Big Data in Human Resource Management - Exploring Opportunities and Challenges to Manage Human Capital

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Abstract

Research has been transformed by big data analytics in a lot of areas like corporate areas of accounting, marketing, supply chain management, and finance. Discussions related to big data analytics have focused mainly on screenings of job candidates in HRM. This study will focus on the usage of big data analytics to address the concerns related to human capital, so that HR can improve the overall productivity of the firm.

This study will also focus on assessing workforce performance with big data sources in real-time to identify and develop the talents who can play a vital role in firm performance and strengthen capabilities of the firm. To ensure successful implementation of big data in the field of HRM, there is also a need to address ethical and regulatory issues like privacy concerns. This study will also discuss how big data can make strategic change in the human resource management and firm as a whole. To fulfil all these objectives, this study will be based on literature search by searching for relevant studies conducted in recent years related to big data analytics. It will add further knowledge to the domain of human resource and help practitioners to address challenges and help organizations to make the most of opportunities related to big data analytics.

Keywords: Big data analytics, human capital, human resource management, human resource, firm performance, supply chain management

1. Introduction

Human resource management (HRM) departments have started making decisions on the basis of big data. Most of the decisions were based on screening of candidates back then (McAbee et al., 2017; Angrave et al., 2016). HR professionals were used to rely on "software to sort through job applications and social media to reduce administrative costs. It is making sense with the views of HR staff. Screening of candidates is a tough, serious task for HR functions. Public databases have a huge volume of data for sorting through and analysing patterns to predict the right candidates and assess those databases that can cost less than

processing applications manually, while resulting in higher chances to interview the right candidates without processing the wrong ones.

From the overall perspective of the firm, "HR-based big data analytics must not be limited to screening of candidates or saving operation costs. The big data should be used to capture the strategic connection between profitability and human capital and to find out how HR can improve the knowledge and skills of employees to improve overall efficiency of the organization and competitive edge (Jackson et al., 2014). For instance, Ployhart et al. (2014) argued the unique combination of human capital resources" and how they are aggregated with a collective goal to create synergies in the firm which are less mobile and more inimitable with their causal ambiguity, social complexity, and dependency.

1.1 Background

Firms can improve profits over costs by improving the value of workforce by providing specialized skills to elicit more knowledge and greater effort or by controlling the cost of human capital (Chadwick, 2017). HR is strategically responsible for finding and nurturing talents who excessively improve the company knowledge and grab opportunities whenever they can (Call et al., 2015; Aguinis & O'Boyle, 2014; Kehoe et al, 2018). HR analyses have usually been based on a conclusion of what has actually happened, instead of assessing what might be possible (Levenson, 2018). Big data holds a huge volume of data which is being recorded constantly from different sources to perform predictive analytics. HR can choose the right actions and allocate resources well with the help of predictive analytics (Wang & Hajli, 2017; Lipkin, 2015; Watson, 2014).

However, there are significant complexities and challenges when using big data in HR (Cappelli, 2017). HR directly controls the data which is quite static. It means there is no specific volume, velocity, or variety (McAfee & Brynjolfsson, 2012). Hence, Cappelli (2017) is absolutely right in this manner. Some studies have also found that a lot of HR managers are not well qualified in big data analytics most of the time (McIver et al., 2018; Angrave et al., 2016). But it may be important to answer strategic questions related to human capital for competitive advantage of the firm. HR should start analysing various sources of data to be relevant, especially the information collected from external purview of HR to evaluate the efficiency of employee, and improve company performance as a whole.

2. Literature Reviews

Digitization has already played a significant role in redefining working approaches and the overall environment of the workspace. The digitization of HRM is among the most explored topics in recent literature. Zehir et al. (2020) investigated the transformation of HRM with AI and big data technologies and their effect on corporate performance. First of all, they discussed the overall impact of digitization on strategic HRM and how AI and big data can improve the "strategic growth of HR. Secondly, they explored the role of digitization in evolution of HR since 1945. With technology advancements, businesses also change the way they manage human capital. Third, they discussed the significance of AI and big data in HR. Finally, they discussed the role of HR in corporate performance with digital transformation of HR. Future directions and suggestions are provided for both researchers and HR professionals to promote the overall performance."

