Fearless path for human resource personnel's through analytics: a study of recent tools and techniques of human resource analytics and its implication

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Abstract The golden rule developed by Gordon E. Moore in 1965 stands forth and upholds its perception, which is observant with trending technology and making organizations, groups and individuals extract benefits from machine. AI, Robotics, Business Intelligence, Big Data and Analytics, Edge Computing, Hyperautomation, Blockchain, Democratization, Human Augmentation, Multiexperience are technical domains and trends supporting ongoing technical progress making mankind to innovate and create superhuman capabilities leaving HRs to fight the battle of replacing technology-literate people with people-literate technology. The likeliness towards analytics and complex algorithms made a breakthrough into a creative zone extending manageable workforce with the rising trends. The primary study with 108 h of leading Service Organizations of India was made to examine the recent tools and techniques for HR analytics which are adopted by them. As we recognized that analytics is driving force for HRs to be strategic business partner and step further for transforming roles. In addition we identified the implication of analytics on various HR data and decisions made by them.

Keywords Big data · Machine learning · Sentiment analysis · Social network analysis · HR analytics · Strategic HR

1 Introduction

Tech-ecosystem made a commendable contribution by making the huge amount of complex and pervasive data generated through web services, blogs, tweets, data warehouse, and social networks into informative data for businesses to reshape [1] and making analytics the basis for transformative roles [2]. The first step towards analytics was posed when managers expressed the need of fact-based comprehension and go beyond the intuitive abilities giving rise to descriptive analytics [3] and diagnostic analytics [4]. In the pursuit of analyzing external data with the organizational data widens the approach of analytics, coining the term “Big Data” [5] and Analytics 2.0 made a hallmark with “Open source community” that provided strong support and even lead to emergence of roles like Big Data Engineers, Business Intelligence Developers and Hadoop Administrators in the job sector that all together focused on forecasting from data. The big IT giants invested time and efforts in the unified concept of statistics, machine learning and data analysis, making Data Science a unified field to study and experiment with full attention towards predictive analytics [6] and prescriptive analytics [7–9]. The innovations in the form of Chat-bot, Smart Reply, Neural Machine Translations have made extensive use of data mining techniques, business intelligence application [10] and complex algorithms arising from machine learning and moving forward with Automated Analytics, is a set-up for Analytics 5.0.

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The new age of IT invites new perspective of work and culture, new associations with technology, new infrastructural framework and new workstation guidance, in all making HR to move from regular routine jobs to strategic business partner [11] making a stepping stone for analytics [12] as the new framework has raised new challenges for HRs in form of true value of employees, organizational guidance system, virtual workplace technologies and digital ethics [13]. In this article we examined the recent tools and techniques for analytics adopted by HRs and its implication on their work and decision making as to support organization as a strategic business partner.

2 Literature review

Big Data is a revolutionized technology providing holistic approach to draw actionable insights from the huge volume, large variety, high velocity, veracity and immense valuable data [14–16]. The popularity of the concept turns the companies to exploit the daily flows of real world information to improve the visibility of operations and raise the performance standards [17]. The organizations who are vouching on Big Data expressed a move towards analytics to refine decision making in various functions, one of them being HR [18]. HR Analytics differ to different people and different organization; some refers it as data matrices, decision making tool and statistical tool for data visualization [19, 20]. The later researches have marked a synthesized and systematic approach for HR Analytics which proves to be beyond HR matrices [11, 21] inviting for more focused approach to draw meaningful insights and play a key role in strategic execution [11]; thus redefining the HR Analytics from new and broader perspective [22].

The rise in accessibility of HR data via new ways of data collection with new technological advancements for analysis, made HR Analytics possible for almost all organizations. The growth curves took a steep rise with analysis on workforce data; leading an improvement various HR functions of the organization [23]—recruitment [24], career development [25], knowledge management [26], quality of task [27].

3 Research methodology

The data in this paper was acquired from qualitative study made with 108 h Directors, HR Heads and HR Managers from Service Industry across different regions in India. 130 h were approached, from which we could not continue with 12 respondents because of their non-availability, 7 were not able to respond properly due to of their personal reasons and 5 were not able to meet the purpose of the

study. Therefore, we conducted study with 108 respondents who have experience from 10 to 34 years, aged between 32 and 53 years, where majority of respondents were females towards late 30 s. All the respondents were qualified and working on analytics for HR data in their organizations.

