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A Study on Enhancing Employee Performance by Implying Data Science and Digitalization: The Moderating Role of HR Function in Digital Era

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ABSTRACT: It has become increasing standpoints in the digital era for organizations to focus on protecting sensitive employee information. In fact, all organizations today have used AI in all functional areas so that work efficiency is increased among employees in the organization. The role of AI is continuing all functions of HR from recruitment to performance appraisal. This research investigates how digitalization and data science work for improving employee performance in this transformation. The research included a survey to 313 respondents from different professionals who well understood the topic being examined on how such digital tools and data-driven strategies impact production and performance such as, IT, HRM and Administrative executives. Data from the survey were analyzed using SPSS 20, which further allowed a deeper exploration of other critical aspects, including adoption of digital tools, making decisions through data, and employee engagement. The results imply that data science and digital technologies fairly means superior employee performance, as they improve efficiency, enhance decision making, and this leads to more engaged and informed workforce. However, the study has emphasized the way of transforming the workplace through digitalization and made useful recommendations to organizations willing to employ data science for performance benefits. Most importantly, it states the essence of investing in digital tools and data literacy to be competitive in this age of digitization.

KEY WORDS: Data Science, Digitalization, Employee Performance, HR functions, Organizational culture, Employee Privacy, Employee engagement, Appraisal, Machine Learning, Predictive analytics.

INTRODUCTION

In recent years, there has been a significant increase in the focus on big data, business analytics, and "smart" environments as a means of influencing organizational decision-making. Organizations are currently working to provide a purpose to the data and obtain value-driven answers that will enhance their performance (Mayhew et al. 2016). This has a significant impact on various members of society, including individuals, businesses, and governments (Chen et al. 2012). Big data may be one of the most significant technological disruptions in business and academic ecosystems in recent years (Agarwal and Dhar 2014). As the label itself indicates, big data refers to large volumes of data generated and made available online and in digital media ecosystems. Big data are generated from diferent type of sources, such as the multiple transac- tions performed daily, posts made on social media, or from the increasing number of sensors installed in numerous objects (e.g., mobile phones, home appliances, cars, etc.). Big data analytics is a tool that transcends pattern analysis, enables the prediction of events (George et al. 2014), and supports artificial intelligence that is capable of automating processes, transforming companies, and establishing new types of businesses (Ng 2018). Additionally, it has the potential to generate value for the advancement of sustainable and prosperous societies.In recent years, there has been a significant increase in the focus on big data, business analytics, and "smart" environments as a means of influencing organizational decision-making. Organizations are currently working to provide a purpose to the data and obtain value-driven answers that will enhance their performance (Mayhew et al. 2016). This has a significant impact on various members of society, including individuals, businesses, and governments (Chen et al. 2012). Big data may be one of the most significant technological disruptions in business and academic ecosystems in recent years (Agarwal and Dhar 2014). As the label itself indicates, big data refers to large volumes of data generated and made available online and in digital media ecosystems. Big data are generated from diferent type of sources, such as the multiple transac- tions performed daily, posts made on social media, or from the increasing number of sensors installed in numerous objects (e.g., mobile phones, home appliances, cars, etc.). Big data analytics is a tool that transcends pattern analysis, enables the prediction of events (George et al. 2014), and supports artificial intelligence that is capable of automating processes, transforming companies, and

establishing new types of businesses (Ng 2018). Additionally, it has the potential to generate value for the advancement of sustainable and prosperous societies.

