchers to create, collect, consolidate, communicate, manage and process information in multimedia and various digital formats for different purposes.

On the other hand, scientific research in strict sense revolves round using the scientific method to generate hypotheses and provide analyzable results. The focus of this paper is not in the strict sense of scientific research. Scientific research in social sciences is the accumulation and establishment of

knowledge which has been systematised and formulated with reference to the discovery of general truths or the operation of general laws.

According to Bhattacharjee (2012) scientific research in social sciences is the systematic process of finding solution to a problem. The systematic process of finding a solution entails the moving back and forth between theory and observation in the science of people, behaviours, societies and economies.

The objectives of this paper are three folds. Firstly, it provides an overview on how ICT had effects on social science research as a whole without drilling into each specific social science disciplines like education, psychology, sociology, economies et al. Secondly, it hopes to enable social science researchers to examine themselves whether

they are leveraging on some of the ICTs. If they are not, they can start adopting some of the ICTs to improve their research productivity. This second objective also enables researchers to reflect on how ICT had transformed the way they conduct scientific research in social science compare to those in previous eras. Lastly, this paper can enable ICT professionals to understand how ICT had effects on social science research. As a result, they can continue to explore and develop new ICT to further improve social science research in collaboration with other social science researchers.

Based on the objectives stated above, qualitative research method is used in this study because it provides better insights on the experience and context of using ICT among social science researchers.

Effects of ICT on social science scientific research

ICT had effects on many facets of social science research. They can be classified into three categories which include:

- a) ICT application in pre-data analysis,
- b) ICT application in data analysis, and
- c) ICT application in post-data analysis.

ICT application in pre-data analysis refers to examples how ICTs are applied on activities of social science research before reaching the stage of data analysis. ICT application in pre-data analysis includes:

- i. Article Availability
- ii. Thesis and Dissertation Availability
- iii. Literature Search
- iv. Content Search
- v. Literature Tracking
- vi. Quantitative Data Collection
- vii. Qualitative Data Collection
- viii. Big Data and Its Analytics

ICT application in data analysis includes examples how ICTs are applied on activities during the stage of data analysis and can be divided into:

- i. Quantitative Data Analysis
- ii. Qualitative Data Analysis

Lastly, ICT application in post-data analysis refers to examples how ICTs are applied on activities of social science research after completing the stage of data analysis which covers:

- i. References and Bibliography Compilation
- ii. Article and Thesis / Dissertation's Discussion among Researchers, Supervisors, Supervisees and during Viva Voce
- iii. Plagiarism Detection
- iv. Journal Manuscripts Submission

ICT application in pre-data analysis

i. **Article Availability** – Before Internet era, journal articles in hardcopy were very common whereas journal articles in softcopy were very rare. In today's world of social science research, journal articles either online or in softcopy are easily available and accessible. This is made possible by Internet technology in which after those articles were being digitized and uploaded into appropriate repositories, researchers can easily and quickly access to those journal articles via opened or secured Internet access. This observation is in line with what Sekaran (2003) had posited that modern technology is getting more popular and is used to perform literature survey. Internet technology also can minimize unnecessary printing to preserve a greener environment.

ii. **Thesis and Dissertation Availability** – Previously, most of the theses or dissertations in hardcopy were confined within libraries in which researchers need to visit from one library to another in order to gain access to the required literature. Lately, many theses and dissertations are available online or in softcopy accessible from Internet or from universities' Intranet.

This is made possible by Internet technology which enables researchers to easily and quickly access more theses and dissertations (Sekaran, 2003; Myers, 2009). Researchers also can print them as required and these can also help preserve a greener environment.

iii. **Literature Search** – Before the advent of internet, researchers need to perform manual search on hardcopies of literature in libraries whereby this is a tedious effort and the search results were limited. On the contrary, a lot of research materials, literature and artifacts today can be searched using Internet search engine like Google (www.google.com), Google Scholar (www.scholar.google.com), Yahoo (www.yahoo.com), Wikipedia (www.wikipedia.org), universities and libraries internal search engines, etc (Sekaran, 2003; Myers, 2009). Moreover, these literature searches can be performed 24 hours of 7 days at the researchers' own convenience. Search engine technology had contributed to this possibility and productivity whereby researchers can easily and quickly perform online search to access more research materials or artifacts.