The study was made via audio calls or Google meet or Zoom for 60–70 min with semi-structured interview after assuring the respondents availability and coordinating with their schedule. We assured to maintain the confidentiality of the respondents, their organizations, their work processes, methods, techniques and tools used for analytics. The interview was performed with open set of questions like—which tool you find to be easy to apply, which platform is more user friendly, how you deal with programming structure, what you do at time of difficulty with data and so forth to understand the recent tools preference and its implication in various situations or data set.

4 Result and analysis

We examined into the data; collected through various scheduled meetings and interactions through our respondents and segmented their viewpoints on the recent tools and techniques and represents the comparative analysis:

4.1 Recent tools for analytics used by HR

HR's had a good transformation journey from arranging documents to HRIS to generating reports and now to dashboard and analysis for decision making. The time is demanding them to play the role of Strategic Business Partner and not just as facilitator or coordinator. Analytics is one step for them to meet the rising needs of the business. Study was initiated with an understanding of recent tools used by them for analysis. Figure 1 shows the result from our data that Power BI is used more than other tools followed by R, Tableau, Python, Visier and others which include paid software or use of excel.

Power BI is the Microsoft tools gained popularity with Gartner's Magic Quadrant for Business Intelligence [28]

Fig. 1 Represents the tools of analytics adopted by HRs in recent times

making aggregations and visualization simple and easy to access for HRs who often find themselves difficult with technology. Now they could easily connect their SQL database or machine learning APIs or tweets with the tool drawing easy report analysis and visualization. It is gaining popularity with ease of sharing data, dashboard and reports, making HRs comfortable with user friendly interface enabling them for peer-to-peer sharing and quick data visualization be it for understanding the working culture with different age, experience and gender or be it for mapping skills and capabilities. My respondents have agreed the use of Microsoft Power BI made an ease of keeping close eye on workforce metric, productivity and performance and providing solutions to common employee problems like performance but sad employee, sincere but low productivity, trustworthy but irregular and many more. The study reveals that **R** has gained popularity for being an open source programming language, written primarily in C, Fortran for statistical computing and been popular among statisticians and data miners for data analysis made my respondents think of studying and applying but find difficult in first instance. But gradually it enable them to implement wide variety of statistical and graphical techniques like classical statistical tests, time series analysis, modeling, clustering etc. with a well known free community support with stronger object oriented programming and with the ability to do analysis on the huge datasets as compared to others. Now HRs in various organizations are making extensive use of **R** for making analysis on employee data sets and draw both descriptive and predictive analysis using various packages. Lately the use of ggplot and R Churn analytics were extensively used for ease data visualization through graphs and take predictions and decisions on employee turnover. It is gaining popularity among HRs as it helps in forming quick statistical computations, reports, dashboard and interactive web applications, helping the HRs to have data visualization even not being the computer scientist [29]. *Tableau* is next likely used tool for analysis, it is quite similar to Power BI but with more functional features and connect well to many data sources whether be SQL, SPSS file or any data set with the ability to do analysis on live platform. It gained popularity among HRs for its user interactive feature and easy with drag and drop feature of use, making HRs across world comfortable to access and create interactive dashboard and stories from the data but it often raises question on affordability as it is not a free source and involves good investment [30]. HRs accepted the fear of data [31] and appreciated the ease provided by *Tableau* in reaching out to the solutions, be it Walmart or FEMSA [30], many have access to “One Organization and One Report” which help them to reach out solution rather get puzzled behind the numbers [32]. *Python* stands next and often used

interchangeably with **R** with ease to learn. *Python* is best known for PyCharm who helps HR in managing daily routine jobs and focus on bigger things and Spyder (Scientific Python Development Editor) which helps HR with data exploration, detailed interaction and better visualization of data. In all, HRs across world reports to be comfortable with its interactive console and wonderful libraries and community [33]. 8% respondents marked the use of *Visier* as find it to be user interactive platform for data aggregations answering for various concerns of the workforce including talent management and taking decisions on retention of employees and connects easily to different HR systems making it one HR BI tool [34]. It is quite similar to *Tableau* but hold more worth as actionable workforce analytics. It is best practiced for its performance analysis and productivity predictions. Table 1 shows the comparison on tools for analytics as stated by the respondents.

4.2 Techniques best adapted by HRs

The power of people data is very well understood by many organizations be it small, medium or large in size. It is observed and accepted fact that now communication between stakeholder and HR is critical and deals with real time reporting with charts, diagrams, correlations and impact. HRs need to adopt best techniques for analytics so as to provide solutions and play the role of Strategic Business Partner. Figure 2 represents various recent techniques adopted by HRs for analysis.

