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An evidence-based review of HR Analytics

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ABSTRACT

We conduct an evidence-based review using an integrative synthesis of published peer-reviewed literature on Human Resource analytics (HR Analytics). Our search of several publication databases identified 60 articles on this topic, however only 14 articles were in quality peer-reviewed journals. Our review of these articles addresses the following 5 questions: (1) What is HR Analytics (how has the concept definition evolved)? (2) How does HR Analytics work (what are the processes)? (3) Why does HR Analytics work (what theories explain cause-effect relationships, antecedents, and consequences)? (4) What does HR Analytics produce (what are the outcomes)? (5) What is required for HR Analytics to succeed (what are the moderators of the analytics-outcome relationships)? We conclude that despite evidence linking the adoption of HR Analytics to organizational performance that adoption of HR Analytics is very low and academic research, and therefore, evidence on this topic is sparse. We offer potential explanations for this paradox and suggest avenues for future research.

KEYWORDS

Human resource analytics; workforce analytics; HR metrics; strategic HRM; talent management; HRIS

Introduction

‘It’s hotter than not! HR professionals are clamoring for “analytics”-the magic numbers that will help them combat attrition, hire the highest of high performers and predict the future success of the organization. We are seeing the surge of interest in analytics as one of the very top initiatives in HR today. Technology providers are embedding applications with functionality to move beyond reporting and actually providing the groundwork for data-driven decision-making.’ (Jones, 2014, p. 43)

Analytics in human resource management has been around for years. For example the notion of measurement in human resources can be traced back to the early 1900s (Kaufman, 2014) and the first book on ‘How to Measure Human Resources Management’ by a pioneer in the modern era of HRM measurement,

Jac Fitz-enz, was published in 1984 (Fitz-enz, 1995). So why, about 100 (or 30) years later, is HR Analytics so hot? Does it actually predict the future success of the organization as the quote above suggests HR professionals want to believe? The purpose of this paper is to begin to address this question and in doing so make two key contributions to the human resource literature on HR Analytics. First, we provide an evidence-based review of existing high-quality research and scientific knowledge about the value of HR Analytics. Second, we identify where new research is needed.

We undertake an integrative synthesis of the published peer-reviewed literature following evidence-based practice guidelines (Rousseau, Manning, & Denyer, 2008). Evidence-based review guidelines are meant to improve decisions by addressing the fact that management practitioners use many sorts of evidence in their decisions, but typically pay little attention to the quality of the evidence (Barends, Rousseau, & Briner, 2014). Barends et al. (2014) define evidence-based management as about making decisions through the conscientious, explicit and judicious use of the best available evidence from multiple sources by translating a practical issue into an answerable question, systematically searching for and retrieving evidence, critically judging the evidence, pulling together the evidence, incorporating the evidence into the decision-making process, and then evaluating the outcome of the decision taken.

In this study, we frame specific questions, systematically search for and retrieve a particularly high-quality source of evidence (published and peer-reviewed articles), and critically examine the quality and implications of the findings and also the pattern and extent of such evidence. We use integrative synthesis which is an accepted evidence-based methodology in order to provide the best available evidence from multiple sources to answer key questions. Integrative synthesis is appropriate for HR Analytics, because it involves triangulating evidence from both quantitative and qualitative published studies (Rousseau et al., 2008) and therefore maximizes use of all sources of published evidence. It investigates patterns across primary research studies, compensating for single-study weaknesses in research design to improve the internal and external validity of the various research findings. Integrative synthesis is not meta-analysis, which involves summarizing quantitative empirical results across multiple studies (Rousseau et al., 2008). With HR Analytics, the cumulative body of quantitative empirical research is insufficient to make a meta-analysis currently feasible. As we shall see, there are very few empirical studies, and only about 16% of organizations even report using HR Analytics (CedarCrestone's 17th Annual HR Systems).

A hallmark of integrative synthesis is using predetermined questions and selection criteria. We chose diffusion of innovation theory (DOI) (Rogers, 2003) as the basis for deriving the predetermined questions that guide our evidence-based integrative synthesis. With only 16% of organizations reporting adoption (CedarCrestone's 17th Annual HR Systems), HR Analytics represents a new innovation, even though it has been discussed for many years. Thus, treating HR

Analytics as a diffusing innovation seems appropriate. Rogers (2003) conceives the decision to adopt an innovation (e.g. something new or a new idea) as a 5-step process: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Since HR Analytics is still relatively new, at the early adopters stage (e.g. less than 20% of organizations), we focus on questions relating to the first two stages: gaining knowledge about HR Analytics and being persuaded about whether to adopt HR Analytics.

The decision to examine HR Analytics through the lens of innovation adoption is also consistent with recent advances in theories regarding why institutions adopt practices. As Paauwe and Boselie (2005, p. 989) noted, new institutionalism examines why organizations within a population exhibit similar characteristics to explain isomorphism of organizations (DiMaggio & Powell, 1983). Isomorphism is when one unit in a population resembles other units that face the same set of environmental conditions. Paauwe and Boselie (2005, p. 990) note that such isomorphism among early adopters is driven by ‘competitive’ factors, such as economic and competitive rationality, managerial rationality and estimated risk-return tradeoffs. They note that later stages of adoption may see increasing influence from ‘institutional’ isomorphism forces, including ‘coercive’ (trade unions, legislation), ‘mimetic’ (copying best practices of others), and ‘normative’ (norms promoted by respected institutions such as universities, professional associations, social networks, etc.). Because we identify HR Analytics as at the early-adopter stage, we frame our review in terms of the ‘competitive’ forces, including rationality and estimated risk-return tradeoffs. Certainly ‘institutional’ isomorphism forces affect more mature HR practices, and may even now sometimes affect the adoption of basic HR Analytics (e.g. when regulations require reporting certain demographic statistics and drive the adoption of analytics methods to produce those reports). However, here we focus on what appears to be the empirically more common situation that HR Analytics is an innovation in the early-adopter stage, and thus we do not examine ‘institutional’ isomorphism here.

