Research Analytics: A Systematic Literature Review

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Abstract

As data-informed decision-making continues to evolve across multiple disciplines in higher education institutions, and as the role of research administration continues to expand from proposal submissions, compliance, and managing research and development expenditures to a profession of an active partnership with investigators to support institutional research, it becomes necessary to have a strategy or model to inform best practices in both strategic planning and business operations within research administration. As numerous research evaluation frameworks and assessment models were proposed to improve the administrative processes of institutional research, this project proposes a data-analytics approach to enhance the services provided by research administrators to minimize risks, maximize efficiencies, and better support researchers and other research and development (R&D) personnel in higher education. This article documents the process of conducting a systematic literature review on leveraging research administration data-analytics in higher education to provide evidence-based practices to inform decision-making regarding strategic advancement in institutional research. The literature review examines current works on how data can be effectively used in process operations, control, and provides new perspectives on how research administration process systems might evolve into a new paradigm of data enhanced operations and control.

Keywords: research administration, data analytics, systematic literature review, strategic planning, business operations

Research Administration Data Analytics: A Systematic Literature Review

Improving Research Administration with Data Analytics

In recent decades, the use of data analytics to inform decision-making has been a common practice in various businesses and industries. In the higher education discipline, several types of analytics (e.g., learning analytics, predictive analytics) have also been widely adopted by public and private institutions to analyze student data, such as student enrollment, retention, attrition for student success (Nguyen et al., 2020; Umer et al., 2021). During this same time, the research administration profession is in a time of significant change due to increased competition, accountability, and compliance from federal and other governmental sponsors. The traditional jack-of-all-trades role or *generalist* has become more fragmented into specialized advanced roles, with a more recent focus on research development (Zink et al., 2022). Not only has research administration expanded in the scope of responsibilities in research support services and client-centered organizational support systems, but the role of research administration has also become increasingly instrumental to expanding institutional research portfolios. In addition, research administration as a profession has grown in its credibility that warrants respect from faculty and researchers, with the introduction of numerous graduate degrees and specialized certifications as a requirement for research administration positions and the new complexities within the office hierarchy (Zink et al., 2022).

The increasingly important role that research administration plays in institutional research demands an urgent need to modernize research administration to keep up with the fast-paced transformation of the profession's diverse responsibilities and operations. A clear strategy to modernize research administration would ensure effective and efficient collaborations between researchers and administrators, better assistance and faster responses to researcher needs, more

manageable workloads for research administrators, more streamlined and simplified business processes, and more efficient tracking of research outcomes. Realizing this need, several evaluative frameworks and assessment models have been published to address current challenges with research administrative processes, increase researcher success, and simplify work across the entire research lifecycle (Bozeman et al., 2021; Hall & Roussel, 2020; Lintz, 2008; Mullen, 2009). While the evaluation of the effectiveness of these proposed frameworks and models are outside the scope of this study, we acknowledge the significance of this field of research and support the continual development of research tools to enhance research productivity, improve day-to-day operations, and better support researchers and faculty, and ensure regulations and compliance requirements are met. Alternatively, however, it is equally beneficial to extract useful information and generate insights from the data handled and collected by research administrators. With the advancement of cloud computing, artificial intelligence (AI), and machine learning, the trend of revolutionizing any business operation with data analytics seems inevitable. Data analytics has already been heavily utilized by big and small organizations, especially in business and other for-profit industries. However, the use of analytics and data-driven, decision-making within the research administration profession and how data analytics can drive growth and success is still in its infancy (Wolf et al., 2021). Data analytics in research administration is not only an effective way of enhancing business operations and strategic planning in institutional research, but such initiatives are arguably necessary to accommodate the development and needs of an increasingly diversified, specialized, and advanced research administration workforce. This study, therefore, calls for an implementation of a data analytics program to research, discover, and interpret patterns within the data to support improvements in research operations and inform strategic decision making. A well-supported and effective data

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analytics program can increase research strengths of an institution, identify priorities for improvement in institutional research, and drive change and growth in research and development (Wolf et al., 2021).

Defining "Research Analytics"

The "research" focus of this study includes any academic activity aiming at the creation of knowledge that are conducted primarily within higher education institutions or joint partnerships between higher education institutions and other entities, such as industries, nonprofit organizations, federal agencies, etc. Borrowing from the definition derived by the Higher Education Research and Development (HERD) survey, a research and development (R&D) activity stands for the "creative and systematic work undertaken in order to increase the stock of knowledge — including knowledge of humankind, culture, and society – and to devise new applications of available knowledge" (National Science Foundation, 2021). Regarding the "analytics" component of this study, in any discipline, analytics requires the ability to collect, manage, analyze, and act on ever increasing amounts of disparate data, at the right speed and within the right time frame (Halper & Stodder, 2014, p. 5). Summarizing the pre-existing definitions of the keywords and the scope of this research, the steps for conducting this systematic literature review is guided by the definition of "research analytics" outlined below:

Research analytics is the science of analyzing data to make data-informed decisions for strategic planning in research and development and business processes around research administration functions. The purpose of research analytics is to identify areas that could be enhanced, troubleshoot current issues discovered by data and resolve them with evidence-based solutions.

