BIG DATA AND HR ANALYTICS IN THE DIGITAL ERA

Abstract

Purpose
This study focuses on how the HR function takes advantage of Human Resource Analytics (HRA), including big data, and discusses factors hindering HRA and data utilization. Moreover, we discuss the implications of the HRA-induced role transformation of the HR function.

Methodology
This is an explorative case study based on qualitative interviews in nine leading Finnish companies.

Findings
Results indicate that both technical and human obstacles, operating with very basic HR processes and traditional information systems, and poor data quality, hinder adoption of advanced HRA. This, combined with lacking skills in analytics and business understanding, inability to go beyond reporting, misconceptions related to big data, and traditional compliance-oriented HR culture pose further challenges for the data analytics capacity and business partner role of the HR function. Senior executives expect no significant advancements of HRA, while HR professionals saw potential value in big data, although skepticism was not uncommon. The results point toward a need for increased co-operation with data analysts and HR professionals in provision and understanding the HR-related data for business-related decision-making. Furthermore, cultural change and organizational redesign may be called for, in addition to overcoming technological obstacles related to big data, for it to have an impact on HR practices. HRA utilization and role transition of the HR function seem closely related and this transformation can be mutually reinforcing.

Originality
This study provides and theorizes explorative data on HR Analytics within a group of some of the largest Finnish companies, pointing towards an immature state of the art in BD and HRA utilization, and there being a relationship between HRA and the role transition of the HR function in organizations.

Keywords
Human resource management, data analytics, HR analytics, big data, performance measurement

INTRODUCTION

With advancing digitalization, new sources of structured and unstructured data (e.g. Beath *et al.,* 2012) are becoming more accessible to HR professionals, enabling them to better analyze the complexity in workforce-related decision-making. The proliferation of digital communication data and sensor technologies, for instance, enable new ways of measuring and understanding employee behaviors with unprecedented accuracy (see e.g. McAfee and Brynjolfsson, 2012; Davenport, 2014). The opportunities of digital technologies to provide data of various kinds in large magnitudes appear almost unlimited. This is also related to the workforce of organizations.

While the interest in the new analytic opportunities, including big data (BD) and artificial intelligence (AI), allowed by digitalization has risen in recent years (Davenport, Barth and Bean, 2012; Brynjolfsson, Hill and Kim, 2011; Davenport, 2014; Tambe, Cappelli & Yakubovich, 2018), and there have been numerous blog posts, white papers, consulting and press reports on HR analytics (HRA), it appears that management researchers have so far given limited attention to it (Marler and Boudreau, 2017). While HR metrics and different levels of analytics in human resource management (HRM) have been around for years (see e.g. Boselie, 2014), traditionally, however, the HR professionals have been unused to working in a data-driven fashion.

Furthermore, riddled by the difficulty of accessing relevant HR data that would allow deeper analysis, many significant decisions have traditionally been made based on past experiences and intuition (Boudreau and Ramstad, 2002, 4). With the challenges of providing even the basic operational reporting on organizations' workforce due to disparate HR information systems, the HR function struggles to advance towards quantifying and analyzing the more complex aspects of their workforce, such as more reliably assessing individual and/or team performance, which would be in high demand (Scullen, Mount and Goff 2000).

There exists some controversy over the whole topic of HR analytics, with some suggesting it is merely a management fad (Rasmussen and Ulrich, 2015), while others point out that HR does not actually have big data at their disposal, and therefore HR has no reason to look for special software or expertise associated with analysis of BD (Cappelli, 2017). Therefore, to advance our understanding of the ways in which data and analytics, including BD, are utilized in HR practices at present, and to chart some challenges faced in the use of HRA, we undertook this explorative field study to find answers to the following research questions:

1. How do the HR functions of our case companies utilize HR data, including BD, for HRA currently?

2. Which are the delimiting factors of HRA utilization, and how could these challenges be overcome?
3. How do HRA and role transition of the HR function interrelate?

Our data is based on the experiences of not only HR professionals, but also systems and analysis professionals among a group of some of the largest business organizations in Finland. Therefore, our study contributes to HRA discussions by shedding light on the current use, prospects and challenges of utilizing HR data, including new promises laid on BD for analytic purposes and more informed business decision-making by considering the full potential of human resources for allowing better performance.

THEORETICAL FRAMEWORK – THE PROMISE

HR Analytics

Human Resource Analytics (HRA) is a relatively new concept (Marler and Boudreau, 2017). In their contribution to HRA literature, Lawler, Levenson and Boudreau (2004) distinguished 'HR Analytics' as separate from 'HR metrics', which are measures of key HRM outcomes, classified as efficiency, effectiveness or impact (Boselie, 2014). HR Analytics, however, are not measures, but rather represent statistical techniques and experimental approaches that can be used to gauge the impact of HR activities (Lawler et al., 2004). Despite this distinction between HR metrics and HRA, there is still ambiguity around the definition of HRA in the literature (Marler and Boudreau, 2017), with some commentators referring to it as merely a "fad" (Rasmussen and Ulrich, 2015; Angrave, Charlwood, Kirkpatrick, Lawrence and Stuart, 2016; Marler and Boudreau, 2017).

However, Marler and Boudreau (2017) found several things in common in the different HRA definitions: HRA is not the same as HR metrics, but instead, it involves more sophisticated analysis of HR data. In addition to HR functional data, it involves integrating data from different internal and external sources. Furthermore, HRA involves sophisticated use of information technology to collect, manipulate, and report data, and it is about supporting decisions related to people. Finally, and most importantly, HRA is about linking HR decisions to business and performance, which connects HRA also with strategic HRM literature and promotes HRM to have a more strategic role in organizations. We follow Marler and Boudreau's (2017, p. 15) definition of HRA in this study, and consider it 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.

Evolution of Strategic HRM

HR functions are said to often collect data on their internal efficiency, not on the business impact of their services and practices, which would be called for to participate in strategy-related decision-making (Lawler et. al., 2004). Boudreau and Ramstad (2007, p. 21), for instance, argue that in order to separate itself from the traditional focus areas, HRM must extend beyond the role of merely producing services into supporting decision-making instead (Lin et al., 2016). Boudreau and Ramstad's main argument, therefore, is that HRM should live up to its mission of increasing organizations' success by improving the decisions that either depend on people or affect them.