Recent years have witnessed an escalation of transformation processes in contemporary organizations linked to the digitalization of business systems. The shift to conducting business entirely in a digital format is gaining traction, supported by optimistic outcomes reported by several of the world's largest corporations. The digitalization of organizational systems can provide a business with a significant competitive advantage, provided it is executed with due consideration of all requisite criteria. Some leaders view the digitalization of business systems merely as a shift to "new hardware"; however, we contend that this perspective is misguided. It is feasible to augment the number of computers within an organization; however, the anticipated economic impact may not be realized. It is essential to recognize that the sought-after competitive advantages can only be cultivated through a comprehensive transformation of the organizational system, necessitating alterations in material, organizational, and human capital. It is essential to recognize that human capital is primarily cultivated within various levels of the education system; thus, the systematic enhancement of digital competencies among prospective or existing employees is indispensable. Thus, digital transformation processes influence not only business systems but society at large, thereby necessitating the inclusion of major stakeholders such as transnational corporations and states. The former have been actively involved in the digital transformation of their business for an extended period, achieving notable success. Additionally, state governments promptly recognized the necessity for systematic management of digital processes, leading to the establishment of various national programs aimed at developing the digital economy. Consequently, we can ascertain that entrepreneurs encounter challenges pertaining not only to the implementation of novel digital technologies and the enhancement of competitive advantages through their utilization, but also to the identification of management tools that are most appropriate for the contemporary digital landscape. Preoccupation with outdated organizational management methods may result in systemic failure, rendering the challenges of digital transformation increasingly pressing in contemporary contexts. Our research examined the scholarly contributions of Denning S., Parker J., Alstin M., Chaudary S., Zaki M., and others, who analyze the transformative effects of digital technologies on economic systems; the studies by Wade M., Ismagilova L.A., Gileva T.A., Westerman G., Bonnet D., and others, which investigate the trends in societal digitalization; as well as the works of Russian academics (Loshkova I.V., Korolev G.V., among others) addressing the challenges of implementing "Industry 4.0" technology platforms in Russia. All of the aforementioned factors compelled us to address the issue at hand. Chernyavskaya et al., 2021

The quantification of performance through metrics, and compensation derived from it, overshadows this perspective. Given the significant role of the human factor in value creation, it is advisable for companies to have various specialized areas, including controlling and HR, concentrate on optimizing human resource utilization to enhance competitiveness. (Szőke, Tóth, Vanó 2022) A report from the State Audit Office of Hungary, published two years ago (Németh, 2020), underscores the significance of this issue by posing critical inquiries regarding public offices and the public sector. It achieves this by employing contemporary IT solutions available in the market to address them, while maintaining a focus on fundamental functions. The questions encompass a range from pertinent and quantifiable objective statements to their validation through accurate information, including the hierarchy of objectives, sub-objectives, and the timeline for their attainment. Not forgetting, of course, the regulatory, institutional and financial framework, as well as the evaluation environment, monitoring and follow-up. The public sector perceives this as a novel and obligatory responsibility—enhancing customer and organizational value (Felméry, 2015)—whereas large corporations regard human IT solutions for operational support as a critical strategic concern. Simultaneously, on a global scale, operators can no longer anticipate a distinct competitive advantage from utilizing this module of integrated management systems (Barna, 2022).

2. LITERATURE REVIEW

2.1 Data Science

The rising trend of open innovation necessitates a comprehensive viewpoint and demands a reevaluation of conventional notions regarding firm boundaries in relation to knowledge exploration, retention, and exploitation both within and beyond organizational limits (Chesbrough, 2006; Del Giudice and Della Peruta, 2013). Quantitative empirical research on external knowledge sourcing indicates that engaging numerous external sources in innovation is an advantageous strategy for enhancing firms' economic performance (Chesbrough et al., 2006; Perkmann and Walsh, 2007; Del Giudice and Della Peruta, 2016). Scholars of open innovation concur that external knowledge sourcing does not supplant internal research and development, emphasizing the significance of "absorptive capacity," which enables firms to recognize, assimilate, and utilize external knowledge (Spithoven et al., 2010). Furthermore, numerous studies have focused on the role of varied relationships and collaborations established by firms with other stakeholders to "absorb" market dynamics. Downloaded by Dr. Valentina Cillo May 2019 (PT) external knowledge (Zahra and George, 2002; Huang and Rice, 2009; Scuotto, Del Giudice, Bresciani and Meissner, 2017). The ability of a firm to leverage external

knowledge is a crucial factor influencing its innovation capacity (Chesbrough, 2006; Scuotto, Del Giudice, della Peruta, and Tarba, 2017).

