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People analytics—A scoping review of conceptual boundaries and value propositions

Aizhan Tursunbayeva, Stefano Di Lauro, Claudia Pagliari

ABSTRACT

This mixed-method ‘scoping review’ mapped the emergence of the term People Analytics (PA), the value propositions offered by vendors of PA tools and services and the PA skillsets being sought by professionals. Analysis of academic research and online search traffic since 2002 revealed changes in the relative trajectory of PA and conceptually related terms over the past fifteen years, indicating both the re-branding of similar innovations and a differentiation of priorities and communities of practice. The market in commercial PA tools and services is diverse, offering numerous functional and strategic benefits, although published evidence of these outcomes remains sparse. Companies marketing PA systems and services emphasise benefits to employers more than to personnel. Across the sources examined, including specialized online courses, PA was largely aligned with HRM, however its development reflects the shifting focus of HR departments from supporting functional to strategic organisational requirements. Consideration of ethical issues was largely absent.

1. Introduction

In an increasingly digitised society, interest in the use of so called big (and small) data has never been greater. Data analytic techniques, of varying sophistication, are being used to understand social phenomena, evaluate policies, tailor consumer marketing, predict voting behaviour, enable precision medicine and a host of other real-world phenomena, evaluate policies, tailor consumer marketing, predict voting behaviour, enable precision medicine and a host of other real-world phenomena. Understanding and optimising the behaviour, enable precision medicine and a host of other real-world phenomena, evaluate policies, tailor consumer marketing, predict voting behaviour, enable precision medicine and a host of other real-world phenomena. Understanding and optimising the behaviour, enable precision medicine and a host of other real-world phenomena. Understanding and optimising the behaviour, enable precision medicine and a host of other real-world phenomena.
and its relationship with other HR-related concepts 2) the contexts in which PA is being used; 3) the value propositions advanced by providers of PA products and services; and 4) training courses currently aimed at PA practitioners. The review was prompted by findings of a recent systematic literature review on HR Information Systems (HRIS) in healthcare, which highlighted the importance of HR data for effective management and organisational efficiency (Tursunbayeva, Bunduchi, Franco, & Pagliari, 2016). It complements a recent review of the academic research literature on HR Analytics (Marler & Boudreau, 2017) by extending the analysis to a wider set of knowledge types. It also addresses calls from within the industry for “independent scientific research” on PA (e.g. Julia Howes, quoted in Levenson & Pillans, 2017).

2. Methods

We undertook a quasi-systematic scoping review, adopting an approach originally proposed by Arksey and O’Malley (2005). Unlike systematic reviews aimed at synthesising evidence from evaluative studies (e.g. Tursunbayeva, Franco, & Pagliari, 2017), scoping reviews are often used to examine emerging topics that are poorly understood, where research is at an early stage, or where pertinent knowledge is being generated outside academia. Scoping reviews thus address broad rather than narrow research questions and seek to profile the literature and understand it holistically, rather than to critically appraise the methodological quality of individual studies (Holeman, Cookson, & Pagliari, 2016).

Since PA is an emergent topic it was appropriate to use this broad approach rather than concentrating on a narrow and likely unrepresentative academic research literature and specific and narrow research questions.

Data collection took place in four main phases, which are summarised below, noting the research objectives addressed by each one.

2.1. Mapping the use of PA-related terms online (Addresses objectives 1 and 2)

To inform our literature searches, we first created a draft set of ten keywords [HR, Human Resource, People, Workforce, Employee, Human Capital, Manpower, Staff, Personnel, Talent], drawing on the results of the recent systematic evidence review on HRIS in the context of healthcare (Tursunbayeva et al., 2016) and adding the word “Analytics” to each of these.

We analysed the prevalence of each of these keyword combinations in online searches, using Google Trends (searched on 10/06/2017), following previous research that uses this free tool to obtain insights on users’ Internet search behaviour (e.g. Nati et al., 2014).

We used additional Google Trends analytics to chart the countries in which each search term has been the most popular, as well as to examine the related terms used alongside PA in online searches in which PA keywords are included. Open coding (Glaser & Strauss, 1967) was applied to the latter to iteratively sort the results into thematic categories.

2.2. Scoping relevant academic research (Addresses objectives 1 and 2)

Using a subset of 7 core keywords refined after Phase 1 (“HR analytics” OR “Human Capital analytics” OR “Human Resource analytics” OR “People analytics” OR “Talent analytics” OR “Workforce analytics” OR “Employee analytics”), we undertook preliminary searches of the academic literature using the Scopus database (30/07/2017). To check the inclusivity of our search results, the titles of articles judged to be relevant were cross-referenced with those appearing in two benchmark literature sources: Firstly, a recent review of academic research on HR Analytics by Marler and Boudreau (2017) which used similar search terms and shortlisted 14 relevant papers dating from 2004. Secondly, a list of relevant articles informally maintained by the Human Capital Analytics Group (HCA Group, 2017) of the Copenhagen Business School, encompassing 28 articles dating from 2002 (as of 30/07/2017).