Similarly, HRA literature points to a more strategic role for HRM (Marler and Parry 2015), and by so doing, connects HRA discussion to strategic HRM and repeated calls for the need of HR to transform into a strategic business partner of the line management of organizations (see e.g. Ulrich, 1997; Lawler and Mohrman, 2003; Jamrog and Overholt, 2004; Vosburgh, 2007; Lin et al., 2016). HRA literature argues that an important part of this transformation is the need of HR to transform towards a more data-driven and consultative orientation in its practices, and to develop its data-driven decision-making capability to have a genuine influence on business strategy in workforce-related matters (Vosburgh, 2007).

While the strategic aspect of HR has been emphasized in the literature, Boudreau and Ramstad (2007, pp. 21-22), among others, maintain that even though HR should extend its scope and change its emphasis, it should not transform away from control and service to decision-making altogether. Control-related tasks include complying with legal requirements and standards, which will remain an important part of the HR function's responsibilities in the future as well. Control, however, should not be the principal focus, as it is a non-value-adding role. The service role of HR, for instance compensation, succession planning, staffing and training, is also important, but Boudreau and Ramstad (2007, pp. 21-22) stress the importance of HR engaging in improving organizational decisions by resorting to decision science and the frameworks it provides to take up a strategy-relevant role.

Big Data

There are various definitions for the concept of BD. A shared feature of them is that they are rather vague (Ward and Barker, 2013). One of the most commonly cited attempts at defining the concept originates in a 2001 report by Meta (currently Gartner). It should be noted, however, that the original work did not use the term 'big data' at all. Gartner based its definition on three Vs: volume, velocity and variety. Later, IBM and others have suggested veracity, referring to the uncertainty of data and confidence in the output of analysis, be added. Oracle, on their part, bases their definition of big data on the idea that data found in traditional databases is enriched by additional data from new sources of unstructured data. These sources may include blogs, social media, sensor networks, and

graphical data, as well as other sources varying in their size, structure, format and other factors. In this definition, therefore, it is essential that new data from non-traditional sources is employed together with existing, more traditional data sources (Ward and Barker, 2013).

The attempts at defining BD above are relevant from an HRA perspective as well. In fact, many of the qualities and features appearing in definitions of big data are very similar to those used to describe HRA. Therefore, it may be said that the recent interest in BD, fueled by the ongoing digitalization affecting various business processes and societies at large (Hajkowicz, 2015, p. 107), offers new opportunities for HRA as well.

While the concept of BD is still open for discussion, Mayer-Schönberger and Cukier (2014) are convinced that big data will revolutionize the established ways of making decisions, and making sense of the prevailing realities (see also McAfee and Brynjolfsson, 2012; Davenport, 2014). Prior to BD being accessible, according to Mayer-Schönberger and Cukier (2014), our lives were guided by analyses based on well-defined hypotheses validated through gathering and analyzing data for the given purpose. Mayer-Schönberger and Cukier (2014) claim that the availability and access to BD may reverse this process we are so accustomed to: by allowing the use of highly advanced mathematical models, big data makes it possible to recognize associations between phenomena which we did not realize might exist.

As pointed out above, this may very well be true for HR data too: organizations have a wealth of information on various aspects related to their workforce, organizational performance, and various external sources, which, in combination, may be perceived as BD that may offer insight for business-driven decision-making if approached with an open mind and appropriate tools of analysis. However, the ample opportunities offered by sophisticated technology also raise ethical concerns. When dealing with person-related data, especially fairness and legal issues related to new types of data and different algorithms used in artificial intelligence and machine learning, solutions utilized in HRA need to be taken into close consideration (e.g. Tambe et al., 2018).

Analytics, Decision Science and HR

Demonstrating the impact of HR activities on business performance requires the use of analytic models, experimental approaches, valid measures, and data on both input and output aspects to establish the causal relationships (Camps and Luna-Arocas, 2012; Bou-Lusar et al., 2016; Lin et al., 2016). Boudreau and Ramstad (2002, pp. 5-6) distinguish between providing HR metrics and providing improved logic and analytics to support decision-making concerning the workforce. They argue that HRM needs to develop into a decision science of its own, similar to accounting and marketing, to guide, analyze, and enhance the decisions concerning the workforce, regardless of whether those decisions are made within or outside the HR function.

According to Fitz-enz and Mattox (2014), analytics is often perceived merely as statistics. Although statistics do play an important role, analytics, however, should first and foremost be considered as a mental framework supported by a set of statistical operations. The key is, therefore, trying to understand the interactions and relationships between various elements connected to a problem that is to be solved. Should this understanding be lacking, analytics provides only little value due to lacking connection to an organization's strategy, being understood by its end users, and being embedded into an organization's processes in order to take necessary actions at the right time. Regardless, a firm belief among organizations using analytics prevails, as LaValle, Lesse, Shockley, Hopkins and Kruschwitz (2011) found in their study: those utilizing it perceived analytics to be valuable.

Rasmussen and Ulrich (2015), too, point out that conducting analytics just for its own sake delivers no value. What is needed is framing the practical business challenges to prioritize the questions that need to be answered with the help of analytics. Therefore, the advancement of HRA requires an academic mindset that takes into consideration the business context so that actionable, sufficiently accurate and broad-enough information for the decision-making needs can be made available for those needing it. The key is to support people-related decision-making (Lawler et al., 2004).

According to Boudreau and Ramstad (2002, pp. 5-7), decision science provides logical but flexible frameworks for optimizing decision-making regarding key resources. Decision science, like analytics, to which it has strong linkages, does not, however, directly provide right answers or actions, but rather offers guidance that helps in identifying and analyzing data to improve decision-making. Building on the ideas of "general" analytics and decision science, the value proposition of HRA is to substitute all transient fads with evidence-based initiatives and data-based decision-making, combining the inputs of academic research on HR and its practice in organizations, prioritizing the impact of HR investments, making HR more rigorous, and moving HR from intuition towards a more objective orientation (Rasmussen and Ulrich, 2015).