AI and big data have become relevant and attractive to companies and consulting service providers. Practitioners and researchers in HRM and "industrial-organization psychology (IOP)" can add a lot of value to AI and big data by contributing their expertise in measuring data related to workforce and analyse the same to manage big data results legally, ethically, and professionally. Oswald et al. (2020) conducted a study on framework and perspective for big data associated with HRM and IOP, including both macro issues

(like changing big data, developing teams, educating candidates and professionals, legal and ethical concerns) and micro issues (like decisions on inclusion of data, linking data sources, etc.). At the end, HRM and IOP practitioners and researchers will be highly important to contribute to the algorithms, substance, communities, and technologies to address AI, big data, and ML applications and problems in companies associated with their expertise.

Wan & Liu (2021) evaluated whether "empowerment-focused human resource management (EHRM)" and "big data enabling (BDE)" can promote intrapreneurship of employee and their impacts on innovation of platform enterprises. They also investigated the contexts of impact on business performance from intrapreneurship. They collected survey data from 155 platform enterprises in China through questionnaire. The sample population included senior and middle managers with complete knowledge of enterprise. It is found that EHRM, BDE, and their combination have positively impacted intrapreneurship which can further improve overall performance of the firm. "Employee intrapreneurship especially had partial mediating role among EHRM, BDE, and performance and complete mediating role among performance and synergy. There was a positive moderating role of "platform strategic flexibility" between employee performance and intrapreneurship." Platform enterprises must be based on utilization and construction of EHRM and big data to promote vitality in the organization and motivate employees to build flexible strategies for adapting with dynamic environment.

Singh & El-Kassar (2019) investigated the level of sustainable capabilities driven by "corporate commitment" by integrating "green supply chain management, big data technologies, and green human resource management" practices as well as how these capabilities can improve the firm performance. They also investigated the extent to which green HRM affects the adoption of big data and improves the relation between both external and internal green SCM practices and their impact on sustainable performance. With dynamic capabilities theory, they proposed an empirically tested conceptual model." The findings established the impact of strategies based on big data on corporate growth when it comes to sustainable performance given internal processes. The study suggested integrating green SCM, big data, and green HRM practices to improve sustainable capabilities of the firm for better performance.

There are basically three trends of digitalization which are bringing HRM to 21st century and redefining the way businesses work and will keep doing so – (1) applying HR analytics in the whole HR lifecycle, (2) emergence of big data in firms, and (3) using artificial intelligence (AI). Lengnick-Hall et al. (2018) covered each trend and major concepts of them for overall foundation of the topic. Secondly, they explained how each of these trends can affect HRM. They explained them with examples of how companies are expanding the use of new practice. Third, they identified some issues related to HRM and concluded with how HR professionals and functions will change in future.

2.1 Research Gap
After conducting literature survey, it is found that majority of studies are conducted on big data analytics and HRM functions. However, there is a vast research gap when it comes to analyse challenges related to using big data in HR and how it can help resolve concerns related to human capital. Hence, this study will fill this knowledge gap and open further research directions.

2.2 Research Question
- What are the challenges in using Big Data analytics faced by HR?
- What are the key big data sources that can address human capital concerns?
- What are the ethical and legal challenges in using big data?

2.3 Research Objectives

- To discuss some of the "challenges faced by HR in using Big Data Analytics"
- To explore major big data sources to address concerns related to human capital
- To review related ethical and legal challenges in using big data

3. Research Methodology

In order to fulfil the objectives of this research, this study adopts "qualitative research approach" which is based on literature search design. Hence, keyword search was conducted using terms like "big data," "big data in HRM," "human capital," "big data challenges for human capital," and so on. On the basis of qualitative analysis, this study proposes some of the most successfully implemented models by researchers related to big data and human resource management.

4. Data Analysis

Considering previous studies, it is observed that business analytics and big data will need companies to redesign the way to approach, refine, and design those approaches and how to align resource planning and allocation strategically. In addition, it has changed the way their expected outcomes are revaluated, their relation with strategic goals, and develop proper key performance indicators. Figure 1 illustrates a research framework which covers the overall research agenda of Mikalef et al. (2019).

