

THE CONTRIBUTION OF HR BIG DATA TO HUMAN RESOURCES MANAGEMENT

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DOI : <https://www.doi.org/10.56726/IRJMETS31858>

ABSTRACT

HR Big Data means a new approach and methodology to manage massive employee data and to identify numerous opportunities for HRM. The ability to process large amounts of data and to find correlations between them constitutes a wealth of information for companies, and especially for the human resources function. The challenge of data analysis for human resources is to identify which data to use and how to use it in order to respond to an HR problem. HR big data is often presented in the management press as something new, or even a "revolution". However, academic work on the subject remains limited to date, which has prompted us to look into this subject and give it more visibility in the scientific and managerial sphere. This article aims to address the potential contributions of HR Big Data to human resources management.

Keywords: Big Data HR; Human Resource Management (HRM); Quantification; Algorithm; HR Department.

I. INTRODUCTION

Data storage is embraced by many fields, from lenses academics to the government and private sectors of businesses, corporations and organizations. The technology timeline has accelerated from information storage and data in books, and hard drives to the use of online storages. This technological speed has transformed the world into a global machine, with the help of computers and mobile devices, quintillions of bytes of data created per day, these data comes from digital photos, videos and social media sites. The Data is received from various sources and also comes in different formats. The companies and organizations must not only be able to store data, but also to use them to derive value from them. The exploitation of this data through the use of Big Data makes it possible to generate intelligence and information that can improve the decision making within companies.

Big Data promises unprecedented value creation through better use data in the information age (Nesvijevskaia, 2019). Big data has become a huge source of productivity gains when the data used corresponds to the real aspects that we want to explore. By facilitating data by being able to speak it, each actor may be able to better understand the context of his company and his profession (Ferréol, 2014).

Since its emergence, data analysis was devoted to related fields and sectors. to the use of figures and calculations such as finance, banking..., nowadays it invades multiple domains previously thought to be excluded from quantification, of which we can cite marketing to predict consumer behaviors and improve strategic positioning of a company, now Big Data is embarking on a new field that of human resources, and begins to convince the management of human resources (HRM) on its usefulness, as a science of data making it possible to bring innovative solutions to HR needs.

The HR function originally managed company records on each employee. With the HR Information Systems, these files have become data. When the data is digital, they can be connected to other data points, thus forming information. This information is analyzed, in order to be used to provide indications employee news. Many HR applications and services are available today, using data processing and algorithms to identify the needs and employee motivations (Silva, 2018). This digital transformation has given rise to the development of a new Big Data phenomenon relating to resource management human resources, the latter is now known as HR Big Data.

HR Big Data means a new approach and methodology to manage data massive on the employees and to detect many opportunities for HRM, the possibility process a large amount of data and find correlations between them is a mine of information for companies, and in particular for the human resources function. The challenge of data analysis for human resources is to identify which data to use and how to use them in order to respond to an HR problem.

HR Big Data is even often presented in the managerial press as a novelty, even a "revolution". However, academic work on the subject remains limited to this Today, the speed at which big data has evolved in all aspects of life has not left people scholars and researchers the time to fully study and understands what makes up big data and its potential is. There is therefore not enough fundamental information in the academic realm to fully understand Big Data. One of the main contributions of this article is to highlight the ignored dimensions of Big Data, that is for this reason that more research on this subject remains interesting especially in the era of digital transformation experienced by the HR function, which is crossed by a multitude of technological solutions and digital practices, overturning the traditional management of human resources which has been dominant for a very long time. This research work aims to systematize previous academic contributions and clarify the novelties of Big Data, its implications and challenges for HRM. This paper aims to address the following problem:

What contribution does HR Big Data make to human resources management?

To this end, we start by drawing up the different definitions of the Big Data concept in the literature, to then focus on the contribution of HR Big Data to resource management and study its different uses in relation to the HR field.

II. LITERATURE REVIEW

2.1. Big Data: Origin, Attempts at Definitions

The meaning of Big Data changes depending on the field in which it is used, because the communities interested in it are diverse. Trying to define the term was an exercise difficult, being the diversity of meanings that characterizes the term. Many researchers and scholars have offered several suggestions in an attempt to highlight the different ambiguous aspects that surround the concept of Big Data. On the other hand, before present the different definitions that we have detected from the literature, it seems to us necessary to address the origin of the term Big Data which dates back to the end of the nineties, discovered by two NASA scientists Michael Cox and David Ellsworth who explained the difficulty encountered in managing and visualizing databases whose size exceeded the IT systems they were deploying at the time.

