

The Current State of Data Governance in Higher Education

Cary K. Jim

University of North Texas, USA. caryjim@my.unt.edu

Hsia-Ching Chang

University of North Texas, USA. Hsia-ching.Chang@unt.edu

ABSTRACT

Recent developments in big data have heightened the need for data governance in any organization. There has been a growing interest and recognition of the importance of data governance in higher education. While multiple research efforts focus on a literature-based approach to conceptualize data governance, evidence-based research on this topic can scarcely be found. Higher education institutes are facing similar challenges in aligning their information technology (IT) efforts with business processes to meet organizational goals. This study aims to address such a research gap and investigates the status quo of data governance practice across tier one universities in the United States. Using Web content analysis, this paper sought to obtain empirical evidence of data governance initiatives, the extent of data governance, and its relationship with IT governance and information governance across a sample of 30 tier one university websites. Results of this study revealed that most of the universities created a new data governance unit with different labels (e.g., data governance, institutional research, or data management/analytics), while some universities extended IT governance or information governance to data governance. These findings shed light on the potential directions of developing data governance initiatives in higher education.

KEYWORDS

Data governance, tier one universities, higher education, web content analysis, decision-making.

INTRODUCTION

The change from paper-based records to digital data opened a lot of opportunities and challenges for many organizations. During the last fifty years, computer software and hardware development continued to advance. Today, any person who interacts with technology locally or network through “wired” or “wireless”, is generating data that are trackable and could be stored over time. The early use of digital technology in American higher education has been researched and documented since the 1960s (Picciano, 2012). Schools and universities have a long history of maintaining academic records and other operational documents. Students, faculty, and staff all contribute to the diverse sources of data in universities regardless of their awareness of how the data are used and for what purpose. From an organizational standpoint, the data stored in their information systems are valuable for decision-making, compliance, assessment and performance evaluation.

Using digital technologies for record management may appear to free up physical space, but this requires an on-going investment to keep up with the advancing hardware and software requirement. “Infusions of technology infrastructure, large-scale databases, and demands for timely data to support decision making have seeped into all levels of college leadership and operations” (Picciano, 2012, p. 10). It is not a simple task to maintain information technology (IT), and business processes while improving teaching and learning efforts for students, staff, and the community (Broad, 2014; Duhaney, 2005; Hora, Bouwma-Gearhart, & Park, 2017; Picciano, 2012). The blending of academia and business processes in higher education offer opportunities for information professionals to connect research to practice. For many universities, their business and instructional processes supported by information technology have become indivisible. The digitalized components within the universities require an inclusive structure to manage data and information for the benefit of the organizations and their stakeholders.

Even though information systems and data techniques continue to advance, the intent of using data to inform decisions is fundamental. The on-going cycle of data analytics provides information for performance, accountability, and other educational objectives such as students learning outcomes. Data-driven decision-making, then, became a widely adopted approach to address these concerns (Hora et al., 2017; Picciano, 2012). Administrative records, financial records, enrollment data, student information, and faculty records are examples of internal data maintained and processed in-house, usually in a form of data warehousing. External data are sourced from third-party applications such as a learning management system, curriculum and instructional tools, digital library resources, and social media data. These are just some examples of data shared and hosted by vendors or in-house. The third type of data that falls between internal and external is research data. Research data management is usually handled based on the institution’s data management policy as well as on the funding agency’s expectations. Therefore, universities do not lack data but rather direction in terms of how to utilize data and information for their benefit and how to protect data as an asset. Hence, the awareness and understanding of data as their asset is the first step. Often “third parties outside of the university may be the first to recognize data opportunities. Governance mechanisms to assure protection of privacy, academic freedom, intellectual property, information security and compliance” in universities is imperative (Borgman, 2018, p. 5). Data governance is needed to guide and facilitate information technology, data processes, and decision-making to

support an organization in reaching its goals. Among library and information professionals, data management or data curation are not new concepts (Koltay, 2016). Library and information science professionals can enrich collaboration among organizations in data and information related activities, such as data governance.