Rogers (2003) notes that the innovation-decision process is an information-seeking and information-processing activity in which an individual obtains information in order to gradually decrease uncertainty about the innovation. At this stage, the individual wants to know what the innovation is, and how and why it works. Consistent with this first information gathering stage, our integrative synthesis addresses these information gathering questions about HR Analytics:

- (1) What is HR Analytics?
- (2) How does HR Analytics work?
- (3) Why does HR Analytics work?

The first question relates to developing construct validity. The second question is about cause-effect relationships and internal validity, and the third question is

about the underlying theoretical framework supporting the logic of the cause-effect relationship.

At the second step of the decision process, the decision-maker seeks information concerning the expected outcomes of adopting the innovation in order to decide whether to adopt an innovation. Questions being asked at this stage relate to understanding the consequences of adoption and what contextual factors might moderate or mediate the general cause-effect relationship. Our integrative synthesis therefore is also guided by these two additional questions:

- (4) What are the outcomes of HR Analytics?
- (5) What moderating factors affect HR Analytics outcomes?

Methodology

Sample-systematic search

We set out to identify scholarly research on HR Analytics. Our research methodology follows the 'integrative synthesis' procedure (Rousseau et al., 2008). We searched 3 major multidisciplinary publication databases: Academic Search Complete, Business Source Complete, and Scopus. Academic Search Complete includes more than 7000 full-text periodicals in the social sciences, humanities, and science and technology. Business Source Complete provides full text from more than 1600 scholarly business journals and indexes over 4300 titles. Additional full text non-journal content includes books, conference proceedings, case studies, and faculty seminars. Scopus indexes, abstracts and provides the contents of 21,000+ journal titles from 5000 publishers. It also covers conference proceedings, book series, and scientific Web pages and patents.

Our search protocol across these databases involved searching article titles for the terms 'HR Analytics', 'Talent Analytics', 'Workforce Analytics', 'People Analytics' or 'Human Resource Analytics'. The variety of such labels reflects the emerging nature of this topic. A review of business and academic publications in the Business Source Premier database suggests the label 'Workforce Analytics' preceded the use of the term HR Analytics and was first introduced in the context of data analytic software developed by a major software vendor (InfoWorld, 1999). The notion of talent analytics appears with the introduction of Talent Management Applications around 2006 (CedarCrestone 2006 Workforce Technologies and Service Delivery Approaches Survey, Ninth Annual Edition) and popularized by consultants (e.g. Davenport, Harris, & Shapiro, 2010). People Analytics is a term that emerges from Google's use of the term to describe their data-driven approach to HRM. In a 2013 blog, John Sullivan argued that the basic premise of the 'people analytics' approach is that accurate people management decisions are the most important and impactful decisions that a firm can make ('How Google Is Using

People Analytics to Completely Reinvent HR,' 2013). The most frequently used term appears to be HR Analytics, but agreement on a commonly accepted term is still emerging. We will use the term HR Analytics in this paper, to encompass research identified and using the other terms above.

We searched exclusively for articles in which our key search terms, (e.g. 'HR Analytics') were included as a single phrase in the title, to insure that our search would identify articles that were specifically about our topic of interest and exclude articles in which HR Analytics was tangential or in which the words HR and Analytics appeared separately and therefore not to 'HR Analytics', the concept. Our search of the 3 publication databases resulted in 60 articles.

Figure 1 summarizes the number of articles by year. The first article in our sample of literature was published in 2003. From 2003 to 2011, there are just a few articles per year. Then after 2010, interest in HR Analytics increases noticeably. There are a number of special journal issues on HR Analytics published in 2011 which may reflect the publicity of Google's success with People Analytics and project Oxygen first appearing in the New York Times in early 2011 (Bryant, 2011; Garvin, 2013) or the appearance in 2010 in Harvard Business Review of an article by Davenport et al. (2010) titled 'Competing on Talent Analytics', which promoted the strategic benefits achieved by well-known firms such as Hurrah's, Google, Sysco, Jet Blue, Best Buy, Dow Chemical, AT&T, and Proctor & Gamble. However, despite some notably well-known articles, the total number and pattern of publications about this topic in mainstream management research journals is still very small. While there are many more blogs, white papers, consulting reports

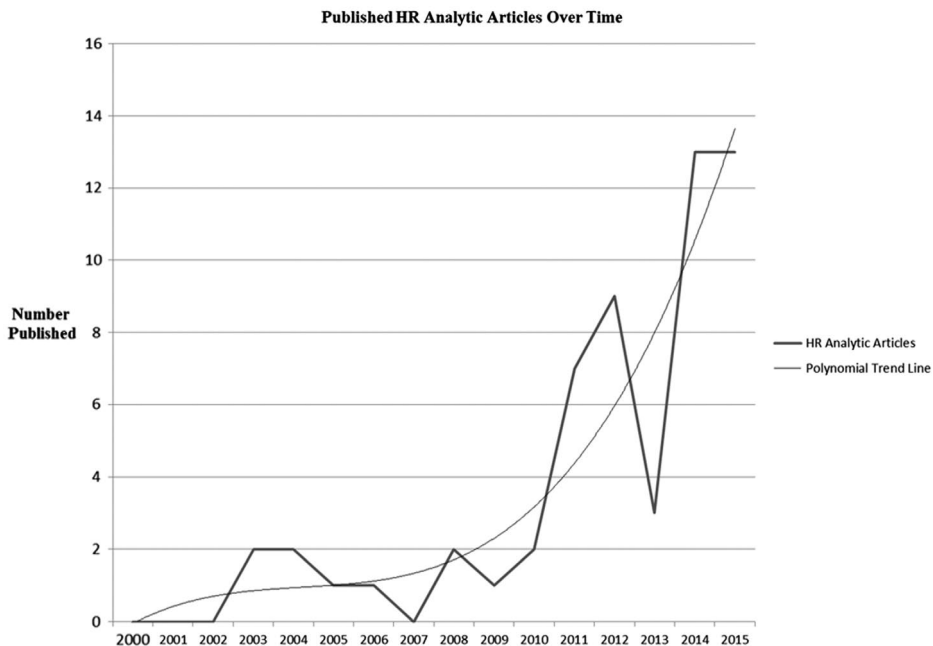


Figure 1. Published Articles on HR Analytics Over Time.

and press reports, it does not appear that management researchers have focused a great deal of attention to the topic.