Big Data has its origins in data science, which is known as La Data science which, by combining technology, the analysis of algorithms as well as the analysis of data stored in the data warehouses or the data Warehouse of the company allows to provide answers to complex problems.

The phenomenon of Big Data has flourished through the avenue of the wave of the Internet of Things which has been accompanied by an explosion of data, something that can be explained by the multiplication the use of digital tools permanently connected to the Internet, namely the smartphones, tablets, sensors and mobile chips. These connected objects make it possible to collect massive data generated daily relating to traces and activities individual, social and collective to deduce usable data. This growing availability of connected and sensor-equipped devices provides companies a vast wealth of information from which it is possible to create new business models, improve business processes and reduce costs and risks (Chui & al. 2010).

Big data has become an important phenomenon in recent years. Born first of inflation the amount of data available due to the advent of social networks and the rise of mobile phones, it has gradually extended to all sectors of society (MayerSchönberger & Cukier, 2014; Menger & Paye 2017).

Ghasemaghahi, Hassanein and Turel (2015) defined Big Data as the application of tools or processes to extract data on a large scale and at low cost, in order to obtain meaningful information that can help improve organizational performance. While Lamba and Dubey (2015) defined Big Data as the use of various analytical methods to obtain useful information from large sets of data to provide businesses with descriptive, predictive and prescriptive results usable.

In the same vein, (Storhaye, 2016) asserts that Big Data corresponds to the use considerable masses of data, from multiple and heterogeneous sources (database internal and external data, use of smartphones, travel, etc.). Their analysis makes it possible to build "models", most generally behavioral. The use of these models using algorithms then makes it possible to anticipate typical behaviors or less predicts a certain probability that they will occur. This is the reason why we then speak of "predictive models".

According to Jeble et al. (2018), big data is an emerging field where various algorithms are adopted IT, technical and statistical to get insights and models from large data sets.

On the other hand Barker and Ward (2013) define big data as a term describing the storage and analysis of massive and/or complex datasets using a serial technique, including: NoSQL¹ and Machine Learning.

Big Data involves a set of various statistical techniques (data mining) that analyze the data. These techniques then attempt to create a formula, or algorithm, which best mimics these data. Big Data is mainly based on the use of algorithms aiming at automation, and are based on an inductive approach which allows carrying out predictions for the future in an attempt to propose alternative scenarios to resolve a problem within the company.

2.2. Characteristics and specificities of Big Data

In 2001, Gartner reported on Big Data using three concepts: volume, velocity and variety., proposing the following definition: « Big data is information that is very large, very fast and very varied which require cost-effective and innovative forms of information processing to improve understanding and decision making » ². From this definition, the Gartner report identified three variables characterizing Big Data at know the increase in the size of the data which has resulted in the Volume, the diversity of data formats which resulted in a Variety of original data sources (internal and external; structured or unstructured), the specificity of Big Data is to be able to process data without predefined relational structure, as well as the dynamics that characterize these data in such a way that they are updated frequently this has resulted in the Velocity. More recently, research on the subject has been able to raise two other characteristics relating to Big Data: this is the Veracity that proves the quality of the data as well as the capacity of this data to release a Value.