The disciplinary affiliation of journals publishing PA research was assessed with reference to their classification in the Scimago Journal Ranking Portal (2017), except for the Scopus articles for which this information was available in the database. Where articles specified keywords these were cross-referenced with our seven search terms to identify those most frequently used. Finally, we analysed the concepts appearing in article titles and abstracts with reference to a framework by Isson and Harriot (2016) which organizes PA into 7 “pillars” according to its potential impact on: 1. Workforce planning; 2. Sourcing; 3. Acquisition/hiring; 4. Onboarding, culture fit, and engagement; 5. Performance assessment and development and employee lifetime value; 6. Churn and retention; and 7. Wellness, health, and safety.

2.3. Scoping commercial PA tools and services (Addresses objectives 2 and 3)

To identify vendors of PA tools and services, we searched for each of our 7 core PA keywords in Google and analysed the first page of results for each one, based on previous studies showing that 91% of searchers check only this page (Van Deursen & van Dijk, 2009). For our analysis we included only the organic results (Ratliff & Rubinfield, 2014), and omitted paid advertisements. The search was conducted on 30/07/2017.

Vendors identified from this search were first classified according to the nature of their business, using a taxonomy, developed by Libert, Beck, and Wind (2016), as Asset Builders; Service Providers; Technology Creators; Network Orchestrators. We then reviewed the narrative in vendors’ online promotional material, to identify the specified or implied benefits offered to prospective purchasers (value proposition). These were iteratively coded before settling on a refined list of benefit categories.

2.4. Scoping online training courses (Addresses objective 4)

Again, using the 7 keywords refined through Phase 1, we searched the Wikipedia list of massive online open courses (MOOC) by “Notable providers” (Wikipedia, 2017) (Search conducted on 30/07/2017). After examining the openly accessible information describing each course, we extracted those most closely related to PA and attempted to assess their learning objectives, insofar as this was possible without enrolling. These were cross-referenced with the “Profile of a Perfect Data Analyst” developed by the Nesta global innovation foundation (2014), which includes: Core skills (Analytical or Technical); Domain and Business Knowledge (Knowledge of the sector, Awareness of business goals and processes); Soft skills (Storytelling and Team-working) and Competencies (Analytics Mindset, Creativity and Curiosity). Available course content was also classified according to Isson and Harriot’s 7 PA pillars framework, as described above. Finally, we emailed course developers and asked for the course creation date and attendance statistics.

3. Findings and analysis

3.1. People analytics in online search trends

None of the terms Manpower Analytics, Personnel Analytics or Staff Analytics were found in Google trends since records began in 2004. Although these terms appear in earlier articles included in a recent systematic review of HRIS (Tursunbayeva et al., 2016), their absence post-2004 suggests that they are no longer in common usage and we therefore decided to exclude them from further analysis. Indeed, these were also not found amongst the search terms or results in Marler and Boudreau’s (2017) related review. The relative popularity of online searches for the remaining seven terms is shown in Fig. 1.
As can be seen in Fig. 1, interest in these terms has grown over the last fourteen years, with searches for Human Resource, HR and Workforce Analytics initially being the most popular. Google users began searching for People Analytics in 2005 and this term overtook the latter in 2007. In the last 10 years, the most popular terms have been People Analytics and HR Analytics. Searches for Talent Analytics, Employee Analytics and Workforce Analytics have also taken place, although relatively rarely compared with the former two search terms. Searches for Human Capital Analytics appeared and rose from 2004, although this term and Human Resource Analytics have since become the least popular of the seven reviewed.

Searches for PA concepts, recorded in Google Trends, were most popular in the USA, India, the UK, Australia and Canada, with users from the USA searching for the most diverse range of terms. Preferences for different search terms varied between countries. For example, the top search terms were, in the USA Human Capital Analytics, in India Talent Analytics and in Australia Workforce Analytics, while searches in the UK were more evenly spread across terms. Where relevant searches were conducted in other countries, these were confined to HR Analytics, People Analytics, or a combination of these two terms. A breakdown can be seen in Appendix A.

‘Related words’ used alongside the seven People Analytics search terms fell into several thematic clusters, based on our open coding (Appendix B). A cluster relating to HR objectives and practices was the most dominant - including aspects of workforce planning, recruitment, talent management and performance/reward. Related words from this cluster were mostly associated with the terms Human Resource, Human Capital and Talent Analytics. The next largest theme concerned Analytics as a class of methodologies, including predictive analytics or statistics. This was followed by a theme concerning the Internet, including searches targeting particular social media platforms (e.g. Twitter), websites (e.g. Wordpress), search engines (e.g. Google search) or analytics engines (e.g. Google Analytics), which could potentially be used as a source of data for informing various HRM requirements. The Internet cluster seems to be unique to the People Analytics keyword, suggesting that the scope of the PA concept extends beyond internal HR processes and practices. The next category concerned Organisations, including references to companies in general or specific organisations offering PA services or technology, such as Deloitte (authors of the Human Capital Trends report). The PA keywords most closely associated with the Organisations category were Workforce and Talent Analytics. A further thematic category relates to the PA Profession – including descriptions of PA consultants, job advertisements or levels of remuneration. Other, less dominant, themes included Learning and Development, (e.g. PA courses, training or academic programs), PA Research (both academic and applied), and Conferences (Wharton School Univ. Pennsylvania). Finally, there was a cluster of searches related to PA in a particular Country, specifically India.