H1: Data Science integration positively impact Employee Performance

2.1.1 Artificial intelligence

Artificial Intelligence (AI) is fundamental to numerous sectors that have adopted new information technologies. The origins of AI date back several decades, yet there is a unanimous agreement on the critical significance of intelligent machines equipped with learning, reasoning, and adaptive abilities today. These capabilities enable AI methods to attain unparalleled performance in learning to address increasingly intricate computational tasks, rendering them essential for the future advancement of human society. The sophistication of AI-powered systems has recently advanced to a level where minimal human intervention is necessary for their design and deployment. As decisions generated by such systems increasingly impact human lives, particularly in fields like medicine, law, or defense, there is a growing necessity to comprehend how these decisions are produced by AI methodologies. Initially, AI systems were highly interpretable; however, recent years have seen the emergence of opaque decision-making systems like Deep Neural Networks (DNNs). The empirical efficacy of Deep Learning (DL) models, such as Deep Neural Networks (DNNs), arises from a confluence of effective learning algorithms and their extensive parametric space. The latter space consists of numerous layers and millions of parameters, rendering DNNs complex black-box models. The antithesis of black-box characteristics is transparency, which entails the pursuit of a direct comprehension of the mechanisms underlying a model's functionality.

2.1.2 Machine learning

Intelligibility need not be uniform across different observers, whether they are experts, policymakers, or lay users lacking machine learning expertise, to facilitate comprehension. One reason, as previously stated, is that a challenge in XAI is the establishment of objective metrics for defining a satisfactory explanation. A potential method to mitigate this subjectivity is to draw upon experiments in human psychology, sociology, or cognitive sciences to formulate objectively persuasive explanations. As Machine Learning (ML) models are increasingly utilized for significant predictions in critical contexts, the demand for transparency from various stakeholders in AI is rising. The risk lies in formulating and employing decisions that are unjustifiable, illegitimate, or that fail to provide comprehensive explanations of their behavior. Explanations that substantiate a model's output are essential, particularly in precision medicine, where specialists necessitate comprehensive information beyond a mere binary prediction to aid their diagnosis. Other examples include autonomous vehicles in transportation, security, and finance, among others. Generally, individuals are reluctant to embrace methods that lack direct interpretability, tractability, and reliability, particularly in light of the growing demand for ethical AI. It is conventional to believe that an exclusive emphasis on performance will render systems progressively opaque. There exists a trade-off between a model's performance and its transparency. Nonetheless, enhanced comprehension of a system can result in the rectification of its shortcomings.

2.1.3 Predictive analytics

Predictive analytics is a robust instrument employed to anticipate future results through the examination of historical data, statistical algorithms, and machine learning methodologies. It has garnered considerable attention across multiple industries for its capacity to optimize decision-making, enhance efficiency, and improve overall performance. Shmueli and Koppius (2011) assert that predictive analytics is especially effective for forecasting the probability of events or behaviors, including customer purchases and employee turnover. The domain employs various methodologies, such as linear and logistic regression, decision trees, random forests, and neural networks, to forecast either continuous or categorical results. Logistic regression is frequently utilized in binary classification tasks, aiming to predict outcomes such as customer attrition or disease probability (Menard, 2002). Decision trees and random forests, as articulated by Breiman et al. (1986), are instrumental in elucidating intricate relationships among variables and facilitating predictions derived from these patterns. Furthermore, machine learning techniques like neural networks and support vector machines (SVMs) are increasingly used to tackle non-linear relationships, as evidenced by the work of LeCun et al. (2015) and Cortes & Vapnik (1995), respectively. Predictive analytics is utilized across various industries, including healthcare for forecasting patient outcomes and refining treatment strategies (Raschka & Mirjalili, 2017), and marketing for customer segmentation and churn forecasting (Neslin et al., 2006). Notwithstanding its potential, challenges endure, including data quality, overfitting, and the interpretability of intricate models. Concerns such as biased models and ethical implications are substantial, as emphasized by O'Neil (2016), particularly in areas like recruitment and criminal justice. With technological progress, predictive analytics is advancing through the incorporation of artificial intelligence (AI), real-time data processing, and the demand for explainable AI, which seeks to enhance the transparency and interpretability of complex models for users (Ribeiro et al., 2016). These advancements are anticipated to persist in propelling the adoption of predictive analytics across multiple sectors, augmenting decision-making processes and enhancing business outcomes.

2.2 Digitalization

Numerous organizations currently implement IT Governance (ITG). IT governance refers to the establishment of decision-

making rights and responsibilities that promote efficient and ethical practices in the utilization of information technology, thereby enhancing business value. IT governance is a crucial element in addressing digitalization across various organizations. Organizations with a growing digital business focus can gain advantages from effective IT governance to manage IT complexities. ITG assists organizations in navigating the escalating complexity of managing corporate IT departments amid a rising business focus. The reassessment of IT strategy's function, transitioning from a merely operational role aligned with business strategy to a strategic role that adds value to the enterprise, exemplifies the phenomenon of digitalization. Organizational culture is a significant factor in the request for digitalization. An organizational culture that aligns with business objectives can enhance performance in areas such as digitalization and IT governance.