RELATED WORK

Data governance exists in different industries and the interpretations of data governance differ. According to Nielsen's (2017) literature review on data governance practices between 2007 and 2017, 32% of published papers came from computer science disciplines, another 32% from information systems, and only 5% were from education (i.e. higher-education education institutions and learning). This provided us a sense of how data governance has been associated with certain disciplines such as computer science and information technology from a technical and system perspective. The inception of data governance typically involves IT, business processes, privacy and security measures. Information technology (IT) governance is used by organizations to guide their data related processes and has a longer history in the business domain. Weill and Ross (2014) defined "IT governance as specifying the decision rights and accountability framework to encourage desirable behavior in using IT" (p. 2). However, data are being collected constantly behind the scenes and it takes some conscious effort to appraise their value to an organization. Weber, Otto, and Österle (2009) explained that data governance includes both business processes and IT to provide organization-wide guidelines to ensure data quality and accountability. Several scholars suggested that when data are viewed as an asset in an organization, they should be monitored and managed (Brous, Janssen & Vilminko-Heikkinen, 2016; Khatri & Brown, 2010; Koltay, 2016; Otto, 2011). Culture and values of an organization are also important and will shape the behavior of individuals and organizations (Putro, Surendro, & Herbert, 2016). Therefore, a systematic approach in the development of data governance will allow an organization to utilize data effectively to achieve their goals. The increased concern over privacy and security due to data breaches is another facet of data governance. "Three major universities and one school district became victims of cyber breaches...it is not just identifiable information. It is also information about the students and their performance itself...the mental processes of students as they are working through equations" (How Data Mining, 2014, p. 2). The joint U.S. congressional hearing examined privacy concerns in education, especially, "the sharing of student information with educational software and cloud service vendors and the laws and guidelines that govern them" (How Data Mining, 2014, p. 3). Thus, the need to examine data sharing and how third parties are using identifiable data should be addressed by data governance in educational institutions. Information governance is another concept presented in relation to data governance in which both are important for organizations to achieve their desired outcomes (Bennett, 2017; Hulme, 2012). Li, Zhou, and Yu (2016) suggested seven core-criteria (based on information governance guidelines) for big data: organization, metadata, privacy, data quality, business process integration, master data integration, and information lifecycle requirements. Khatri and Brown (2010) suggested a data governance framework with five decision domains: data principles, data quality, metadata, data access, and data lifecycle. The Data Governance Institute (2017a) provided a data governance framework with three main branches: Rules and rules of engagement, people and organizational bodies, and processes. Each main branch from the framework contains components that guide an organization to develop data governance that will fit their needs. Brous et al. (2016) provided a systematic review of data governance principles and identified 27 related key concepts including: accountability, decision rights, compliance, privacy, security, and metadata management. The 27 related key concepts are arranged under four major principles: organization, alignment, compliance, and common understanding. In summary, data governance serves as the guiding framework that should address organizational goals and business processes (decision-making, culture, and values), legal obligations and compliance (accountability), risk management (privacy and security), data management (data quality and metadata) and the roles humans play (data stewards and data owners). Data governance should continue to mature and adapt for the organization's changing needs and processes.

PURPOSE OF THE STUDY

We believe that good data governance can only be meaningful when it aligns with the institutional goals and values in a sustainable manner. Based on the limited amount of research on data governance in education (Nielsen, 2017), there is a need to explore this topic for a better understanding. This paper is the first attempt to address the lack of research of data governance among higher education institutions by exploring the current practice of data governance among the tier one research universities in the United States. This study focuses on the following research questions:

1. What is the current status quo of data governance among tier one research universities in the United States?
2. What type of information is available from the universities that present their data governance initiatives in their websites?