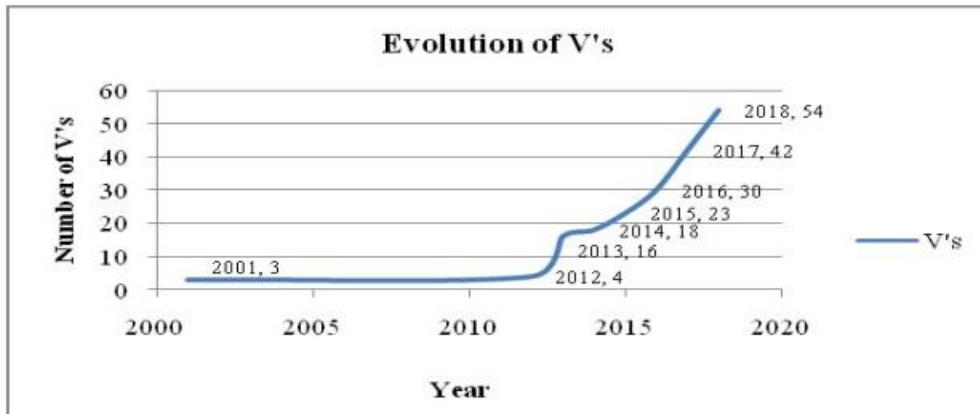
The particularity of NoSQL databases is that they do not use a relational model. Therefore, there is no table with a fixed number of attributes and characteristics. The schema is therefore either absent or flexible. This makes it possible to group data with different structures, unlike SQL which is a relational model that groups databases in which information is organized with two-dimensional arrays called "tables". Rows correspond to records. Each record contains a group of information - attributes - related to a subject. If the data is unstructured or if the format of the data is likely to change over time, the NoSQL databases would be a better choice. NoSQL databases are best when data is unstructured, large, or the relationships between the data are not critical. If the data are structured and the links that bring them together are meaningful, SQL databases are privileged.
<https://www.saagie.com/fr/blog/>

Translation by us: Original text: « Big data is high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making »

Saggi and Jain (2018) have evolved the definition of Big Data proposed by the report of Gartner going from 5 "V" to 7 "V" adding to the Valence list (which relates to complexity: Valence represents the interconnection between data. The more valence there is between the data, the more the complexity of the data increases) and Variability (Variability means that the meaning changes rapidly, that the data is dynamic, evolving).

The first three "V" dimensions (Volume, Velocity, and Variety) of Big Data have appeared from 2001 later different big data v-characteristics started to see in the daytime, different scholars in different periods have come up with many V's; These characteristics have emerged to suit different applications and fields intervention of Big Data. Recently a study was conducted by S. Dhamodharavadhani, and he attempted to summarize the characteristics available in the literature to obtain a best picture of Big Data. From this it has been observed that there are more than 54 dimensions of V (characteristics) as: Visual, Virality, Volatility, and Visualization ... (S. Dhamodharavadhani & al 2018).

Other works have treated Big Data far from the technical aspect. Indeed, Mayer-Schönberger and Cukier (2014) showed that big data can be recognized not only from its characteristics mentioned above but also from the methods and techniques of data usage. Indeed, classical scientific methods begin usually by assumptions related to causal mechanisms and are empirically tested using data rigorously collected for this purpose. Related research methods to Big Data, on the other hand, usually start with data collected in a way less selective without prior hypothesis and look



Source : S. Dhamodharavadhani, & al (2018), Unlock Different V's of Big Data for Analytics.

Figure 2.1 - The evolution of the V's

for patterns or correlations (which do not necessarily imply causation). While the classical scientific method can be described as assumption-based, Big Data is called the assumption-based approach on the data.

Boyd and Crawford (2012) characterized Big Data as "a cultural, technical phenomenon and science based on the interaction between:

- The technology used focuses on increasing the accuracy of the algorithms used to link large amounts of data, collect and analyze data and increase computing power.
- Analysis: Analysis refers to the ability to represent data from large datasets to identify trends and statements concerning economic, social, legal and technical problems.
- Mythology: It is a belief that large datasets provide a higher form of intelligence and knowledge that can generate ideas previously impossible ("glimpses") with an aura of truth, objectivity and clarity.

The interest of this definition is to highlight the various points surrounding the notion of Big Data, indeed, the definition cites the role and ultimate goal of Big Data which is represented through the analysis of large datasets which requires the use of technology by the use of certain tools or processes in order to deduce results, this phenomenon is judged by a mythology that states that the more data there are, the greater the circle of knowledge is expanded, leading to the conclusion that Big Data is a cultural phenomenon combining the science and technology.

2.3 What are the differences between the quantification tools adopted in HR?

Big Data is often mixed with other tools intended to quantify human resources. We have chosen to devote this section to the presentation of the differences between the set tools for measurement in human resource management.