- iv. **Content Search** – Previously when literature were in hardcopies, researchers needs to perform manual search on certain key words or phrases by reading line by line of the literature. Whereas in today’s world of research, researchers can utilize the softcopy literature’s search or find function (also called content search) to search for specific key words or phrases in which this is more effective and productive. This observation is also support what Sekaran (2003) had stated that online search using technology is inexpensive and can improve the identification of relevant sources of literature. Such content search also enables a researcher to evaluate quickly whether a particular article or thesis etc is worthy for his or her deeper review. Moreover, the content search also helps qualitative researcher to count the frequency of certain key words appear in an interviewed transcript more effectively.
- v. **Literature Tracking** – In the past, researchers have to sort, classify and store all their literature or artifacts that they had reviewed into computer folders or physical folders / place holders. Researchers also need to create their own tracking mechanism e.g. in word document or spreadsheet format to track and manage their reviewed literature so that they can re-use or refer to in future. Doing these manually can be daunting tasks. With the advancement of ICT, researchers can still use the old approaches but more and more researchers now are using software like Mendeley (www.mendeley.com) which can help manage, share and discover the literature contents and contacts that they had reviewed. Using software like Mendeley to track a researcher’s literature is saving time and effort as well as capable to manage lots of literature that the researcher was not possible in the past. The benefits derived from the experience of using Mendeley are in concurrence with the finding of MacMillan (2012); who discovered that Mendeley offers collaborative and productivity features to researchers, students, librarians and faculty members.
- vi. **Quantitative Data Collection** – For some quantitative research in the past, data was collected from hardcopy or email survey in which survey questionnaires were distributed to all the intended respondents for their responses (Sekaran, 2003; Bhattacharjee, 2012). Lately, data can be collected via online, web-based or Internet survey e.g. using Google Documents (www.google.com) or Survey Monkey (www.surveymonkey.com), etc. Using these purpose-built software and Internet technology which are greener technology in data collection can reduce the time and cost to collect surveyed responses from the respondents. Not only online survey can be administered more effectively, the data collected in its original format can be input directly into the statistical software. Direct input is faster and more accurate compare to hardcopy method in which researcher needs to manually convert the scores from hardcopy into softcopy before statistical processing can be initiated. Converting the scores manually is laborious and might contain some inaccuracies due to human entry error. Albeit online survey inherited the advantages as mentioned above, a researcher needs to assess whether his sampled respondents know or can have access to Internet in order to fill up the online survey.
- According to Bhattacharjee (2012), sampling bias for web survey may result when the survey website cannot prevent multiple

submissions or excluded respondents who do not have access to computer, Internet, who are poor, senior or from minority groups that are not ICT savvy.

vii. **Qualitative Data Collection** -

Previously data collected by qualitative researchers in voice format needs to transcribe into text manually i.e. play and replay the audio recorder, listen and write down or key in what was heard into the text (Bhattacharjee, 2012). In some instances, transcriber or transcription machine were used to aid the tedious transcribing process. In today's world of qualitative research, voice recognition software like Dragon Naturally Speaking (www.nuance.com/dragon) can be used to automatically convert voice into text without requiring the researchers to transcribe the recorded voice into text manually. Moreover, software like Dragon Naturally Speaking can also enable researchers to edit documents and emails, launching applications, open files and control the mouse movement etc through merely voice recognition. This area of ICT advancement has greatly improves a researcher's accuracy and efficiency in qualitative data collection. This finding is in line with the findings of Snider (2002) and Lee (2011) that using speech recognition software did produce faster and better quality of writings compare to keyboard method of writing or traditional paper-pencil mode.

