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Stakeholder Readiness for Adopting a Big Data Governance Framework in a South African Metropolitan Municipality

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Abstract

Digital transformation in the public sector can lead to innovative ways of working with stakeholders, improved service delivery frameworks, and data-driven societal benefits. However, not all public sector organizations, particularly local governments, are ready to adopt digital technologies such as big data. Governance frameworks are critical for technology management, and key stakeholders must be prepared before technology adoption. Recognizing that top management support is crucial for digital transformation projects, this study looked at the state of readiness of metropolitan municipalities in South Africa to adopt a big data governance framework (BGDF). The study had two objectives: first, to assess the readiness for a big data governance framework, and second, to identify what the respondents considered essential in such a framework. Framed by the technology readiness index (TRI), the study found that the stakeholders were not only ready but also had a good idea of what should be included in the framework. Both of the findings resonate with extant literature. The study concluded that the technology readiness index was suitable for investigating digital transformation readiness and that the proposed big data governance framework is a viable initial option.

Keywords: Digital Transformation, Big Data Governance Framework, Technology Readiness, Metropolitan Municipality, Local Government.

1. Introduction

Digital transformation has become inevitable and irrevocable in local government (Ahn & Chen, 2022). Digital transformation is the process whereby organizations use digital technologies to respond to environmental changes (Zhu, Ge & Wang, 2021). Thus, digital transformation is more concerned with strategy than technology (Zhu et al., 2021). For long-term growth, absorption and adoption of digital technologies with organizational transformation and renewal are necessary (Miceli et al., 2021). Miceli et al. (2021) refer to this growth as thriving beyond surviving. Digital transformation uses technology to enhance experiences and satisfy customer needs, from improving automation to rebuilding business models (Mergel et al., 2019). The benefits of digital transformation fall within what Zhu et al. (2021) refer to as the thriving stage of digital transformation. The thriving stage is the third of three stages after the embryonic and development stages and deals with implementations, dynamic capabilities, social factors, maturity frameworks, and digital transformation drivers (Zhu et al., 2021). Whereas strategy is fundamental to the development stage, governance is essential to the embryonic stage (Zhu et al., 2021). Mergel et al. (2019) support Zhu et al.'s view of the environmental drivers of digital transformation in their findings which showed that 83% of the change in public administration came from the external environment. However, 17% of transformational pressure is from internal sources. Like Zhu et al. (2021), Mergel et al. (2019) considered technology less important than organizational change. This was particularly noticeable for the internal factors, where business processes and models were the primary

foci of transformation. Similarly, Myeong et al. (2021) suggest that expensive infrastructure and technology are less critical than social factors, with the caveat of the requirement of solid leadership.

Public organizations have adopted the term digital transformation from the private sector to refer to the competitive use of technology (Mergel et al., 2019). Likewise, the public sector has adopted technologies such as big data from the private sector (Vydra & Klievink, 2019). A recent addition to big data research is big data governance, which is still in its infancy in the public sector (De Souza & Jacob, 2017). Safitri (2021) observed that big data holds four primary opportunities for local government; evidence-based policy setting, improved service delivery, better citizen engagement, and easier city management. Safitri (2021) provides several key factors required to reap the benefits of big data. Foremost are top management support, organizational change, privacy and security, data availability, cost, skillset and knowledge, and technological infrastructure. The need for technology policy is the primary concern of the embryonic stage of digital transformation, according to Zhu et al. (2021). Included in the list is big data policy-setting. A big data governance framework (BDGF) for the public sector is vital as uncertainties and doubts regarding skills, software, and hardware equipment hinder the fast-tracking of big data adoption (Klievink et al., 2017). On the other hand, digital transformation in local government has been observed to be limited due to a lack of readiness by top management (Srinavin et al., 2021). The readiness of key stakeholders is crucial as they use their organizational status, power, and motivation, to affect technology adoption and drive the success of the technology implementation (Mori, 2010).

