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Digital Innovation, A tool for Aligning IA Efforts

Summary Statement: IA digital innovations act as a bridge between the amount of information produced and the ability to integrate it, helping institutions and researchers in the successful alignment of efforts.

1. Introduction

Digital technology has become increasingly important as firms seek to achieve their business goals. As a result, digital technology's pervasive effects have recently led to radical restructuring of entire industries and best practice procedures including impact assessment (Nylén, & Holmström, 2015). The recent adoption of digital innovations by impact assessment organizations, such as high-performance computing, interlinked databases, social media platforms, and GPS enabled devices, has led to many important advancements in public engagement, data gathering, increased knowledge and skills, and monitoring (Galán-Díaz et al., 2015; Sherren, et. al, 2017; Esteves et al., 2012). This paper seeks to explore the relationship between digital innovation and impact assessment by identifying a number of associated opportunities and more importantly, challenges that exist today.

2. What is Digital Innovation?

According to Fichman, Dos Santos and Zheng (2014), digital innovation is defined as a "product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT." This process implies a focus on product innovation instead of process innovation (Swanson 1994). In addition, digital innovation also heavily relies on the role of digitization – "the encoding of analog information into digital format" (Yoo et al., 2010). Digitization is an extremely important procedure that makes physical products and processes programmable, sensible, addressable, communicable, memorable, traceable, and associable (Yoo et al., 2010 & Yoo, 2010).

3. Opportunities Related to Impact Assessment and Digital Innovation

Impact Assessment is a "long-established practice with wide-ranging procedures for data collection and analysis, focused on the anticipation of impacts from policy or project proposals" (Sherren, et. al, 2017). In an increasingly digital world, impact assessment practitioners have a growing opportunity to leverage a broad range of datasets, including digital images and associated text in archives and social medial sources (Esteves et al., 2012). As a result, impact assessment digital innovations serve as a bridge between the amount of information produced and the ability to integrate it, helping institutions and researchers successfully align efforts.

Information pertaining to the relationship between impact assessment and digital innovation is sparse. Recent studies suggest that the advancement of machine learning, image digitization, and data aggregation and visualization techniques will reshape the way impact assessments will be completed (Sherren, et. al, 2017). For example, "advances in publishing technology have come with the widespread means to easily produce and publish image, audio, and video and therefore a need to widen the lens through which we observe human/environment issues" (Sherren, et. al, 2017).

In a recent article written by Sherren, Parkins, Smit, Holmlund and Chen (2017) the importance of digital innovations, specifically digital images, in relation to social impact assessment (SIA) is examined. The article places emphasis on culturomics – *the study of human culture through the analysis of changes in word frequencies in enormous digital text databases* – as an important SIA tool to complement stakeholder engagement efforts. In addition, Sherren, et. al, (2017) report underscores the importance of image-based archives and social media data for developing new SIA tools, for example tools to address declining response rate and lack of youth engagement in impact assessment (Bradford et al., 2015), and the various challenges associated with automation, digitization, interpretation and justice related to these data sources.

4. Challenges Related to Impact Assessment & Digital Innovation

Recent advances in technology has made way for the explosive growth of public data available online. Sources such as sensors, social networks, Internet of Things, and the Internet are generating endless amounts of data everyday (Yoo et al., 2010). In addition, "with the vision of extracting useful knowledge and the promise of data-driven decision-making, big data have been emerging as a hot topic in the research community" (Provost & Fawcett, 2013). Big data refers to the phenomenon of having large volumes of information in a variety of structured and unstructured formats accumulating at a high velocity (Laney 2001; Monroe, 2011). Big data is often described as information that is typically, automatically generated, in real-time, through search engines, financial transactions and sensing devices; however, there are also numerous other forms of big data spanning a variety of diverse fields, such as, health, state surveillance, astronomy, etc. (Boyd & Crawford, 2012; Kitchin 2013, Lerman, 2013).

While the benefits of accessing information sourced from sensors, social networks, Internet of Things, the Internet, and big data are often understood, these sources also pose numerous technical challenges due to their scale, sensitivity, complexity and heterogeneity. The following sections seek to explain some of the common challenges that impact assessors face when utilizing digital data, as well as provide practical examples of different initiatives and case studies that relate to each topic.

Expertise:

Data collected through digital innovations are often difficult to interpret, analyze and validate. As a result, very few people are able to successfully analyze these data sources. For example, "the analysis of big data requires the development and

application of robust statistical techniques in the context of complex (e.g. high dimensional) or high-volume data." (Mah, 2017). In addition, a strong data governance strategy is necessary to manage and securely store the information extracted from digital sources.

One of the most common challenges impact assessors face when analyzing digital information is achieving data homogenization. Any digital content be it audio, video, text, and image, can be easily stored, transmitted, processed, and displayed using the same digital devices and networks; however, digital data comes in several different forms and often originates from heterogeneous sources resulting in information that is fragmented and difficult to aggregate, and therefore, analyze (Yoo et al., 2010). As a result, impact assessors often lack the technical acumen/expertise to successfully harness this information.