**Figure 1** – A Research Framework for business analytics and big data
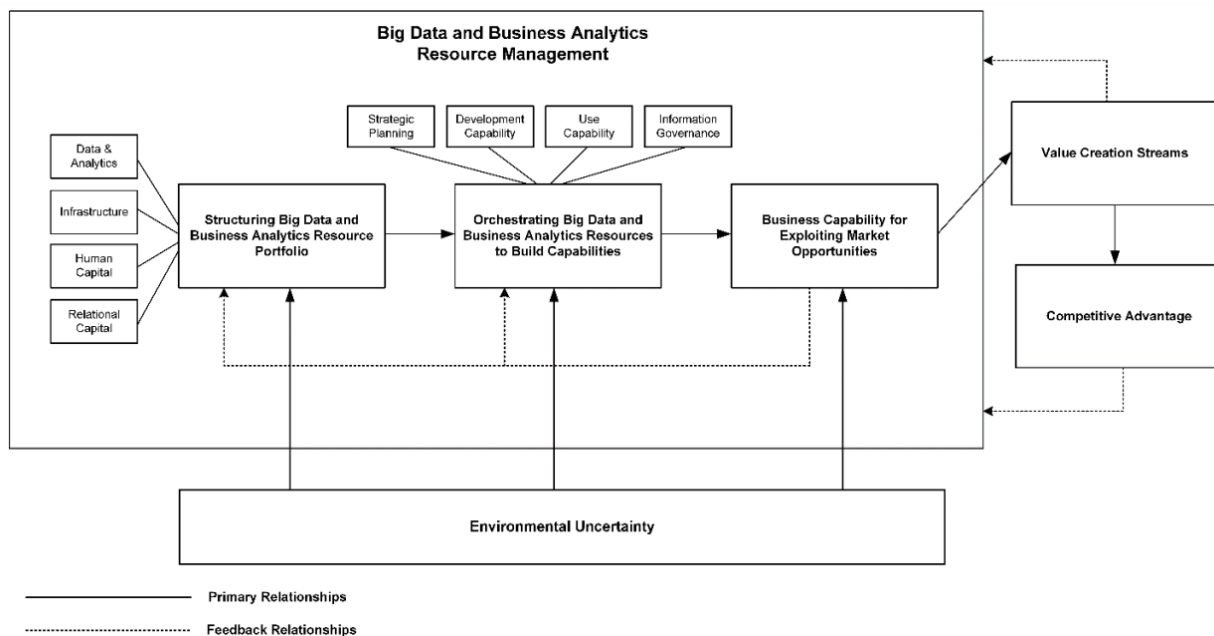
Source – Mikalef et al. (2019)

Proposed HR Analytics Model
Using analytics refers to improvement of operations in key areas and it is found that HR analytics is helpful to HR managers to improve contribution of HR to firm performance. Researchers have observed that there is a lack of testing of HR analytics models which affected their implementation (King, 2016; Angrave et al., 2016; Reddy & Lakshmikeerthi, 2017; Minbaeva, 2017). Due to embryotic nature of HR analytics, there are also limited empirical evidences to identify the typical HRA model and there is also low adoption of this model which affects the growth of best HRA practices which are universally accepted. Etukudo (2019)

explored the strategies of HR managers to implement HRA for firm performance. Several methods and approaches have been discussed for HR analytics along with theoretical recommendations and models. By considering the suggested models and methods in previous studies, Etukudo (2019) developed a model to implement big data analytics in HR (Figure 2). It consists of vital procedures needed to make big data analytics successful in HR.