viii. **Big Data and Its Analytics** -

According to Schroeck, Shockley, Smart, Romero-Morales & Tufano (2012), big data is characterized by larger volume (from terabytes to exabytes per file size), greater variety (consists of structured, semi-structured and unstructured data), higher velocity (fast generation, collection and processing of data before losing its value) as

well as lower veracity (uncertainty or low quality). Before the big data era, datasets were not inter-mixed for research purpose in which structured data (i.e. data with nominal, ordinal, interval and ratio scales) is separated distinctly from semi-structured (e.g. email, tweets, free-form texts) or unstructured data (e.g. audio, video or multimedia formats). Structured data generally is used in quantitative research whereas semi-structured and unstructured data is used in qualitative research. Even though all structured, semi-structured and unstructured data is used in mixed-method research, they are extracted and used distinctly in respective quantitative or qualitative portion of the mixed-method research (Creswell & Plano Clark, 2011).

In the new dawn of big data era, big data analytics are used to process the big data after it has been collected in order to generate meaningful output which is useful for business intelligent tools. Big data analytics can be delivered from a pool of networked resources or through cloud computing (e.g. private, hybrid, community or public clouds). Cloud computing is used because it offers attractive features like scalability, elasticity and measurability (National Institute of Standards and Technology, 2011). Big data analytics consist of several components like Hadoop Distributed File System (HDFS), Mapper and Reducer, NoSQL (e.g. HBase, Cassandra, Couch Base), data stores, content repositories as well as some processing models (Zikopoulos, Eaton, deRoos, Deutsch & Lapis, 2012; Eltabakh, 2013).

The output generated by big data analytics also can be used for data analysis in social science research in which the research process can be shortened as the output of big data analytics is already available. This is different from typical social science

research in which data collection is purpose-built (Sekaran, 2003; Bhattacharjee, 2012) and data collection can take very long time to complete. Even though it is data rich, but researchers need to consider issues related to big data that might negatively affect social science research. For example, embarking a research only based on big data availability rather than based on research problem can be an abuse or issue. How to address data veracity, data authenticity, missing or incomplete big data can be a challenge as well (Computing Community Consortium, 2012; Global Pulse, 2012). Ethical consideration also can be a concern since some big data accessed are highly sensitive e.g. customer data in which using their data without explicit approval clearance might result into unnecessary legal implications.

ICT Application in data Analysis

i. **Quantitative Data Analysis** – In the past, exploratory factor analysis, multiple regression, t-test and Analysis of Variance (ANOVA) were common data analysis techniques used among researchers conducting quantitative research (Sekaran, 2003). During that time, statistical software were not easily accessible in which they were limited in functionality e.g. most of them were command-based rather than Graphical User Interface (GUI) and usually located in universities' computer labs. Researchers need to book and had limited time to access the software. Moreover, researchers or students during that time need to study and understand the statistics formulas or equations before they were allowed to use the statistical software. A lot of changes had taken place since then. Not only data analysis techniques like path analysis, covariance based Structural Equation Modeling (SEM), variance-based

SEM (partial least squares), hierarchical regression analysis, hierarchical linear modeling et al (Hair, Black & Babin, 2010) are gaining popularity, statistical software e.g. Statistical Package for Social Science / SPSS (www-01.ibm.com/software/analytics/spss/) are more advanced and rich with a lot of features and functionalities (Field, 2009; Sekaran, 2003). Their costs of ownership are also lower in which many researchers can afford to acquire and install them into their computers. With this, researchers can work on it at any time they want. Today, statistical software are more user friendly whereby researchers or students can treat the software as “black box” and only focus on the interpretation of the results generated instead of remembering the formulas or equations being learned.