This study explored the readiness of key stakeholders at a principal metropolitan municipality to accept BDGF as a precursor to adopting big data for digital transformation. The base logic for the research was based on digital transformation's need for policy setting at the embryonic stage (Zhu et al., 2021) and top management's readiness to adopt technology as a critical success factor (Safitri, 2021). A subsidiary aim was to identify what features should be incorporated in a BDGF in the sample metropolitan municipality. Using the setting of the South African City of Tshwane Metropolitan Municipality (CoT), the following research questions guided this study:

- What is the readiness of the key stakeholders in a metropolitan municipality to adopt a big data governance framework?
- What should big data governance frameworks include for a local government environment?

The report proceeds as follows. Section 2 provides a background to the study. Section 3 describes the research approach and the compliance with ethics. Section 4 describes the study's findings, and section 5 concludes the study.

2 Theoretical Background

Big data is central to BDGF. The definition of big data provides the means to differentiate it from conventional data and consequently dictates how to manage it uniquely (Plotkin, 2020; Shlomo & Goldstein, 2015). Nevertheless, big data is more straightforward to describe than define (De Mauro, Greco & Grimaldi, 2016).

2.1 Big Data

The fourth industrial revolution (4IR) era ushered in advancing technologies in data collection, storage, mining, synthesis, and analysis, making it possible to use large volumes of data to inform real-time decision-making (Rubinfeld & Gal, 2017). With its impact on pre-existing economic, social practices, business, and ways of life, big data has been likened to oil in the 3rd Industrial Revolution (Hirsch,

2013; Markowitz, 2019). The most basic definition of big data uses the 3Vs, volume, velocity, and variety (Emmanuel & Stanier, 2016). The 3Vs shown in Table 1 describe high-volume, high-velocity, and high-variety information assets that require new forms of processing to enable enhanced decision-making, insight discovery, and process optimization. (Jony et al., 2016). Big data includes raw and processed data, data storage, managing data, processing, and analytics required to derive value from it (Merino et al., 2016). Consequently, people with appropriate knowledge, competencies, and analysis skills are critical for the end-to-end management of big data (Abdulla et al., 2015).

Volume	Big data accumulation is now measured in zettabytes and requires new methods and technologies to manage the big data lifecycle and derive value (Chavan & Phursule, 2014). These volumes render big data challenging to capture, store, manage and analyze using traditional data management and storage tools (Zerhari, Lahcen, and Mouline, 2015).
Velocity	Big data velocity measures data creation, streaming, and aggregation (Jony et al., 2016). Velocity includes the dynamics of data assimilation as well as the need to disseminate real-time analysis (Casado & Younas, 2015).
Variety	Variety refers to the heterogeneous nature of big data, which includes traditional structured data, semi-structured and unstructured data in the form of audio files, images or photos, XML files, and videos (Della Valle, Dell'Aglio, & Margara, 2016). Semi- and unstructured data make it almost impossible for traditional data storage to manipulate big data (Wang et al., 2010).

Table 1. The 3V's of Big Data

2.1.1 Drivers of Big Data

With the private sector leveraging big data for increased profit margins (Joseph & Johnson, 2013), government and open data initiatives are the drivers for big data in the public sector (Munné, 2016). Big data opportunities include improving government service delivery and changing modern cities into smart cities (Giest, 2017). Accordingly, in 2019, the South African Presidential Commission on the Fourth Industrial Revolution was appointed to render advisory services to enable the government to take advantage of the opportunities presented by the digital industrial revolution (South African Government, 2019). Big data has many aspects, including cyber security and risk management (Jang & Lee, 2019), implementation (Kim & Cho, 2018), smart grids and energy distribution (Munshi & Yasser, 2017), customer relationship management, and citizen-centric analytics (Ju, Liu & Feng, 2018), government e-services (Rajagopalan & Vellaipandiyan, 2013) and governance maturity (Soares, 2012). Another aspect is innovation in response to the organization's environment, internal structure, and processes (Lewis, Ricard & Klijn, 2018; Wang et al., 2019). However, following the three stages of digital transformation, a governance framework is required before implementing big data (Zhu et al., 2021).