Figure 2 – Proposed Model for Implementing Big Data Analytics in HR
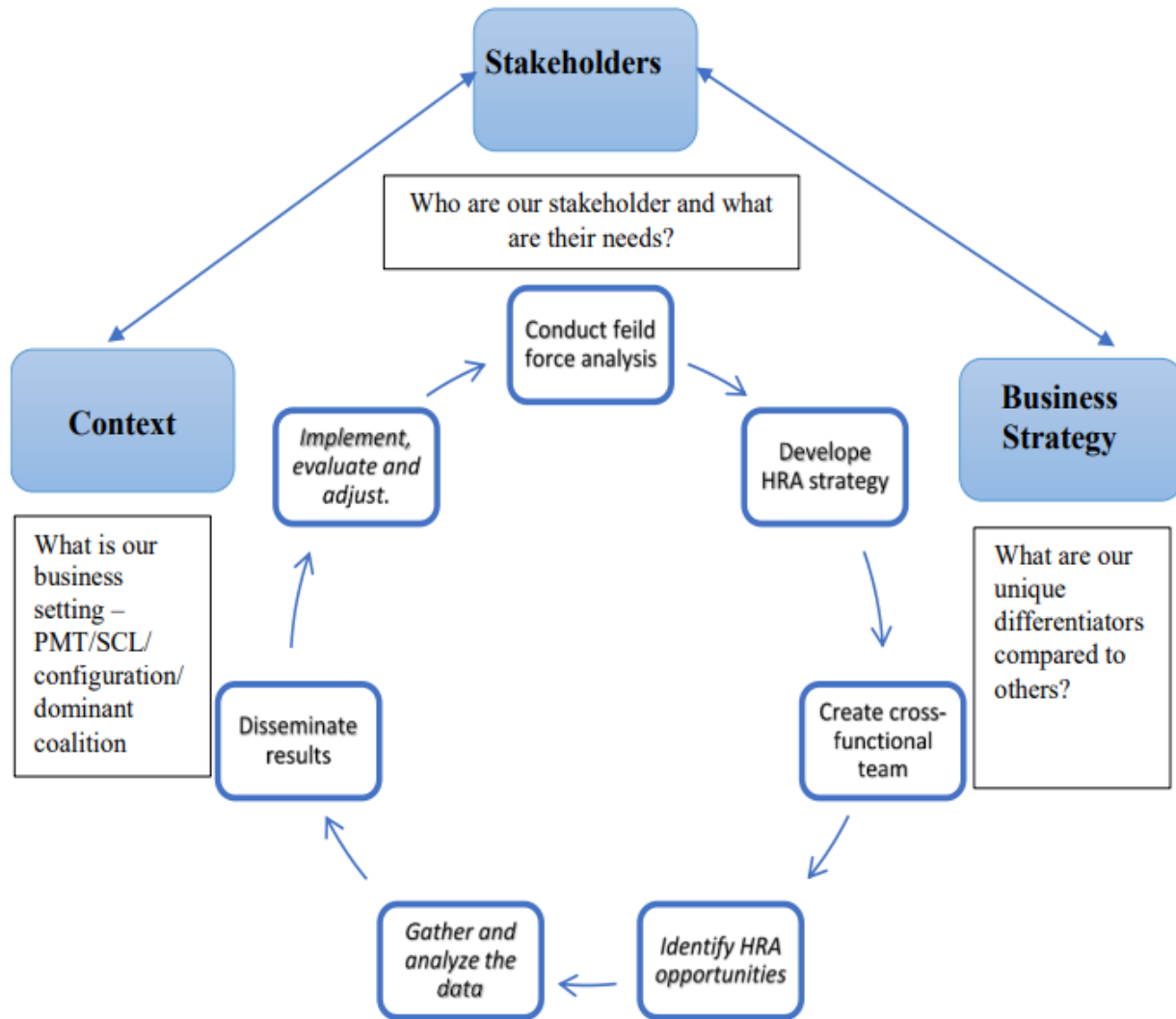
Source – Etukudo (2019)

4.1. Challenges in using Big Data analytics faced by HR

4.1.1. Knowledge of HR team

HR must have support from top management to manage big data analytics. A lot of HR members are not "trained as data scientists (Waters et al., 2018). They have to achieve complete knowledge of how analytics works even though HR doesn't perform data processing itself. Senior HR managers have to know how variables must or could interact when analyses address strategic queries properly and avoid spurious conclusions and irrelevant analysis (Minbaeva, 2018; Angrave et al., 2016). For instance, it would not be

easy to get implication on the potential of applicant completely on the basis of several typos in profiles made on LinkedIn (McAbee et al., 2017).