In response to these challenges, in 2009, an innovation initiative introduced by the United Nations (UN) called Global Pulse was established to explore how new digital data sources and real-time analytics technologies can help policy makers attain a better understanding of changes in human well-being and emerging vulnerabilities. Since its inception, "Global Pulse has been investigating the viability of using new sources of real-time information to support development planning, monitoring and evaluation" (UN Global Pulse, 2013). Information collected includes online content and data exhaust. Online content is described as "what people say" and includes data collected from: international and local news sources, comments and public social media content, online advertising, publicly accessible blogs, forum posts, e-commerce sites and websites created by local retailers that list prices and inventory. Conversely, data exhaust is described as "what people do" and includes: "passively collected transactional data from the use of digital services such as financial services (including purchases, money transfers, savings and loan repayments), communications services (such as anonymized records of mobile phone usage patterns) or information services (such as anonymized records of search queries)" (UN Global Pulse, 2013). The initiative relies on a network of strategic partners that include private sector organizations and research institutions that have the requisite data, tools and technical expertise needed to collaborate on the development of effective solutions. Projects vary in complexity and tackle a range of pertinent global issues, some of which include: utilizing social media analysis to understand attitudes toward immunizations, analyzing anonymized mobile phone data to monitor populations' mobility patterns before, during and after natural disasters and comparing official food prices with price quotes published online to gauge inflation in real time (UN Global Pulse, 2013).

Reliability/Credibility:

The reliability and the credibility of the source the information originates from is often subject to question due to biases. For example, according to a recent study conducted by Mah (2017) information generated from a variety of institutions have inherent biases

and exclusions in the data collection process, and there are often misalignments or bugs in the automatically generated data.

As a result, impact assessors are now seeking alternative data sources to gain additional insight to a variety of topics. In a 2016 article written by Ladle et. al, the importance of culturomics and impact assessment is discussed. Ladle et al. attribute public interest as a key driver in the successful application of conservation agendas and interventions. For example, Ladle et al. (2016) argue that metrics of cultural baselines and long-term impacts of conservation actions can be used to enhance the design of conservation interventions with a public dimension. Such metrics have been historically produced through traditional survey approaches, but these are inevitably constrained by cost, standardization of design, and difficulties of defining historical baselines" (Ladle et al., 2016). Ladle et al. argue that digital innovation and culturnomics serves as an important tool for gathering this type of data. For example, the authors provide a case study that demonstrates the cultural impact of choosing a nature-based mascot for the 2014 Brazilian FIFA World Cup. Following the unveiling of 2014 FIFA mascot Fuleco, a Brazilian three-banded armadillo, there was a spike in public interest in this highly vulnerable endangered species as evidenced by a major increase in Google searches (in both English and Portuguese). As a result, Brazilian scientists capitalized on the public's interest and lobbied government officials, resulting in the establishment of the *Tatu-Bola* Wildlife Reserve in March 2015 to protect the armadillo (Ladle, et al., 2016).

Ownership, Access, Control and Privacy:

Personal (private) Information extracted from digital sources is regularly done without the individual's knowledge and/or permission. This results in various issues surrounding ownership, access, control and privacy of personal data. In addition, issues associated to the user's rights to access, inquire, compute, and present results relating to data collected from digital sources is also often highly contested and has become a regular fixture in global news headlines.

As a result, companies, research institutions, NGOs and impact assessors are looking to strengthen and standardize their security, privacy, and legal measures to protect individual's personal information which has subsequently lead to the emergence of various different initiatives and frameworks. For example, in 2017 UN Global Pulse Initiative annual report proposed a general guidance note on data privacy, data protection and data ethics for the United Nations Development Group (UNDG) concerning issues related to big data (UN Global Pulse, 2017). The purpose of the guidance note is three fold:

1. *Establish common principles across UNDG to support the operational use of big data for the achievement of the Sustainable Development Goals (SDGs);*
2. *Serve as a risk-management tool taking into account fundamental human rights; and*

3. *Set principles for obtaining, retention, use and quality control for data from the private sector.*

5. Conclusion

Traditional statistics, household surveys and census data regularly utilized in impact assessment procedures have been effective in tracking medium to long-term development trends, but can be ineffective in generating the real-time picture required to develop timely action to protect vulnerable populations in the fast-changing world (UN Global Pulse, 2013). As a result, specialized practitioners are increasingly turning to new digital technologies and innovations when conducting impact assessment. The key objective of this paper is to outline the crucial role that digital innovation plays in relation to the practice of impact assessment, as well as highlight the various opportunities and challenges practitioners' face when utilizing digital sources. Based on the research conducted, it is evident that digital information is being collected at an unprecedented rate and scale (in a variety of different amounts and formats) thanks to digital innovation. This influx of digital information has given impact assessors greater access to key information necessary for conducting a variety of meaningful projects that in turn, positively influence society. Conversely, digital information also poses numerous pertinent challenges for impact assessors inhibiting their ability to homogenize, source, analyze, validate, store and protect information collected. As a result, it is vital for sponsors and practitioners of impact assessment to employ robust data governance strategies, led by industry experts, in order to adhere to privacy laws, legal requirements and international best practices.

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