Machine Learning Which employee is capable for new learning or challenge expressed from the past performance data? How retention should be taken in next quarter depends on employee turnover and business ability derived from the data sets? How to do resume analysis to select best talent? [35]

The questions like this often faced by HRs and even challenge them to prove themselves as strategic business partner. Machine learning in this scenario gives ability to learn from data without being specifically dip into programming and can make decisions based on the training data. In recent times its best used to ascertain the probability of occurrence, understanding the trend [36], engagement possibilities and lately it is distinguishing the mails from spam to non-spam mails which help HRs to refer to the right information.

Regression Analysis As the concept explains the variation of independent variable over the dependent, helps HRs to ascertain the level of employee satisfaction affect employee loyalty or does experience affect the performance or reliability on the employee if working for more than 5 years. Regression analysis has contributed and is continuing well for HRs to make even a small change in

Table 1 Comparison on tools for analytics as stated by the respondents—HR'S

Purpose	R	Python	Tableau	Power bi	Visier
Likelihood to use (as per responses)	60.1% Respondents expressed somewhat liking	40% Respondents expressed somewhat liking	Most Likelihood to use is expressed by 62.03% respondents	55% of respondents expressed most likelihood to use	Not much respondents were interested to use
Objective of use	Data Analysis and Statistics, Quick graphs	Deployment and Production ease at visualization after understanding various packages and its use	Data Visualization, Sharing reports and publishing	Business Intelligence Analytics and Interactive Visualization	Data Analysis and Sharing reports
Learning graph	Difficult in the starting and took good time in understanding	Coding and understanding is little tedious but later get smooth and work is in flow	Quick to adapt and implement, user friendly	Self pace learning	Quite comfortable as it has built-in graphs and data visualization ease
Packages and graphs most used by HRs	ggplot2, zoo, shiny	Pandas, caret, scipy	Donut chart, waterfall chart, bubble chart, geographical visualization	Pie charts, Line charts, area charts, slicer, map charts	Annual charts, comparative charts
Cost and support	Open source with good community support	Open source with good support from the community	Expensive with quick to get results. For publishing purpose need to purchase	Open source and good for non-technical group	Download of proprietary <i>Visier software</i> and <i>open source software</i>
Usage	To draw solutions on employee trends, recruitment and performances	To study performances, employee engagement, social media, pulse survey	To study trends in recruitment, employee cost and benefits, employee or department contribution analysis, gantt chart	To study head count analysis, geographical analysis, performance analysis, training efficiency, trends and employee turnover analysis	To do planning, talent acquisition analysis, learning and ad/hoc analysis and risk monitoring

Fig. 2 Techniques of analytics adopted by HR

their decisions as it result in big transformation for cost sheets or employee trust or workforce management [27].

Genetic Algorithm: Traditionally it require the user to provide with the huge evaluations to get the good results but now it have user preferences during the problem solving sessions which is best be achievable through mined models. HRs developed interest in this as it ease the frustration and generate high quality solutions which are attainable like allotment of employees to projects without

adding cost, talent management and then retaining them or engaging employees through “artificial creative”—puns and jokes [37].

Association Analysis It helps the HRs to create association in huge data and reduce data noise by limiting the algorithm and develop patterns. The practitioners are able to trace interesting relations with the various variables of the data through association rule of mining like using Wecka and its Apriori Algorithm [38]. It might help HR to ascertain training increases cost but increases performance when work culture is supportive or experience employee is an asset rather cost, change is a planned process even in real world and many like this.

Sentiment Analysis AI and Machine Learning made a good contribution for the analysis related to opinion [39]. To a far way it helps HR in determining the sentiments of employee related to change, project, innovation, policies, working environment, immediate manager, task assigned or any work related issue. RapidMiner is often used by HRs to ascertain the right sentiments of the employees—

positive or negative and pitch for the right move. The entire set of data is classified according to feelings or opinions with positive, neutral or negative and then modeled unlabeled to cover entire set of emotions and helps the users to draw decision.

Decision Tree It is a type of classification analysis used to build the tree model to attain the gain ratio. Basically it shows the factors of the decision which can be discounted and does not increase the cost with only requirement of data sets of correctly identified variables [38]. It is best used method in training modules by HRs.

Social Network analysis The growing pace of internet with world connectivity made social connects an ease. The networking skills sorts many concerns from identifying talent to pitch for business [40], look for training association to comparing performances of various software and many more. In all builds interrelationships in various fields and business front. HR gains advantage from this analysis as they are able to reduce recruitment cost, connectivity cost, pacing with the world and stand strong as strategist.