Critical evaluation of evidence

We then divided the research into articles published in scholarly peer-reviewed journals and those published in non peer-reviewed periodicals. The latter articles are more likely to be less objective and represent consultants and vendors interests in promoting their HR Analytics service or product (Angrave, Charlwood, Kirkpatrick, Lawrence, & Stuart, 2016). Of our original sample of 60 articles, the publication database search categorized 32 as appearing in peer-reviewed journals.

We then classified the 32 peer-reviewed articles by whether they were in publications that appeared on the Journal Quality List (JQL) 56th Edition published by Professor Anne-Wil Harzing. The JQL is published to assist academics to identify journals of an appropriate standard for assessment of scholastic performance. When we applied this additional criterion, 16 articles of 32 peer-reviewed articles were eliminated because they did not appear in journals on the JQL. This classification is shown in Table 1. This included 8 articles that were published in Workforce Solutions Review, which is published by the International Human Resource Information Management Association, a professional association. Two additional articles were eliminated because one was simply an introduction to a special issue on HR Analytics and the other article did not address the topic of HR Analytics. Of the 14 remaining articles, 7 were published in Human Resource Planning (renamed in 2008 to People & Strategy) which is a journal published by the Human Resource Planning Society and included in the JQL.

Table 1. Peer-reviewed publications on HR Analytics.

Journal Publication	#	JQL
Employment Relations Today	2	N
European Journal of Operational Research	1	Y
Human Resource Management Journal	1	Y
Human Resource Planning	1	Y
Journal of Business Strategy	1	Y
Journal of Cases on Information Technology	1	N
Journal of Contemporary Management Issues	1	N
Management Science	1	Y
Organization Dynamics	1	Y
People & Strategy	9	Y
Public Manager	1	Y
Strategic HR Review	1	N
Strategy & Leadership	2	N
Workforce Asset Management	1	N
Workforce Solutions Review	8	N
Total	32	

Note: JQL stands for Journal Quality List 56th edition, 27 Nov 2015 published by Professor Anne-Wil Harzing. People & Strategy replaced Human Resource Planning in 2008.

Categorization

For the remaining 14 articles in scholarly peer-reviewed journals, we then categorized each article by which research question the article addressed and by research approach. This categorization is summarized in Table 2. First, we categorized the articles according to whether they addressed one or more of the five questions guiding this research. In Table 2, these are labeled as: what is HR Analytics, how does it work, why does it work, what are the outcomes of HR Analytics, and what are moderating factors that affect these outcomes.

In evaluating our third question, **why does HR Analytics work**, we created 4 categories of theoretical perspectives that explain key cause and effect relationships from the major social science disciplines that underlie management science: (1) Strategic management, (2) Macro-organizational behavior, (3) Micro organizational behavior, and (4) Other. Within strategic management, we included theoretical frameworks that explained key cause and effect relationships such as the Five Forces Perspective of Competitive Advantage (Porter, 1996), the Resource-based View (Barney, 1991) and Strategic HRM (Becker & Gerhart, 1996; Becker, Ulrich, & Huselid, 2001; Boudreau & Ramstad, 2005; Delery & Shaw, 2001; Huselid, 1995; Jiang, Lepak, Hu, & Baer, 2012; Kaufman & Miller, 2010; Lepak & Shaw, 2008; Ulrich, 2005). Within the macro organizational behavior, we include the following theoretical frameworks: Diffusion of Innovation (Rogers 2003), Institutional theory/isomorphism (DiMaggio & Powell, 1983), Management theory of Fashions and Fads (Abrahamson, 1991, 2009), Technological Determinism and Socio-materiality (Leonardi & Barley, 2008; Marler & Fisher, 2013; Orlikowsk & Scott, 2008). Within micro organizational behavior, we include the following theoretical frameworks: Technology acceptance models (Marler & Dulebohn, 2005; Marler, Fisher, & Ke, 2009; Venkatesh, Morris, Davis, & Davis, 2003) and the Theory of Reasoned Action or Planned Behavior (Ajzen, 1991; Ajzen & Fishbein, 1977). Within the 'Other' category, we included theories from other disciplinary domains such as capital budgeting theory and return on investment/cost of capital theories from finance.

Categorization by methodological approach

Empirical approach

For research to effectively inform evidence-based management, we must be confident in the conclusions drawn from the study. There are four types of relationships between key constructs that research must address in order to meet satisfactory empirical standards. **These four relationships are typically referred to as conclusion validity, internal validity, construct validity, and external validity.** Conclusion validity establishes whether there is a relationship between two constructs. Internal validity establishes whether this relationship is causal and if so the direction of causality. Construct validity investigates whether measurement

Table 2. Categorization of Peer-reviewed Journal Publications.

Study Authors	What is HR Analytics?	How does it work?	Why does it work? Theoretical logic and frameworks	What are the outcomes?	What are moderators to outcomes?	Level of Analysis	Empirical or Not	Research Method
Lawler et al. (2004) <i>Academics</i>	Process using statistical techniques linking HR practices to organizational performance	Logic, Analytics, Measures and Process (LAMP Model)	Strategic HRM based on Resource-based view perspective	Efficiency measures are widespread; only 34% of survey companies have HR measures assessing impact		Company	Empirical	Descriptive Statistics of Survey of 37 Fortune 500 companies
Harris et al. (2011) <i>Consultants</i>	6 types of analytical processes for analyzing HR data	Various analytical techniques	Premise is strategic HRM; HRA predicts improved individual and organizational performance	Effectiveness and Impact	HR professionals' analytical capability	Company	Non-quantitative Empirical	Illustrative Case Studies
Bassi (2011) <i>Consultant</i>	An evidence-based approach for making better decision on the people side of business and consists of an array of tools and technologies, ranging from simple reporting of HR metrics all the way up to predictive modeling					Involves individuals, groups and company levels	Non-empirical	
Mondare et al. (2011) <i>Consultants</i>	Demonstrates the direct impact of people data on important business outcomes	6-step process beginning with identifying key business outcomes, collecting data, and structural equation modeling	None discussed-HR Scorecard implied	General Reference to Business Impact	Need statistical capabilities	Individuals and groups within a company	Non-quantitative Empirical	Illustrative company case study
Coco et al. (2011) <i>Consultant and Business Professional</i>	Using a value linkage decision model that identifies causal linkages between people measures and key business metrics		None discussed-HR Scorecard implied	General Reference to Business Impact	Management buy-in	Individuals and groups within a company	Non-quantitative Empirical	Illustrative case study of Lowe's introduction of HR Analytics