METHODOLOGY

A Web content analysis is used to collect and analyze available information publicly released by the universities on their websites and webpages. The identification of tier one research universities in the U.S. is based on the rankings from the Car-

negie Classification of Institutions of Higher Education (Indiana Univ. Center for Postsecondary Research, 2017). It is a recognized ranking system to classify higher education institutes in the U.S. The Carnegie Classification evaluates for-profit and non-profit higher education institutes and assigns ranking based on the type of degree granting program and the level of research activity at each. The R1 ranking is commonly referred to as tier one or top-tier which is the highest ranking in the Carnegie Classification. Tier one indicates a doctoral degree granting institute with the highest research activities. In 2017, there were 115 research universities in the U.S. listed in the R1 (tier one) criteria.

Thirty tier one research universities were selected for the initial sampling of this study based on their geographic location and business structure: for-profit vs. non-profit. We anticipated to identify data governance practices among the leading universities (tier one) in U.S. to inform future studies of data governance model and framework for higher education and related environments. Each sampled university website was searched to identify information regarding their data governance practices. Using existing documents and web content as a source of data are often referred as nonreactive measures and this type of data can be a better representation of the phenomenon comparing to data collected through self-reporting mechanism (Wildemuth, 2017, p. 165). The presence of online information released by each university was used as an indicator of their progress or awareness of data governance practices. The first part of the evaluation process is to review whether an existing data governance program is established, how the program is represented within the organization and what approach is taken to govern data as an asset. Furthermore, the primary goal of this paper is to examine the current data governance practices among the sampled universities instead of comparing the level of completion of their data governance efforts. In order to collect relevant data that are meaningful for analysis, a Data Governance Checklist was developed. It is derived from key literature on data governance with seven major criteria identified that would fit for the context of higher education (Brous, et al., 2016; Khatri & Brown, 2010; Koltay, 2016; Li, et al., 2016; Otto, 2011). A coding schema was developed to examine and collect evidence of the status quo of their data governance practices.

The seven criteria and definition of the Data Governance Checklist is presented in Table 1. Each criterion is designed to minimize overlapping ideas and to allow analysis of existing online documents and information from the sampled universities.

Data Governance Checklist Criteria	Definition
Data Governance Body	A group of stakeholders who formalize the data governance practice at their organization
Data Quality	Guidance on the accuracy, availability, integrity, data standards, and the intended use
Data Access or Restriction	Specific access or restriction policy on the data
Data Security	Guidance on system security to protect data and privacy issues of sensitive data
Data Stewardship, Ownership, and Roles	Roles and responsibility of those who interact with the data at various levels within an organization
Metadata Documentation and Organization	Structure and methodology to document and maintain data: e.g. data dictionary, metadata scheme
Business Process Integration	Core business process that is parallel to the data process, and management of both

Table 1. Data Governance Component Checklist

The Data Governance Body is a group of stakeholders who are interested in the development and oversight of the data governance program. Membership in this group can be formed internally but can also include other experts outside of an organization. When reviewing the institutional webpages, we looked for an official group or unit that hosts the data governance program information as an indication of their web presence. The data governance body is different from the other roles supporting the process. Other frequently discussed roles in data governance are data stewards, data owners, and data committees (Koltay, 2016; Otto, 2011; Rosenbaum, 2010). Data Stewardship, Ownership, and Roles indicated positions of those who have a vested interest and actively engage in the process of data governance within their institution. We explored to determine if the universities presented these roles in their webpages and how these roles are explained in their web content.

Data Quality is the foundation of the data-driven decision-making process. If the data are not genuine and trustworthy, the output will be misleading and ineffective. If the data collected are not relevant to the organizational goals, they will not be informative to decision making process. For this criterion, we looked for any description or statement in relation to data quality from the webpages.

Data Access and Restriction are important to regulate access rights and put limitations on the use of data within an organization. For example, staff who handle the institution's data should be given certain access or limitations to avoid misuse of the data. It also implies proper procedures to grant access for users who should have access to the data. This component is determined by

identifying specific policies and procedures on the webpages addressing user access or restrictions. Sometimes, Data Security can be confused with access and restriction. Access and restriction are established for rights and limitations as for how users are retrieving and interacting with the data. Security is about safeguarding the data and valuable information of the organization. We use the term security to cover related concepts, such as privacy, confidentiality and data breach protection. Each institution may have its own definition, covering similar or different elements in its webpages.