The respondents were questioned on the use of these techniques on various HR related issues. Table 2 represents the usage percent of techniques on various HR data related decisions, the percentage (up to single point decimal) is calculated by noting the number of respondents accepted the use on various decision sets and later each cell is divided from total i.e., 108 and multiplied by 100.

5 Impact of HR analytics on HR practices

The efforts of HRs are commendable and their acceptance to move with technology is making revolutionized change in the results out of analytics. Google, Accenture, Shell, Nestle, Deloitte, IBM, SwedBank are few examples who made successful implementation of HR analytics and

receives good business profits. Table 3 shows the present and future impact of HR Analytics on various HR functions.

These impacts can have more multiplied effect if organizations invest more time in preparing HRs for future tech-environment, train them to integrate with new technology, improve their career growth scale and make them realize about their new roles. The basic challenges HRs are facing: need clarity on how to link their structured data with big data [52], physical challenges of implementing HR Analytics [53], absence of support team, lack of preparation for change [25] and need for a technology with AI supporting analytics for them.

6 Analytics implication on HR role and decision making

HR analytics raged with the debate from dashboard, HRIS, excel sheet to software [31]. What, Why, When and Where of analytics was not only challenging for HRs but also employee engagement requires serious consideration [54]. With time and now, support from analytics community, awareness [55] and acceptance [56] made HRs to step into analytics domain and experience the journey from data to insight. Descriptive analytics was comfortable for HRs through excel but predictive analytics created a wave and penetrate HRs to explore and experience themselves [57]. The most reported achievement was in recruitment process where analytics made a drastic turn and establish a step for being business partner [24]. Big data and analytics changed HR approach to see Performance, Capability, Capacity and Retention by developing strong emotional connect, network and ROI [58]. Network analysis specifically contributed and pitched for talent community with functional clarity and role definition enable an increase in operational

Table 2 Usage percentage on application of techniques to reach decision on various HR issues as per respondents

HR issues	Machine learning	Regression	Association analysis	Sentiment analysis	Decision tree	Social network analysis
HR planning [41]	73.1	6.4	5.5	19.4	–	5.5
Career management [42]	12.03	28.7	6.4	25	–	–
Recruitment analysis [24]	63.8	67.5	26.8	25	26.8	41.6
Employee performance analysis [43]	78.7	60.1	22.2	5.5	9.2	6.4
Employee satisfaction level [43]	53.7	21.2	19.4	79.6	–	–
Employee engagement [44]	–	29.6	8.3	77.7	59.2	–
Employee empowerment [45]	6.4	7.4	5.5	–	–	–
Employee turnover analysis [46]	75.9	33.3	42.5	–	62.03	36.1
Predictive analysis [6]	71.2	56.4	39.8	7.4	38.8	31.4

Table 3 Present and future impact of HR analytics on various HR functions

HR function	Tool or software	Impact of HR analytics
Recruitment	Social networking analysis	All the respondents who are using analytics accepted (100%) that HR Analytics has changed the working of HR towards the recruitment process in terms of posting jobs, looking for talented candidate and approaching them
	IBM'S Watson	Facebook, Tweeter, Instagram and other Social media sites will be used to post a job and hire a talented person
	HireVue—AI driven tool	Video interviewing software which will analyze candidate language, personality and expressions [47]
Training and learning	Python, R, Tableau	62.03% states that the training modules are well organized as per the need. Outdated stuff is replaced with new techniques with new methods. Direct conversation with mentor made a heart out interaction. This contributed towards clarity and much better performances
	e-Learning—social sites, mobile devices, machine learning	Helps in comparing the learner's performance, understand diverse learning styles and preferences. Giving utilization of predictive analysis and multi-source knowledge mapping which will recommend and provide feedback with intervention of mentor based on employee performance [48]
Employee engagement	Actimo, machine learning	79.6% reported an increase in the engagement of employee out of which best method is developing transparent reports and visualize the data of participation with performance
Career development	Python, machine learning, sensitivity analysis, social media	Communicating even with non-desk employee effectively, support and train when needed and track the individual employee participation with insights [49]
		42.5% HRs accepted that they are able to plan jobs in much better way after clear analysis on projects, needs, growth prospects, opportunities and threats. Analytics is making a way out
Employee retention	Tableau	Leaders with proactive insight can foster talent for new opportunities and train and support career growth [50]
	Sage people, Sage HR	67.5% HRs reported that the retention rate showed a positive trend as they are able to work better on their policies, procedures, and employee safety and satisfaction
Employee performance	R, Python, Tableau, Vsier	Analytics highlights the critical factors, expectations and skills which helps the managers to positively allocate duties [51]
	Servicenow, Monday.com	73.1% has accepted that through analytics a steep rise in performance is marked as they are able to make performances reasonable than intuitive
		Give insight in trends, predictions and low time. It is helping managers and employee themselves to track their performances and compare with the standards. It improves the reliability and no scope of biasness

effectiveness [59]. Sentiment analysis racing from networks to employees helped in better decision making during change, initiating new projects and commitment of employee [60].