Presently, numerous organizations are confronting various challenges related to digitalization, with IT governance performance being a primary concern for managers in this domain. Firms extensively utilize IT governance to achieve substantial returns on their IT investments and to gain a competitive edge over companies that lack effective IT governance. Nonetheless, numerous facets of this domain, including the impact of organizational culture, require further examination [6]. The IT Governance Institute asserts that IT governance is not conducted in isolation but is shaped by its surrounding environment [8]. This underscores the crucial influence of environmental factors, particularly culture, in IT governance. Organizational culture is frequently held accountable for failures in IT investments. Cultural disparities can also affect management styles [21]. Thus, at the organizational level, cultural disparities are a contributing factor to varying levels of IT governance performance.

H2: Digitalization has positive impact on employee performance

2.2.1 Organizational culture

An organizational culture comprises a compilation of organizational conventions, values, attitudes, and practices that promote ongoing learning and professional development (Marsick and Watkins, 2003; Watkins and Kim, 2018; Watkins and Marsick, 1997). In the contemporary, rapidly evolving environment, establishing an Organizational Learning Culture that links organizational learning to performance enhancement is essential for an organization's competitive capacity (Lau et al., 2019). In a structured change environment, a company with an Organizational Learning Culture can convert the learning process into a constructive, communicative, and collaborative model, wherein employee learning occurs through a systematic and task-oriented approach that identifies and addresses specific organizational learning requirements (Cummings and Worley, 2015). An OC has been identified as positively correlated with organizational innovation and contributes to the maintenance of employee job satisfaction and performance, as well as that of IJM within their organization (Camps and Luna-Arocas, 2012; Wang and Ellinger, 2011). The relationship between an organizational culture and other workforce-related variables necessitates comprehensive empirical investigation and endeavors (Egan et al., 2004; Lin et al., 2019). The current research on an organization cultural is founded on the metrics developed by Watkins and Marsick (1997) and Marsick and Watkins (2003) in the Dimensions of Learning Organization Questionnaire (DLOQ), which has been validated across diverse cultural contexts (Watkins and Kim, 2018). Consequently, we embraced the construct delineated in the DLOQ to enhance our comprehension of the execution of an OC within the Taiwanese organizational change milieu, considering its rarity and the importance of empirical investigation.

2.2.2 Employee Privacy

Data privacy pertains to the safeguarding of personal or sensitive information against unauthorized access, dissemination, or exploitation. It emphasizes the necessity for individuals to maintain authority over their personal data. Data security encompasses the strategies and protocols implemented to protect this data from breaches, theft, or other nefarious activities. Collectively, these concepts are essential for safeguarding sensitive information, including employee records, from threats. Historically, numerous efforts have been made to conceptualize concerns regarding information privacy. The notion of information privacy concerns is influenced by Smith et al. [10], who were pioneers in articulating consumer privacy apprehensions through the Concern for Information Privacy (CFIP) scale. The CFIP scale is the predominant instrument for assessing consumer privacy concerns [4]. Malhotra et al. [12] adapted the CFIP scale for the online environment. The authors encapsulate their findings in the Internet Users' Information Privacy Concerns (IUIPC) scale. Unauthorized Secondary Use refers to the issue wherein information is gathered for a specific, disclosed purpose but subsequently utilized for an alternative, secondary purpose. Improper Access refers to the user's apprehension regarding unauthorized individuals gaining access to confidential information. Finally, Errors addresses the user's apprehension regarding the potential presence of intentional or inadvertent inaccuracies in their stored personal information. Additionally, the IUIPC scale delineates three dimensions: Collection, Control, and Awareness, with the former being derived from the CFIP. The Control dimension pertains to the user's capacity to manage their personal information, including the option to decline participation in a service. Awareness of Privacy Practices pertains to the user's understanding of the company's data utilization.