Information derived from research analytics can strengthen research performance, build capacity, and strengthen knowledge and discover within higher education institutions.

Purpose and Research Question

As addressed by Wolf et al (2020), because research analytics is in early stages of development in some higher education institutions, and non-existent in many, to date, limited empirical research has addressed the data analytics approach to enhance research administration services in the higher education domain. This study fills this literature gap by conducting a systematic literature review of the use of data analytics in research administration within the higher education domain. In this project, we sought to provide higher education research administration and support personnel with critical knowledge related to leveraging data analytics to make evidence-based decisions around institutional research and the research administration profession. The specific research question, or objective of this study, was to answer, "Based on existing literature, what are the critical elements of instituting an effective data analytics program to inform decision-making within the research administration profession?"

Method

This study is a systematic literature review. A systematic literature review is a rigorous review of research results (Iden & Eikebrokk, 2013). This systematic literature review on the use of data analytics in research administration was conducted using an eight-step systematic literature review approach (Lame, 2019). Each of the steps in Figure 1 were used in this systematic literature review. This process begins by formulating specific review questions and criteria, including determining what elements are outside of the limits of the study (step 1). Researchers

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locate relevant research and studies, assess the quality of the study materials, analyze, and interpret the overall trends and results of the selected research.
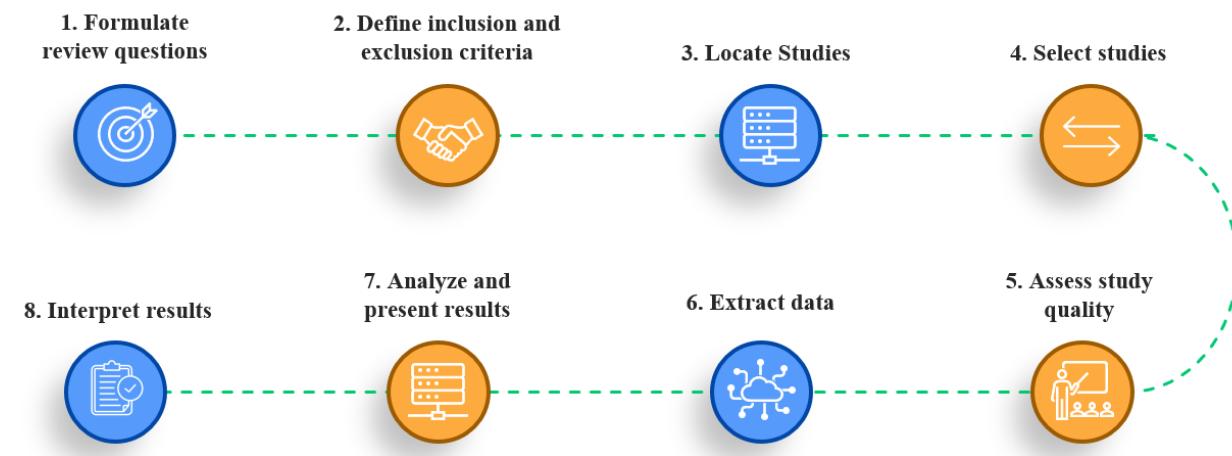
Figure 1. Steps to Conducting a Systematic Literature Review (Lame, 2019)

Review Questions

The review questions specifically addressed by this study are:

1. What research has been conducted on leveraging data analytics in the field of research administration for the purposes of data-informed, decision-making and improvement of business processes?

2. Based on extant literature, what are the critical elements of instituting an effective data analytics program to inform decision-making in research administration?

3. What other findings and conclusions can be drawn from existing research?

Define Inclusion and Exclusion Criteria

Articles included in this review came from two knowledge disciplines, institutional research and data and analytics. For articles related to institutional research, only studies

conducted within the United States (U.S.) context were included in the review. Due to the discipline of data analytics being relatively new within research administration, the geographical criterion does not apply to articles related to data analytics. Data analytics is a hybrid discipline between academics and business; therefore, this review includes literature from both peer-reviewed academic journals and research reports from prominent organizations in the data analytics industry. These articles reported on either or both of two distinct areas: (1) the use of data analytics/ business intelligence and (2) enhancement of operations and efficiencies in research administration. Some included articles documenting the elements of data analytics maturity models from various disciplines, others included interviews with research administrators on best practices of data governance, strategy, data quality, data analysis and expertise. Some included articles that explored different ways of improving business processes in research administration using evaluative frameworks or assessment models. Articles that were not written in English were excluded. Articles reporting on universities outside of the U.S. or published before 2000 were excluded to better reflect current federal funding trends and institutional cultures in the United States.