2.1.2 Big Data Governance Framework

Big data governance is an enterprise model of managing the data lifecycle from creation to archiving or retirement of the data. Governance enshrines the data policies, standards, and procedures to monitor compliance, create value and manage risk exposure (Abram, Schneider & vom Brocke 2019). Thus, a BDGF is the collective of best practices required to exercise authority and control over enterprise data assets and incorporate people, processes, and technology to manage and protect data as an enterprise asset (Ladley, 2019).

2.2 A Proposed Big Data Governance Framework

Recognizing that no single BDGF applies to all circumstances, Al-Badi, Tarhini, and Khan (2018) synthesized several data governance frameworks to propose an inclusive framework, which they

assessed against the ISO 8000 data governance framework. The Al-Badi et al. (2018) framework includes eight processes shown in Figure 1 and Table 2.

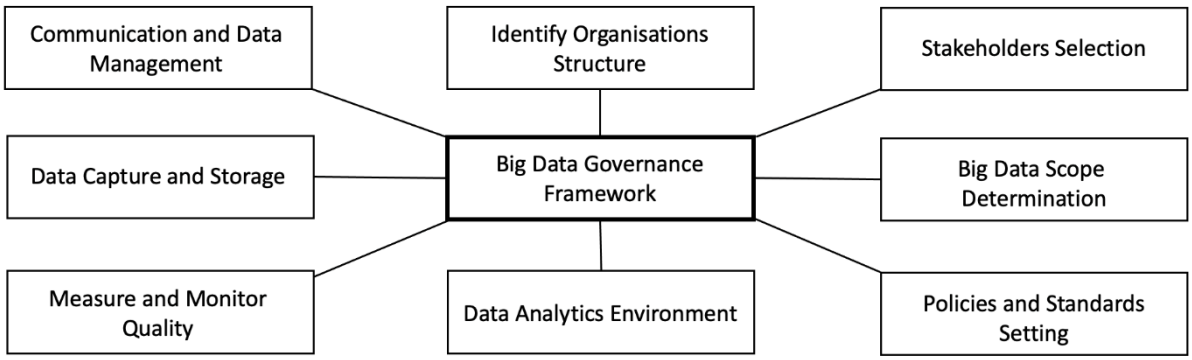

Figure 1. Proposed Big Data Governance Framework (adapted from Al-Badi, Tarhini & Khan, 2018)

2.3. Stakeholders

Stakeholders are individuals, groups, or entities with a legitimate interest in an enterprise's affairs (Brugha & Varvasovszky, 2000). Stakeholders can be internal or external to the organization, directly or indirectly influencing the adoption and eventual use of technologies (Berardi, 2013). Ultimately, internal stakeholders' behavior determines the fate of a project (Beringer, Jonas & Lock, 2013). This is no different in governmental projects (Al-Rashidi, 2013), where the stakeholders' roles and responsibilities are critical for successful adoption. Alharthi, Krotov, and Bowman (2017) identified humans as one of the barriers to big data adoption.

McGrath and Whitty (2017) classified stakeholders into four classes: invested, contributing, observer, and tertiary, while Günther et al. (2017) emphasized that value-creation through big data occurs when organizations realign work practices, organizational models, and stakeholders' interests to reap the benefits of their use. However, Rezazade, Mehrizi, and Lashkarbolouki (2016) warn that a realignment can mean a radical departure from the existing ways of doing business and from the logic, values, and beliefs that drive work practices and behaviors in an organization.

2.4 Metropolitan Municipalities

The government in the Republic of South Africa is federated into national, provincial, and local governments. Local government is further differentiated into Category A: Metropolitan municipalities, Category B: Local Municipalities, and Category C: District Municipalities (South African Government, 1998). Compared to non-metropolitan municipalities, metropolitan municipalities are more likely to need a BDGF in response to big data accelerators (Montin, 2016) as they embark on technology initiatives and investments to meet and exceed customer and citizen expectations (Berst, 2015).