HR reporting is part of a logic of describing HR phenomena through the reading the dashboards and the social balance sheet, we can qualify the HR reporting to a description of the past that allows adequate decisions to be made for the future, with developments in the field of human resources quantification, reporting HR is no longer perceived by HR managers as being an optimum solution to dysfunctions and problems related to the management of human resources, which required the search for other more effective tools, hence the emergence of HR analytics. Conversely, the objective of HR analytics is decision-making and is part of an approach potentially called HR audit. The priority aim of HR analytics revolves around understanding and analysis rather than information and communication. In effect, HR analytics has promised to go beyond the descriptive aspect of the phenomenon by leaning towards analytics by seeking to identify the causes of the occurrence of the phenomenon under study. The HR reporting adopts descriptive statistics while HR analytics uses statistics explanation by referring to the regression method or factor analyzes as well as the predictive statistics, according to many researchers, HR analytics can be qualified as an evolution of HR reporting, the two disciplines cannot be analyzed with the same way, however, they are not at all contradictory because they share the use of the quantitative approach. With a view to developing measurement in human resource management, a new current has emerged that of big HR data which supplants in notoriety that of analytics HR, with which it

is often confused. There are, however, important differences between these two approaches. HR big data mainly uses unstructured data, often external to the company, while the HR analytical approach mainly values the structured data, very often internal. This gap gives rise to approaches that are significantly different since, in the end, HR analytics and HR big data do not use the same tools statistics, valuing data of different natures and quantities (Cercle, 2017).

What can be put behind the term Big Data is therefore not reducible to a technique of data analysis but rather an inductive exploratory approach. She demands more than mastery of statistical analysis techniques, starting with experience in the field application (Storhay, 2016).

Table 2.1 - The differences between the quantification tools adopted in HR

	Reporting HR	Analytics HR	Big Data HR
The target priority	Inform Communicate	Understand Analyze	Analyze Solve
Purpose	Describe the HR problem	Identify the cause of HR problem	Solve the HR problem, prevent HR risks
Level operating Data	Descriptive analysis	Explanatory analysis, Predictive	Predictive analysis, Perspective
Data mobilized	Data mostly internal	Data mostly structured internal	Structured & unstructured data
Statistics Tools	Descriptive statistics (mean, median, sorts to dishes, cross-sorting, etc.)	Modeling econometrics descriptive and predictive (simple regression or multiples, analysis factorial...)	Predictive modeling, decision trees, model aggregations, learning models, neural networks, etc. Data mining Inferential statistics
Steps adopted	Represents a reality Study each phenomenon isolation	Put the data in relationship between them Study the links between phenomena (look for the causality between variables)	Establish a forecast in using a predictive model (look for the correlation between variables) Model scenarios and their impact on results of the company
The Approach type	Approach based on operational indicators	Approach based on Hypotheses	Approach based on data
Actors and managers	HR professionals	Econometricians, statisticians	Data scientists
Beneficiaries	Managers	Leaders	
Levels intervention	Target operations operational and tactical of the company	Target strategic business operations	

III. METHODOLOGY

The contribution of Big Data to human resources management

3.1 The positioning of Big Data in the discipline of management sciences

Many research disciplines have integrated the phenomena of big data into their reflection. Not only genomics, epidemiology and astronomy, but also education and history use Big Data technology. The use of Big Data,

especially in the social and human sciences fields, would have the potential to revolutionize research, condition of appropriating the right tools for the humanities and social sciences (Manovich, 2012).

Big Data finds its place in the management approach based on evidence (Evidence Based Management in English EBM) which consists of making decisions relating to the management based on scientific foundations as well as concrete evidence, with a view to make appropriate decisions in the day-to-day business. This approach has been initially applied by the marketing departments to continuously improve customer results, organizational capabilities and business results, it has focused on then extended to other functions of the company and recently to the management of resources human resources by bringing more rationality to the decisions to be taken by managers and HR managers that were previously judged as decisions based on the intuition of these officials. Indeed Big Data has given a new impetus to the human resources function by making it more credible and more reliable than it was before, this need for relevance in decision-making choices is justified by the perpetual quest for growth levers by the companies, thus human resources constitute an important mine to be exploited by making using Big Data and trying to install it permanently in the habits of managers HR.

3.2. HR Big Data and Human Resource Management

The combination of Big Data and human resources has given rise to a new name known as Big Data HR. So that the HR function can really take advantage of all the benefits that digital promise, it must actually bring together many parameters, starting with that of a data culture, which clearly still makes it sorely lacking. “Analytics” and “Big Data” offer a set of very broad for the HR function (Storhaye, 2016). The diagram below shows the steps acquisition of a “Data” culture within a company and more specifically within the HR function.