HR managers should have basic knowledge of research methodology, such as construct validity and reliability, to be effective (McAbee et al, 2017; Janssen et al., 2017). According to Marler & Boudreau (2017), when there is a conflict between manager's beliefs and data analysis, beliefs usually win. Hence, HR should be ready to justify the findings of big data and why it should be counted on over traditional faith, given that analytics have been done precisely.

4.1.2. Analysing specialized, disparate data

A lot of relevant data sets don't belong to HR systems for big data. Rather, they are spread over several parts of the business (Marler & Boudreau, 2017; Angrave et al., 2016). Performance of an employee is evaluated not only on the basis of HR reports and appraisals, but also in domains like production, marketing, and customer service information as analytics are cross-functional by nature (McIver et al., 2018). Data must be centrally owned by the firm instead of a business unit (Minbaeva, 2018). Centralized management strengthens top management for big data analytics.

4.1.3. Lack of collaboration with stakeholders

It is important to have a strategic partnership with major stakeholders to ensure effective analytics of HR big data. At the end, line managers take care of key data and have a direct influence on productivity, human capital, and firm performance (Sikora & Ferris, 2014; Armstrong, 2016). It is important to consider big data in best interest of everyone. The firm performance can be improved with a partnership between line managers and HR. HR and line management would both show interest to learn the excellence of training programs in consumer satisfaction and quality, along with association of retention programs with improved customer service. Employees are also important stakeholders as they have direct association with collection of data. It is important to have transparency on type of data being collected and strategic nature of analytics (Tomczak et al., 2018).

4.2. Big Data Sources that can address Human Capital Concerns

The concept of machine learning is the technology that works behind big data. It is quite confusing when software segments dataset and processes the data constantly until the program learns correlation among variables by detecting patterns and developing models which complete dataset to understand the relation and predictors. For example, a huge set of patient data is used by the researchers to know the factors contributing to specific disease (Wang & Hajli, 2017). A Google's undertaking, "Verily" is aimed to determine common predictors of blindness (Harris, 2019).

In contrast, a lot of data sources are available to help decision makers in real-time to gain knowledge about common patterns and quick options for interventions. The pros and cons of some data sources are listed in Table 1, which will soon be available and are now available (Waters et al., 2018). HR usually uses only one of these indicators. Without having the ideal solutions of data analysis, some of the common downsides are also discussed with these sources.

Table 1 – Pros and Cons of some Data Sources

Data Sources	Pros	Cons
HR data	Easily available	Relevant details may be non-existent
Operations/Production Data	Accurate evaluation of output may be provided	HR access may not be possible by organisational elements

Video analytics	Possibility to identify behaviours	Not completely functional yet
Social Media	Might be available	Marketing may control it. HR doesn't use it for internal evaluations
Sensor data	Possibility to identify actual employee output and quality	Lack of infrastructure

4.2.1. Social Media

HR big data analytics usually rely on social media data, especially data available in LinkedIn, for screening applicants (Davison et al., 2012). Aggregated comments from social media by users of the service or product of firm can be the answer to a lot of questions. Social media can be analysed by firms like TMobile and Heineken can help find out which features or products are winning acceptance from consumers and whether branding and advertising are effective (Peterson, 2016; Marr, 2017).

4.2.2. Video Analytics

Though still in the beginning, video analytics can be helpful in contexts of operations in contexts of retail service or shop floor to know the changes in performance. Point of sale, inventory, and video analytics can be helpful to detect incidents and patterns of theft (Austin, 2018). Video screenshots can be used at safety checks when actions are not taken well (McAbee et al., 2017). There are other uses of this technology like mapping real-time behaviour of customers for improving experience (Borad, 2017). With the maturing of technology, the analytics can help find out the performers who have exceeded standards to be used as paradigms for training. For instance, video analytics can help find out when consumers can be served more likely with polite behaviour.

4.2.3. IoT

These days, a lot of products are compatible with chips and sensors to report status of the product back to the consumer or manufacturer, which creates an "Internet of Things (IoT)" collectively (Lee 2017; Krotov, 2017; Saarikko et al., 2017; Porter & Heppelmann, 2014). These days, apparel retailers like Marks & Spencer and Macy's use RFID tags for inventory management, while brands like Gucci use the same technology to avoid counterfeiting of products (Caro & Sadr, 2019). Using IoT for big data in a lot of contexts would need software, transmission, storage, and sensor capabilities to be integrated and available (Lee & Lee, 2015; Krotov, 2017).