The available of more advanced techniques and statistical software enable researchers to conduct higher quality and more complex research. For example, more complicated conceptual frameworks with multiple constructs pointing to each others can be handled using Smart PLS (www.smartpls.de) for partial least squares (Hair, Hult, Ringle & Sarstedt, 2013) or using Analysis of Moment Structures / AMOS (www03.ibm.com/software/products/us/en/spss-amos/) for SEM (Byrne, 2010). Higher quality of research is possible using SEM to evaluate and confirm whether datasets are fitting into the model compares to other exploratory approach (Hair et al., 2010).

ii. **Qualitative Data Analysis** – Last time there was lack of software to aid researchers in performing qualitative data analysis in which researchers need to perform it manually or using computer

spreadsheet to perform basic sorting, searching and highlighting. Recently, the use of Computer Assisted / Aided Qualitative Data Analysis Software (CAQDAS) by researchers are gaining popularity in which NVivo (www.qsrinternational.com), ATLASTI (www.atlasti.com), MAXQDA (www.maxqda.com), SPSS Text Analytics et al. are used to support qualitative research in terms of transcription analysis, coding, text interpretation, recursive abstraction et al. (Myers, 2009; Corbin & Strauss, 2008; Sekaran, 2003).

Moreover, software like Transana (www.transana.org) also can be used for video transcribing in certain qualitative research. The availability and use of CAQDAS greatly improve accuracy and effectiveness of a researcher in terms of transcribing from audio or video to text as well as to perform the necessary encoding and abstraction before moving on to the next stage of the research. This observation is in support of the comments from Myers (2009), Corbin & Strauss (2008) and Sekaran (2003). Also according to Myers (2009), albeit there are benefits of using CAQDAS, but researchers need to understand that they are just tools or enablers. They should avoid drilling in too detail and fail to see the big picture of research.

ICT Application in post-data analysis

i. References and Bibliography Compilation – Last time researchers tend to compile references and bibliography manually. They literally typing in to build the entire section of the references or bibliography then followed by sorting them in ascending order. Recently, while researchers are writing, they can use citation or reference management software like End Note (www.endnote.com), Zotero

(www.zotero.org) or Mendeley et al. to help select citations and populate the references or bibliography automatically (Myers, 2009). This type of software can improve researchers' efficiency and accuracy while preparing their articles or theses.

ii. Article and Thesis / Dissertation's Discussion – In the course of producing an article, thesis or dissertation, there are needs for discussions or communications among researchers, supervisors, supervisees or during the viva voce. In the past, face-to-face meeting, audio meeting or Short Message Services (SMS) were common whereby video conferencing was rarely used. In some occasions, when video conferencing was used, the quality was not good e.g. high latency, choppy voice et al. as the bandwidth requirement was high but the network technology or connectivity was low e.g. 64Kbps only. Whereas now in an advanced ICT era, video conferencing, Skype, Facebook, Yahoo, Lync, Sametime, Whatsapp et al. can be a means for effective communication. Moreover, to facilitate sharing of research materials, seeking comments from subject matter experts, enable analytics to monitor papers published, as well as following some scholarly works, certain software platforms or websites can be used e.g. Academia.edu (www.academia.edu), Research Gate (www.researchgate.net) et al. All these ICT tools are capable to facilitate appropriate communication and knowledge sharing in virtual mode which can save a lot of cost and traveling time. Furthermore, using Academia.edu and Research Gate can speed up the learning curve as well as incur the least cost of learning by clarifying a researcher's doubts with a large pool of expertise or / and following their scholarly works. The above observations are also concurred with the findings of Grosbeck &

Holotescu (2012) and Crawford (2011); who had discovered that there are increasing awareness and use of social media to boost collaboration in research.

iii. **Plagiarism Detection** – Previously, plagiarism acts were slow and hard to detect as the authority of universities or journals dependent on readers to identify them manually while they were reading through the submitted articles or theses / dissertations. With the advancement of ICT, readers or researchers can use plagiarism checker software available in the market like Article Checker (www.articlechecker.com), Plagiarism Checker (www.grammarly.com), Dupli Checker (www.duplichecker.com) etc. to detect any fault of plagiarism has been committed. According to Myers (2009), plagiarism is the worst sin in academia whereby the advancement of ICT or Internet had enabled a person to plagiarize someone's work very easily. Hence, to curb plagiarism speedily and effectively, ICT like the plagiarism checkers as mentioned above are used to neutralize this type of threats.