Metadata Documentation and Organization are intended to provide structure and information about the data stored in the various systems within an organization. It is a common understanding among information professionals that metadata is meant to support organization and provide a description of the data for users. Some common forms of metadata documentation are data dictionary, metadata standards, thesauri, etc. The form of metadata implementation was assessed by reviewing the universities' data management mechanism from their web content.

The last criterion is the indication of business process alignment in the web content of each university. Business Process Integration is the backbone of any data governance process in an organization. Several scholars discussed the significance of business process integration with data governance to support the organization's overarching goals and mission (Brous, et al., 2016; Khatri & Brown, 2010; Otto, 2011). When reviewing the institutional data governance webpages, we looked for identifiable information, or business strategies, or processes integration in their data governance practices. Other information collected depends on its availability, such as department or unit that oversees the data governance practices, data governance documents, or policy in their webpages.

FINDINGS – PRELIMINARY RESULTS

Every effort has been made to discover publicly available information from the universities' websites. If the data governance information is hosted in a restricted web domain, that information will not be accessible to us and therefore won't be included in this initial data collection.

The preliminary result includes information collected from web content including online documents and hyperlinks from the 30 tier one universities data governance webpages. There are a variety of terms and concepts used by each university to describe their efforts in data governance. The use of the Data Governance Checklist helped target searches and organize identified information from existing key components of data governance in their organization. First, we used the Google search engine to locate the institution website by entering the full university name and the keyword "data governance". Then, we compared the Google search result with an internal search of the university website with the keyword "data governance". During data collection, we recognized the different organizational structure and naming mechanism they used among information technology, data related services and information related services.

Table 2 presents the offices or units which oversee data governance initiatives or data related services at their institution. The result indicated most of the data governance activities are supported by a designated group of members in the form of a committee, council, or working group in the universities. The second and third largest groups of staff who support and supervise data governance processes are the Information Technology departments as well as Institutional Research. Some institutions have their own single unit of data management and analytics that were not associated or under another department within the organization. An interesting fact during this initial data collection is two of the universities have two or more joint office/units that support both data governance and IT governance, shown in the last row of Table 2.

Office or Unit Represented	Count	Percentage
Data Governance Council, Working Group or Committee	10	33%
Information Technology	7	23%
Institutional Research	6	20%
Data Management or Analytics Unit	4	13%
Other units such as security or administrative	3	10%
No indication of data governance practice	2	6%
Two or more joint office/units governing data practices	2	6%

Table 2. Offices or unit within the university where information of data governance is hosted

The Data Governance Checklist is used to distinguish each specific component within the universities' data governance practice. The brief definition of each criterion can be found in Table 1. Each count is discrete in the following data analysis. One or zero was assigned to the checklist to present an indication of yes or no based on the content of their webpages (Table 3).

Data Governance Checklist Criteria	Count	Percentage
Data Governance Body	23	77%
Data Quality	16	53%
Data Access or Restriction	28	93%
Data Security	23	77%
Data Stewardship, Ownership, and Roles	22	73%
Metadata Documentation and Organization	19	63%
Business Process Integration	23	77%

Table 3. Findings of each data governance criterion by count and percentage

The initial analysis of the webpages with the Data Governance Checklist presented the majority (93%) of universities have policies and procedures of data access or restriction at their institution. About three quarters (77%) of the universities showed a data governance body in the form of a committee, working group, or council that directs and supports data governance practices at their institution. Furthermore, more than half of the universities appeared to exercise the other key principles of data governance at their institution in data quality, data stewardship/ownership, and metadata documentation and organization.