4.3. Ethical and Legal Challenges in using Big Data

When it comes to HR big data analytics, unintentional violation of the "Equal Employment Opportunities Act," "Title VII of the U.S. Civil Rights Act," "Americans for Disabilities Act (ADA)" and other regulations and rules related to job discrimination is the most serious legal concern. It goes without saying that most of the senior HR managers would reject the conclusion of analytics as illegal and as false as possible when the data predicts that overall performance of the firm would improve when all minorities were demoted of specific ethnicities. However, issues related to discrimination with big data might be more subtle and serve to worsen earlier patterns of discrimination.

Even though the data sets don't contain ethnic or racial backgrounds, it could be the fact that data analytics might claim that a specific group of staff are excellent and training must be based on the experiences and background of that group. If the work culture had tolerated the subtle discrimination earlier, the conclusions might be technically right from big data analytics, i.e., identifying actual stars is accurate. This way, machine learning can repeat understood biases. In this case, data would not just exclude potential stars, but they also refuse proper experiences or academic backgrounds that can help predict potential stars. Hence,

senior HR managers should guide data scientists to be specific to analyses which can worsen potential patterns of discrimination or confirm common biases.

Privacy is another major concern with the invasive use of analytics. Companies like Amazon, Microsoft, Walmart, etc. have introduced tracking platforms for collecting geolocation, audio, and accelerometer and other information from employees on daily basis (Shell, 2018; Heath, 2016; Sheng, 2019). These systems are capable to identify knowledge-sharing and predictive actions by teammates and people, such as, identification of informal workgroups with members in several spots (Shell, 2018). Though these employers and researchers are probably well-intentioned, there are 64% employees who were concerned on potential eroding of their personal data in a study conducted by Accenture (Sheng, 2019). A lot of employees consider these systems as inescapable as "Big Brother surveillance." Hence, some employees might show counterproductive behaviour (Tomczak et al., 2018).

Real-time data sources for tracking the actual employee output instead of tracking every movement of employee would be a lot less questionable and might be comfortable to majority of employees. There are several laws applicable to big data analytics in HR functions, such as the "Fair Credit Reporting Act," "Health Insurance Portability and Accountability Act (HIPAA)," and the "Genetic Information Act" in the US (Federal Trade Commission, 2016; Cohen & Mello, 2018). For example, HIPAA might govern any data of the employee which might have health-related information and a lot of HR details. The HR big data analytics is also subject to comply with the "General Data Protection Regulation (GDPR)" in the EU. The GDPR covers the data processed, distributed, transmitted, queried, or stored in Europe when non-European companies or staffs are the part of it (European Commission, 2018).

5. Results

However, all these ethical and legal issues are based on core theme, even the GDPR, i.e., there should be care and transparency taken by the employer and consent must be taken from the employees. Employees might be legally complying when HR takes certain actions like communicating about why and how data will be collected from employees, exercising due care to protect the data, using the data only for its required purpose, and getting written, voluntary, and explicit consent from employees related to data collection. In addition, HR is a lot more likely to seek employees' consent when actual product or output is clear on the collection of data from employees.

Figure 3 illustrates a potential framework for big data analytics and HR decision-making in a retail or manufacturing firm. It is believed that big data can significantly improve the deployment and evaluation of employees and relation between HR and other divisions of the firm. Big data may need re-educating and rethinking of senior HR managers." Proper partnership with line manager and acquisition and retooling the skills is important to make the most of predictive analytics (Minbaeva, 2018; Lipkin, 2015; Watson, 2014). Irrespective of scepticism shown by the researchers related to future of big data in HR (Cappelli, 2017; Angrave et al., 2016), it is believed that HR should rely on big data for transformative change and avoid being neglected in future (Porter & Heppelmann, 2014).