2.5 Technology Readiness

Technology readiness may refer to either the technical maturity of the technology (Gavankar, Suh, and Keller, 2015) or the socio-technology readiness of users, consumers, and enterprises (Ahmed, Qin, and Aduamoah, 2018). Technology readiness is people's propensity to embrace and use new technologies to accomplish goals (Parasuraman & Colby, 2015).

Potential technology implementations can be initially assessed through stakeholders' and organizations' readiness for the technology.

Process	Description
Communication	Inherent in the data governance of providing the right sets of data to the right people at the right time is the dependency on communication for data collection and dissemination.
Organizational Structure	The organizational structure influences big data governance, which should be aligned with the objectives and vision of the organization.
Stakeholder Selection	A key element is the identification of relevant stakeholders such as data scientists, analysts, business stewards, data stewards, and steering committees.
Big Data Scope	It is imperative to define the scope of big data and ensure it applies to the organization. The scope frames the technology selection, stewardship, information governance, data definition and usage standards, master data management, metadata management, data lifecycle management, risk, cost containment, and communication.
Policies and Standards	The BDGF is essential for framing policies, processes, and standards for effectively managing and ensuring big data availability, usability, integrity, consistency, auditability, and security.
Data Capture and Storage	The BDGF must provide guidelines and measures for secure data assimilation, storage, and dissemination tempered with accessibility.
Data Quality	The quality of the disseminated data depends on the assimilated data's accuracy and quality. The BDGF must provide guidelines for managing, monitoring, and measuring data throughout the data lifecycle.
Data Analytics Environment	The BDGF must provide guidelines for setting an environment that assimilates and disseminates accurate data. For the quality of decisions, guidance for extracting, transforming, loading, and extracting big data is crucial. Alignment of the data with business strategy must be considered in this process.

Table 2. Big Data Governance Framework Processes

From an organizational context, readiness can be deduced by considering the socio-technical factors to determine the preparedness of people, processes, and technology (Nair, Chellsamy, and Singh, 2019). Scholars and social scientists have developed frameworks and models to measure the multi-faceted human disposition towards technology and its usage (Nilsen, 2020). While most theories center around behavior, the interest in this study is pre-behavioral. At the organizational level, assessment can be done through the technology, organizational and environmental (TOE) framework, which has proven reliable in assessing technology readiness (Nair, Chellsamy, and Singh, 2019). At the individual level, the technology readiness index (TRI) proposes that individuals' interactions with new technologies can be categorized into four psychographic factors views (beliefs, perceptions, feelings, and motivations) (Parasuraman, 2000). TRI proposes that optimism and innovativeness have a positive influence on the readiness of stakeholders for new technology. Conversely, discomfort and insecurity are inhibitors of readiness (Parasuaman, 2000). According to Chiu and Cho (2020), optimism is a positive belief that technology increases efficiency, control, and flexibility in people's daily lives. Innovativeness reflects a tendency to be a thought leader or pioneer in testing innovative technology-based services or products (Chiu & Cho, 2020). Discomfort reflects individuals' perceptions of lacking control and confidence (Chiu & Cho, 2020). Insecurity refers to distrust of technology, stemming from skepticism about its ability to work appropriately and concerns about its potentially harmful consequences (Chiu & Cho, 2020).

Cohn (2015) identifies strong executive leadership as one of the critical elements for successful governance. With the potential for sizeable digital technology investments to be underutilized, it is imperative to understand stakeholder perceptions upfront so that appropriate change management

interventions are initiated (Hayes, 2018). Consequently, the technology readiness index (Parasuraman, 2000) guided the stakeholder interviews.

3 Research Approach

The research approach for this study followed an interpretive philosophy in acknowledging that people and their feelings, attitude, and beliefs are active actors in defining new knowledge and understanding of the phenomenon at a particular place, time, and circumstance (Guha Thakurta & Chetty, 2015). A deductive-inductive research approach was adopted to make logical conclusions from a set of premises for theory-testing research (Bhattacherjee, 2012) of the TRI constructs and to identify new patterns in the empirical data. Empirical data was collected using semi-structured interviews at a single metropolitan municipality in South Africa with a cross-sectional time horizon. The City of Tshwane consented to interviews with selected stakeholders based on their areas of expertise, influence, and appointment designation. Ethics clearance for the study was obtained from the Commerce Faculty of the University of Cape Town before the data collection. All participants consented to an interview and the recording of the interview. Due to the COVID-19 pandemic, the participants were interviewed through Microsoft Teams.