A rather tall order, one might utter. This, however, being the value proposition of HRA, it needs to be borne in mind that even the most sophisticated analytics models drawing from vast data sources will not produce much concrete value if they fail to answer the right questions (Rasmussen and Ulrich, 2015). Rasmussen and Ulrich further maintain that often the focus of HR is on validating internal practices of the function, such as the ROI of training programs or the efficiency of onboarding, while the focus should rather be on adding value to business decisions through analytics.

Learnings from e-HRM literature

HRA and BD fall under the wider concept of e-HRM, defined by Bondarouk and Ruël (2009) as an umbrella term "covering all possible integration mechanisms

and contents between HRM and information technologies (IT), aiming at creating value within and across organizations for targeted employees and management" (p. 507). E-HRM has also been defined as a set of "configurations of computer hardware, software and electronic networking resources that enable intended or actual HRM activities (e.g. policies, practices and services) through coordinating and controlling individual and group-level data capture and information creation and communication within and across organizational boundaries" (Marler and Parry, 2015, p. 2).

In their review of e-HRM and human resource information systems (HRIS) research, Bondarouk, Parry and Furtmueller (2017) provide an integrative framework as a basis for future research. They divide the factors affecting the adoption of e-HRM into three areas: technology, organization, and people. Furthermore, they divide consequences of e-HRM adoption following Lepak and Snell (1998) into operational, relational and transformational. They further recognized a shift both in the goals of e-HRM from efficiency to improved HR service provision, and to the strategic reorientation of the HR function.

Coordination between HR, IT and corporate goals (DeSanctis, 1986), organizational policies and practices regarding, e.g., data access, security and privacy (Eddy, Stone, and Stone-Romero, 1999), as well as ethical issues (Taylor and Davis 1989) have been found to have effects on e-HRM and HRIS adoption. Limitations, such as budgetary restrictions or lack of technically qualified personnel (Magnus and Grossman, 1985; Martinsons, 1994), have also been recognized regarding e-HRM adoption.

Key issues in e-HRM adoption, according to Bondarouk et al. (2017), include top management support (e.g. Mayer 1971), user acceptance, communication and collaboration between units, HR skills and expertise, leadership, and supportive culture. Lack of top management support may lead to usage of HRIS for merely clerical purposes instead of strategic tasks (Kossek et al., 1994). Employee-level HRIS user acceptance and adoption have been found to be supported by involvement in development (DeSanctis, 1986), employees' mindsets, stakeholder commitment (Olivas-Lujan, Ramirez and Zapata-Cantu, 2007), and internal marketing (Cronin, Morath, Curtin and Heil, 2006).

Additionally, consistent communication, collaboration, and shared vision between IT and the HR function (Tomeski and Lazarus, 1974; Magnus and Grossman, 1985; Panayotopoulou et al., 2007; Tansley and Newell, 2007), in addition to training HR professionals in using new systems, are needed to support adoption of HRIS and e-HRM (Martin and Reddington, 2010; Panayotopoulou et al., 2007). Moreover, earlier studies on 'people factors', focusing on leadership and culture, found that IT-friendly culture, supportive leaders and trust are associated with greater adoption success of e-HRM practices (Bondarouk et al., 2017), resulting in better efficiency, savings in work, cost and time (e.g. Kossek et al., 1994; Panayotopoulou et al., 2007), and better reporting (Hannon et al., 1996).

Furthermore, e-HRM has been argued to enable professionals to adopt HR to strategic decisions (Cronin et al., 2006), or have a positive impact on HR planning (Beulen, 2009). The literature emphasizes the strategic potential of e-HRM to support the long-term strategy evolution of an organization by transforming HR from merely administrative work into strategic partnership with management (Bell et al., 2006; Panayotopoulou et al., 2007). Marler and Parry (2015) found that managers involved in making strategic decisions can determine the extent of an organization's e-HRM capabilities, but also that the deployment of e-HRM has significant effects on the strategic role of HRM in organizations.

In a similar vein, Minbaeva (2017), discussing human capital analysis (HCA) falling under the broad umbrella of e-HRM, argues that its development in organizations requires working with three dimensions: data quality, analytics capabilities, and strategic ability to act. She defines HCA as an organizational capability rooted in individuals, processes, and structure, comprising the three abovementioned dimensions. She further proposes that development of HCA at the individual level requires having committed individuals to ensure, e.g., flawless data organization, and acquiring and developing analysts with needed skills. Moreover, she suggests that development at the processes level requires building systems and establishing workflows to continuously support data quality, linking the results of analytics projects with existing organizational processes, and encouraging experimentation and enabling follow-up actions via HR business partners. At the structures level, she proposed the necessity of continuous investments in formal, centralized coordination of data collection and organization, creating a culture of inquiry, making evidence-based decisions a habit, and equipping top management with tools for action linked to current and future strategy discussions. Development requires working with all three dimensions simultaneously at the individual, process, and structure level.

While there are bold claims of the benefits of adoption of HRA and e-HRM, Bondarouk et al. (2017) conclude, however, that the field of e-HRM requires more theoretical and methodological development. They further suggest that the HR profession has already undergone a role evolution from being mainly administrative (1970s and 1980s) to being relational (1990s), and more recently, adopting a strategic transformational role in organizations.

METHODOLOGY AND DATA

We set out to explore how the HR functions of nine Finnish companies - counted among the biggest business organizations in Finland - are utilizing analytics and big data in managing their workforce. To study this fairly new and ill-defined field, and to take a more holistic perspective on it, we decided to rely on a qualitative approach (Guba and Lincoln, 1994; Eriksson and Kovalainen, 2015; Saunders and Townsend, 2016), and more specifically, explorative case study (Yin,

2014), to discover and better understand how our case organizations spanning various industries utilize HR data and HRA presently, and in which ways they are planning to utilize them in the future.