Analytics has proved its relevance in recent times of COVID-19 adversities, when the world suffering from crisis, be it on health, economy or education. The global crisis has triggered the new human resource revolution [61] magnetizing towards more technological advancements and virtual systems. This has a serious impact on employee performance and employee turnover [62]. Despite this situation, many analysis shows, the employees and organizations that are open for technological development fit for survival and experience smooth sail. Flock, Pukka Team as a Virtual Workspace gained more acceptance; Gamification, AI, Machine Learning are used for employee engagement, employee mental health and physical well-

being and data visualization; Python and R gained market demand for its easy working approach and good community support. HR Analytics during these times gained more popularity for its insight and decision making.

Contribution of the present study and managerial implications

It's an accepted fact that analytics is a present and future but on the same side efforts are required from the organization and the managers to make adoption of HR Analytics an easy process for its user's. Figure 3 shows the proposed framework for easy adoption of HR Analytics, explaining: that the concerned authorities must start from identifying the trend and tool available for analytics, preparing the organization for adopting by scanning the present resources and funds and thereafter preparing for future. It is really important to inform the users about the use of analytics by explaining the business problem and not just the HR

Fig. 3 Proposed framework for an ease of adopting HR analytics

problem and treat that scenario similar to introducing change or rather to call for change management as IT integration is a new aspect of HRs to initiate their jobs. The organization also needs to develop good data secured systems, make use raw and processed data from both internal and external sources [63]. Once the necessities of the technology is met, it is important to ensure the training for the users on the technology which organization is planning to adopt for better working and clarity of concepts, the training with hands on experience will be more effective than only learning and understanding about the concepts. The development of cross-functional analytical team will contribute to adoption process by focusing on developing team skills, storytelling skills and analytical skills which can help the learning, sharing and execution in more appropriate way for the user's [63, 64] and together the users can explore better than working individually on new technology. The organization should hire statistician, database management experts and data security experts to handle the statistics, data and reduce the fear of execution. These steps will contribute in developing positive attitude and develop an ease towards the adoption of HR Analytics.

HRs are making a wonderful move towards technology and rebuilding many of their functions in improved ways. The paper provides a guide to new user of HR analytics about various tools and techniques of analytics but HRs is still hesitant to make use of technology despite comfortable user interface, large free community support and online tutorials. The future need is for the technology which can help HRs to have quick data cleaning so that they are not scared of data and able to access with simple applications and as soon as the data is extracted there should be auto generated suggestions on usage of packages as they feel puzzled in application. Possibly, if HRs can experience drag and drop interface on their analytical tools then it is more likely that they get comfortable with analytics and come out of their fears of using "Programming" to study the data.

7 Conclusion

We have presented the details of recent tools and technologies used for analytics by HRs and its implication on their roles and decision making which is supporting them to emerge as business strategic partner. Businesses are making big data a daily scoop inviting new approaches to work with better decision making. Sentiment analysis, Network analysis and Machine Learning have made remarkable contribution in managing employees as well as businesses. The access to huge data set and drawing insights was a dream for HR as they believed it requires technical skills and they can report and present. HRs need to invest some time in understanding the working of analytics and record their daily data in a systematic way. The group needs to open up and develop connect with the analytics community and update and upgrade themselves on new learning's. An investment of time in learning technology like Analytics helps them to draw right decision than only institutions. As time and now has proved a shift in HR roles from traditional structures to managing employees on virtual platform. As discussed, with the help of analytics, HRs are not only describing or diagnosing but also predicting and prescribing and mitigating some serious downfall holding a new vision of technology-literate workforce which is even operative from remote as reality is seen through COVID-19. Finally, the increase use of Analytics by HR is influencing the businesses with better decision making and reaching out the expectations. The software developers can also contribute by developing simple software for analytics with drag and drop feature for many non-tech users or tool with auto-suggestion once the data is uploaded.

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