Levenson (2011) <i>Academic and Consultant</i>	AMO Strategic HRM model; Contingency theory of Organizational design; Competitive labor markets	Strategic HRM based on Resource-based View perspective	General Reference to Business Impact	HR professionals' analytical skills; TMT political support	Individual, group within a company	Non-quantitative Empirical	Illustrative case studies and descriptive statistics of Fortune 500 Company survey
DiBernardino (2011) <i>Consultant</i>	Using 3 new Human Capital Metrics that link measures of human capital costs to financial measures to calculate HR ROI		General Reference to Business Impact		Company	Non-quantitative Empirical	Illustrative case study
Aral et al. (2012) <i>Academics</i>	A way to measure and monitor individual performance	Combining incentive pay practices with HR Analytics with HCM software	Agency theory	16.5% higher sales	Use of incentive pay and HCM software; industry – more applicable to manufacturing	Company	Empirical
Giuffrida (2014) <i>Consultant</i>	HR teams can build ideal hiring profiles and predict hiring quality		Efficiency and Effectiveness	Executive buy-in; necessary resources	Company	Non-empirical	Conducted fixed and random effect regression analyses on 5-year (1995–2006) panel data of 189 firms
Falletta (2014) <i>Academic and Consultant</i>	Defines HR Analytics in terms of 18 HR practices and surveys companies to see which are used. Employee surveys clearly predominant. Next talent profiling and HR metrics		15% companies with HR Analytics play central role in HR strategy;; 75% have a group or employee dedicated to HR Analytics; primarily firms conduct employee surveys		Company	Empirical	Reports third-party descriptive survey results
							Descriptive results of Survey of Fortune 1000 companies; 220 respondents

(continued)

**Table 2.** (Continued).

Study Authors	What is HR Analytics?	How does it work?	Why does it work? Theoretical logic and frameworks	What are the outcomes?	What are moderators to outcomes?	Level of Analysis	Empirical or Not	Research Method
Douthitt and Mondore (2014) <i>Consultants</i>		Multi-step method described—see Mondare et al. (2011)	HR Scorecard by Becker et al. (2001)		Unintegrated data from Legacy HCM systems	Individuals and groups within company	Non-quantitative Empirical	Illustrative case study of unnamed retail company
Rasmussen and Ulrich (2015) <i>Academic and Business Professional</i>	HR Analytics is a fad	Multi-step process beginning with business problem-follow LAMP Model	Strategic HRM and psychological theory of cognitive dissonance	No outcome predicted except that HRA will not be a part of the HRM function in organizations	HR professionals lack analytical mindset; existing beliefs and cognitive dissonance	Individuals and groups within company	Non-quantitative Empirical	Illustrative case studies from Maersk Drilling
Pape (2016) <i>Academic</i>	Decisions based on analyses of relevant HR data	HRA depends on collecting key data necessary to conduct a particular analyses	Operational research methods	Most cost effective data elements to collect and store in a HCM software to support HRA; Efficiency and Effectiveness		HR processes; Individuals and companies	Empirical	Operational research methods
Angrave et al. (2016) <i>Academic & Business Professionals</i>		Multi-step process beginning with business problem-follow LAMP Model; Why it does not work	Resource-based View and Institutional isomorphism theories	HRIS delivers only efficiency metrics; Suppliers of HR Analytics do not deliver business impact; Low HR Analytics adoption rate; Risk HR Analytics coopted by Finance	Lack of skills in HRM function		Non-empirical	Based on interview with HR professionals and literature reviews

of the key constructs is sufficient to adequately assess the relationship. Finally external validity establishes how generalizable the relationship is and whether there are contextual contingencies that might affect the observed relationship.

We evaluated the empirical approach used to provide evidence concerning identified relationships within the specified level of analysis. We first classified each article based on whether it was empirical or non-empirical. Empirical studies involved reporting the results of a scientifically designed validity study that carefully measures and tests relationships derived from theory or to inductively derive relationships based on observed qualitative data. The former type of research represents empirical research based on a positivism epistemology and the latter fits more into relativism (Rousseau et al., 2008).

We also identified research that was not empirical in that its content was largely conceptual or prescriptive. In to this category, we also included articles including brief case-studies used for illustrative and prescriptive purposes rather than for inductively deriving possible relationships between constructs or based on well accepted scientific qualitative research protocols.

Levels of analysis

We chose to identify the levels of analysis addressed in the research because HR Analytics is a process that can be used on individual and group level data. Level of analysis is also important to report to insure that the underlying theoretical framework is consistent with the level of analysis used to conduct the research. The level of analysis used in any study should be clearly linked to the theoretical foundation. We therefore categorized the research reported in the article based on whether individual, group or company level was being evaluated or analyzed. In this categorization, we found the majority of the articles focused at the company level of analysis. Where studies focused on the individual level of analysis, this also involved nested data in which individuals were nested in groups such as departments, divisions or business units and these were nested in a company. Only one study involved quantitative analyses, and in this case, the handling of multi-level nested data was correctly addressed.

Results

We summarize the coding of our sample of articles on Table 2. A clear pattern is discernable. The current body of knowledge concerning HR Analytics addresses questions concerning how HR Analytics works, 12 of the 14 articles addressed this question in some fashion. Consistent with being at an early stage of innovation adoption in which rational competitive forces is a focus, over 40% of the articles assumed a strategic management theoretical framework. Also consistent with assuming a strategic theoretical lens, the majority, 9 of the 14 articles focused on the company level of analysis. Another notable result of this summary is the predominance of non-quantitative empirical evidence. As Table 2 shows, the vast

majority of management articles are non-quantitative empirical case studies. Of the 14 published peer-review articles, 10 do not involve testing of theoretically derived hypotheses. Instead, most of the published research provides short illustrative case studies. These are not, however, case studies that are designed following an underlying qualitative empirical protocol with rich descriptive qualitative data, but instead are short illustrative case studies. We classified these as non-quantitative empirical studies.