Figure 3 – A potential framework for Big Data Analytics and HR decision-making
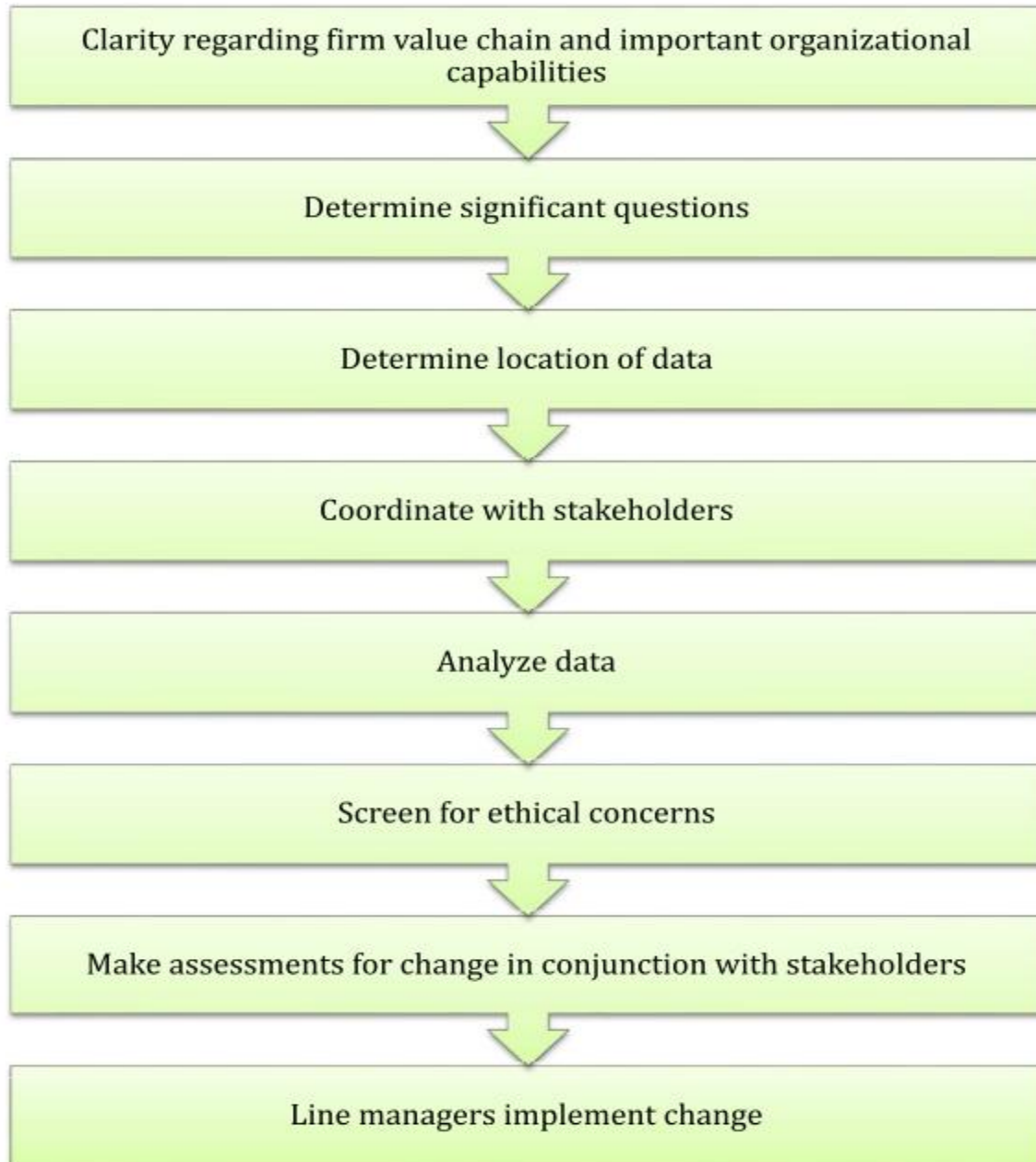
6. Conclusion

Big data analytics in HR functions which focus on the impact of individual actions on firm performance can transparently and positively redefine the relation between employee and employer. Building trust and focusing on small wins with the help of storytelling and big data analytics can bring change in both HR

function and in the organization. Rather than just giving benefits by screening candidates, HR should manage human capital strategically for better firm and individual performance.

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