The Search Process

The search process was organized according to guidelines found in (Lame, 2019). Keywords used in this analysis were "Data Analytics" and "Research Administration." The goal was to identify research articles that are of validated quality and fulfill the article inclusion/ exclusion criteria outlined in the previous section. The literature search process began with Boolean searches in the following online directories, namely Applied Social Sciences Index and Abstracts (ASSIA), Education Database (ProQuest), and ERIC (Educational Resources

Information Center). An additional search was also conducted to locate theme-specific articles at the Society of Research Administrators International (SRAI)'s *Journal of Research Administration* and the National Council of University Research Administrators (NCURA)' *Research Management Review.* Per guidance by Lame (2019), a search of the "grey literature," (p. 1635) such as theses, conference proceedings, technical reports, statistical reports, and market research reports was also conducted. In total, the article searches for this review involved 3 online databases, 16 articles, 7 data analytics maturity models/ technical/ market research reports, 2 books, and 3 papers from conference proceedings. Details of the selection are shown in Table 1. This search resulted in business reports from the leading organizations in data analytics and research administration/ higher education, and a final search on various online directories.

Table 1. Selection of Articles, Reports, and Working Papers for the Literature Review

Journals	Maturity Models/ Business Reports	Databases	Books	Conference Proceedings
Journal of Research Administration (3) Administration and Society (1) Data Science Journal (2) International Journal of Information Management (1) IFLA Journal (1) Decision Support Systems (1) Information Engineering Express (1) Information Systems and E-Business Management (1) IEEE Transactions on Knowledge and Data Engineering (1) MIT Sloan Management Review (1) Research Management Review (1) The Review of Higher Education (1)	Analytics Center of Excellence (1) Information Security Technical Report (1) EAB (1) Gartner National Science Foundation TDWI Deloitte Insights (1)	ASSIA – Applied Social Sciences Index and Abstracts Education Database (ProQuest) ERIC – Educational Resources Information Center	Evidence-Based Practice: An Integrative Approach to Research, Administration, and Practice Big Data Analytics	International Conference on Engineering Design (1) International Conference on Information Systems (ICIS) (1) INTED 2018 Conference Institute of Higher Education Research Projects Series (University of Georgia)

Synthesis of Findings

The findings of the systematic literature review resulted from the selection and analysis of 16 articles, 7 data analytics maturity models/ technical/ market research reports, 2 books, and 3 papers from conference proceedings. The review identified two key objectives for the utilization of data analytics in the research administration discipline and six critical elements of instituting an effective data analytics program to inform decision-making in research administration. The two main objectives of leveraging data analytics in research administration are:

1. Using data to inform strategic planning
2. Using data to inform day-to-day business processes and operations

Using Data to Inform Strategic Planning

One way to use data-informed decision-making is to look for opportunities for improvement through the data available to the institution's research administration office. The availability of high-quality and easily accessible data can answer key questions related to strategic planning in institutional research. Such as identifying strengths and priorities of improvement in the institution's research agenda and looking for ways to promote the strengths and coming up with solutions to remedy areas that need improvement. Wolf (2020) describes one example of setting targeted research priorities at a large research-intensive institution with the use of data-informed strategy and investment. In his interview with the Society of Research Administrators International, he described a challenge with research at his institution where faculty members were competing against a pool of limited resources to start-up research programs and begin applying for external funding. One way of mitigating this challenge was to

confirm institutional research strengths at the university in order to identify capacity for growth and opportunity. Using both internal and external data at hand, particular research strengths and opportunities were identified for further resources and dedicated support. Using information derived from institutional data (research analytics), the research development team developed a program to fund and diversify the university's research priorities and provided significant resources to support these research areas to expand and broaden their scope.

Using Data to Inform Day-to-Day Business Processes and Operations

Apart from using data to inform strategic planning, research administration offices can also benefit from using data to inform the efficiency of their daily work routine. Like other industries, information must be communicated in an effective and efficient manner to ensure smooth operations in the field of research administration. Lintz (2008) describes several methods research administrators rely on to communicate and handle requests coming from stakeholders whose information may travel through various channels. Other challenges such as ensuring effective, efficient, and streamlined collaborations between research administrators, faculty, business managers and investigators are also important. In addition, research administrators play a significant role in making sure proposals are submitted in a timely manner, ensure compliance of funded sponsored grants and contracts, and that pre- and post-award systems operate efficiently. Institutional collaborations extend beyond local entities (Lintz, 2008, p. 72), the increase of university-industry partnerships pose new opportunities and challenges related to efficiencies, operations, project management, and workload management within the research administration units—especially for public institutions. Research analytics uses a different type of data to generate insights on how business processes and operations can be enhanced within

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research administration units (Wolf, 2022). Grant and contract data, for example, are helpful at examining trends of topical areas that are funded across the institution. In addition, identifying strengths and weaknesses of an institution's research portfolio, research analytics uses data to build team science, evaluating where the strengths are in terms of everyday business processes, and use of analytics and data-mining tools to strengthen areas of focus, improve areas where there are limited resources, to streamline processes, and to minimize risks (Wolf, 2022).

Factors Influencing Research Analytics Capabilities

Drawing on the guiding theories and conceptual works discussed in the literature, current scholarship suggests that the development of research analytics capabilities depends on the six factors listed below:

1. *Data* – the sources and types of data collected and analyzed,
2. *Analytics* – the analytics staffing, and tradecraft needed to generate insights from data,
3. *Technology* – the availability of IT infrastructure to support an analytic initiative,
4. *Governance* – the policies and standards around leveraging data analytics,
5. *Culture* – data-informed, decision-making culture, and
6. *Leadership* – senior leadership's commitment to support an organizational strategy around success in analytics and data-informed, decision-making.