iv. **Journal Manuscripts Submission** – In the past, journal manuscript submission used to be via email communications between researchers / authors and journal's editors / coordinators. Now web-based journal manuscript management and peer-review software, electronic manuscript submission or management systems like Elsevier (www.editorial.elsevier.com), Wiley (authorservices.wiley.com/bauthor/journal.asp), Sage Publications (www.sagepub.com/journalgateway/msg.htm) et al. are commonly used among the community of researchers and journals / publishers. Using such systems can reduce their time of submission and checking the

status of publishing. Moreover, using such systems can greatly improve the productivity and quality of work to administer the submission as well as the peer-review management in which miscommunication, lost or delay of communication can be minimized. The above observations are in line with the findings of Kulm (2008) and Heintzelman & Nocetti (2009) who had commented that online manuscript submission and review systems can introduce effectiveness, enhance communication as well as reduce turnaround time for decisions on manuscripts.

Challenges facing ICT in scientific research in Nigeria

There are many challenges facing information professionals on the use of ICT in our different research libraries in Nigeria. Currently, very few out of the numbers of research libraries in Nigeria can boast of full ICT application especially in e-library. Some of the other challenges are highlighted below:

i. **Funding:** Sustainability of the technology is the major nontechnical constraint in research institutions. Research institutions are facing a lot of challenges in sourcing for funds to sustain libraries in line with the advent of ICT. Unlike the academic area where there is a percentage of allocation for equipping libraries, in research institutes in Nigeria, this is not the case. The fund allocated to a research library is always as a result of how the Librarian in charge can lobby the management through budget or proposals. Therefore, in most research libraries, the issue of underfunding is a major task confronting the sustainability of ICT. In research institutes where the political economy is slanted, coupled with the absence of a policy, libraries and

information centre may suffer from neglect and hence be unable to develop and use ICT.

ii. **Inadequate Technology and Infrastructure:**

This is another challenge facing ICT in research libraries. Most of the times, it is telecommunication services that is providing either low bandwidth, technical faults and other networks configuration problems. According to Jensen (2005), there are also 'many external systemic factors such as electricity, transport networks, import duties etc. which impact on internet services delivery not only on research libraries but generally on the African continent. In some institutions, access is limited, not only by the number of internet service points, but also by the time that access is available or permitted, aside the difficulty of bandwidth. Yet for research purposes, access to the internet is no longer a luxury or prestige it is a necessity.

iii. **Shortage of Expertise** is another constraint highlighted by Minishi-Majanja (2004). He enumerated three major task of:

1. Issues of re-skilling lecturing staff so as to improve their ICT competency.
2. Lack of systems manager/support staff/ICT experts.
3. Low level of users' epistemological access. Manda (2006) observed the lack of ICT knowledge and skills among staff. Ikoja-Odongo (2006) describes the problem of brain drain, where staff sent overseas for training either does not return to their posts or are taken up by other organization who can offer them higher remuneration on return.

The challenge of technical support and maintenance aspects of ICT is another problem confronting ICT in Nigerian research libraries. Poor maintenance and insufficient skills to diagnose system

problems is more or less a general problem in Africa as a whole. The problem of technical expertise is two faceted. In the first glance, there are not enough people qualifying or attaining ICT specialist skills at the speed of which the technologies are adopted. Secondly, the problem of brain drain where a few experts opt for better paying job overseas is on an increase in Nigeria.

All these challenges correlated with the findings of Onilude & Apampa (2010), when a study was done to access the effects of ICT on research and development activities at FIRO in Lagos, some of the challenges highlighted were:

- The bandwidth available to the institute is inadequate compared to the number of users, which accounts for the low speed of connectivity encountered by users.
- Inability to monitor the network from a central location, which also underscores the underdevelopment of ICT infrastructure.
- Analysis shows that while a majority of staff are conversant with basic operations of computers vast majority required further training.

Other challenges highlighted include irregular power supply, failure and high cost of local internet service provider (ISPS), poor organization design and user dissatisfaction with low bandwidth.