Our case organizations are headquartered and domiciled in Finland. All the companies have revenue exceeding EUR 1 billion, and besides two, all have a workforce exceeding 10,000 employees. The companies are well established globally in their respective industries, and taken together, represent a significant proportion of the largest Finnish companies. Their industries span manufacturing of heavy industrial goods, the energy sector, manufacturing of packaging materials, retail trade, financial services, and mobility services. The identities of both the companies and the informants are not disclosed, for reasons related to anonymity and confidentiality.

To tap into the most relevant information concerning the use of HR analytics of our case companies, we targeted key informants of each organization deemed to possess the knowledge and expertise of the organizations' abilities to utilize analytics and big data in HR. For this purpose, we contacted the highest ranked senior HR managers, who further referred to us experts in HR data and/or analytics within their organizations for further interviews. Descriptive information on the interviewees (11 in total) and the interview data are provided in table 1.

Table 1. Interview data

Company	Interviewee job title	Interview duration	Transcription
A – Industrial goods	Head of HR	47:48	7 pages
B - Energy	Head of HR	50:16	7 pages
C – Industrial goods	Head of HR Head of HR and development	1:09:24 1:04:53	10 pages 8 pages
D – Packaging materials	Head of HR	51:30	7 pages
E – Financial services	Director, HR systems	59:38	9 pages
F - Energy	Team lead, HR Systems and Analytics	55:37	8 pages
G – Retail trade	Director, HR Systems	1:29:29	15 pages
H – Industrial goods	Director, HR Systems and reporting Manager, HR reporting	1:58:00	13 pages
I – Mobility services	Head of HR	48:46	7 pages
	Total	10:52:35	91 pages

In qualitative studies, researchers are expected to explain and justify their data collection and analysis transparently in relation to their purpose (Baker and Edwards, 2012; Robinson, 2014), thereby allowing its critical evaluation, including

number of interview participants. Such justification is based on needs of transparency, showing that data collected are of sufficient depth in relation to the research purpose (Saunders and Townsend, 2016), and ideally continuing until saturation is reached (Morse, 1994). In this study, the number of interviewees (11) can be considered relatively low (see Saunders and Townsend, 2016). However, regarding the purpose and the explorative nature of the study, we consider that by carefully selecting nine large companies to be studied and by finding the best possible experts to serve as informants, and further, by carefully conducting both the interviews and analysis, we reached the depth and saturation of the empirical data required for our research purpose. We admit, when probing deeper into some more specified topics raised in our study, that more extensive data may be required in future studies.

The data were acquired through semi-structured interviews (Eriksson and Kovalainen, 2015; Saunders and Townsend, 2016) conducted at the premises of our case companies during spring 2016. The advantage of semi-structured interviews is that there is a systematic and comprehensive approach in the interviews, while the tone is conversational and informal, allowing for the informants to express their viewpoints freely (see Eriksson and Kovalainen, 2015). The themes of the interviews revolved around three topics. First, we wanted to understand the basic metrics that HR is focused on currently and utilizes in managing the workforce. Second, the interviewees were encouraged to discuss more advanced techniques and capabilities that HR is applying to understand the workforce-related issues within the organization. The last theme of the interviews was related to the perceived opportunities and challenges related to BD and its use in HR.

We apply qualitative thematic analysis (e.g., Eriksson and Kovalainen, 2015) to the data. While performing qualitative thematic analysis, the role of the theoretical framework is to serve as a loosely guiding aid of analysis, but one should not strictly adhere to it. Instead, the theoretical framework allows attention to be focused on what is relevant for the purpose of the research and the specific research questions. The actual analysis of data proceeded from close reading of the transcribed interviews to acquaint ourselves with the data. Next, we codified the data to form coherent themes through our interpretation of the data, which then served as vehicles for communicating our findings. Thematic qualitative analysis fits well with our data, which were collected through semi-structured thematic interviews.

RESULTS – THE CHALLENGES

It is worth noting from the outset that the identified challenges emerging in utilization of HR data and advanced analytics were multifaceted and interconnected at various levels of HR practice. The most common challenges that appeared to hinder HR from advancing their capability of operating in data-driven mode

were: 1) the lack of required skills, 2) lack of business understanding, 3) poor data quality, 4) outdated IT infrastructure and systems, 5) difficulties in moving beyond reporting, and 6) misconceptions regarding big data and its utility for HR. We will present our findings thematically in what follows.

Missing Analytical Skills and Business Understanding

Three major issues were found related to lacking skills. The first aspect was the required strong mathematical knowledge and thinking, which the HR professionals considered as rare skills within HR. Second, the lack of skills needed to utilize the already existing analytical tools and information systems surfaced in the data. The third issue hindering the adoption of advanced analytics, according to our data, was the needlessly narrow focus: analytics were typically perceived from the HR function's internal perspective alone, thus missing the business perspective stressed to be important, for instance by Rasmussen and Ulrich (2015).

The lack of business understanding was brought up on several occasions, and some informants emphasized the importance of close cooperation of HR analytics with other functional specialists like finance and accounting. An additional issue appearing in the data was the challenges related to the readiness of the organizations to act upon the numbers reported and analyses conducted. These challenges to act related not only to the HR function itself, but management of different functions HR was providing analyses to. It may be inferred that a general perception of the interviewees was that many HR professionals lack the abilities to benefit from data and analysis because of their insecurity related to their math and analytics skills, and, therefore, they choose not to use them in their work at all.

An additional issue in relation to lacking the skillset to perform insightful HR analysis is the perceived inexperience of HR professionals with logical frameworks, the importance of which is highlighted by Boudreau and Ramstad (1998). As a solution, an interviewee suggested forming a centralized analytics function to support the organization as a whole.

> This lack of capability within our HR people is one of our major roadblocks keeping us from advancing with analytics ... people in developmental roles have not focused on benefitting from any analytics and logical frameworks during their careers. So even if we gave them all information, processes and tools, it will not take us anywhere because they lack the understanding to benefit and use them in their daily work ... In my opinion it would be better if we instead built a center of excellence around analytics where we would have experienced people that are able to interpret value from analytics and then facilitate the rest of the organization to benefit from that knowledge. (Company C, Head of HR and development)

To summarize our findings related to skills and business understanding perceived to be missing in HR professionals' own assessment, it would appear that there is a growing mismatch between the expectations laid on the HR function,

not least by the HR professionals themselves, and what is perceived to be attainable by the current staff of HR. The problem is not only that the current staff may be out of tune when it comes to analytical skills, but more generally, the issue connects to the role evolution of HR and its apparently ambivalent status in many organizations. It is apparent that there is a role confusion in terms of the focus of the practices HR is expected to carry out. While the aspired focus is on decision-making support, the prevailing reality is anything but, in most cases. Control and service appear to be the overriding roles of HR.