The following section outlines the operations of each variable of interest within the context of research administration within higher education institutions.

Data

The first proposed factor, *data*, identifies the sources, access, quality, and standardization of data and metrics, and the system of data documentation and metadata management. Articles included in this literature review posit that effective research analytics capabilities in an

organization require data to be (1) sourced from a consistent data warehouse, (2) of high quality, (3) trusted throughout the institution, and (4) easily accessible.

During recent years, many companies satisfy their needs for strategic information by applying a data warehouse (DW) and online analytical processing (OLAP) technologies into their structured databases (Perez et al., 2008). In the research analytics discipline, there is potential in sourcing the internal data that is used to complete research administration functions from a consistent data warehouse that integrates data from multiple sources.

In addition to a consistent data warehouse, the quality and trustworthiness of the data are instrumental to building effective research analytics. Poor data quality, unactionable results, and nebulous recommendations are top hindrances to stakeholders' reliance on analytics to make decisions (Kune et al., 2020). Marsden and Pingry (2018) cited high quality data inputs as necessary components for meaning replication of "erudite modeling and estimation" that create immediate value. Quality data is a necessary condition for good outcomes such as analysis, or replicability (Marsden & Pingry, 2018). Marsden and Pingry (2018) point out that reproducibility is often compromised due to researchers and funding agencies' inexperience or unfamiliarity with adhering to appropriate data standards and data access. Therefore, another crucial requirement for effective research analytics is that analytics needs to be performed using high quality data and data that are trusted throughout the institution. Examples of data and metrics available for research data analysis include the number of sponsored research dollars per full-time equivalent (FTE); expenditures per FTE; number of graduate students and postdoctoral students supported; number of proposals submitted; dollars requested; and number of awards (Lintz, 2008, p. 73). Examples of data and metrics that are of interest to research administrators include the number of faculty proposals versus awards won, turnaround processing time, indirect cost (IDC) recovery

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rate averages, and success rates per department for applications submitted to sponsors (Qureshi, 2022).

Apart from the relevance and quality of data collected by the institution, another determinant of effective research analytics is the availability and accessibility of data to research administrators at all levels. A character of an optimally operating analytics program is the possibility of data democratization. Lefebvre et al (2021) defined data democratization as the enterprise's capability to motivate and empower a wider range of employees—not just data experts—to understand, find, access, use, and share data in a secure and compliant way. To give a practical example, data analytics industry leader Tableau is built on the philosophy that products should be built to expand access to data within an organization, not to centralize and control it (Fay, 2020, p. 4).

Analytics

The second proposed factor, *analytics*, identifies the development of analytics staffing and hiring to acquire the analytic kills and techniques needed to generate insights from data. Research administration, like other industries, depends on the acquisition of human capital specializing in data analytics to support an analytics initiative. Mikalef et al (2018) asserted that the capacity to utilize big data technologies and tools, and to make strategic decisions based on outcomes, is highly dependent on the skills and knowledge of the human resources. However, staffing in analytical roles, or staffing in general, has been an ongoing challenge for many organizations. Specifically in higher education, a survey study revealed that the vast majority of higher education leaders saw staffing in technical roles as a major issue (EAB, 2022). In addition, to maximize the business value of analytics, companies need employees who understand the business and can cross the communication divide that often exists between information

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technology and other departments (Marsden & Pingry, 2018). Another important aspect of analytics staffing is acquiring and retaining adequate staff members with full-time data reporting and analytics responsibilities. According to Wolf et al (2020), data staff often have other responsibilities in research administration, and very few institutions have full-time data staff within their research administration units.

Apart from sourcing analytics talent, research administrators need advanced technological tools and techniques in business intelligence to successfully implement an analytics program. Translations of insights from data into powerful business decisions requires institutions to catch up with big data and data analytic tools and techniques as fundamental enablers of evidence based, data-driven predictive decisions (Seres et al., 2018, p. 9491).

Besides analytics talent and technological tools, research points to the presence and effectiveness of relevant professional development in leveraging data analytics and self-service analytics tools as additional criteria for the optimization of an analytics initiative (Lefebvre et al., 2021, p. 1). These two features support the organization to develop and achieve data democratization by enhancing employees' data analytics skills to- and the opportunity to conduct analyses that are appropriate for their work. Specifically regarding analytical and self-service analytical tools, according to the Analytics Center of Excellence (2020), processes and tools involved in research analytics should be regularly reviewed and revised as needed. This requirement is important in ensuring the current tools and techniques used for leveraging data are keeping abreast of the fast-paced technological changes in data analytics.

Technology

The third proposed factor, *technology*, identifies the availability of an advanced and coherent IT infrastructure to store, manage, analyze data, and support an analytic initiative and

its integration into existing environment. The *technology* factor also encompasses the funding and resources available to invest in an advanced and coherent IT infrastructure that supports analytics for all parts of research administration and potential users.