Our results suggest there is still much room for academic researchers to add to the HR Analytics literature and conversation. In the following discussion we address the 5 questions that guided our evidence-based research and identify areas where additional research is needed to augment the current body of knowledge about HR Analytics.

What is HR Analytics?

Human Resource Analytics (HRA) is a relatively new term; first appearing in the HR published literature in 2003–2004 according to our research of major databases. In an article titled ‘HR Metrics and Analytics: Use and Impact’ appearing in *Human Resource Planning*, published by the Human Resource Planning Society, Lawler, Levenson and Boudreau (2004) distinguish ‘HR Analytics’ as separate from ‘HR metrics’. **HR metrics are measures of key HRM outcomes, classified as efficiency, effectiveness or impact.** In contrast, Lawler et al. (2004) state **HR Analytics are not measures but rather represent statistical techniques and experimental approaches that can be used to show the impact of HR activities.** Despite this distinction between HR metrics and HR Analytics, there still is definitional ambiguity in the literature.

Of the 8 definitions briefly summarized in Table 2, five of them characterize HR Analytics, more generally, as either an analysis process or decision-making process. Two of the descriptions are more specific in that they list specific components of HR Analytics, either specific analyses (Harris, Craig, and Light 2011) or specific practices (Falletta, 2014).

Bassi (2011) argues that HR Analytics can be considered both as ‘systematically reporting on an array of *HR metrics*’ or more sophisticated solutions, based on ‘predictive models’ and ‘what-if scenarios’. In addition, Bassi’s definition includes the notion of taking an ‘evidence-based approach’ to making decisions on the ‘people side of the business’. She concludes HR Analytics ‘is an evidence-based approach for making better decisions on the people side of the business; it consists of an array of tools and technologies, ranging from simple reporting of HR metrics all the way up to predictive modeling. (Bassi, 2011, p. 16)’. Finally, focusing on the link with strategic HRM, Mondare, Douthitt, and Carson (2011) define HR Analytics as demonstrating the direct impact of people on important business outcomes.

Adding controversy, Rasmussen and Ulrich (2015), and also to some extent Angrave et al. (2016), suggest HR Analytics is a fad. Fads are ‘largely insignificant, non-rational swings that come and go with little or no lasting impact on the language of management techniques or organizations themselves’ (Abrahamson & Eisenman, 2008). They arise from a chance conjunction of forces that trigger diffusion largely based on bandwagon effects and eventually disappear when the inflated expectations for the innovation are not realized (Abrahamson, 1991; Abrahamson & Eisenman, 2008).

These definitions and labels have several things in common. First, HR Analytics is not HR Metrics. It involves more sophisticated analysis of HR-related data. Second, HR Analytics does not focus exclusively on HR functional data, and involves integrating data from different internal functions and data external to the firm. Third, HR Analytics involves using information technology to collect, manipulate, and report data. Fourth, HR Analytics is about supporting people-related decisions. Finally, HR Analytics is about linking HR decisions to business outcomes and organizational performance. This fifth component of the definition of HR Analytics captures the most compelling aspect of this construct and links it to the strategic HRM literature. HR Analytics appears to offer more than HR Metrics through its potential to connect HR processes and decisions with organizational performance, which is an avenue to elevating HRM to having a more strategic role and joining other business functions at the strategy table.

Bringing all these various definitions together, we define HR Analytics as:

A HR practice enabled by information technology that uses descriptive, visual, and statistical analyses of data related to HR processes, human capital, organizational performance, and external economic benchmarks to establish business impact and enable data-driven decision-making.

Our discussion characterizes HR Analytics as a HRM innovation. Rogers’ (2003) Diffusion of Innovation Theory (DOI) defines an innovation as an ‘inter-related bundle of new ideas’ that diffuses across social groups in a predictable and consistent way. An innovation can be new to an individual or to a larger group. Kossek (1987) defined an HRM innovation in terms of whether an HRM program, policy or practice is *perceived as new* and whether it is designed to influence employee attitudes and behavior. HR Analytics when first introduced to an organization will be perceived by those who use it as new whether or not the adopting organization is an early adopter or the last to adopt this HRM practice. *The second requirement for an HR innovation is that it is designed to influence employee attitudes and behaviors. HR Analytics is a HRM practice that is designed to provide managers with information that connects HRM processes to employee attitudes and behaviors and ultimately to organizational outcomes.*

It is too early to assess whether HR Analytics is long-lived innovation that eventually diffuses across companies to become an institutionalized HRM practice

or a short-lived fad. The answer may be illuminated by answering the remaining questions posed below.

How does HR Analytics work?

Many of the articles, 6 out of 14, prescribe some version of the LAMP model, first introduced in the book *Beyond HR: The New Science of Human Capital* (Boudreau & Ramstad, 2007). The letters in LAMP stand for logic, analytics, measures, and processes, which Boudreau and Ramstad (2007) argue are the four critical components of a measurement system necessary both to uncover evidence-based relationships and also to motivate enhanced decisions based on those analyses. They also suggest that these four elements may be key to understanding the cause-effect relationship between HRM processes and strategic HRM and business outcomes. In addition to the LAMP model, the multi-step processes described in several of the articles also appear to operationalize aspects of the HR Scorecard, another model linking HRM processes and people to business outcomes, which is detailed in *The HR Scorecard: Linking People, Strategy and Performance* (Becker et al., 2001). Indeed, Lawler and Boudreau (2015) report that among HR leaders the 'HR scorecard' was among the more frequent analytics elements listed as existing now, while others were planned for the future.

There would appear to be great potential to invoke theories of innovation, social influence and cognition to help guide and explain the cause-effect relationships between HR Analytics antecedents, outcomes and moderators. Industrial psychology has some history addressing this question with regard to the adoption of 'utility analysis' in the 1970s and 1980s (Cascio & Boudreau, 2010). Boudreau (2012) has also suggested that decisions of leaders outside the HR discipline may be influenced by considering their dominant 'mental models', and by 'retooling' HR analysis and reporting using analogies to frameworks from other management disciplines such as operations, finance and marketing (Boudreau, 2010; Rousseau & Boudreau, 2011).