Furthermore, the ways in which to organize HR analytics raised discussion among interviewed HR managers. Opinions have been expressed that HR analytics should be removed from the HR function's control altogether (e.g. Bersin 2013, 2015), and instead be given to an "analytics function" centering on advanced analytics related to all business metrics, such as sales, productivity, HR, and customer data. Our interviews indicated no single, dominant option for organizing HR analytics. Some HR professionals suggested a centralized model, and some had organized analytics under the HR function, while in some cases analytics were integrated with HR, but at the headquarter level together with the analytics function. In some cases, HR analytics were organized locally in different countries. Furthermore, in some instances both HR data management and its analytics were outsourced fully or partially.

Data Quality and HR Information Systems Issues

The quality and accessibility of data appeared as a theme that the HR professionals of our case organizations were deeply concerned about. Most interviewees were of the opinion that the data quality in their organizations was inadequate, and that the data was often spread across so many different HR systems that accessing it was cumbersome. Despite the shared concerns regarding poor HR data quality, data quality was monitored systematically in only one case organization.

> What we're lacking is the platform, I mean the technology where we could effortlessly crunch all our data ... to start linking those independent data points together. We have done our homework and created processes that provide us data from performance, leadership, organization, cost – we have it all – but how could we pull all this together to produce accurate picture where we are, like our finance department is capable of doing. (Company C, Head of HR)

Several interviewees reported their organizations having recently put special emphasis on consolidating their HR systems spectrum. A fitting example of the realities the HR professionals were struggling with is an HR director noting that, until just a short while ago, they had to deal with over 100 different HR information systems which had recently been consolidated under one system with only a few global and a few local exceptions. Most of the HR professionals in our data still felt they lacked the means of combining HR data from different systems into an accessible and usable form.

Difficulties of Moving from Basics to Advanced Analytics

Our interviewees shared an opinion that the metrics they were used to reporting were heavily focused on the HR function itself. This suggests that these metrics were built from the needs and perspective of the administrative role of HR. The focus was on evaluating what HR function does, rather than evaluating the value created by following established HR practices within the organization. For some organizations, even reporting some of the most basic metrics, such as an up-to-date headcount, appeared as an arduous task due to cultural differences between operating regions.

> For example, we have this Excel that we use to collect the information, then we ask people to fill in some categories about headcount, and our lovely people in China had written "yes" when they were supposed to fill in a number. Then we need to call back to China "nice to hear that you have this type of headcount, but how many?" – Our maturity is unfortunately still at this level. (Company D, Head of HR)

Based on the data, it may be said that our case organizations are at very different stages of maturity in their thinking related to HR analytics. As noted by Marler and Boudreau (2017), the distinction between HR metrics and HR analytics found in the literature is ambiguous, and the distinction between them appeared even more ambiguous for those operating in the field. This was especially observable in our discussions focusing on HR analytics when we asked our informants to provide concrete examples of HR analytics in use. For the most part, the examples given were referring to basic reporting, self-service HR dashboards and standardized metrics.

> This development with analytics is very slow, we go year-by-year, always learn something new and in this sense, all this fuss about big data and other similar things is premature ... there's lot to do even with basic data, so that they could effortlessly provide the five key metrics in place. Those would fulfill their needs for very long time ... before the next strategic level towards predictive analytics. (Company C, Head of HR)

It also became obvious in our interviews that although HR analytics were perceived as very important, it was challenging for the HR directors and HR analytics professionals to describe concrete steps for proceeding from basic reporting towards more predictive and prescriptive analytics. The lack of longer-term vision and goals was rationalized by still being at the stage of struggling with basic reporting and systematizing the operational role of HR.

> When I joined this organization, my possibilities to focus on anything else but ensuring everyone gets paid somewhat accurately every month, were comparable to survival chances of a snowman in hell. If the basic processes are not working, you shouldn't aspire doing anything else because you simply don't have the time. (Company I, Head of HR)

Only a small minority of our case organizations had engaged in experimental approaches and statistical techniques in the analysis of HR data to gain even some preliminary understanding of the linkages and causalities. Although many were enthusiastic about advancing to more predictive and prescriptive analytics, only a few could describe concrete use cases implemented or in the pipeline. This lack of concreteness suggests that the use of more advanced analytics within HR is still in its infancy in our case organizations.

Those who reportedly had practiced analytics asserted that the experiments had made them aware of what they do not know yet. This suggests that in the efforts towards developing analytical capabilities, it would be important and advisable to conduct small experiments with more advanced analytics, even if the basic foundations still need some work. Becoming aware of the blind spots through experiments gives the HR professionals a foundation upon which the needed knowledge and skills can be built, and which can direct the efforts in doing so in the future.

However, as Rasmussen and Ulrich (2015) have pointed out, even the most advanced analytics models will not produce much concrete value if they fail to answer the right questions. In this vein, an interviewee admitted that their organization had implemented a costly HR information system, only to find out that the measures and data gathering were flawed. As a result, the whole data gathering processes had to be re-designed.

> We, and very likely many other companies out there, will make dumb mistakes when defining what needs to be measured and how that data should be collected. (Company A, Head of HR)

Based on our data, it appears that while HR analytics appear as a tempting next step forward in creating value based on HR data, the mismatch between the data that is currently available appears to render the proposed opportunities of HR analytics unattainable for most of our case organizations at present. Furthermore, the ways in which analytics could be applied by utilizing the current information systems, with their limitations related to analytical functionalities, pose an additional challenge for taking the next step for HR.