Research institutions rely on technological advancements to enable applications of analytic techniques to gain insights from large amounts of hybrid (structured and unstructured) data (Seres et al., 2018, p. 9494). As mentioned in the *Data* section, many infrastructure projects face the challenges of developing practices and solutions for research data management which in compliance with good scientific standards make the research data discoverable, suitable and accessible for society potential reuse (Latif et al., 2019). To mitigate these challenges, one of the ways is to explore the possibility of cloud computing as a platform for big data analytics in view of the storage and computing requirements of the data (Khan et al., 2018). For instance, Brandt et al (2021) developed a research data infrastructure for the material science discipline to extend and combine the features of an electronic lab notebook and a repository. The infrastructure incorporates the possibility of structured data storage and data exchange with documented and reproducible data analysis and visualization, so that researchers can be supported throughout the entire research process (Brandt et al., 2021). In the field of research administration, some institutions have existing information systems in place to establish knowledge repositories and knowledge "banks" to facilitate the transfer of explicit knowledge. According to Lehman (2017), however, "the existing information system needs to be easy to navigate, robust, continually updated, and linked to existing work processes" (p. 61) to support an advanced knowledge management program within the profession. The IT infrastructure should also be a scalable system that can support the ever-increasing volume of data being used, and the services provided by the current data system should go beyond static reporting (i.e., the ability to customize)

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(Russom, 2011, p. 12). Apart from the scalability and versatility of the data system, another desirable feature is the availability of in-database analytics. According to Russom (2011), managing big data in a data warehouse is challenging when that warehouse is modeled for reports and OLAP only. Last but not least, aligning with the vision of data democratization, tools used for interaction with data should be able to support all staff with minimal training required (Analytics Center of Excellence, 2020).

Governance

The fourth proposed factor, *governance*, identifies the processes, policies, roles, and standards around data collection, access, and use to allow for effective leverage of analytics without applying to many restrictions. Data governance covers a wide array of aspects in processing data. Apart from building standard, repeatable processes, reduce costs and increase effectiveness through coordination of efforts and by enabling transparency of processes (Koltay, 2016, p. 304), data governance also encompasses the satisfaction of all matters of finding, cataloging, and masking data, integration of fluid data sets, delivery of built-in compliance, and leverage of advanced machine learning capabilities (Seres et al., 2018, p. 9494). Mature organizations are now recognizing the importance of information security governance—that is how information security processes are directed and controlled both within the organization and between the organization and its business partners (Ashenden, 2008). An effective data governance strategy is critical for research administration units to ensure data are well protected, due to the growing concerns and risks of information security breaches.

Data governance enables better decision-making and protects the needs of stakeholders. Data governance helps to ensure that data are usable, accessible and protected (Watts, 2020). Data governance reduces operational friction and encourages the adoption of common

approaches to data issues. An effective data governance strategy helps to avoid data

inconsistencies or errors, which lead to integrity issues, poor decision-making, and a variety of

organizational problems (Watts, 2020). Koltay (2016) noted that the academic sector,

librarianship, as well as library and information science should pay attention to data governance,

although it attracted attention mainly in the business sector. Research institutions should devise

an advanced data governance strategy to harness the potential and power of data in research

administration.

Culture

The fifth proposed factor, *culture*, identifies the practices within and between

departments in exploring areas where data can contribute to decision-making across the

organization to improve processes, share insights, and inform action planning. Specific to the

field of research administration, the *Culture* factor encompasses the level of extent to which

data-informed decision-making is part of the culture of a research administration unit. This factor

involves research administrators' perceived use and cultural acceptance of data analytics in their

department or work units, the interactions between IT and institutional research offices,

enterprise orientation to managing analytics, exploration, and utilization of opportunities where

analytics can be leveraged to drive decision-making, the extents to which results and insights are

used to inform strategic targeting, value creation, and action planning, etc.

Research administration units that prioritize data analytics development value the

effective use of data. They believe effective use of data is the future of research administration.

Their commitment, support, and willingness to use data in supporting decision-making are

critical factors in ensuring the successful development of a data-informed decision culture

(Webber et al., 2019, p. 6). Seres et al (2018) noted that true digital transformation of these

institutions can be achieved only if the significance of the digital culture is comprehended and accepted by all organizational units, and adopted as part of their own culture (p. 9493). In higher education, the introduction of data-informed decision-making culture is evident in performance-based funding, institutional rating systems, and the increasing use of data mining and analytics (Hora et al., 2017, pp. 392–393). Specific to research administration, as the marketplace and funding opportunities for sponsored research become more competitive, and funders hold research entities more accountable, research administration professionals will need to learn new skills that employ the use of advanced data analytics, data science, and business intelligence tools to remain competitive and sustain research programs and growth (Wolf et al., 2021).

For a sustainable research analytics program, all employees, not just data experts, are encouraged to use data to perform their own analysis to complete job duties (Lefebvre et al., 2021, p. 2). In addition, it is important that the analytics specialist or team communicate and collaborate closely with research administrators to collect and analyze data, compile results, and present insights that are helpful for enhancing the administrative aspects of institutional research, such as general operations around pre- and post-award activities, policies, and practices around indirect rates, and supporting the investigator in navigating the complex system of sponsored research. A benefit of this collaboration is that, while casual users are encouraged to perform their own analysis, data scientists have more time to act as coaches, leading to the creation of communities between technical and non-technical users (Lefebvre et al., 2021, p. 8).