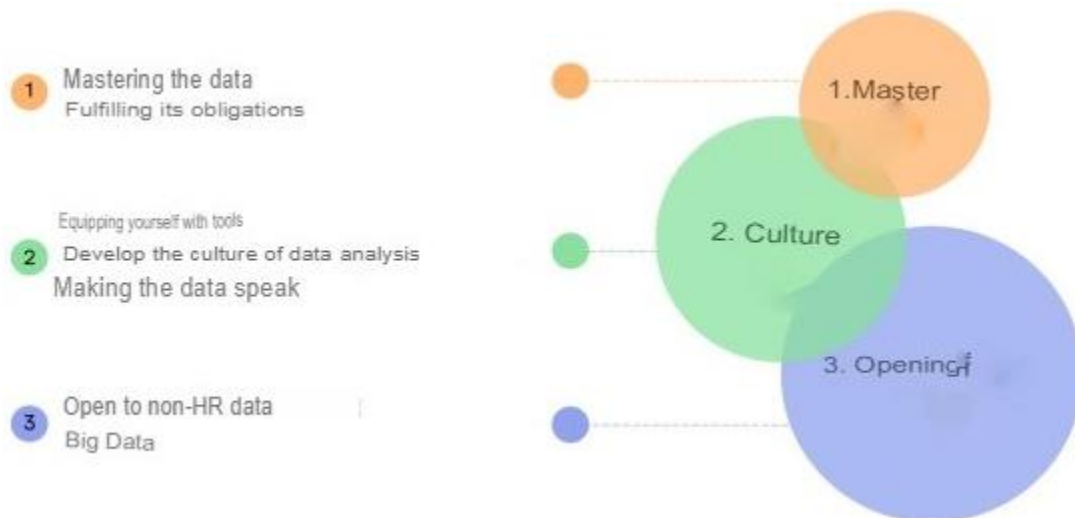


Figure 3.1 - The steps to becoming a HRD « data-oriented" HRD »

Source: Storhaye, P. (2016), Transformation, RH and digital: De la promise to the roadmap, ed EMS management and society.

Building a data-driven culture within an HR function is essentially based on on many steps to be implemented which are as follows (Storhaye, 2016):

- Fulfill its reporting obligations: compliance with HR reporting standards requires far-reaching importance, in fact, particular attention should also be brought to the basic data which allow the minimum requirements to be met of a HRD in terms of legal and internal reporting. This involves looking at the how these are constructed and what they are used for beyond simple respect compliance.
- Start with the data: by putting in place processes that enable data to be capture; have the means, knowledge and experience to make them usable and maintain them; have an HRIS whose architecture is designed around Data's ; have analytical tools and master them.
- Open and broaden the field of investigation: by analyzing internal data in using, for example, semantic analysis techniques or data from the use of smartphones, sensors in the work environment or objects connected; by cross-referencing HR data with data from other universes (putting for example in relation to

customer satisfaction and internal climate) internal or external to the company; by making more systematic use of information than employees publish on the Internet, in particular through social networks.

Once acquired, this culture of data analysis must be able to enable practitioners HR to engage in an approach that goes beyond the stage of simple descriptive statistics to invest the field of explanatory methods. This essentially consists of setting light of relationships between variables and uses techniques that have been used for a long time in other professional fields such as marketing. If we combine these techniques the contributions of Big Data, HRDs would have tremendous potential here of information and communication. The field of exploration is wider than you might think, including included with the usual data from an HRD (Storhay, 2016).

The promise of “big HR data is to quickly access relevant information, to simplify access to data and contribute to the structuring of new knowledge useful to the management of the human factor in the organization (Cercle, 2017).

HR Big Data crosses the company's internal data with external data not structured like those from social networks. On the one hand, this approach is important in improving the cost-effectiveness of HR decisions, as well as to prove their effectiveness and make them important in major decisions at the within a company. On the other hand, it is about improving the performance of a company. Some tools help companies to recruit and job seekers to find jobs. The data collected makes it possible to recommend job profiles or positions to candidates. Other tools allow employees to develop internally in their company, or offer training or mobility recommendations, when others contribute to refine the selection of applications received while carrying out an automatic sorting using the Big Data algorithms (Levy, 2020).