Difficulties in Connecting the Dots between Big Data and HR

As noted above, the HR professionals of most of our case organizations admitted there were still challenges in even systemizing the basic KPI reporting on HR metrics, and only a small minority had advanced towards synthetizing multiple data sources with analytical techniques. Therefore, it was not surprising to find out that, for most interviewees, even the prospect of benefitting from the utilization of big data appeared well beyond their current grasp.

> I wouldn't say achieving value from big data is impossible for us, but in order to get there we must better work out our analytics within our basic processes before

> we're able to derive value from even more data. Although it is my principle to gather more data than we're able to benefit from currently – just in case – the value will be realized through concrete examples that enable us to progress in a smart way. This big data as a concept, it has some current sexiness to it. (Company C, Head of HR and development)

In contrast to those interviewees who saw big data as more of a current management fad, two interviewees noted that big data had been part of their organization's core business for years already. None of the interviewees, however, made any claims of having benefitted from the use of big data, and some questioned whether their organization's workforce would be sizeable enough to make the available data feasible for analytics to benefit from analytical methods associated with the use of big data for decision-making.

> Very few organizations in world had headcount big enough so that you could go behind actually big numbers. In some organizations like Walmart, where you have like a million employees, then it is big enough, but the statistical significance in fragmented business like ours is too small and it's likely not going to work for us in the same way. (Company C, Head of HR)

An informant saw the value of big data for HR particularly with respect to it being able to enrich existing data sources. These vast data sources, currently not attainable by HR, could be used to better understand how work gets done and how the organizational processes could be better designed to optimize overall performance.

> When looking at big data from the perspective of HR function, it means that we can link data sources that reside within HR to sources that are owned by other functions, like CRM and finance data. We want to see if our activities have any impact on how certain unit performs. If we deliver training program, we want to see what is the impact of that on our overall performance. This is how big data is currently perceived. (Company A, Head of HR)

Based on our data, while recognizing the potential of HR (big) data and HR analytics, even representatives of the HR functions of leading Finnish organizations appear to be rather limited in their perceptions of its usability for HR analytics. The same applies to data-driven HR in general, as is evident from our findings: while the potential is appealing, establishing working solutions for the daily HR conduct to make it a reality appears cumbersome to achieve. Table 2 condenses our findings of the HRA usage and challenges encountered by HR professionals of our case companies.

Table 2. HR data utilization and HRA challenges by company

A – Industrial goods	HR aims at creating analytics skills to develop business. Relies on fact-based decision-making. Importance of behavioral sciences in HR recognized. Data quality measured on regular basis. HR data is combined with data from

	other sources and functions. Struggles with limited resources, quality of HR master data and difficulties in combining data from multiple sources.
B - Energy	HR reporting and visualization highly automatized, allowing full visibility of data to supervisors. HR metrics very traditional. Lacks analytical skills in HR. Considers itself too small to use BD.
C – Industrial goods	Willing and ready to develop HR analytics. Modelled management to be measurable to define causal relations between management, atmosphere and performance. Recruiting mathematician to HR to implement analytics strategy. Emphasis on validation of subjective indicators like personnel surveys or evaluations. Lack of understanding analytics a limitation in HR.
D – Packaging materials	Traditional HR metrics; laborious to maintain and update. Limitations of HR system hampers usage of analytics, as do lack of discipline in following defined HR processes, and skills and resources in HR. People-oriented approach and ability of HR professionals to interpret the data (in addition to sole reporting) emphasized. BD seen as an opportunity, but worries for possible 'over-use' of data in HR.
E – Financial services	HR reporting burdensome, more efficient information gathering processes under construction. HR metrics emphasize costs and headcount. No demand by business management for development of metrics used. New centralized HR system implemented, infant analytics only. Importance of analytics appreciated but not prioritized. Aspired cooperation between financial function and HR.
F - Energy	New centralized HR system implemented and solution for BD analytics found. Basic HR reporting well-functioning, goal to develop more predictive analytics enabled by the new tools. Analytics technology in place, lack of mathematical skills limiting development and fully benefitting from the potential provided by the systems.
G – Retail trade	Relatively low level of usage of analytics, ambitious goals for data and analytics use in place. Concrete plan for actions and priorities to develop analytics competences. Data currently in silos, making utilization hard. Struggles with appropriate systems and analytics skills in HR.
H – Industrial goods	Global HR system in use. Relatively good data availability, lot of manual work in reporting required. Traditional HR metrics. Reporting focused on historical development, goal to develop predictive analytics. Lacking management support in defining most essential business issues to support through analytics.
I – Mobility services	New HR system in implementation. Lot of attention put in developing HR analytics and its possibilities. HR team targeting HR analytics established. Head of HR favors implementation of cutting-edge analytics solutions. Defining business-oriented base for developing HR and analytics prioritized.

While aspirations abound and practical steps towards data-driven HR were taken in our case companies by making use of IT-based human resource information systems (HRIS) and similar e-HRM solutions, which built on resources made available by digitalization, interestingly, our findings go against the implications and conclusions of the recent Digital Economy and Society Index (DESI) report of the European Commission (European Commission, 2017) in some respect.

The DESI report ranks Finland among the top performers of EU member states in digital competitiveness (European Commission, 2017). With big data and analytics based on it being one of the most prominent manifestations of digitalization, the picture painted by the DESI report on Finnish businesses' capabilities in integrating digital technologies represents an interesting anomaly with our findings. In official statistics, Finland ranks as the third most advanced of European nations after Denmark and Ireland (European Commission, 2017) in terms of digital competitiveness, but at least in terms of readiness to utilize big data in business decision-making in an HR context, our findings raise some questions whether the DESI assessment actually fits the bill in the Finnish case, as the companies our data is based on, ranking among the largest in Finland, are generally considered to be among the forerunners in technology adoption in their business conduct.