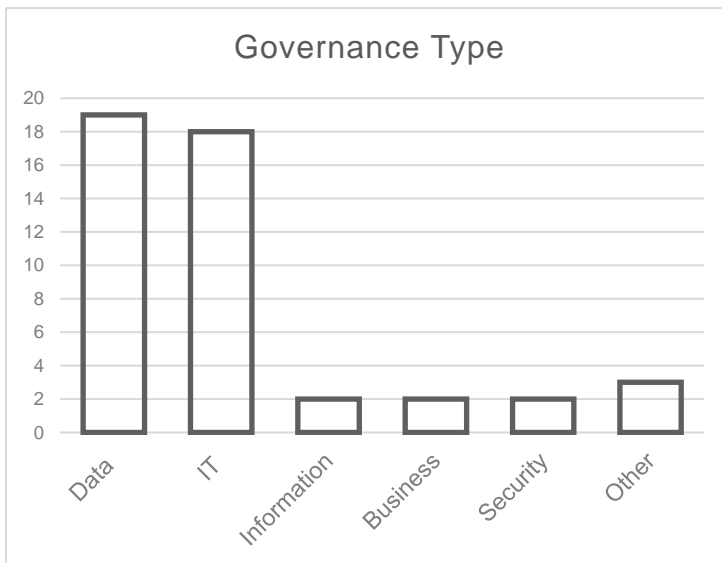


Figure 1. Types of governance found on the universities webpages

14 university webpages that provide their direct statement on data governance. As stated before, it was impossible to mutually exclude data governance from IT governance because the perception of each depends upon the university. Therefore, we included only statements that address data governance directly in Table 4. The direct statements retrieved from the university websites represented the variety of perspectives and approaches. Some universities consider data governance as a process or underlying principles, while others construe it as a part of best practices to support business operation and system integration. The majority of the statements also cover overlapping key concepts presented in our Data Governance Checklist. Therefore, we organized the statements according to basic sentence structure in which “data governance” is the subject and the predicate is what and how the institution describes data governance.

While examining the type of data governance initiative or program at each institution, we recognized that terms such as information, data, or IT governance are used similarly and differently to represent their practice. For example: IT governance, information governance, or data management are used together to describe their current practice of data governance. Figure 1 displays the count of the term data governance, IT governance, information governance, business governance, security and other types of governance found on the webpages. Note, some universities displayed more than one type of governance, for example, data and IT governance is the most common combination among the 30 universities. A further investigation is needed discover why there is such a disparity in their data governance practices.

Part of the Web content analysis is to examine information provided by the universities’ webpages about their view on data governance. We were able to locate

Criteria	Examples of Statement by Universities
Data Governance Body	"The [Data Stewardship] Council addresses issues concerning data management including usage, sharing, integration, access, security, privacy, quality, and compliance" (The University of Chicago, 2018, para 3).
Data Quality	"Data governance adds value to our administrative and academic data systems by the establishment of standards that that promote data integrity and enables strategic integrations of information systems" (Vanderbilt University, 2018, para 1).
Data Access or Restriction	"Data Governance is the process of establishing and managing information about the data collected and used by the University...This ensures a common and consistent understanding of what data exists, term definitions, availability, sensitivity classification and access restrictions" (University of Norte Dame, 2018, para 1)
Data Security	"Data governance includes all the policies and practices that ensure UDW+ [online information system and dashboard] provides the university community with accurate and consistent information while protecting data security and confidentiality" (New York University, n.d., para 1).
Data Stewardship/Ownership, and Roles	"[Data Governance Stewardship] determine formal roles for those in charge of data. This does not mean that everyone on campus is not responsible despite formal roles." (University of Wisconsin at Madison, 2018).
Metadata Documentation and Organization	"This program [Data Governance program] will result in a sustainable and efficient set of controls, data standards and data policies for UTA, with the potential to extend its scope over time to other areas with UTA" (The University of Texas at Arlington, 2018).