The study used purposive sampling to identify knowledge-rich and well-informed participants (Etikan, Musa & Akassim, 2016) who held influence and functional and technical expertise in data trusteeship, stewardship, ownership, and custodianship. A pilot test (Zikmund, Carr & Griffin, 2013) of the semi-structured interview was undertaken with two participants and adjusted accordingly after each interview. Where necessary, further minor adjustments to the interview schedule occurred ad hoc to clarify the respondents' responses. The interview data were analyzed using thematic analysis, where words are not taken for their semantic face value but analyzed for deeper interpretation to reach the assumptions underlying the data and elucidate probable themes (Braun & Clarke, 2006; Vaismoradi, Jones, Turunen, & Snelgrove, 2016). Table 3 summarizes the steps followed for the data analysis based on Braun and Clarke (2006).

Step	**Process**
Familiarization	This stage involved transcribing the audio and video data, reading through the text and taking initial notes, and generally becoming familiar with the data (Braun & Clarke, 2006; Vaismoradi, Jones, Turunen, & Snelgrove, 2016).
Coding	In this stage, phrases and sentences were marked with codes to describe their content and highlight the main points and common meanings (Braun & Clarke, 2006; Vaismoradi, Jones, Turunen, & Snelgrove, 2016).
Generating themes	This stage combined related codes across the data to form a theme (Braun & Clarke, 2006; Vaismoradi, Jones, Turunen, & Snelgrove, 2016). Ambiguous codes were discarded or combined. The study used a deductive-inductive thematic approach. The deductive approach was derived from the themes advocated by the TRI theory (Parasuraman, 2000). The inductive approach incorporated new findings from the collected data (Azungah, 2018) into a proposed model.
Review of themes	This step ascertained the usefulness and appropriateness of the crafted themes against the data. Themes deemed vague are reworded, combined, split, or discarded until the final set is congruent to the data that provided the base for them (Braun & Clarke, 2006).
Defining and naming themes	This stage provided a succinct and easily understandable name for each theme. Defining the themes would ensure consistency in line with understanding the data (Braun & Clarke, 2006) and link themes to show how they complement each other (Vaismoradi, Jones, Turunen, & Snelgrove, 2016).

Table 3: Thematic Analysis Process (based on Braun and Clarke (2006))

4. Findings

The City of Tshwane (CoT) is regarded as the capital city of South Africa and the largest municipality by land mass. CoT was established in December 2000 through the amalgamation of the City Council of Pretoria, Akasia, and Centurion Town Councils. In 2008, the Metsweding District Municipality, Dinokeng, and Kungwini Municipalities were incorporated (Tshwane, 2019). The mergers brought together disparate legacy systems that resulted in duplications, lack of integration, and high license and application maintenance costs, making a data governance framework imperative.

4.1 Big Data Governance Framework Readiness

Fourteen participants were interviewed for this study with designations ranging from Deputy Director to Departmental Head. The respondent set provided a mix of managers who manage service delivery's operational and tactical aspects and senior managers who sit at executive meetings.

Although it was recognized as necessary, CoT does not have a documented BDGF: *"... we currently do not have a form of big data governance approach or framework." (DH1)*. The ramifications were alluded to by DH2: *"I do not think we capture the data appropriately and ... I would even argue that we are not even truly aware of the type of data we generate" (DH2).*

4.1.1 Optimism

The respondents were optimistic about the value-add of BDGF despite the organization's lack of a framework. *"... all organizations [need a BDGF] because data is about the reality on the ground that informs you on what is happening. It's very important for you to know, because ... [accurate] data becomes very important in that regard" (DH3). "[It is] imperative to have [a BDGF] ... because you need big data governance to be able to manage and monitor the data as it is with regard to access, authorization, usage and storage of the particular data." (DD5).*