Why does HR Analytics work?

Very few of the articles we reviewed referred to an explicit theoretical framework. This is not unexpected; given the majority of the articles were primarily non-quantitative empirical research. Consistent with the strategic HR theoretical framework underlying the LAMP model and the HR Scorecard, we coded 4 articles (Coco, Jamison, & Black, 2011; Douthitt & Mondore, 2014; Mondare et al., 2011; Rasmussen & Ulrich, 2015) as having implied theoretical frameworks derived from strategic management theories and in particular, the Resource-Based View, which focuses on developing internal value producing and unique capabilities and resources. The implication of this theoretical perspective is that

HR Analytics is associated with or can cause better performance and competitive advantage when it is unique and value producing.

Interestingly, the one study that empirically tested specific hypotheses (Aral, Brynjolfsson, & Wu, 2012), adopts agency theory as the primary theoretical lens. Aral and colleagues argue that companies which use a combination of pay for performance compensation, Human Capital Management (HCM) software, and HR Analytics are more productive because this combination allows managers to both align incentives and monitor employee behavior. Using a panel sample of 189 firm-level data collected over 5 years from 1995 to 2006, they show that firms with this combination of capabilities and resources were significantly more productive. Particularly distinctive about this study, the authors exploited the longitudinal nature of their data to establish a cause and effect relationship such that having all three factors produced subsequent higher firm-level productivity. Moreover, they also found that HR Analytics alone did not enhance productivity. Only in combination with HCM software or in combination with HCM software and pay for performance does HR Analytics predict productivity. Although Aral et al. (2012) use agency theory as their explanatory framework, their results are also consistent with strategic HRM Ability Motivation and Opportunity theory (Delery & Shaw, 2001; Jiang et al., 2012). Companies that hire individuals that have ability, and provide motivation and opportunity to perform their jobs well, will perform better than their rivals who do not have this combination. Their results might also be interpreted as consistent with the LAMP model, in that it was a combination of “analytics” with a “process” (pay for performance) and “measures” (from HCM software) that seemed to produce the greatest effect.

What are the outcomes of HR Analytics?

As noted above, the one study of our 14-article sample that empirically tested hypotheses provided strong evidence for a cause-effect relationship between HR Analytics and financial performance (Aral et al., 2012). However, Harris, et al. (2011) also note that efficiency outcomes (e.g. cost savings on HR processes) are *unlikely* to result in business impact because administrative costs typically only represent 3% of a company’s selling, general and administrative expenses, so no amount of savings wrung from reducing HR administrative expenses is likely to have any impact on business performance.

Providing triangulated evidence for a relationship between business impact and use of HR Analytics established empirically by Aral et al. (2012), 6 non-empirical articles provide illustrative case studies which the authors argue document a positive relationship. For example, Coco et al. (2011) provide a detailed case study of how the home improvement retail chain, Lowes, used HR Analytics to establish a link between HR processes, employee engagement, and store performance. Through use of HR Analytics, Lowes was able to establish that highly engaged employees lead to 4% higher average customer ticket sales per store. Harris et al.

(2011) provide high-level case study examples to illustrate the 6 analytical tools they argue comprise HR Analytics and link these to business impact. For example, they describe how Google uses HR Analytics to predict employee performance using their applicant database. Sysco uses HR Analytics to establish causal links between work climate surveys, delivery driver employee satisfaction, customer loyalty and higher revenue.

Finally, a couple of studies document the low level of HR Analytics diffusion across companies, which is surprising given the early, albeit sparse, evidence supporting a causal link between HR Analytics and business outcomes. Falleta (2014) conducted a survey to determine use of HR Analytics across Fortune 1000 firms. With a sample of 220 firms, Falleta (2014) reported that only 15% of respondents claimed HR Analytics played a central role in determining or implementing HR strategy. Furthermore, HR Analytics primarily consisted only of analyzing employee survey data. Lawler et al. (2004) and Lawler and Boudreau (2015) report the results of a survey of over 100 Fortune 500 companies suggesting less than a third of these companies have HR Analytics that measures the relationship between HRM processes and people and business impact. This ratio is low particularly considering that the survey shows that over 70% use HR metrics to establish how efficient their HR processes are.

Clearly there appears to be a disconnection between persuasive evidence of positive business impact and decisions to adopt and implement effective HR Analytics. Results addressing our next question may suggest possible explanations.

What moderating factors affect HR Analytics outcomes?

As documented in Table 2, a review of the literature on HR Analytics suggests 3 important requirements, or moderators, of HR Analytics success. These are having HR professional analytical skills (Angrave et al., 2016; Bassi, 2011; Giuffrida, 2014; Levenson, 2011; Mondare et al., 2011; Rasmussen & Ulrich, 2015), gaining managerial buy-in (Coco et al., 2011; Giuffrida, 2014; Levenson, 2011; Rasmussen & Ulrich, 2015), and having HR information technology (Angrave et al., 2016; Aral et al., 2012; Douthitt & Mondore, 2014).

The most frequently cited reason that HR Analytics is not more widely adopted is the shortage of analytically skilled HR professionals. Bassi (2011) predicts that in the absence of necessary IT acumen (how to use analytic software tools) and financial skills (how to access and use measures of business results), HR functions will inevitably cede responsibility for analytics to both the IT and finance functions. Angrave et al. (2016) echo this concern and raise another problem,

‘If HR is not fully involved in the modelling process, there is significantly greater scope for models to be constructed in a way which fundamentally misunderstands the nature of human capital inputs into the processes of production and service deliver. Instead of recognizing the flexibility of labour; that productivity and performance change with skills, motivation and design of people-processes interactions, labour is modelled as

a fixed cost that needs to be controlled. Unless analytics is embedded in a full and comprehensive analytical model, the more limited information available in dashboard formats may be misinterpreted by operational and financial managers with limited patience for or understanding of HR. (p. 7)

Thus, not only does the lack of analytical skill appear to be impeding the uptake of HR Analytics within companies, there is a concern that should HR Analytics be adopted it will not be controlled by HR professionals but by others who may misinterpret or misspecify the analyses. The implication is that not only will HR professionals miss an opportunity to develop a competency that improves their strategic decision-making and impact on organizational performance but also it may be problematic for society in that employees and employment opportunities may be negatively impacted (Angrave, et al., 2016). In contrast, Boudreau (2010, 2012) and colleagues (Cascio & Boudreau, 2011; Rousseau & Boudreau, 2011) have argued that an appropriate collaboration between HR leaders and functional experts in disciplines such as finance, operations, marketing, and engineering may be key to developing the logical frameworks for HR Analytics that can engage key decision-makers and connect more clearly to organizational outcomes.