Discussion and Conclusion

There are some lessons learnt from the above applications of ICT in social science research. These include the achievement of increase speed, increase quantity, improved quality, reduced complexity as well as lower the cost of research. These productivity benefits are in concurrence with the findings from some research scholars like Sekaran (2003), Corbin & Strauss (2008) and Myers (2009). Through the use of ICT-

based research tools, research cycle or duration can be shortened as indicated from some examples shown in the previous section. With the use of ICT and the increase speed of research, more research articles, theses, dissertations et al. can be produced in which this will increase the knowledge contribution within the research community.

Moreover, research quality can be improved as the use of certain ICT-based tools can improve accuracy and completeness of a research as evidenced in some ICT application areas e.g. qualitative data collection and analysis as well as in the references and bibliography compilation. Using ICT-based tools also can reduce research complexity as exhibited in the handling of complicated conceptual frameworks or complex big datasets which inherit characteristics like larger volume, greater variety, higher velocity and lower veracity. Last but not least, the reduction of research cost is possible with the use of ICT-based tools because less man hours are required as productivity of researchers had increased.

Despite the benefits of using ICT in social science research as mentioned above, there are some concerns as well. Firstly, using ICT in research might require high learning curve for some researchers who are not familiar with such ICT tools especially senior researchers who have already get use to the traditional manner of conducting research. In order to address this concern, a researcher's adaptive attitude, trainings as well as user-friendly ICT tools should be designed and built so that the steep learning curve can be flattened as much as possible. According to Linton (2009), through social support and its network, older adults can overcome their ICT learning challenges.

Once they are not alienated from the use of ICT, they will value ICT more as a symbol of competence and intelligence.

Secondly, the use of ICT enables research, theses, dissertations and articles can be produced in a shorter time-frame in which authority of universities or research companies might revise the goals set for the researchers. For examples, they might shorten the research duration given to the researchers, increase the research quality expectation, raise the number of academic articles published before promotion or reduce the research funds. In order to address this issue, continuous research improvement might be considered so that a researcher can constantly review which aspect of the research process, tool or skill he or she can improve upon in order to increase his or her research productivity and competitiveness. Deeper understanding of this issue and its possible solutions can be candidate for future research.

Thirdly, the proliferation of big data and its analytics had created large pools of data or data rich social environment. There might be tendency to conduct research based on datasets which are already available whereby emphasis might not focus on research problem but rather focus on what data a research can "salvage" or research by the convenient of big data. This concern can be addressed through critically review each research proposal so that fundamental research philosophy, principle and process are uphold in the context of knowledge contribution (Sekaran, 2003; Myers, 2009; Bhattacharjee, 2012).

Last but not least, constant use of some ICTs e.g. communication tools might decrease the social skills of some researchers as their interactions now largely dependent on ICT

tools whereby human touch is gradually lacking. This situation might redefine the social research world which is different from the one that we know in the past. In order to strike a balance between social interaction and ICT-based communication, researchers are advised to juggle the balancing act between the two from case to case basis. Further research surrounding this issue can be conducted in order to provide deeper insight on how ICT had effects on researchers' social skills. This paper is based on the author's observations and experience in using ICT tools to conduct social science research whereby it is also a limitation in which there is no empirical evidence to support the observations claimed.

Recommendations

Recommendation for future work also includes the conduct of an empirical study to determine whether social science researchers are actually using the ICT tools in achieving the benefits depicted in this paper as well as what are the inhibitors that they are trying to overcome.

Furthermore, future work can be a deeper research to evaluate how big data and its analytics can affect social science research especially in this new dawn of big data era.

In conclusion, ICT is a new norm and also an indispensable enabler to increase the productivity of a social science researcher albeit there are some hiccups or issues along the way that inhibit the pursuit and contribution of knowledge. The literature reviewed and observations made in this study also in line with the IS Success Model (DeLone & McLean, 2003) that ICT had contributed to the achievement of productivity gains of social science researchers. Through multiplier effect,

productivity gains by many researchers using newer ICT will further accelerate and multiply the overall body of knowledge in social science research.

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