Table 4: Direct statements that support each component of the Data Governance Checklist

DISCUSSION

According to a survey by Childers (2017) for the Higher Education Data Warehousing Forum, data governance is the most frequent topic among 57% of their surveyed universities for the second year (2016 and 2017). The latest result of the Top 10 survey by Childers and Walz (2018) again showed data governance as a priority topic and became a priority category in 2018. It is worth mentioning that several components in the data governance from their 2018 Top 10 survey also reflected similar observations as our study, such as administration of data governance, metadata and data definitions, data quality and role-based access.

Through the examination of data governance structure and processes, the sampled universities seem to have different overarching governance structures. For example, some universities created new units to lead the data governance initiatives; other universities began with their IT department and extended their work to address data governance. There are also a minority of universities working toward an integration of information and data governance in which IT plays a supporting role. Figure 2 presents a Venn diagram which depicts the relationships between data governance and two other types of governance, IT governance and information governance. The intersecting areas denote the interplay between different governance structures that work together with data governance initiatives, while non-intersecting areas illustrate the standalone governance structure in the sampled universities. Note, the number in parentheses reflects the count displayed in Figure 1.

Interestingly, two universities strategically extended their information governance to integrate data governance and/or IT governance. This approach can support interconnections as information governance refers to a broader concept that entails data governance and IT governance (Bennett, 2017; Smallwood, 2014). In addition, information governance is often considered within the scope of IT to address the importance of information within a modern organization (Faria & Simpson, 2013). As a result, many universities thus far do not seem to have embraced information governance as a relevant part of their framework to inform the creation of their data governance. As for the representation purpose, interplay between data governance and IT governance, ten universities (about one-third) have data governance embedded within the IT governance structure, and only one university demonstrated its inclusion of information governance, IT governance and data governance on the webpages.

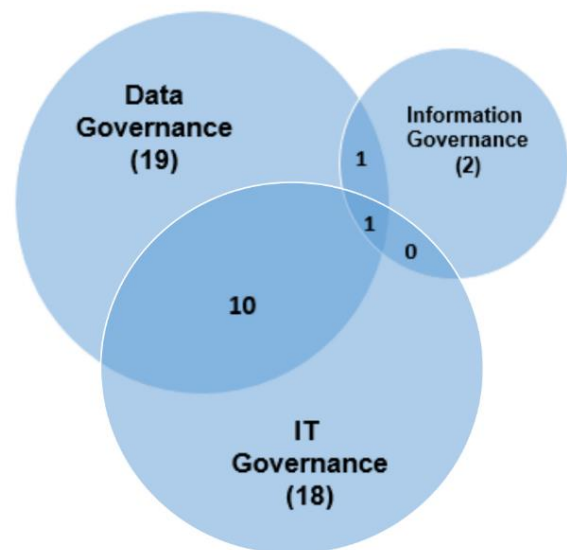


Figure 2. The interplay between data governance, IT governance, and information governance found on the universities' webpages.

Based on the evidence collected from the 30 tier one research universities, it has shown that most institutions have awareness of data governance and are in the process of forming policies and procedures for their institution. The mixture of information available from their webpages provides information of their current state of data governance. Yet, due to the design of this exploratory study and the collection of web content from the sampled universities, our study has limitations. First, the initial collection of web content for this study can only serve as a starting point to inform future research in this topic. The varied organizational structures and concept terms found in universities' data governance policies require further inquiry with each institution. The use of surveys or interviews with university officials within their IT, data or information units can provide valuable insight into their strategy. Institutional culture and values also have an impact on their views and approach to data related mechanism and processes. We recognized that organizational culture and values are important to the development and success of data governance policies and programs in higher education. However, culture and values are not simple variables that we can examine through the web content analysis in this study and should be further researched in light of their connection to data governance at the universities. Further comprehensive research is needed to establish a uniform model or framework for data governance in higher education.