Big Data in HR is essentially based on modeling logic. In effect, engaging in a so-called “predictive” approach is based on having collected large masses of data whose in-depth analysis makes it possible to identify models to from which predictions can be made (Storhay, 2016).

The usefulness of Big Data lies in the large amount of data processed using statistics to identify significant variables. This is the crucial first phase in development of a predictive model. Once these variables have been identified and any correlations between them studied, they can be grouped into large families, then put in place actions to adjust the malfunctions observed. Big Data offers also the possibility of predicting the impact of one or more variables on the results final. (Circle, 2017).

Big data is in the process of operating a revolution within organizations and particularly in management science. If finance has always been confronted with the problem of having reliable numbers of data is now the challenge facing all business functions, including HRM. Organizations today collect a great deal of data and thus hope to anticipate the answer to certain problems which could arise, including those of management and human resources management. (Brillet & Gavaille, 2017).

Big Data can intervene in many HR professions, providing them with more reliability and legitimacy at the level of the decisions taken, thus it will save time appreciable but which has considerable effects on the HR professions. This is justified by the automation entrusted by the adopted algorithms of certain recurring and heavy activities; in this way the human resources will have more time to devote to the problems priority HR, something that will revolutionize the work of human resources.

The table below proposes some fields of intervention of HR Big Data in different HR professions:

Table 3.1 - The fields of intervention of HR Big Data within the HR function

HR professions	The fields of intervention of Big Data HR
Recruitment	The algorithm can “predict” who will be the best candidate for a position given. Prospect new profiles and new skills; Save time in sorting applications that could be addressed by targeting, by first filter, employees whose skills, values or profiles correspond to the needs of the company
Staff integration	Data analysis plays a major role in determining the

	best integration programs according to the profile of the people recruited and the positions they will occupy
Talent retention	Through the use of predictive retention models to anticipate which talents are likely to leave the company, when they will do and why they will make that decision.
Training	Suggest courses "personalized" to employees, taking into account the history of past training and the training needs to be fill for each employee.
career management: mobility, promotion	Propose the appropriate profiles to benefit from internal mobility or a promotion taking into account the experiences acquired, seniority...by using Big Data algorithms.

IV. CONCLUSION

By way of conclusion, the Big Data dynamic has led to the emergence of analytical methods which are not new as such but which are little used in companies, except for a few specific areas. These methods all have the same purpose: to relate the data to each other and try to distinguish "forms" or "patterns" meaningful. In addition to traditional hypothetico-deductive methods to which the business world is accustomed, they offer a different perspective that could easily espouse some of the defining traits of the HR culture. HR Big Data enables HR professionals to make reliable decisions based on evidence and science and not only on the intuition of decision makers, which brings a certain legitimacy to the HR function and positions it within the company as a business partner.

Indeed, HR Big Data has proven its effectiveness in the decisions taken by professionals. HR, this can be read through the results and gains obtained by companies with adopted this new method of data analysis which promises the HR function solutions revolutionaries to the various issues affecting the management of human resources. The introduction of HR Big Data in HR policies tends towards a transformation organizational structure favoring the individualization of human resources policies, through the personalization provided by Big Data HR algorithms in terms of the suggestion of solutions that can be adapted in a personalized way according to the needs and expectations of each employee, in particular the case of suggestions for training offered by the big data algorithms. In addition, it is worth remembering the interesting potential that the Big Data offers the HR function its ability to predict, and which can act as being an optimum solution at the level of different HR professions, as is the case with prevention of the risk of talent drain, by developing predictive models based on the pool of information held by human resources on their personnel, the system Big Data then makes it possible to identify the talents likely to resign, which allows decision-makers to propose solutions can contribute to the retention of these talents. Big Data also promises significant time savings for HR professionals, thanks to the automation of recurring and heavy activities offered by Big Data algorithms, in this way the human resources will have more time to devote to the problems priority HR.

The contributions of HR Big Data to human resources management is of great value, however, the challenge that arises in the application of HR Big Data is ethical and legal, the question of data manipulation raises many debates within the sphere academic and scientific relating to data security and the legal limits of their use, interesting topic that can be addressed in future research.

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