Role transition of HR function

While our informants clearly recognized the need for HR to assume a more consultative approach to support decision-making, as suggested for instance by Vosburgh (2007) and Lin et al. (2016), adopting this more consultative approach, however, had proven hard to achieve in practice. According to the interviewees, the HR functions of our case organizations have faced slow-to-overcome challenges in adopting a more consultative role to support the decision-making, as explained by a senior HR manager:

> I've been trying to teach everyone in HR to conduct the analysis based on data, not just pull together awful lot of graphs and numbers ... They leave the responsibility to make sense of it to the business line management, which is always risky. We here in HR are the experts in workforce, so it would be logical that we make the recommendations based on our analysis too. (Head of HR, Company D)

The HR functions of most of our case organizations were used to working with a strong service mindset, delivering only services that the business lines requested. It became clear in several discussions that the HR function had not changed this approach, but instead, settled into service delivery mode without questioning the sensibleness of requests originating from business lines. Some interviewees clearly acknowledged this problem.

> Our management team hasn't given us much expectations beyond the standard reporting, which is focused on calculating overall costs and headcount. Their only concern is just that those numbers are accurate. They have not asked us to deliver much insight beyond the basics. (Director, HR systems, Company E)

Evidently, HR acting based on data has been limited in most of our case organizations, making it challenging to respond to this change quickly. In some of our case organizations, the biggest obstacle in advancing with analytics maturity was the inability of the organization, or rather, the management, to act based on data

and analysis provided by HR, rather than the technical and data-related challenges. Table 3 presents our findings related to role transition of the HR function in our case companies.

Table 3. Role transition of HR function by company

A – Industrial goods	HR has undergone change from administrative to more business-oriented recently. HR emphasis on talent management, incentives, and change management and planning. Company-wide aspirations to strengthen business intelligence and decision support.
B - Energy	Head of HR seen as strategic partner by the executive team for years, increasingly co-operates with the board. Investments in self-service model for administrative HR to increase transparency and availability of HR data. Aiming at fact-based HRM.
C – Industrial goods	New Head of HR after CEO change to renew HR organization. Clear goals for HR, monitored by executive team and board. Highly business-oriented HR, no "own" agenda.
D – Packaging materials	Transformation of HR from administrative to consultative orientation led by newly appointed Head of HR. Roadmap for HR developed; merger support and management development key issues. A corporate-wide common HR system in pipeline.
E – Financial services	Emphasis on internal service provision. Role of HR heightened due to industry disruption. Regardless, HR very reactive and rigid; paper-based processes dominate. More agility is sought.
F - Energy	Basic HR processes standardized and digitalized recently. Head of HR integral member of executive team. HR function building self-service model to support business transformation and organizational culture change.
G – Retail trade	Foundation of common HR is being constructed to replace scattered solutions. HR processes are being standardized and centralized. Aiming at change from 'transaction-based function' to 'business support function'.
H – Industrial goods	Recent organizational change exploited to renew HR from centralized and formal to decentralized and more informal mode of operation. HR has own strategy, and firms-wide 'people strategy' in place. Head of HR made member of executive team recently.
I – Mobility services	Basic HR processes standardized recently; new HR information system being implemented. HR reoriented to better support changed needs of business. Head of HR influential member of executive team. Personnel work experience development a central theme for HR.

It appears, much in line with the literature calling HR to evolve from its traditional administrative and control role into being more strategic in its orientation, and becoming a consultative partner of business line management (e.g. Marler and Parry, 2015), our case companies' HR functions too have gone through a role transition, rather recently in most cases, to become more closely integrated to business-critical decision-making at the top of the organization.

An integral part of this role transition seems to be the HR function's transformation, gravitating it towards a more analytic, tightly coordinated, systematized, IT-solutions-based, and, overall, business-oriented stance. This development is

reflected in HR professionals reporting their function having become 'standardized', processes having been 'digitalized' and new 'HR information systems' having been put in action or being implemented. Thus, it may be inferred that the ongoing "technologization" (Zacher, 2017) fueled by digital transformation has allowed e-HRM (Bondarouk and Ruël, 2009; Bondarouk et al., 2017), HRA (Marler and Boudreau, 2017) and HCA (Minbaeva, 2017), relying on the HRIS resources (Bondarouk et al., 2017) built in the past, and now being updated to more efficiently serve the future business-led needs of precise and actionable HR information and insight based on (big) HR data, to materialize. In effect, due to this development, it is possible to speculate whether the HR function may be evolving from its soft roots into a hard, data-driven decision science of its own, as called for by Boudreau and Ramstad (2002), and whether this would be a welcome trajectory for the future HR.

Based on the above, a hypothesized association between HRA utilization and role transition of HR may be proposed for future validation or refutation: utilization of advanced HRA may lead to HR function evolving into being more strategically oriented – and being recognized as such by business management – due to technologization of HR and the associated perception of exactness brought about by the use of sophisticated analytics tools offering presumably "hard facts" for business-related decision-making. On the other hand, the association may be reversed: having been acknowledged as strategy-relevant, HR may "feel pressured" to update its orientation in HR work towards being more analytics-oriented and therefore turn to HRA and the tools it offers. Speculations of causality aside, it appears likely that the two phenomena are mutually reinforcing.

DISCUSSION

Our results suggest that while interest in HRA is high in the corporate practice, there are significant differences between organizations' goals and capabilities to deploy such analytics. Some of the studied organizations were clearly more advanced with the use of HRA, and they were also making significant efforts to continue advancing the analytical capabilities by acquiring more expertise and needed tools. Many organizations, however, still had to focus on systematizing the very basic HR processes and modernizing old legacy HR information systems hindering their capacity to analyze data to answer the critical workforce and business-related questions, and thus provide additional insight for decision-making.

We may also conclude that there was considerable ambiguity in how our informants perceived the concepts of HRA and BD. This is not entirely surprising, however, given that the literature utilizes various concepts, such as e-HRM, HRA, HCA, and HRIS, essentially referring to very similar phenomena rather liberally, and by so doing, adds to the conceptual confusion. Although there were clear aspirations to conduct "advanced predictive analytics", only a minority could

describe concrete use cases where they would apply these more advanced analytical techniques, let alone describe a concrete vision for advancing with such advanced HRA. This lack of understanding is likely to slow down the progress in many organizations, not just in our case organizations.