3.2. People analytics in published academic research

3.2.1. Comparison of search results with ‘benchmark’ lists

Searching the Scopus database using a structured query combining our seven key terms yielded 58 relevant academic articles; almost all published in or after 2012. The table listing the included articles (after removing duplicates, and non-relevant returns: n = 5) is included in Appendix C together with the articles from the two ‘benchmark’ lists. The two ‘benchmark’ lists did not have any article in common. Marler and Boudreau’s review of academic research contains considerably more post-2012 articles than HCA group’s list. Informal communication with the HCA group confirmed that their list is not systematically maintained but rather is a place to record articles of special interest. While our Scopus search identified more relevant articles than that shortlisted by Marler and Boudreau (58 vs. 14), only three of the same articles are covered in both reviews (by Aral, Brynjolfsson, & Wu, 2012; Bassi, 2011; Rasmussen & Ulrich, 2015). Fig. 2 shows the number of relevant articles appearing in our search and the two benchmark comparators, in the years 2002–2017.

3.2.2. Disciplinary focus

As can be seen in Fig. 3, while the majority of publications in all three sources come from the Business, Management and Accounting disciplines, the results from our Scopus search, Marler and Boudreau’s academic literature review and the HCA group’s list vary in several ways. Most significantly, technical disciplines such as the computing and mathematical sciences are strongly represented in Scopus and somewhat in Marler and Boudreau’s lists but absent in the HCA group’s list. The list derived from the HCA group, in contrast, shows a strong representation from Psychology. Interpreting these differences requires a recognition of the different scope and timeframes of the sources. Using our targeted search terms in Scopus yielded only studies published after 2008, whilst the HCA group’s list goes back to 2002. Manual
inspection of the pre- and post-2008 publications suggests that PA emerged from organisational psychology and psychometrics but has since been marked by a trend towards the computing and data sciences. Authors publishing most on this topic in the last five years come from industry, not academia; indeed one fifth of recent articles found in Scopus are affiliated with IBM, revealing the company’s strategic shift towards business consulting and analytics. Nevertheless the difference between these sources partly reflects the addition of the word ‘analytics’ to the search terms in our Scopus search and Marler and Boudreau’s review, compared to the HCA group’s list.

3.2.3. Search terms and authors’ keywords represented in published articles

The most popular keywords specified in articles derived from our Scopus search results were: Workforce Analytics; HR Analytics; Human Resource Management; People Analytics; and Human Resource Analytics. Not all articles in the HCA list specified keywords but where this was the case, these were divided between various HRM practices such as Diversity, Turnover, Engagement, Burnout, and Strategic HRM, and organisational impacts such as Organisational (or departmental) Performance, productivity or strategy. An additional keyword appearing in the this list was ‘meta-analysis’, reflecting the inclusion of review papers involving this method. The only keyword overlapping with our Scopus search terms was Human Capital, reflecting the focus of the HCA group. Very few articles in Marler and Boudreau’s review of HR Analytics research used keywords. These keywords included: HR Analytics and Human Resource Analytics; Information Systems including Human Resource Information Systems; and generic HR terms such as Human Resource or Human Resource Management.

The keywords from all three lists were pooled to produce the word map shown in Fig. 4. The size of the words indicates their relative frequency.

Fig. 5 shows the annual frequency with which our core PA search terms, refined via phase 1, were specified as keywords by authors of academic articles in the combined list. Only five out of the seven terms are included, as Talent Analytics and Employee Analytics did not appear as keywords amongst these articles.

3.2.4. PA objectives/practices represented in the articles

Most of the articles in the combined list were general overviews or discussions of PA as an area of practice or a sub-discipline of HR. This included defining what PA is, its adoption rates in diverse organisations, types of data that may be used for PA analyses, and potential success factors and barriers that could affect PA implementation within organisations. While such generic PA articles appeared in our Scopus results and
in Marler and Boudreau’s list, the HCA group’s list only included studies focusing on the use of PA for specific HR objectives. Nevertheless, all of the PA objectives/practices from Isson and Harriott’s (2016) 7 pillars framework were present in the studies analysed, as described in Table 1. Many focused on performance assessment and development and employee lifetime values (e.g. remuneration levels for different gender groups) and onboarding, culture fit, and engagement (e.g. linking motivational antecedents, strategic implementation and company performance). Another dominant category, primarily in the studies found in Scopus, is workforce planning, including studies concerned with new scheduling models or identifying and estimating employee expertise. Other studies focused on the use of PA for: churn and retention (e.g. employee turnover and their impact); wellness, health, and safety (e.g. strategies for reducing employee burnout); sourcing (e.g. identifying key metrics to evaluate talent acquisition strategies or recruitment channels); and acquisition/hiring (e.g. evaluating potential biases using data mining and profiling tools during candidate screening).

Studies that did not belong to any of the aforementioned categories were grouped into separate categories. These included studies that focused on: collaborations (e.g. studying work patterns from employees’ collaboration activities); diversity and inclusion (e.g. understanding how demographic factors and workforce composition can affect individual, team or organisational performance); People Risks (e.g. quantifying human risks and reviewing existing risk measures); and inter-organisational relationships (e.g. investigating how PA can be used in investment processes).