Leadership

The sixth and final proposed factor, *leadership*, identifies the senior leadership's commitment to support an organizational strategy around success in analytics, and valuing data as a strategic asset to support evidence-based decision-making. Specific to research

administration, the *Leadership* factor involves senior leadership's cultural acceptance of analytics, their commitment to support the growth of data analytics capabilities across all aspects and departments of research administration to establish a data-informed decision-making culture across all levels of employees.

Research showed that senior leaders supportive of data analytics development:

1. value data and appropriate analytics,

2. focus on key strategic priority areas to deploy analytical solutions, and

3. show continued commitment to establishing a data-informed culture.

(Webber et al., 2019, p. 6)

A data analytics senior leader believes that data-informed innovation adds to the competitive advantage in research success. Work units under such leadership often have a strategy related to the use of data analytics, and the efforts align with the business goals of the domain (Kesari, 2023). Initiatives such as the development of strategies to manage business, big data alignment, knowledge management, change management and business process transformation can in turn impact the organizational leadership and the governance (Ong, 2016, p. 75). Apart from having a data strategy in place, involving data experts in strategic decision-making is of paramount importance to developing a data-informed culture. Specifically, senior leaders should have an established partnership with analytics professionals as a strategic partner rather than eliciting their input on an ad hoc basis. On the contrary, according to a survey report compiled by the EAB (2022) on data analytics in higher education, many institutions underutilize data professionals, often relegating them to compliance reporting and ad hoc data delivery rather than incorporating their insight into the regular decision-making process (EAB, 2022, p. 14).

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Existing literature provided additional evidence of factors in senior leadership that may hinder the development of an organization's data analytics program. For example, executives are often not digital savvy (Weill et al., 2021), which may lead to miscalculations of the condition of their organizations' data analytics development, such as a disconnect between senior leadership's perceptions of their employees' data analytics capabilities and the employees' actual capabilities (Davenport et al., 2019).

Discussion and Conceptual Framework

This systematic literature review builds on previous research in the area of research analytics but hopes to overcome prior shortcomings by establishing a conceptual framework to strengthen the discipline of research analytics development. Figure 2 shows the resultant conceptual framework titled *Research Analytics Capabilities* (RAC).
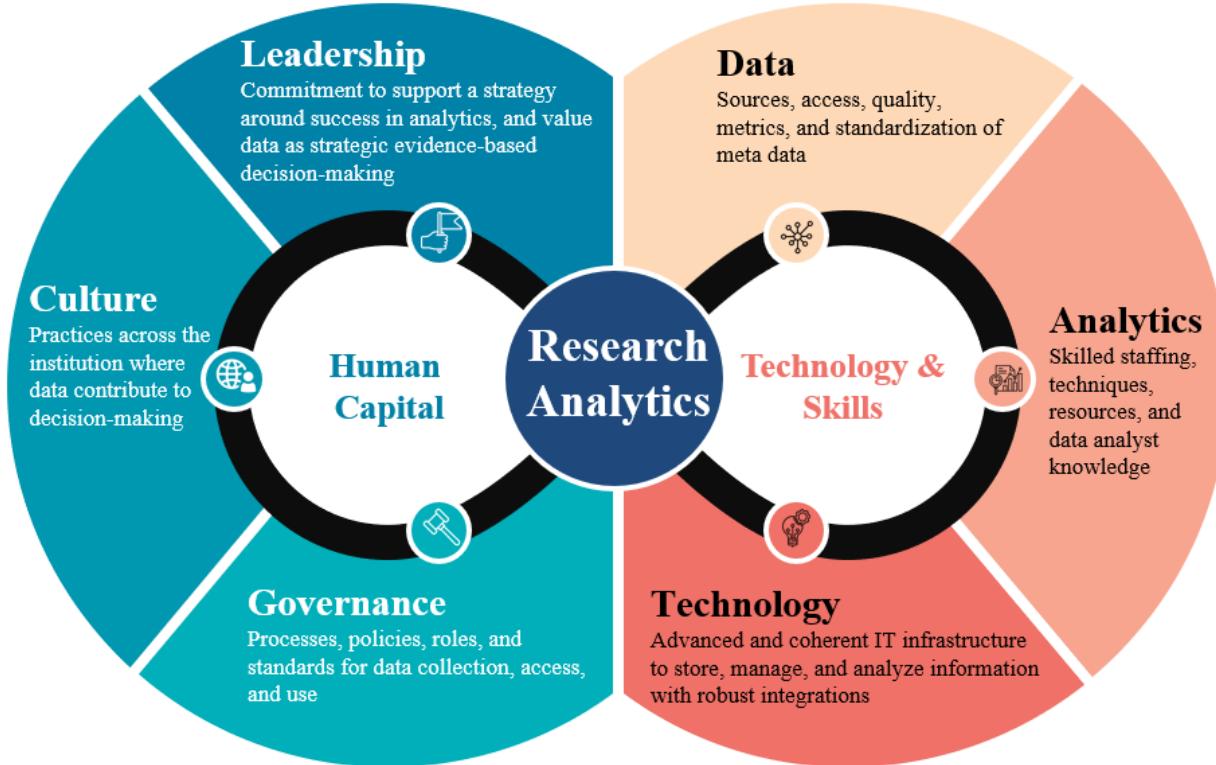
Figure 2. The conceptual framework of *Research Analytics Capabilities* (RAC)

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The systematic literature review on research analytics capabilities reveals six major factors and numerous criteria that may be significantly associated with the development and optimization of a research analytics program. The inclusion of a factor or criterion in the framework was based on its relevance of the study, the degree of differentiation, and its effective operationalization. The numerous criteria deserve further analysis and study that are beyond the scope of this systematic literature review.