We also found that, in many instances, the senior executives responsible for management of our case organizations were not expecting significant advancements in the area of HRA, but were rather content with the prevalent situation and the ways in which HR practices were carried out (cf. Kossek et al., 1994). We find this to be somewhat surprising – even alarming – as, in many cases, the application of advanced analytics, and even the utilization of big data, is at the core of many of our case organizations' business models. It is therefore hard to fathom that the low levels of expectations with regard to HR big data usage would be due to lack of understanding of either analytics or big data as such, but rather to the inability to grasp the concrete benefits of them with regard to the "people aspect" of their business, and the important management support in HRA (e-HRM) adoption (Bondarouk et al., 2017) that was missing, leaving HRM operating in predominantly administrative mode (Marler and Parry, 2015).

This limited perception from senior management has likely been strengthened by the HR function's historical role of focusing merely on delivering the compliance and standard service aspects of HR, and of not being considered as a capable consultative partner contributing to business-related decision-making (Lin et al., 2016) backed up by data and analytics regarding the workforce. Becoming a consultative partner may require deeper co-operation between data analysts and HRM assuming different forms, like tailored dashboards, data interpretation support, joint analysis, data or analysis outsourcing, or even professional hybridization between HR staff and data analysts.

Our findings coincide with Davenport et al. (2012) and Minbaeva's (2017) findings that in order to benefit from advanced analytics and HR big data, organizations must establish new ways of working to replace the traditional, intuition-based operating mode of HR. This may happen, as Rasmussen and Ulrich (2015) have proposed, through transferring the responsibility of more advanced analytics, beyond the standard reporting, to being under functions with greater analytical maturity like finance, IT or marketing. As the companies' business will become ever more focused around delivering value from data and analytics (see e.g. Brynjolfsson et al., 2011; Davenport, 2014; Kubina et al., 2015), it is likely that the responsibility of conducting HR analytics will become a part of a centralized analytics function in order to enhance both the efficiency and effectiveness (Haines and Lafleur, 2008) of analytics.

This would not only help in building critical mass in terms of analytical skills required, as explicitly suggested by Minbaeva (2017) and implied by several other commentators (see e.g. Bondarouk et. al., 2017, Rasmussen and Ulrich, 2015; Bondarouk and Rüel, 2009; Marler and Parry, 2015 Panayotopoulou et al., 2007),

but also effectively turn HR towards being more data-driven in its orientation to support strategic decision-making concerning workforce and business alike.

Because most of the case organizations of our study still had a lot of work to do in systematizing and increasing automation of basic HR reporting, applying even some basic analytical techniques to HR data, let alone utilizing the opportunities of BD to enrich the analytical insight, were perceived as rather futuristic visions. Some of the interviewed HR directors and analytics experts saw potential value in BD and the techniques related to it, while the majority were notably skeptical of the prospects. The need to struggle with challenges related to currently existing datasets, and the existence of only a few attempts at coming up with use cases where the potential of BD could be tested, would imply that the impact of BD for the practices of the HR function will remain moderate in the foreseeable future.

Bean's (2016) assessment of the challenges related to adopting BD as being not technology-related, but rather people-related, would appear to be only partially right based on our findings. In line with Bondarouk et al. (2017), technology-related issues are clearly a part of the equation in the daily realities of HR, based on the experiences of our informants as discussed above. The importance of various information systems, HRIS included, have increased over time – even unnoticed. In most contemporary organizations, information systems have become mission-critical: when systems fail, the work affected comes to a grinding halt. Systems, in good and bad, have therefore become more influential, and critical, than they are often given credit for. Ultimately, of course, systems and technology are human creations, and in that sense, Bean's (2016) point is valid.

Minding both the technology-related limitations and the people factor, the adoption criteria for BD to benefit organizational decision-making, outlined by Bean (2016), form an actionable basis. His advice is deceivingly simple: to successfully adopt BD, organizations need cultural change, redesign of organizational structures, and change management (Bondarouk et al. 2017). Given that both cultural change and organizational redesign are among the most painstaking undertakings any organization may set onto (see e.g. Weick and Quinn, 1999; Alvesson and Svenigsson, 2016), it follows that the successful adoption of BD will still require a long time for most organizations' HR functions – not just our case organizations' HR. However, the level of adoption is likely to increase after the HR functions are able to acquire the needed capabilities enabling them to take advantage of more advanced analytics in the first place, and later, enrich and deepen those insights with non-traditional sources of data.

Overall, taken together, our findings suggest that the challenges of making an impact on business-related decision-making through data concerning workforce are numerous (Lin et al., 2016). To overcome these challenges, it is essential to have the required elements in place simultaneously (corresponding to Minbaeva's [2017] framework on HCA): meaningful applications; access to appropriate, good quality data (Eddy, Stone, and Stone-Romero, 1999) – including BD; the

tools and expertise to harness the data available; and the needed skills to conduct analysis and deliver recommendations for action. It is also essential to find the means to overcome the hesitation of decision-makers to rely on HR data and analysis, rather than intuition and past experience, when it comes to decision-making regarding "soft" people-related business decisions.

Moreover, this may need many out-of-the-box solutions regarding the organizing and co-operation solutions (Bondarouk et al. 2017) between HR professionals and the data analytics function of organizations, ranging from ad hoc data provision and interpretation support to full scale hybridization between some specific occupational positions like "data driven HR analysts". In this new HRM landscape, it is likely that IT specialists, data analysts, and mathematicians need to work together to fulfill the varying informational needs of organizational members. Also, it may be that most of the actual HRA usage happens in the business line management independently through HRA dashboards and similar applications, instead of the HR function providing the information by request.

Finally, even though an ethical perspective on HRA and technologies employed in it was not our focus in this study, it needs to be pointed out that there are potential ethical challenges related to the new data sets and algorithms various AI solutions and machine learning utilize in performing complex HRA (Tambe et al., 2018). Therefore, the future HR professionals should be well aware of the issues like fairness in decision making, and understand the black box of algorithms, which, if utilized without due caution and necessary understanding of the inner workings of HRA systems, may lead to biased decisions, or even violating the legal rights of the personnel analyzed and managed based on the results. If sufficient awareness and understanding is lacking, the risk of ethical challenges materializing in overly technology-reliant HR is a very real and daunting prospect.

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