2.3 HR functions

Armstrong (1997) Human Resource Management is defined as a strategic approach to acquiring, developing, managing, motivating, and securing the commitment of the

organization's essential resource—its personnel. HRM deals with concerns related to human resources such as hiring, training & development, compensation, motivation, communication, and administration.(Patidar, 2014) HR experts in each discipline may execute more than one of the more than six vital functions such as recruitment, safety, employee relations, compensation & benefits, compliance, and training & development. (Mayhew, 2017) Mooney (2017) The HRD manages numerous essential functions within a business. It is significant in terms of labor law compliance, record-keeping, recruitment and training, compensation, relational support, and addressing specific performance issues. The HRM holds out three separate functions such as a line functions, a coordinative functions, and staff functions. (Dessler & Varkkey, 2011) The functions performed by managers are recognized by all organizations. For the handiness of study, the function execute by the resource management can roughly be categorized into two categories Managerial functions (staffing, directing, and controlling), and Operative functions (Procurement, Development, Compensation, and Maintenance). (Chand, 2016) To look at HRM more expressly recommend that it consists of four fundamental functions staffing, training and development, motivation, and maintenance. That might say that HRM is contained of four activities like hiring people, preparing them, stimulating them, and keeping them. (DeCenzo& Robbins, 2015)

H3: HR functions positively affect employee performance

2.3.1 Performance Appraisal

Takeuchi et al. (2007) defined performance appraisal as the employers' perception that employees' performance can be critically evaluated based on measurable outcomes. The performance appraisal encompassed the shared objective of highlighting feedback on employee development and team performance. Employee output is defined as the results of individuals concerning processes, outcomes, significance, and achievement (Nassazi, 2013). Productivity, quality, efficiency, effectiveness, and attendance are indicators of employee performance (Arinanye, 2015). The cumulative achievement of a specific mission, assessed against predetermined criteria of accuracy, cost, and efficiency; or a methodical strategy for augmenting operational productivity by enhancing the performance of individuals within an organization. Performance appraisal is a structured formal mechanism between the employer and employees that involves ongoing observation and evaluation of employee performance (Bhardwaj, Singh, and Kumar, 2020).

The significant of the performance appraisal system is partially due to the essence of the modern business climate, which is to achieve organizational goals and remain competitive in highly competitive markets through superior employees' performance (Chen & Eldridge, 2012). In addition, the performance appraisal system can be used to assist the management decision making on termination and retention towards the employees (Rowland & Hall, 2012). According to Maley (2013), if performance appraisal is executed without clear objectives, it can have a serious impact in terms of employee's dissatisfaction and as a result of low performance and low organizational commitment by employees. Hence, performance appraisal is important in contributing to employee's motivation. This point is supported by Samarakone (2010), people tend to recognize negatively rather than no recognition at all. Moreover, performance appraisal can motivate the employees, increase the employees' morale and thus increase their performance in work. Based on the study of Fakhimi and Raisy (2013), there is a positive relationship between performance appraisal and the employees' behavioural outcome like affective commitment, turnover intention, work effort and motivation to improve. This are also supported by Pettijohn et al. (2001), if the employees are not appraised for their good performance, the employees will perform badly in next time.

2.3.2 Learning and Development

Training and development could increase the performance of the employees. At any level of the organization, such as strategy, tactics or operations, the need for employee training and development may occur within the levels. Training and development can be used as a method to guide a person and improve their operational and managerial skills when needed to perform a job with the resources which providing by organisations. So, their employee will turn into more comfortable with their work and more efficiency in performing their tasks which lead the organization to be more effective. Therefore, in order to leverage and maximise the value and capacity of employees, training and development are the core aspects of every business (Chukwuka and Dibie, 2024). Elnaga and Imran (2013) have stated that training and development help individuals in reducing their frustration or dissatisfaction that encountered in workplace. According to Asim (2013), training and development of employees serve as the tool in enhancing the abilities and competencies of employee that required to do a task, it also provides the opportunity to make employees become more comfortable with the outcomes of their success. Not only that, but enhanced competencies also contribute to improve the performance and retention. This is because the outcome are not as expected when a task is not performed well, and therefore the employees will has a sense of demotivated to keep well performance in their workplace. They might even decide to leave the company as they will think that think they are no longer productive in the company and are not satisfied with their work. According to Bapna et al (2013), therefore, training and development is an important part in human resource, as it can not only maximize personal returns, but also attract better talents into the organization. Also, Atif et al. (2010) added that, training and development is one of the effective methods to increase the commitment of employee as it able to motivate the employee in organization that helps