Levenson (2011) identifies the specific analytical competencies needed for HR professionals to perform HRA effectively. These are basic data analyses, intermediate data analyses, basic multivariate models, advanced multivariate models, data preparation, root cause analysis, research design, survey design, and quantitative data collection and analysis. According to the survey of HR Analytics professionals he and his colleagues collected (Levenson, Lawler, & Boudreau, 2005), however, the higher level statistical skills needed to establish business impact are not in high demand. The bad news is that even at this low level of demand there is an inadequate supply. Less than one third of HR Analytics professionals reported having competency in advanced multivariate statistics and that proportion drops to only 3% when only considering HR professionals not specifically hired for HR Analytics. Finally, Rasmussen and Ulrich (2015) argue that in addition to a shortage of technical skills, recent evidence suggests that chief human resource officers with a clear business focus are also in short supply.

The second requirement for HR Analytics to be successful is politically based. In order for HR professionals to gain access to the cross functional data needed to perform their analyses, managers from other functions must be willing to provide access and also to be involved in the process. In addition HR professionals must build credibility among senior managers who may not believe data-driven results. Rasmussen and Ulrich (2015) observe that there is a tendency to reject data that threatens existing beliefs. When new data suggests personal beliefs are misguided, people choose their belief system and reject the data. In order to overcome such resistance, those involved in HR Analytics must involve key stakeholders in the process ahead of conducting the analyses. Coco et al. (2011) describe how the

HR team at Lowes, a home improvement retailer, went to great lengths in order to build trust and buy-in for their HR Analytics project from senior managers and those outside the HR function. Thus, introducing an innovation such as HR Analytics into an organization involves acknowledging the role of resistance to change and resistance to abandoning the predominant role of intuition in managerial decision-making (Falletta, 2014).

Finally, several articles noted the importance of HRM information technology such as HCM software. Indeed, Aral et al. (2012) demonstrated empirically that companies with HR Analytics but without HCM software showed no performance effects. The other studies indicate, however, that information technology (IT) can be both an enormous enabler and a significant impediment to HR Analytics. As an enabler, conceptually HRM IT/e-HRM should capture, store and make accessible data from across company functions and produce reports, dashboard, and scorecards. The reality of current HRM IT capabilities, however, does not match the promise. Several articles noted significant impediments. For example, data are not collected or inaccurate (Angrave et al., 2016; Bassi, 2011; DiBemardino, 2011; Pape, 2016). Data are not accessible or integrated across functions, geographies or divisions (Douthitt & Mondore, 2014). Finally, analyses and resulting reports are basic and reflect outdated descriptive efficiency-based metrics (Angrave et al., 2016; Falletta, 2014). Those companies performing HR Analytics appear to be conducting these analyses despite HRM IT rather than because of it. This situation is likely to change as technology vendors see HR Analytics as a way to sell more products and invest in improved functionality and ability to integrate disparate data. But for now, it appears that promises of 'push button' intuitive HR Analytics via e-HRM technology such as HCM software or integrated Talent Management Cloud-based solutions should be examined very carefully and critically (Angrave et al., 2016).

Discussion and future research

In conducting our review of the literature on HR Analytics and despite evidence of a growing interest in this innovation, we found very little and limited scientific evidence to aid decision-making concerning whether to adopt HR Analytics. Of the 14 articles selected based on meeting scientific quality criteria from an initial population of 60 articles, ultimately only 4 involved empirical analyses of HR Analytics. Of these 4, only one addressed empirically evidence linking HR Analytics to company performance. The remaining 10 studies individually provided little to no evidence supporting internal validity, conclusion validity, and generalizability. There were no theory-based predictions of relationships and no data collected to evaluate theoretical predictions. Consequently, the sample articles provided very limited scientific evidence. On the other hand, they did provide some information concerning important contextual moderators and a basis for some triangulation with the few empirical studies to get some degree

of generalizability. Clearly, however, a major conclusion that emerges from this literature review is the need for more scientific research.

A striking finding was the paucity of scholarly articles focusing primarily on HR Analytics or the similar search terms that we used, and the even smaller number of empirical studies among that group. Evidence about HR Analytics is definitely in its infancy. As Figure 1 shows, there have been some notable events (Google's publicizing Project Oxygen in 2011, the *Harvard Business Review* describing best-practice case studies in 2010), that seem to have spawned special journal issues on HR Analytics (Bryant, 2011; Davenport et al., 2010; Garvin, 2013). We focused our search on peer-reviewed articles appearing in respected scholarly management research journals, and found that of the 60 management journal articles, only 32 of them were in peer-reviewed journals, and of those 32 article, only 16 appeared in the Journal Quality List often relied upon by universities to evaluate publications for tenure. Our aim with this focus was to isolate the sort of evidence often emphasized by evidence-based management advocates. Undoubtedly, there are many more blogs, white papers, consulting reports and testimonials available to decision-makers, but it appears fair to say that a decision-maker hoping to draw upon high-quality peer-reviewed scholarly work will find very few studies available. It is also notable that the vast majority of articles of the JQL-listed journal articles (9 of 14) appeared in only one journal, 'People and Strategy', a journal aimed at the intersection of the interests of practitioners, consultants, and academics. It appears that the topic of 'HR Analytics' has not caught the interest of the majority of the management scholarly community, unlike other HR issues such as selection validation, employee turnover, goal setting, and performance-based rewards. The small number of articles suggests that we are still at a very early stage of attention from the management professional community. The even smaller number of articles appearing in scholarly publications suggests that management scholars have shown even less interest in examining the antecedents and consequences of HR Analytics. This is unfortunate, in view of the significant strategic implications HR Analytics has for the role HRM plays in organizations and for the HR profession, in light of some evidence of a positive correlation with HR Analytics and organization effectiveness and impact as detailed in this integrative review.