As information professionals, we believe our profession can contribute to an organization's data governance initiative due to our expertise in information related work and services for the various settings. There is no one-size-fits-all solution to data governance. Our study does not propose a single solution approach to data governance, rather, we surveyed the data governance initiatives and practices based on the university's web presences to assess its status quo. We observed consistent themes across the samples in which a governing body with defined roles and access are important constituents within an organization. We also observed the use of software solutions to address their data governance need in many of the universities. To support data-driven decision making, most universities strive for business intelligence (BI) advancement utilizing a variety of analytics tools along with information technology (IT). BI and data analytics are all about using data for decision making and support. In order to acquire quality data for effective data analytics, a data governance or data management framework has to be in place to guide the process. It is evident that BI/analytics efforts co-evolve with data governance. More than 50% of sampled universities focus on BI betterment by indicating the advanced analytics tools in their webpages, such as SAS, Qlikview, Tableau, Cognos, SAP HANA, and OLAP cubes. One university specifically adopted a data governance platform, Collibra, to break down the data silos. This implies that using technology tools or software solutions could aid in navigating the complex data governance process. It is essential to further research on the interrelationship between an organizational structure of data governance and the digitized processes of data governance. Can the adopted solutions provide the one-stop-shop for a unique institution such as higher education? What are the elements in data governance that cannot be addressed by technical solutions but through the integration of human resources or supports?

The next step for our study is to complete the data collection of all tier one universities and collect other evidence to verify our observation from the web content such as interviews or surveys. Another aspect to explore is to identify models or frameworks used by the universities and if these draw from theoretical or conceptual work of data governance from other disciplines. Which type of governance should serve as the foundation of data governance for higher education and how it should vary based on the institutional view on data and information? As Koltay (2016) suggested, "librarianship as well as library and information science also should pay attention to DG [data governance], albeit it attracted attention mainly in the business sector" (p. 304). It is our attempt to examine data governance in higher education from an information science perspective in hopes of understanding the significance of the interplay of data governance, IT governance, and information governance. The current landscapes of data governance among tier one universities are diverse and how they evolve will reflect the institutions' business approach and management as well as their academic vision and mission.

CONCLUSION

Data and information are both valuable assets for higher education. The need for information and data to support the dual roles as an academic institution and a business organization needs a systematic way to manage data and information. The goal of data governance in higher education should be strategic to address the needs and interests of stakeholders from students, staff, faculty, administrators to the larger research community. This paper conducts an evidenced-based study using Web content analysis that substantiates the current state of data governance among higher education. This exploratory approach provides information on one aspect of this phenomenon. Further data collection such as interviews or surveys can provide more in-depth insights in regards of data governance in higher education institutes and to address any information not released in their public domain webpages.

The findings highlight the different approaches undertaken by higher education on data governance. While information governance oversees people activities, technology, and processes (Information Governance Initiative, 2018), data governance revolves around managing information-related processes (The Data Governance Institute, 2017b). This perspective leads us to ongoing discussions regarding rethinking the role of information governance in data governance initiatives. Although the results from this study are not conclusive due to limited sample size, they are certainly worth investigating in depth with wider

populations in tier one universities. It is our plan to further explore the rest of the tier one universities (85 out of 115) to get a better view of data governance among all the tier one universities in the U.S.

For publicly funded education entities, such as public universities, there are distinct features in comparison to a for-profit organization. Accountability, compliance, and transparency are the basis of a public domain that demonstrates equality, accessibility, and stewardship of public resources. Therefore, with the vast amount of data within an education institution, data governance should be in place to protect data assets and to guide the data processes to meet organizational goals. This paper is the first study to collect evidence of data governance across a sample of tier one research universities, thus contributing to the understanding of current state of data governance among leading research universities. Several organizations and universities have taken the lead in forming data governance to guide their decision making and control of data (Borgman & Wada, 2016; Chapple, 2013; Data Quality Campaign, 2018; Reeves & Bowen, 2012), but more work is needed to examine the maturity of data governance implementation. Other types of growing data such as social media and communication channels should also be considered in the data governance framework. If a higher education institute is to invest in software solutions and information architecture to support its business processes and services, a comprehensive data governance framework will help inform decisions in technology investment. The direction taken by the organization on data governance and how it evolves to keep up with the growing big data trend will be one of the determining factors of success in the decades to come.

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