3.3. PA vendors represented in Google search results

As described in the methods section, we analysed the results appearing on the first Google page found when searching for each of our 7
core keywords, after removing paid advertisements. Most search results were links to Vendor websites (e.g. IBM’s HR Analytics main page). The remaining results related; in order of frequency; to News (e.g. Forbes), Research (e.g. Harvard Business Review), PA-related Communities (e.g. Kaggle), Organisations/Platforms providing access to educational materials on PA (e.g. HCA Group webpage, Coursera) or specific training programmes in which PA is a component (e.g. Human Resources MBA), and Conferences (e.g. Wharton people analytics conference).

Terms used by vendors: Many vendors’ websites contained several PA-related terms, although these varied in emphasis and frequency. Examples include, “We'll show you how to build your Talent Analytics solutions. Point solutions demonstrate ROI of people analytics to the business” (PWC, 2017), “People analytics, also known as talent analytics or HR analytics, refers to the method of analytics that can help managers and executives make decisions about their employees or workforce” (Cornerstone, 2018). Here, we also identified an additional PA-related term “Labor Analytics”, used by Kronos, which did not emerge in the previous phases of analysis. Further details of vendors’ descriptions and the definitions they follow are provided in Appendix D.

Stated value proposition: The following overlapping categories of promised benefit emerged from the qualitative analysis of vendors’ online marketing narratives: (A) Better strategic decision making through access to reliable information and analytical tools; (B) Improved data handling processes using innovative approaches to data collection, combination, analysis and interpretation; (C) Improved people management resulting from greater efficiencies and HR decision making; (D) New technological solutions for collecting, storing or analysing HR data, including automating these processes; (E) Direct impacts on HR or strategic business outcomes, such as optimising human resource assets to increase income relevant to payroll; and (F) Employee-oriented benefits such as improved work experience or job satisfaction. Companies that appeared amongst the relevant web pages, but only provide business-to-business marketing services to PA vendors (e.g. TechTarget), were not included in this analysis.

We mapped the vendors according to their types, terminologies and stated value propositions, to produce the PA landscape map shown in Table 2.

3.4. People analytics courses

After searching the Wikipedia list of MOOC by “Notable providers” (2017) we identified three with one or more of our keywords in their title. Two explicitly include the term PA, – both originating from universities, one in Russia and one in the USA. The other, developed by a Canadian consulting firm, uses the term HR Analytics.

All three are introductory-level courses, explaining how PA can be used for diverse HRM practices (see Table 3). Each covers different types of HR data and the various ways in which it can be analysed (Knowledge of the Sector) to achieve diverse organisational objectives (Awareness of Business Goals and Processes). Categorizing the curricula according to the 7 PA pillars framework (Isson & Harriott, 2016), revealed that the two courses specifically focused on PA covered cases related to Performance and development and lifetime value, Onboarding, culture fit, and engagement, Workforce planning, and Acquisition/hiring. Collaboration emerged as a separate theme, and is described in the course syllabus as “principles behind using PA to improve collaboration between employees inside an organisation so they can work together more successfully” (People Analytics course, Massey, Haas, & Bidwell, 2017).
4. Discussion

The results of our scoping review demonstrate the emergence of the term People Analytics and related concepts over the last 15 years, both within academic research and in online searches. They also delineate the value propositions stated by PA vendors and summarise the core training objectives of PA MOOC.

4.1. Terminological trends

Our analysis of the PA-associated terms used in academic sources and in Google searches reveals an evolving and diversifying field originating in the traditional HRM profession (historically influenced by industrial psychology), through a critical period of innovation in digital infrastructure, technologies and analytical capabilities, reflecting broader trends in the digital economy over the period studied. A range of relevant terms were already being used to search Google when records began in 2004, including Workforce Analytics, Human Resource and HR Analytics, although the latter terms only started appearing as keywords in academic articles from 2012. Human Capital was the first of our keywords to appear amongst the academic articles (in 2008). Academic articles specific to PA emerged only in the last two years and this is now the most popular of the relevant terms according to Google Trends, closely followed by HR Analytics. In practice, many of these terms are being used interchangeably, both by academics and vendors, although some practitioners align HR analytics with conventional HR and PA with a broader range of enterprise-level and strategic analytics (Van Vulpen, 2016). Google searches for one or more of our key terms took place in as many as 13 countries, with preferences for different search terms differing between regions (Our analysis of ‘Related words’ in Google queries also revealed a cluster of searches related to PA in India, which may be attributable to online activity surrounding the HR Analytics India Summit 2017) Among academics, the most commonly used terms were Workforce- HR-, People-, and Human Resource- Analytics, while vendor websites show a preference for Workforce-, Employee- and Talent- Analytics.

Changes in terminology over time reflect the evolution of the HR field, from conventional personnel management functions (e.g. payroll), towards the greater use of IT systems and data for strategic purposes such as workforce planning (e.g. Haines & Lafleur, 2008). They also suggest a re-branding of similar concepts by successive practitioner cohorts and vendors, as they seek to differentiate their knowledge, services or products in a competitive market. Elements of both the changing focus and rebranding of concepts can be seen in the recent appearance, both in academic papers and MOOC, of the concept of Collaboration or Relationship Analytics, reflecting the growing use of social media or organisational network analysis (see Objectives of PA).