reduce turnover. Apart from increase the commitment, training and development also able rising the organization's productivity. This is because it not only able the employee more resourcefully, but it as an opportunity for employee to learn their roles and work more competently. There are different studies suggest that training and development has a positive relationship on the productivity of workers. For example, the research of Satterfield and Hughes (2007) showed that training and development have the impacts on the actions and capabilities of the employees, which results in better performance and constructive improvement for the employees. Ekaterini and Constantinos Vasilios (2009) reported that training and development is one of the most common approaches to improve the employee's productivity. Rohan and Madhumita (2012) also indicated that investment in trainings such as problem-solving, decision-making, human interaction, and collaboration has also had a significant influence on the pace of development of companies and on their performance. (Karim, Choudhury, and Latif, 2019).

2.4 Employee Performance

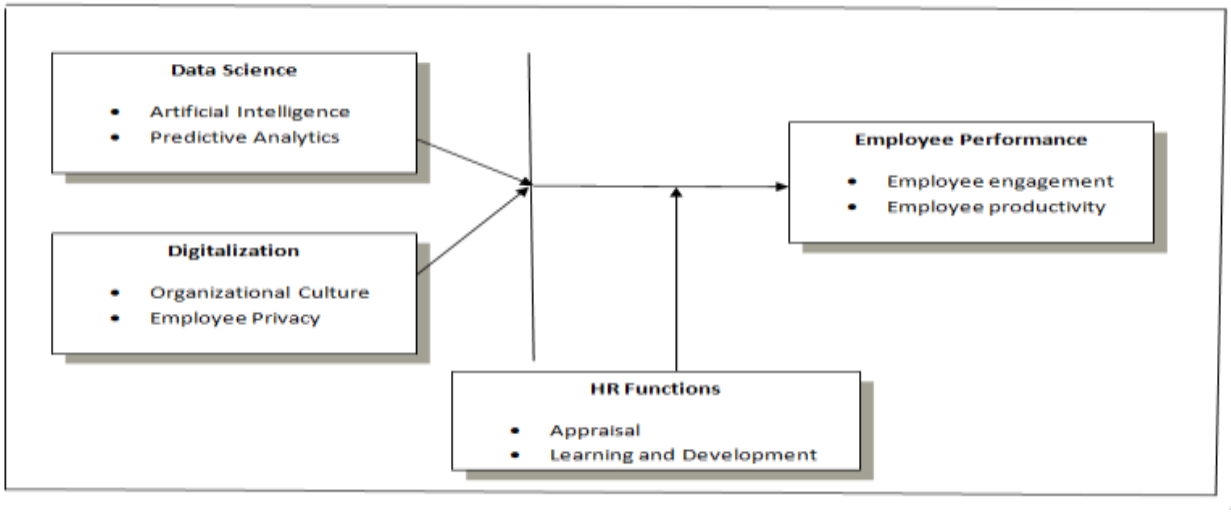
The performance of an employee is defined by their actions and inactions. Employee performance involves quality and quantity of output, presence at work, accommodative and helpful nature and timeliness of output. According to the results of the study conducted by Yang (2008) on individual performance showed that performance of the individuals cannot be verified. Similarly he asserts that organizations can use direct bonuses and rewards based on individual performance if employee performance is noticeable (Yang, 2008). In line with Yang (2008), Bishop (1987) investigated employee performance and revealed that acknowledgment and recognition and reward of performance of employees direct the discrimination between employee productivity. Moral and productivity of employees is highly influenced by the effectiveness of performance of an organization and its reward management system (Yazıcı, 2008). To satisfy customers, companies exert considerable effort but neglect to prioritize employee satisfaction. Customer satisfaction is contingent upon employee satisfaction. Because, if employees are satisfied, they will do more work therefore ultimately customers will be satisfied (Ahmad, 2012). Employee performance is actually influenced by motivation because if employees are motivated then they will do work with more effort and by which performance will ultimately improve (Azar and Shafighi, 2013)