4.1.2 Innovativeness

The perceived value of big data governance was observed to stimulate innovativeness among stakeholders. One respondent shared a mental picture of the future role of a BDGF*: "OK, my role is to ensure that a #1 we know where data is, #2 we know how that data is protected and what needs to be done in terms of protection. I need to ensure that people who are accessing that data are authorized to access this data, and then we do data classification to know where our critical data lies within different departments within the organization" (DD5).*

Similarly, another respondent showed a willingness to champion the course to derive maximum benefits from a framework: *"... in an era where there is no responsibility and accountability, someone needs to step in. So I think the role is going to be (1) to coordinate the formulation of the framework. (2) to coordinate the gathering of their resources for the strategy and the framework and to also, possibly (3) run the community, whether it's in the form of a committee or a forum that then looks at the ongoing monitoring of the implementation of the framework" (DH0).*

4.1.3 Discomfort

The respondents expressed their discomfort with approaches to data handling and usage. *"I am not at ease at all ... You can even go now inside each department. If you go to [a department] and ask them about something that happened in [their] space, you get two different things" (ADH3).* Follow-up questions discovered that such negative factors do not necessarily discard the thought of adopting BDGF. *"[We should] try to coordinate some of the things around big data. Let us look at what already exists from a system perspective and say how you coordinate the big data so that people can use it for decision making and planning" (ADH3).*

DD4 advocated more communication to overcome discomfort, *"I think if we were communicating these more aggressively … a concerted effort at institutional level to make sure that there is a lot of awareness being made, not only through publication of leaflets or notifications, but holding workshops." (DD4),* DH1 was more uncomfortable with lack of compliance than communication: *"I do not think it is a question of communicating. It is a question of whether we need to comply with this law. As with any other regulation or law, if you do not comply, fines or penalties can be leveled against the city. So, we need to move with haste so that we can ensure that we comply with the law." (DH1).*

4.1.4 Insecurity

DIR1 acknowledged insecurity but also recommended mitigations to counter the potential negative impacts. *"I think I am in for [cloud computing], you know, but the problem is that we should put proper systems and mechanisms in place so that we don't find ourselves thinking we are putting data somewhere in the cloud, only to find that no, one day when we need that data, it is not accessible" (DIR1).* Likewise, DD6 acknowledged the potential insecurity and recommended a measure to help contain the risk. *"I think in terms of working with the service provider we must make sure that they transfer their skills and they make sure that they provide us with the data that they have been generating for months with us. We must make sure that we have all the data …" (DD6).*

Some respondents were relatively secure about the data. *"We have actually made quite a significant investment into this area, and so I am quite content that we do have the tools in place, but of course, this is always a moving target" (DH1).* Others felt less secure: *"I think in terms of recovery capability, the city would not recover outright until we centralize that, so that we have data back-up, data recovery, etc. from data management and protection point of view" (DD5).*

4.1.5 Readiness Summary

The findings support the proposition that optimism and innovativeness positively influence the readiness for a BDGF. While the respondents acknowledged discomfort and insecurity, visionary stakeholders may counter this with innovativeness and be prepared to adopt BGDF. The implication is that the organization must leverage the enthusiasm and willingness presented by the respondents.

4.2 Big Data Governance Framework for a Local Government Environment

The interviews provided insights into what the respondents expect from an ideal framework from the perspective of a local government environment. In the absence of a BDGF, the data analysis was primarily grounded. Nevertheless, the data resonated with Al-Badi et al. (2018).