4.2. Affiliation and disciplinary focus

Echoing a recent systematic review on HR Analytics (Marler & Boudreau, 2017), we observed that the authors of most published articles on PA came from consulting or technology companies. This trend has also been reported in previous research on HRIS, in which consultancy firms feature prominently (Ruel & Bondarouk, 2008). Most of the academic articles and PA courses included in our review approach PA as a sub-field of HR, which was also reflected in the headline curriculum of the three MOOC. Nevertheless, our analysis shows that research in this area is highly interdisciplinary. While most articles come from the Business, Management and Accounting domains, social science has remained prominent, and the importance of the computing and data sciences is increasingly evident, echoing the growth of HRIS and digital innovations for monitoring, evaluating and predicting work.

4.3. Objectives of PA

The most popular objectives and practices, based on Isson and Harriot’s 7 pillars model, were performance assessment and development and employee lifetime values; onboarding, culture fit, and engagement, and workforce planning. Our thematic analysis yielded four additional categories – employee collaborations; diversity and inclusion; people risks, and inter-organisational relationships. The emergence of these categories illustrates the rapid development and diversification of the field, as already discussed with reference to terminologies and disciplines. One example is the shift in emphasis from HR practices focused on individuals, to their interactions, affiliations and performance as groups, including the use of data on social and organisational networks. The significance of this shift has recently been highlighted in a report by Bersin for Deloitte (2016), who predicts that relationship analytics will soon come to replace traditional organisational design/re-design approaches. An increasing emphasis on measuring people risks (Marsh Risk Consulting, 2017) via analytics is also noteworthy, including not only conventional risks such as staff attrition, organisational reputation or customer safety, but also new forms of cyber-risk for which these new methods are well-suited, such as hack vulnerability or data theft (e.g. Royal & Windsor, 2016). Other recent trends include the use of linked employee data and analytics as a substitute for conventional psychometric testing in the acquisition and management of talent (indeed, the term PA was historically used to describe this sort of test-based employee profiling). One market indicator of this emerging trend, is the recent acquisition of psychometric assessment specialists Cut-e by AON, a global professional services firm that uses data and analytics to help companies manage workforce risks, health and retirement (Consultancy.uk, 2017).

4.4. Business value offered by PA

All of the companies identified through our online searches are either service providers or technology creators. Providers of PA services typically offer strategic and operational consulting aimed at improving the collection, management and use of data for understanding and evaluating work behaviour or outcomes and optimising human resources. PA technology vendors offer IT systems for achieving these aims by making workforce intelligence and predictive analytics more accessible, thus supporting strategic decision making and improving business outcomes, reflecting the vision of ‘actionable analytics’ (Dykes, 2016). Cross-referencing vendors’ stated solutions with the coded articles in our review revealed some overlap in vision and intentions, but little evidence of the benefits promised. Thus, while business analysts are promoting new ways of creating measurable organisational impacts through PA, objective academic research is needed to evaluate these.

4.5. PA skills being sought

An indicator of how companies are actively seeking value from PA can be seen in the MOOC we analysed, including the market leader in PA training (Wharton Business School). The fact that we were able to identify only three such courses, only one of which was explicitly labelled as “People analytics”, suggests that the supply of training is far from sufficient to meet the need for relevant skills amongst HR professionals. Nevertheless, the increasing inclusion of PA within university curricula on business and management (e.g. the HR Analytics and Research course from the University of Denver, USA), along with new programmes in data science (e.g. the MSc in Data Science, Technology and Innovation from the University of Edinburgh, UK), and the emergence of other relevant online courses (e.g. People Analytics training with Gene Pease) will go some way towards addressing this deficit. In the meantime, the growth in professional conferences focused on PA (e.g. the Wharton People Analytics Conference or HR Analytics...
India Summit 2017) indicates the desire, primarily amongst international HR professionals, to fill this gap. The establishment of a new “HR Analytics Academy” in 2016 in the Netherlands, also suggests that these ‘advanced’ approaches will soon be finding their way into routine HR practices.

4.6. Working definition

In their recent review, Marler and Boudreau (2017) summarise HR analytics as: “An HR practice enabled by information technology that uses descriptive, visual, and statistical analyses of data related to HR processes, human capital, organisational performance, and external economic benchmarks to establish business impact and enable data-driven decision making”. While our broader scoping analysis reveals similar objectives, we note that vendors such as Accenture, IBM and QuestionPRO have begun to extend this to improvements in employee experience and satisfaction. Indeed, employee experience was identified as key priority for future HR in the latest Deloitte (2017) report, which states: “The concept of ‘total employee experience’, focused on design thinking and the simplification of work, will become a major focus in HR”. Thus, based on our study, we would offer the following definition of People Analytics “People Analytics is an area of HRM practice, research and innovation concerned with the use of information technologies, descriptive and predictive data analytics and visualisation tools for generating actionable insights about workforce dynamics, human capital, and individual and team performance that can be used strategically to optimise organisational effectiveness, efficiency and outcomes, and improve employee experience”.

5. Conclusions, caveats and recommendations

Scoping reviews are exploratory research exercises and the intention here was to provide insights about this emerging area by mapping the terms, concept and practices associated with PA, rather than to provide an in-depth analysis of PA innovations, professions, markets or research. The results nevertheless indicate the direction of developments and the increasing readiness of PA to embrace new innovations and market demands. Given the rapid pace of technological change, this represents only a snapshot of the field to date.

