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BOOK REVIEW

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Big Data on Campus. Data Analytics and Decision Making in Higher Education.

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The main objective of *Big Data on Campus. Data Analytics and Decision Making in Higher Education* is to describe the conceptual underpinnings of the various roles of data analytics within higher education institutions (HEIs), together with providing an overview of developments in data sources, data curation and analytical models. Using a series of focused discussions and case students leading data analytics experts and higher education leaders describe how analytics can facilitate effective data-informed decision making (DIDM) in domains such as admission decisions, retention and enrollment management, student life and engagement, academic and career advising, student learning and assessment, and academic program planning. 'Big Data on Campus' is well suited to its aspired audience of senior administrative leaders, practitioners of institutional research, technology professionals, and graduate students in higher education. Each chapter draws on a comprehensive body of literature, both in terms of relevant academic research as well as practical applications.

'Big Data on Campus' is a timely book as HEIs find themselves operating in an increasingly complex and competitive environment and face an increasing pressure to respond to economic, political and social changes (Daniel, 2015). Despite growing interests in exploring and unlocking the added value of the exponentially increasing amounts and sources of data available, there is still relatively limited research into big data in higher education. Whereas many colleges and universities are generating examples how analytics can help advance in several strategic areas such as resource allocation, student success and finance, many institutions still view analytics as an expensive endeavour rather than an investment (Bichsel, 2012). In their seminal work, Davenport et al. (2010) conclude that whereas many companies have massive amounts of data at their disposal, most fail to utilize it in any meaningful way. This observation seems particularly pertinent to the current situation most HEIs find themselves in. Large data sets in higher education now exist about learners, their learning and the environments in which they study (Sclater et al., 2016) and many institutions have made significant progress in building data warehouses and implementing tools to provide better access to administrative data that were previously locked away (Drake & Walz, 2018). Yet, while HEIs are collecting more data than ever before, data analytics is often applied only to satisfy credentialing or reporting requirements, rather than to improve strategic decision-making, and with much of the data collected not even used at all (Bichsel, 2012).

The emphasis of 'Big Data on Campus' is on data analytics in US higher education, yet its relevance will resonate with HEIs across the globe as these face similar challenges and opportunities with respect to data analytics. In particular, the editors discuss data analytics developments in the realm of data-driven decision making (DDIM). DIDM is defined as 'the process of organizing data resources, conducting data analysis, and developing data insights to provide the contexts and evidence base for formulating organizational decisions' (p. 8). While DDIM has obvious similarities with DDDM, the book makes a convincing case of emphasizing the former. Whereas DDDM

can be described as a process in which decisions are typically routine and operational in nature and even suggested by algorithms in the absence of input by human decision makers. Instead, 'DIDM recognizes that human judgement is a key element in complex, dynamic, and strategic decision making' (p. 7) such that data are leveraged effectively to allow for humans to decide.

The book is organized into twelve chapters, which are separated into four parts.

Chapters 1–3 constitute the first part 'Technology, Digitization, Big Data, and Analytics Maturity as the Enabling Conditions for Data-Informed Decision Making' which provides an overview of the increasing presence and prominence of data analytics, big data and predictive analytics in higher education.

Chapter 1 describes how the higher education sector has long suffered from an inability of exploiting the vast amounts of available data towards generating actionable insights to improve organizational outcomes. Often described as 'data rich but information poor' (Reinitz, 2015), this situation asks for organizational, cultural and strategic changes as to unlock the potential of new technologies and data infrastructures (Davenport et al., 2001). The chapter then quickly moves to introducing DDIM as the paradigm required for organizing these changes and identifies three main conditions to enable effective DDIM in higher education: the people, the technology, and the process and culture. With data analytics leadership, data engineers, architects, analysts and scientists, up-to-date and user-oriented data management tools and reporting tools, and an analytics process and culture all in place, DDIM can yield improvements in six domains: students success, curriculum innovation, addressing community needs, operational effectiveness and efficiency, strategic agility and data governance.

Chapter 2 moves on to focus on how artificial intelligence, machine learning and big data have evolved and transformed decision making in HEIs. The chapter raises several issues regarding the potential ways in which future innovations in these domains will further upset current practices and the need to balance data-based predictions with human insights.