4.2.1 Communication

The respondents observed the need for communication both internally and externally. *"Let us look at what already exists from a system perspective and say how you coordinate the big data so that people can use it for decision making and planning, but also make use of it for our own vision so that we must improve customer experience" (ADH3). "I think if we were communicating these more aggressively … a concerted effort at institutional level to make sure that there is a lot of awareness being made, not only through publication of leaflets or notifications, but holding workshops." (DD4).*

4.2.2 Organizational Structure

The organizational structure influences were observed in the respondents' answers.*"If you go to [department g] and ask them about something that happened in the [departmental] space, you get two different things" (ADH3).* "*It is about maybe convincing decision makers to say data is important and as such, let us start taking care of it because in fact data is big business" (DH3).*

4.2.3 Stakeholder Selection

Stakeholder selection was integral to the organizational context. *"It is about maybe convincing decision makers to say data is important" (DH3). "... someone needs to step in … whether it's in the form of a committee or a forum that then looks at the ongoing monitoring of the implementation of the framework" (DH0).*

4.2.4 Big Data Scope

Respondents showed appreciation for the need to define the scope of big data. *"Our definition, perhaps we need an institutional definition of what we call data and of what we call information. So there has to be a clear institutional position or definition of these two and the significance of it" (DD4).*

4.2.5 Policies and Standards

Multiple respondents referred to policies and standards. *"If we have a centralized one (recovery plan) that deals with that, the disaster recovery plan must be end-to-end to talk to any system or any device that carries data within the organization" (DD5). "I think in terms of working with the service provider we must make sure that they transfer their skills and they make sure that they provide us with the data that they have been generating for months with us. We must make sure that we have all the data" (DD6). "It is a question of whether we need to comply with this law … we need to move with haste so that we can ensure that we comply with the law" (DH1).*

4.2.6 Data Capture and Storage

Data capture, storage, and dissemination were areas of concern for some respondents. *"I do not think we capture the data appropriately and then in some cases I would even argue that we are not even really aware of the type of data we generate" (DH2*). *"… you need big data governance to be able to manage and monitor the data as it is with regard to access, authorization, usage and storage of the particular data." (DD5).*

4.2.7 Data Quality and Data Analytics Environment

The respondents often combined data quality and data analytics. Concern regarding the data quality was observed as accurate and adequate data is integral to data analytics for helpful information. *"[We should] try to coordinate some of the things around big data. Let us look at what already exists from a system perspective and say how you coordinate the big data so that people can use it for decision making and planning" (ADH3). "…data is about the reality on the ground that is informing you on what is happening. It's very important for you to know, because … [accurate] data becomes very important in that regard" (DH3).*

5. Discussion and Conclusion

This study set out to assess the readiness of key stakeholders to adopt a BDGF within a metropolitan municipality, with a secondary aim to determine what should be included in such a framework. The respondents were capable and experienced stakeholders who were observed to be optimistic about adopting BDGF and provided innovative ideas to enhance the adoption and facilitate the usage of big data technologies. This finding was in accordance with the drivers of the technology readiness index (Parasuraman, 2000). Likewise, inhibitors of discomfort and insecurity were identified. However, it was observed that the inhibitors could be offset through innovativeness. Hence, the municipality would do well to leverage the enthusiasm and willingness presented by the respondents.

The secondary objective was to identify the components of a BDGF. As the respondents were not directly asked for their opinion in this regard, the findings were grounded in analyzing the respondents' answers to the TRI questions. The grounded findings aligned with the proposed framework of Al-Badi et al. (2018): communication, organizational structure, stakeholder selection, big data scope, policies and standards, data capture and storage, data quality, and data analytics environment. Overall, the respondents were ready for the initial phases of developing a BDGF for which the Al-Badi framework may be a good fit in a metropolitan, municipal setting.

As with all research, several limitations were encountered in the study. The most significant limitation is the approach of the initial TRI model. Using the later TRI 2.0 (Parasuraman & Colby, 2015) may provide more detail for determining a prospective BDGF specific to the research setting of a metropolitan municipality. The study's cross-sectional nature was not a limitation for readiness but will require a more extended period for accurately defining a suitable BGDF. A lesser limitation was the use of online interviews due to Covid-19 precautions. Face-to-face interviews may have provided richer data.

Several potential research areas were indicated during this study, including what local governments can do to improve BGDF readiness and if the framework may translate to other public sector organizations. These recommendations will require identifying mutual and unique contexts to guide the applicability or adaptions needed to the proposed BGDF to apply to other public sectors and industries.

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