One purpose of scoping reviews is to inform the design of future systematic reviews by testing and refining literature search strategies. Here, this enabled us to identify a more comprehensive set of search terms than we had previously been aware of and showed that focusing on activities explicitly described as ‘analytics’ is no guarantee of revealing the diversity of the domain. It also demonstrated the importance of widening searches beyond academic databases to uncover relevant grey literature, and of including emerging terms such as “Human Capital Data”, “Human Resource data”, “Talent data”, “Workforce data”, “Analytics in HR”, “HR metrics”, “HR predictive analytics”, “Collaboration Analytics”, “People Intelligence”, “Labor Analytics” and “Relationship Analytics”. The diversity of disciplines represented amongst academic and online sources of PA insights also suggests that scholars and practitioners interested in this topic should look beyond the HR or management literature for relevant studies, including in specialist sectors where PA is being applied, such as banking, security or healthcare, and examine real-world applications in addition to academic research.

The first page of Google results arising from each key search term provides only a snapshot of the vendor ecosystem. Deeper, iterative web searches, and consultation exercises with PA experts would be valuable for understanding the ‘analytic maturity’ of organizations in diverse sectors, drawing on existing frameworks (e.g. Lismont, Vanthienen, Baesens, & Lemahieu, 2017; Grossman, 2018), as well as for elucidating the changing business demands for PA and identifying PA services not represented online.

Finding so few empirical studies leads us to join other reviewers in calling for more academic research in this area, including evaluation
studies, case studies of PA implementation and simulation studies exploring the potential outcomes of new PA models before they are implemented, as well as to examine the nascent introduction of machine learning and Artificial Intelligence in the context of workforce management (Meister, 2017).

Amongst the wide variety of sources examined, we noted a marked absence of ethical considerations in relation to PA practices, some of which are covert or reach beyond the boundaries of organisations themselves. Examples include the monitoring of personal social media or email activity, which have implications for privacy, the use of algorithmic decision making for recruitment or promotion, which has potential to introduce bias and discrimination, and the digital abstraction of personality and ability profiles from real world data without the need for psychometric testing, which raises issues for transparency and consent (Wiedemann, 2018). With advances in privacy regulations, such as recently enforced European General Data Protection Directive, PA practitioners may soon have to re-think some of these approaches. Although lawyers, ethicists and management scientists are already addressing some of these issues (e.g. Bodie, Cherry, McCormick, & Tang, 2017; Dagnino, 2017; Pasquale, 2015), our observations suggest that this is a blind spot for the PA profession itself and we recommend further research to understand how practitioners, vendors and employers are reconciling the drive for innovation with requirements for transparency and accountability. Ethics in PA will be the focus of a special Professional Development Workshop at the 2018 British Academy of Management Conference, which also draws on this review (Pagliari, Tursunbayeva, & Antonelli, 2018).

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Appendix A. Relative popularity of keywords in individual countries (from Google Trends)*

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<th>India</th>
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<td></td>
<td></td>
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<td>Singapore (100)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Netherlands (40)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>South Africa (27)</td>
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<td></td>
<td></td>
<td>Brazil (19)</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Germany (17)</td>
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<td></td>
<td></td>
<td>Spain (11)</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Poland (3)</td>
</tr>
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<td>People Analytics</td>
<td>51</td>
<td>44</td>
<td>27</td>
<td>43</td>
<td>50</td>
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<td>Workforce Analytics</td>
<td>53</td>
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<td>46</td>
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<tr>
<td>Talent Analytics</td>
<td>49</td>
<td>88</td>
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<td>–</td>
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</tr>
<tr>
<td>Human Capital Analytics</td>
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<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
<tr>
<td>Employee Analytics</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
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<td>Human Resource Analytics</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td></td>
</tr>
</tbody>
</table>

* Google Trends description: Values are calculated on a scale from 0 to 100, where 100 is the location with the most popularity as a fraction of total searches in that location, a value of 50 indicates a location which is half as popular, and a value of 0 indicates a location where the term was less than 1% as popular as the peak. Note: A higher value means a higher proportion of all queries, not a higher absolute query count, so a tiny country where 80% of the queries are for "bananas" will get twice the score of a giant country where only 40% of the queries are for "bananas".

Appendix B. Related words used in searches for People Analytics terms (Google trends, searched on June 16, 2017)*

<table>
<thead>
<tr>
<th>Related topics</th>
<th>Employee analytics</th>
<th>HR Analytics</th>
<th>Human Capital Analytics</th>
<th>Human resource analytics</th>
<th>People Analytics</th>
<th>Talent Analytics</th>
<th>Workforce Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR Objectives/ Practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Employee benefits</td>
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<td></td>
</tr>
<tr>
<td>Employment</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human capital</td>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human resource management</td>
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</tr>
<tr>
<td>Human resource management system</td>
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</tr>
<tr>
<td>Human Resources</td>
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<td>25</td>
<td>100</td>
<td>5</td>
<td>30</td>
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<td>Workforce</td>
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<td>10</td>
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<td>10</td>
<td>95</td>
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<tr>
<td>Workforce management</td>
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<tr>
<td>Workforce planning</td>
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<td></td>
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</tr>
</tbody>
</table>
India 5 5

*Related topics in Google Trends defined as “users searching for your term also searched for these topics”. Includes results for the most popular topics (or Top): Scoring is on a relative scale where a value of 100 is the most commonly searched topic, a value of 50 is a topic searched half as often, and a value of 0 is a topic searched for less than 1% as often as the most popular topic.