Chapter 3 concludes the introductory part of the book by zooming in on one of the key aspects of DIDM in higher education: predictive analytics. The chapter adopts a comprehensive working definition, such that predictive analytics encompasses both the development of analytical insights derived from predictive modelling applied to organizational data assets (i.e., data mining) and the incorporation of business knowledge used for optimizing decision making. Approached in this sense, the pertinence of predictive analytics with respect to DIDM becomes self-evident, after which the chapter concludes with providing a short overview of the most common modelling approaches to predictive analytics and several examples and case studies demonstrating its potential.

Part two 'The Ethical, Cultural, and Managerial Imperatives of Data-Informed Decision Making in Higher Education' comprises *Chapters 4–6* and deals with the aforementioned enabling conditions for effective DIDM. *Chapter 4* focuses on one particular risk associated with the increased availability of data analytics in higher education; the misuse and misunderstanding of data reports and visualizations. The chapter identifies three specific factors that give rise to such misuse (i.e., inaccurate presentation of data, misinterpretation of data and ethical and privacy considerations) and provides examples of how confusion and misinformation can be avoided when following principles of good design.

To further facilitate effective DIDM in higher education, *Chapter 5* emphasizes the importance of strategic analytics and how it bolsters institutional research operations in HEIs. The chapter summarizes several key characteristics of strategic analytics, such as the use of modelling and optimization algorithms, a culture of using data analytics to inform strategy decisions, adopting an enterprise perspective in terms of analyses, and monitoring and anticipating organizational responses in the face of environmental changes (Davenport, 2006). The chapter concludes with a few case studies, which further serve to emphasize the importance of senior leadership in treating 'data assets as a strategic asset and truly use it to inform critical decision-making processes with the goal of developing competitive advantages' (p. 119).

Chapter 6 wraps up part two of the book by arguing how a strong data governance infrastructure is vital for enabling a data-informed culture. To this end, the chapter adopts a very comprehensive data governance in that it is 'a multifunctional organizational strategic initiative which enables, enforces, and formalizes the proactive

management of its essential data assets to achieve the organization's business goals' (p. 123). The chapter then moves on to argue that a good data governance programme in HEIs can help build trust, promote transparency and encourage buy-in.

Having introduced the framework for DIDM in higher education in part one, and elaborated on its key characteristics part three, part three of the book then provides five exemplary case studies. *Chapter 7* describes the potential of data analytics in terms of decision making around admissions and enrolment management. While highlighting the various opportunities to apply descriptive, predictive and even prescriptive analytics in this realm, the chapter also points out that successfully applying enrolment analytics should be deployed carefully, thoughtfully, and purposefully as to mitigate risks of adverse outcomes.

Chapter 8 moves on by describing how—once students have indeed enrolled- HEIs can effectively deploy predictive analytics and DIDM in advising, financial aid, and student-support services for improving student success.

Chapter 9 adopts an even broader scope by acknowledging the full lifecycle of student engagements with personalized service and connected experiences from when a student first shows interest in the university to well beyond their graduation. For this, the chapter adopts the concept of Constituent Relationship Management (CRM) technology, emphasizes how 'For all their potential benefits, CRM projects are difficult to scope and successfully deliver due to their complexity' (p. 203) and identifies executive support, financial support, staffing, data and data modelling as critical factors for realizing CRM success.

Chapter 10 of the book is devoted to learning analytics, a highly popular application of DIDM in higher education. Defined by Siemens (2013) as the measurement, collection, analysis and reporting of data about learners and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs, learning analytics can provide real-time, personalized and actionable feedback through so-called dashboards. The chapter describes how learning analytics, when addressing users' needs and perspectives, can improve course design, pedagogy, advising and—ultimately- learning, but only when adopted and implemented at scale.

Chapter 11 then explores how business officers in colleges and universities have used and can better use analytics to effectively support institutional financial and operational efficiency.