This literature review has practical significances in both academia and industry contributions. Academic researchers in data analytics and/ or research administration can refer to the conceptual framework as a guide for them to understand the basic tenets of developing an effective analytics program, to build on or respond to the structure and theoretical considerations underpinning this framework. This study is beneficial for research administration personnel looking for solutions to inform strategic decision-making and enhance business processes. Non-profit and industry research enterprises interested in a data analytics initiative can reference this conceptual framework to self-evaluate their organization's research analytics capabilities, or to build instruments for benchmarking analytics maturity or organizational performance.

As with any research study there are limitations in this systematic literature review. One limitation that must be considered is the fact that, due to the complex and constantly evolving nature of research analytics, the current framework may not capture all the factors and criteria related to research analytics capabilities. Another consideration is that research analytics is a new academic discipline, and as a result, this review suffers from limited resources and previous conceptual or empirical works relevant to this study. The lack of academic knowledge in this field prompts the following recommendation for future research – an extension in all aspects of the body of knowledge concerning research analytics. The increase in academic attention the

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field receives can improve the overall quality of research in this field and may build strategic

capacity for research within higher education.

References

Analytics Center of Excellence. (2020). *Advanced Analytics Capability Maturity Model (A2CM2)*.

Analytics Center of Excellence.

Ashenden, D. (2008). Information Security management: A human challenge? *Information Security

Technical Report*, *13*(4), 195–201.

Bozeman, B., Youtie, J., & Jung, J. (2021). Death by a Thousand 10-Minute Tasks: Workarounds and

Noncompliance in University Research Administration. *Administration & Society*, *53*(4), 527–

568. https://doi.org/10.1177/0095399720947994

Brandt, N., Griem, L., Herrmann, C., Schoof, E., Tosato, G., Zhao, Y., Zschumme, P., & Selzer, M.

(2021). Kadi4Mat: A Research Data Infrastructure for Materials Science. *Data Science Journal*,

20(1), Article 1. https://doi.org/10.5334/dsj-2021-008

Davenport, T. H., Guszcza, J., Smith, T., & Stiller, B. (2019, July 25). Analytics and AI-driven

enterprises thrive in the Age of With. *Deloitte Insights*.

https://www2.deloitte.com/us/en/insights/topics/analytics/insight-driven-organization.html

EAB. (2022). *Leadership Perspectives on Higher Education Data Strategy* (p. 28) [Survey Report]. EAB.

https://pages.eab.com/November-2022-Leadership-Perspectives-Higher-Education-Survey-

Results-WP.html

Fay, C. (2020). *Perceptions of Community College Institutional Research Leaders on Data Democratization—ProQuest* [Mixed Method, Northern Arizona University]. https://www.proquest.com/docview/2414767595?pq-origsite=primo

Hall, H. R., & Roussel, L. A. (2020). *Evidence-Based Practice: An Integrative Approach to Research, Administration, and Practice: An Integrative Approach to Research, Administration, and Practice*. Jones & Bartlett Learning.

Halper, F., & Stodder, D. (2014). TDWI analytics maturity model guide. *TDWI Research*, 1–20.

Hora, M. T., Bouwma-Gearhart, J., & Park, H. J. (2017). Data driven decision-making in the era of accountability: Fostering faculty data cultures for learning. *The Review of Higher Education*, *40*(3), 391–426.

Iden, J., & Eikebrokk, T. R. (2013). Implementing IT Service Management: A systematic literature review. *International Journal of Information Management*, *33*(3), 512–523. https://doi.org/10.1016/j.ijinfomgt.2013.01.004

Kesari, G. (2023, January 4). Does Your Data & Analytics Strategy Have These 10 Crucial Elements? *Forbes*. https://www.forbes.com/sites/ganeskesari/2022/05/31/does-your-data--analytics-strategy-have-these-10-crucial-elements/

Khan, S., Shakil, K. A., & Alam, M. (2018). Cloud-Based Big Data Analytics—A Survey of Current Research and Future Directions. In V. B. Aggarwal, V. Bhatnagar, & D. K. Mishra (Eds.), *Big Data Analytics* (pp. 595–604). Springer. https://doi.org/10.1007/978-981-10-6620-7_57

Koltay, T. (2016). Data governance, data literacy and the management of data quality. *IFLA Journal*, *42*(4), 303–312.