Future research might draw upon and expand the study of Aral et al. (2012). This study is laudable, but it is also notable for its rarity. It provides an interesting model for future research, in that it approaches a well-accepted issue in the HR field – the role of performance and pay in motivating performance – and examines the additional effects of HRM information technology and HR Analytics. One can imagine other issues such as applicant job choice, selection system validity, training effectiveness, employee development, and performance evaluations, etc. that are also the subject of decades of research, and that might serve as platforms for examining the additional effects of HR Analytics.

The social phenomenon of HR Analytics adoption and use is also amenable to the same sort of research attention that has been paid to the emergence of other innovations such as the adoption of 'utility analysis' in the 1970s and 1980s (Cascio & Boudreau, 2011), and other disciplines such as sociology, economics, and psychology. Still, even with this history, we know precious little about the factors that lead HR and other leaders to attend to HR innovations and measurement generally, and to HR Analytics in particular. The findings from past empirical and theoretical studies of innovation adoption would provide fertile ground for constructing hypotheses regarding the expected patterns of adoption regarding HR Analytics and other current HR innovations.

Our review of the literature underscores the presence of three significant moderators that appear to impact the relationship between adoption of HR Analytics and organizational impact. First, in order to implement HR Analytics effectively, companies need employees with the right knowledge and skills to collect the correct data, perform the right statistical analyses and then to communicate the results in a meaningful and accessible way. Second, those working on HR Analytics projects need to build a network of supportive stakeholders across and up the company hierarchy. Third, although IT should be an enabler of HR Analytics, this result depends on the quality and accessibility of the data and capabilities of e-HRM software system. Future research is needed to better document the influence of these contextual factors. Indeed, these three moderators may be also better studied focusing on specific HR processes, such as staffing, performance management, training and talent development rather than attempting to study adoption and impact across the gamut of HRM practices.

Broadly, there are two notable paradoxes. First is that despite the popularity of HR Analytics there is very limited high-quality scientific evidence-based research on this topic. The second paradox, perhaps related to the first paradox, is the apparently limited adoption of HR Analytics when the available research seems frequently to suggest that it is associated with positive organizational outcomes. Research might address both these paradoxes by systematically proposing theory-driven hypotheses. For example, the theory of new institutionalism noted earlier might suggest that this is not a symptom of a lack of belief that HR Analytics can work, but rather the natural progression of innovation adoption in which only a small proportion of organizations attend to such evidence, because they are the only ones willing to take the risk of early adoption. Thus, no matter how compelling the initial evidence, later adoption will be driven more by institutional factors such as regulatory requirements and mimicking leaders, than by evidence of rational economic returns. On the other hand, theories of strategic decision-making might suggest that if rational decision-makers believed the existing evidence, adoption would be much more widespread, and so the explanation may be that something about the existing evidence is either not credible, or that there is a belief that the effects will not be replicated.

If decision-makers are to have evidence-based information to guide the adoption of HR Analytics adoption and to understand its effectiveness, clearly a more focused and systematic research approach must evolve. It is not that existing research offers no information, but the paucity of empirical studies and the diverse and very high-level nature of the questions and findings suggest that greater precision and more unifying nomological frameworks are needed. What frameworks might serve this purpose? As we have illustrated here, frameworks describing innovation adoption might serve as the basis to understand the current and likely future of HR Analytics adoption and diffusion. Macro-organizational theoretical frameworks can address how an HR Analytical bandwagon may develop or how academic research is implicated in HR Analytical adoption (or not). Frameworks such as LAMP (Boudreau & Ramstad, 2007), may offer the basis for understanding how elements of HR Analytics relate to changes in decisions. Finally, frameworks such as the resource-based view, the HR Scorecard (Becker et al., 2001) and Ability, Motivation and Opportunity strategic HRM theory (Delery & Shaw, 2001; Jiang et al., 2012) that connect data, decisions, human capital changes, and strategic outcomes may also offer enticing frameworks for testable hypotheses and rigorously-constructed research questions. These all can serve as fertile avenues for future research contributions.

Our observations above might apply as well to other HR innovations such as talent management and performance management. Regarding talent management, the definition and underlying theoretical frameworks are evolving to reflect a more global, boundaryless and non-standard work ecosystem and more uncertain economic and strategic context, and that at present even the definition of the term 'talent management' may be in flux (Cascio & Boudreau, 2016; Collings & Mellahi, 2009). Thus, the emerging elements of talent management, including incorporating non-standard work arrangements and risk-optimizing tools such as real options theory may present similar questions and patterns to those that we have described here about adoption patterns and effectiveness. Regarding performance management, there is an upwelling of experiments with approaches that remove ratings, incorporate social networks enabled by information technology into feedback, and emphasize conversations between managers and employees. As with HR Analytics, there is an abundance of case studies and testimonials regarding these new approaches, with an arguable need for unifying research frameworks and programmatic scholarly research into both their effectiveness and their adoption patterns (Ledford, Benson, & Lawler, 2016).

In conclusion, our review suggests that despite being a very 'hot topic' among HR professionals, a search for peer-reviewed research in listed scholarly journals reveals a strikingly small amount of scholarly scientific research. That research is dominated by qualitative case studies, which draw upon well-accepted management frameworks, but typically at a very broad general level. Using Rogers' innovation adoption framework, we found that the research can indeed be used to inform adoption questions, but decision-makers hoping to find a sufficient

body of evidence to guide them will be disappointed. This may be a symptom of typical innovation adoption patterns, where both adoption activity and evidence are sparse, and early adopters must be risk-takers in the face of uncertainty. Or, it may be a symptom of a pattern in which high-quality evidence about emerging HR practices is generally sparse and not grounded in unifying frameworks. Finally, it is interesting that the available evidence suggests that HR Analytics has positive effects, yet adoption appears very slow. Again, it is unclear whether this is because all innovations must rely on a small set of early adopters, or if it suggests that decision-makers do not believe or are not aware of the existing evidence. We conclude that these questions are fascinating and worthy of high-quality research, and hope our review will contribute to the emergence of such research.

Disclosure statement

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