Chapter 12 wraps up the book by concluding that the 'The transformation in the use of data analytics for informed decision making in higher education has begun' (p. 285), after which the developments of data analytics in higher education are described using Davenport's Five Stages of Analytics Maturity model (Davenport, 2018; Davenport et al., 2010). This final chapter then provides a checklist for leaders in higher education keen to support further developments: people, process, technology and culture and concludes by expressing the hope that 'Big Data on Campus' 'leaves the reader with new insights and an excitement for the future of data analytics in higher education' (p. 307).

In collecting a series of essays and case studies on the potential impact of data analytics and the roles of decision makers and institutional researchers, editors Webber and Zheng and contributors have produced an ambitious book. 'Big Data on Campus' provides principles of good practice, examples of data analytics that have actually been implemented, and argumentation for its use in informing a wide array of areas, ranging from admissions and enrolment decisions, promoting student success through advertisement and course management systems, to improving 'connectedness' with key stakeholders, but also to maintain energy-efficient buildings and practices, and to facilitate institutional financial and operational efficiency. Having managed to successfully fit all this in one comprehensive volume is commendable. Another strong aspect of the book is how it explains the nuances between DDIM and DIDM and the importance of human, ethical and cultural factors in this respect. As such, 'Big Data on Campus' will no doubt prove to be very useful in guiding institutional efforts towards developing comprehensive data analytics frameworks.

One aspect that readers might consider less appealing is that, in trying to be as comprehensive as possible, the book often offers a vast multitude of options, factors and issues to consider. This can be quite overwhelming and potentially installs some sense of confusion or uncertainty. For example, in its concluding chapter, 'Big Data on Campus' starts off with several in-sentence lists, such as the key components of a successful

data governance program and the main determinants for establishing a data-informed decision culture. It then introduces Davenport's Five Stages of Analytics Maturity (Davenport, 2018; Davenport et al., 2010), as well as the subsequent DELTA model (Davenport et al., 2010) and the two additional Plus factors added by Davenport (2018); followed by EDUCAUSE's maturity index for measuring 32 factors of analytics maturity across six different dimensions.[1] This, then, is followed by listing several criteria for setting up strategies for success in realizing analytics maturity, together with four steps defined by Gartner (2018) for moving an institution's capability to have greater organizational impact and four factors for building capacity in institutional research as defined by Webber (2018). All this culminates in a final checklist of four key aspects of technology development (i.e., people, process, technology and culture), at which point some readers might no longer see the wood for the trees.

An issue that could have deserved a more prominent position in 'Big Data on Campus' is that data analytics-relevant questions for HEIs not only cover different domains (e.g., enrolment admission, student success or financial aid), but also vary in terms of whether they are descriptive, predictive, diagnostic or causal in nature. Analytics such as ad-hoc reports, statistical analysis, forecasting and predictive-modelling techniques are generally well-suited for describing overall situations, detecting unusual patterns and early risk-detection and the book shows insightful examples and successful applications of each. While the potential of data analytics in the form of prescriptive and analytics and optimization methods (Davenport & Harris, 2007) has certainly not gone unnoticed, caution is warranted as the result of data analytics efforts may fall short of the mark. For example, effective study advising not only requires early detection of at-risk students for timely intervention, but also proper diagnosis for determining the right intervention. Students can struggle similarly in terms of academic achievement, but for very different reasons and such important distinctions can be missed when the data infrastructure picks up symptoms but not the underlying determinants. Then, being able to decide what the best intervention is for whom also requires empirical evidence of the relative effectiveness of the different alternatives that can be considered. Generating such evidence entails rigorous scientific evaluations, such as randomized field experiments, which comes with its own set of practical and ethical challenges to consider.

Concluding, *Big Data on Campus. Data Analytics and Decision Making in Higher Education* persuasively argues that the transformation in the use of data analytics for informed decision making in higher education has not only begun but is well underway. The book provides the reader with important insights in how the increasing amounts and sources of data can be leveraged to improve a wide array of domains and outcomes, but makes an equally compelling case that human judgements remain of key importance in the often complex, dynamic and strategic decision-making processes in higher education institutes.

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ENDNOTE

[1] For more information on EDUCAUSE's maturity index, refer to EDUCAUSE's Benchmark Service at: https://www.educause.edu/about/discover-membership/educause-benchmarking-resources

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