Kune, L. F., Enever, J., & McNelllis, J. (2020). *Marketing Data and Analytics Survey 2020: Optimism Persists as Results Fall Short of Expectations* (Business, Survey Research No. G00726025; pp. 1–25). Gartner. https://emtemp.gcom.cloud/ngw/globalassets/en/marketing/documents/2020-data-and-analytics-survey-research.pdf

Lame, G. (2019). Systematic Literature Reviews: An Introduction. *Proceedings of the Design Society: International Conference on Engineering Design*, *1*(1), 1633–1642. https://doi.org/10.1017/dsi.2019.169

Latif, A., Limani, F., & Tochtermann, K. (2019). A Generic Research Data Infrastructure for Long Tail Research Data Management. *Data Science Journal*, *18*(1), Article 1. https://doi.org/10.5334/dsj-2019-017

Lefebvre, H., Legner, C., & Fadler, M. (2021). Data democratization: Toward a deeper understanding. *Proceedings of the International Conference on Information Systems (ICIS)*.

Lehman, D. W. (2017). Organizational Cultural Theory and Research Administration Knowledge Management. *The Journal of Research Administration*, *48*(2), 52–66.

Lintz, E. M. (2008). A Conceptual Framework for the Future of Successful Research Administration. *Journal of Research Administration*, *39*(2), 68–80.

Marsden, J. R., & Pingry, D. E. (2018). Numerical data quality in IS research and the implications for replication. *Decision Support Systems*, *115*, A1–A7.

Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2018). Big data analytics capabilities: A systematic literature review and research agenda. *Information Systems and E-Business Management*, *16*(3), 547–578.

Mullen, C. A. (2009). Re-Imagining the Human Dimension of Mentoring: A Framework for Research Administration and the Academy. *Journal of Research Administration*, *40*(1), 10–31.

National Science Foundation. (2021, December). *Higher Education Research and Development Survey (HERD) | NCSES | NSF*. https://nsf.gov/statistics/srvyherd/

Nguyen, A., Gardner, L., & Sheridan, D. (2020). Data analytics in higher education: An integrated view. *Journal of Information Systems Education*, *31*(1), 61.

Ong, V. K. (2016). Business intelligence and big data analytics for higher education: Cases from UK higher education institutions. *Information Engineering Express*, *2*(1), 65–75.

Perez, J. M., Berlanga, R., Aramburu, M. J., & Pedersen, T. B. (2008). Integrating Data Warehouses with Web Data: A Survey. *IEEE Transactions on Knowledge and Data Engineering*, *20*(7), 940–955. https://doi.org/10.1109/TKDE.2007.190746

Qureshi, S. A. (Director). (2022, January). *Metrics and Data: Research Administration* [Presentation]. https://www.youtube.com/watch?v=eLYwBjujjIQ

Russom, P. (2011). Big data analytics. *TDWI Best Practices Report, Fourth Quarter*, *19*(4), 1–34.

Seres, L., Pavlicevic, V., & Tumbas, P. (2018). Digital transformation of higher education: Competing on analytics. *Proceedings of INTED2018 Conference 5th-7th March*, 9491–9497.

Umer, R., Susnjak, T., Mathrani, A., & Suriadi, L. (2021). Current stance on predictive analytics in higher education: Opportunities, challenges and future directions. *Interactive Learning Environments*, *0*(0), 1–26. https://doi.org/10.1080/10494820.2021.1933542

Watts, S. (2020, April 16). *What Is Data Governance? Why Do I Need It?* BMC Blogs. https://www.bmc.com/blogs/data-governance/

Webber, K., Zheng, H., Webber, K. L., & Zheng, H. (2019). Data-Informed Decision Making and the Pursuit of Analytics Maturity in Higher Education. *Institute of Higher Education Research Projects Series*. https://ihe.uga.edu/rps/2019_010

Weill, P., Woerner, S. L., & Shah, A. M. (2021). Does Your C-Suite Have Enough Digital Smarts? *MIT Sloan Management Review*, *62*(3). https://sloanreview.mit.edu/article/does-your-c-suite-have-enough-digital-smarts/

Wolf, B. (2022, April). *Hot Topics in Research Administration—Baron Wolf*. https://soundcloud.com/srai-shop-talk/hot-topics-in-research-administration-episode-2-baron-wolf

Wolf, B., Hall, T., & Messina, H. (2020, February 13). *Data Analytics and Research Administration, Results of a National Data Collection*. Society of Research Administrators International. https://www.srainternational.org/blogs/srai-news/2020/02/13/data-analytics-and-research-

administration, https://www.srainternational.org/blogs/srai-news/2020/02/13/data-analytics-and-research-administration

Wolf, B., Hall, T., & Robershaw, K. (2021). Best Practices for Research Analytics & Business Intelligence within the Research Domain. *Research Management Review*, *25*(1), 37.

Zink, H., Huges, D., & Vanderford, N. (2022, September 28). Reconfiguring the Research Administration Workforce: A Qualitative Study Explaining the Increasingly Diverse Professional Roles in Research Administration [Resources for Research]. *Journal of Research Administration: Society of Research Administration International*. https://www.srainternational.org/blogs/srai-jra2/2022/09/28/reconfiguring-the-research-administration-workforc