Appendix C. Analysed articles from Scopus, HCA group, and Marler and Boudreau lists

<table>
<thead>
<tr>
<th>N</th>
<th>Reference</th>
<th>Journal Discipline</th>
<th>Keywords used</th>
<th>PA objective</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Scopus List</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Human resource information systems</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Big data</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Incentive systems</td>
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<td></td>
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<td></td>
<td>- Information technology</td>
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<td></td>
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<td></td>
<td>- Performance pay</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Production function</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Principal-agent model</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Complementarity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Enterprise systems</td>
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<td></td>
<td>- ERP</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>- Productivity</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Dong, S., Johar, M., &amp; Kumar, R. (2013). Workforce analytics for knowledge-intensive service delivery using a private service marketplace. In <em>WITS 2013 - 23rd Workshop on</em></td>
<td>Computer Science</td>
<td>- N/A</td>
<td>- Generic</td>
</tr>
</tbody>
</table>

Information Technology and Systems: Leveraging Big Data Analytics for Societal Benefits.


Marler And Boudreau List


11. - N/A - N/A - Generic


**HCA Group List**


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**Appendix D. Vendors’ descriptions and the definitions they follow**

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Definition</th>
<th>Web Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deloitte</td>
<td>Smarter insights with workforce data analytics. Analytics perspectives and solutions Can you predict which high performers are at risk of leaving months before they resign? Merge external data with your own business metrics to project next year’s workforce demand? And can you triage resumes to predict employee success and tenure – before you hire? Here are just a few examples of how companies can gain smarter insights and stronger outcomes with workforce data analytics and cognitive computing.</td>
<td>Not specified</td>
<td><a href="https://www2.deloitte.com/us/en/pages/deloitte-analytics/solutions/analytics-in-action-workforce.html">https://www2.deloitte.com/us/en/pages/deloitte-analytics/solutions/analytics-in-action-workforce.html</a></td>
</tr>
<tr>
<td>TechTarget</td>
<td>We are a trusted information hub for all the essential human resources (HR) technology you rely on to do your job. We know that HR leaders have many difficult, strategic technology decisions to make when trying to find the best employees, keep them happy, and get them paid. <em>Workforce analytics</em> is a combination of software and methodology that applies statistical models to worker-related data, allowing enterprise leaders to optimize human resource management (HRM).</td>
<td></td>
<td><a href="http://searchhrsoftware.techtarget.com/about">http://searchhrsoftware.techtarget.com/about</a></td>
</tr>
<tr>
<td>Company</td>
<td>Description</td>
<td>Source</td>
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<td>------------------</td>
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<td>--------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Competitive</td>
<td>Competitive Analytics [CA] helps organizations integrate all the necessary analytics and develop a strategy to truly get the best from your team. We help you understand who your top performers are, where inefficiencies may occur, and how you can recruit, empower, and motivate other employees. CA helps you ensure that the data being used is timely, clean, and accurate. Because organizations often have employee related data spread throughout departments, in myriad file formats, and within multiple systems, Competitive Analytics blends data sources to develop a complete workforce database, which can then be easily used to develop your employee analytics. Competitive Analytics displays our comprehensive labor analyses in easy-to-interpret, interactive dashboards so executives can make employee related decisions immediately.</td>
<td><a href="http://competitiveanalytics.com/employee-analytics/">http://competitiveanalytics.com/employee-analytics/</a></td>
<td></td>
</tr>
<tr>
<td>Analytics</td>
<td></td>
<td>Gartner defines <strong>Employee Analytics</strong>, also known as Workforce Analytics, as, advanced set of data analysis tools and metrics for comprehensive workforce performance measurement and improvement. It analyzes recruitment, staffing, training and development, personnel, and compensation and benefits, as well as standard ratios that consist of time to fill, cost per hire, accession rate, retention rate, add rate, replacement rate, time to start and offer acceptance rate.</td>
<td></td>
</tr>
</tbody>
</table>
| McKinsey &       | Identify and enable talent-driven performance  
Top employees outperform average employees by up to eight times. To stay ahead, leading companies identify, attract, develop, and retain these top employees. How do they do it? By developing a people strategy that is based on data and analytics. | https://www.mckinsey.com/business-functions/organization/how-we-help-clients/people-analytics |
| Accenture        | Imagine all the questions you’ve ever had about your workforce answered: which people are needed for specific projects? Do you have the resources you need to successfully grow your organization? How are individuals performing against KPIs? Analytics reveals the answers, giving you solid, reliable insights so you can plan, recruit and manage with confidence. We’ll help you analyze HR trends, set workforce capacity and capability goals, track progress, monitor performance and automate services. By equipping you with integrated, strategic insights we can help you speed up decisions, reduce risk and empower your management team. | https://www.accenture.com/us-en/service-accenture-analytics-talent-and-hr-analytics   |
| IBM              | HR analytics enable organizations to use their wealth of employee data to make better decisions about their workforces and improve operational performance. From attracting top talent, to accurately forecasting future staffing needs or improving employee satisfaction, HR analytics tools empower organizations to align HR metrics with strategic business goals. | https://www-01.ibm.com/software/analytics/solutions/operational-analytics/hr-analytics/     |
| PWC              | Our tactical and predictive analytics programs will help you address specific workforce trouble spots so you can manage issues before they appear. We’ll show you how to build your Talent Analytics solutions. Point solutions demonstrate ROI of people analytics to the business | https://www.pwc.com/us/en/hr-management/people-analytics/predictive-analytics.html         |
We have a wide range of experience assisting clients with targeted analytic, modeling, and forecasting requirements to address the top workforce concerns today. We have pre-built talent analytics services to cover the full HR/employee lifecycle – from talent acquisition to performance, safety & learning management, to retention and retirement – all designed to assist your organization solve critical workforce and business objectives. We offer analytics around total rewards that will enable your organization to optimize across different benefits and compensation options. Every talent analytics and predictive service we offer has one goal in common: apply advanced analytic techniques to solve a critical workforce problem and thereby, demonstrate value of talent analytics to the entire organization.

**Kronos**
Transform your workforce data into actionable insights. Organizations need to identify, predict, and manage opportunities for cost savings and productivity gains — all while improving the quality of their products and services. But how can they achieve productivity gains and stay within budget when they lack a reliable way to measure and analyze workforce performance?

**SAP SuccessFactors**
Improve business decisions with trusted intelligence from SAP SuccessFactors Workforce Analytics. Benefit from the technology and expertise of a global leader in people analytics and business intelligence solutions to accelerate your organization’s understanding of Big Data in HR and use workforce data strategically to drive business impact. SAP makes workforce analytics simple and accessible for HR professionals, analysts, and business partners so they can quickly and accurately answer key questions about your workforce and influence talent and business decisions being considered by your managers and executives.

**Talent Analytics**
Why Talent Analytics? 8 Compelling Reasons to Engage with Us:

**Ultimate Software**
HR leaders use workforce analytics in various forms, such as predictive and prescriptive analytics. Predictive Workforce Analytics helps managers comb through mounds data to determine which employees have the...
greatest potential of success with the
organization. The data also predicts
which employees are most likely to leave
in the near future.

Prescriptive Workforce Analytics
prescribes actions HR leaders can take to
help develop and retain key members of
the workforce, based on data uncovered
from predictive analytics.

Both are an essential part of workforce
analytics and when used together, these
tools can make all the difference!

Why Do Companies Invest in Workforce
Analytics?

All great companies are made up of the
right people in the right positions.

Workforce analytics allows HR leaders to
determine who the right people are,
which tasks suit them best and how to
ensure they remain satisfied in their roles.

Ultimate Software has designed
workforce analytics tools that are easy to
understand and utilize effectively.

Analytics aren’t just for statisticians
anymore. A growing number of
organizations are using analytics to
examine and act upon data about their
people in the workplace. Known as
workforce analytics, these sophisticated
tech tools are changing the HR game, and
those companies willing and able to
harness the power of Big Data for
analytics are seeing great gains and
meaningful advantages over their
competition.

UltiPro*

At Ultimate Software, our award-winning
solution for HR, payroll, and talent
management, UltiPro*, offers a range of
predictive and prescriptive analytics
designed to combine managers’ expertise
with proven algorithms. The winning
result? Knowledge without bias.

Visier

Visier Workforce Intelligence is a cloud-
based people strategy platform that
provides answers to hundreds of pre-built,
best practice questions, across a range of
HR and business topics. Unlike the reports
offered by your HR management systems,
Visier delivers insights. Insights that
reduce resignations. Sharpen recruiting
effectiveness. Optimize learning. And
drive business outcomes.

QuestionPRO

Employee analytics tool providing 360
reviews, online surveys, weekly pulse to
increase employee retention, improve
morale, and create workforce efficiency.

TalentLMS

Simple and comprehensible analytics
about everything that happens inside
your elearning environment.

Cornerstone

What Are the Benefits of People
Analytics?

People analytics helps organizations to
make smarter, more strategic and more
informed talent decisions. With people
analytics, organizations can find better
understanding and assist in overall
management.

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offered by your HR management systems,
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about everything that happens inside
your elearning environment.

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People analytics helps organizations to
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informed talent decisions. With people
analytics, organizations can find better
understanding and assist in overall
management.
applicants, make smarter hiring decisions, and increase employee performance and retention. Cornerstone’s suite of people analytics products apply sophisticated data science and machine learning to help organizations more efficiently and effectively manage their people. Cornerstone’s analytics suite gives organizations options for viewing, understanding and acting on talent data across the entire employee lifecycle. This includes Cornerstone View, an interactive data visualization application that gives business leaders deeper intelligence about their people, Cornerstone Planning, an intuitive workforce planning application that helps organizations easily create, manage and execute accurate hiring plans over multiple time horizons, as well as Cornerstone Insights, its predictive and prescriptive analytics solution that equips business leaders with the intelligence to better recruit, train, manage and develop their people.

technology and expertise to large sets of talent data, which results in making better management and business decisions for an organization. People analytics is a new domain for most HR departments. Companies are looking to better drive the return on their investments in people. The old approaches of gut feel is no longer sufficient.

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Digital Academy and the Global Interprofessional Workforce Council.