2.4.1 Employee engagement

A primary challenge identified in the literature is the absence of a universal definition of employee engagement. Kahn (1990:694) characterizes employee engagement as the integration of organizational members' identities with their work roles; in this state of engagement, individuals utilize and manifest themselves physically, cognitively, and emotionally in their role performances. The cognitive dimension of employee engagement pertains to employees' perceptions regarding the organization, its leadership, and the working environment. The emotional dimension pertains to employees' sentiments regarding each of the three factors and their positive or negative attitudes towards the organization and its leadership. The physical dimension of employee engagement pertains to the physical energies expended by individuals to fulfill their responsibilities. According to Kahn (1990), engagement entails being both psychologically and physically present while fulfilling an organizational role. Employee engagement is frequently characterized as the emotional and intellectual commitment to the organization (Baumruk 2004, Richman 2006, Shaw 2005) or the extent of discretionary effort demonstrated by employees in their roles (Frank et al 2004). While it is recognized that employee engagement is a complex construct, Truss et al. (2006) define it succinctly as 'passion for work,' a psychological state that encompasses the three dimensions of engagement identified by Kahn (1990) and reflects the overarching theme present in all definitions. The presence of various definitions complicates the assessment of employee engagement, as each study investigates it using distinct methodologies. Moreover, without a universal definition and measurement of employee engagement, it cannot be effectively managed, nor can the efficacy of improvement efforts be ascertained (Ferguson 2007).

3. FRAMEWORK

This research framework examines the influence of data science and digitalization on employee performance, emphasizing the moderating role of the HR function in the digital age. The independent variable (IV), data science and digitalization, denotes the incorporation of sophisticated digital technologies and data analytics in organizations, anticipated to enhance operational efficiency and employee productivity. The dependent variable (DV), employee performance, is assessed through factors including productivity, work quality, and overall task efficacy. The HR function serves as a mediator in this framework, shaping the adoption and utilization of digital tools within the organization. HR's role in recruitment, training, employee development, and fostering a technology-driven culture can either amplify or hinder the impact of digitalization on employee performance. Particularly, HR practices including the provision of digital skills training, assistance for technology adoption, and the promotion of a culture of continuous learning can enhance the connection between digitalization and performance. Conversely, insufficient HR engagement may restrict the potential advantages of digitalization on employee performance. The study seeks to examine if the HR function moderates this relationship, positing that robust HR practices will amplify the beneficial impacts of data science and digitalization on employee performance.



4. METHODS

The study sample consisted of employees with experience in the business and financial sectors of Bangladesh, specifically targeting those in departments pertinent to digital tools, data science, and employee performance. Respondents were chosen for their expertise in specific departments, requiring at least two years of relevant work experience to guarantee informed responses grounded in contemporary, real-world situations. This selection criterion sought to obtain insights from professionals capable of offering practical knowledge regarding the influence of digitalization and data science on employee performance.

The sample frame theoretically included the entire population of business or finance professionals in Bangladesh. Three hundred fifty questionnaires were disseminated to employees in the IT, HRM, and administrative departments. The survey produced 313 fully completed and valid responses, resulting in a response rate of 89.71%. The elevated response rate is deemed substantial and indicates significant engagement from the target demographic, particularly as surveys involving senior management generally exhibit reduced response rates (Menon, Bharadwaj, and Howell, 1996).

4.1 Consideration of Sample Size

To confirm that the sample size of 313 is statistically sufficient and representative of the population, a theoretical formula for sample size determination will be utilized to validate the statistical integrity of the sample. This guarantees that the findings are dependable and relevant to the wider population of employees in the business and financial sectors in Bangladesh. The authors will delineate the methodology employed to ascertain the sample size and confirm its sufficiency for generalization in the final paper.

4.2 Preliminary Assessment of the Questionnaire

Before distributing the final survey, a pre-test was administered to a small group of five participants. The pre-test aimed to evaluate the clarity, relevance, and efficacy of the questionnaire in obtaining the desired information. This process facilitated the identification of ambiguities or issues within the survey questions that could impact data quality. The pre-test feedback was utilized to enhance the questionnaire, ensuring it accurately identified the factors influencing employee performance concerning digitalization and data science.

4.3 Data Acquisition

The data was gathered utilizing a standardized, non-comparative questionnaire that employed a five-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). The questionnaire evaluated multiple factors concerning respondents' intentions to stay with their organization, emphasizing the influence of data science, digitalization, and HR functions on employee performance. The survey was disseminated electronically, and responses were collected from professionals with expertise in IT, HRM, and administrative roles who were suitably equipped to comprehend the subject under investigation.

4.4 Data Examination

The data gathered from 313 respondents was analyzed utilizing SPSS 20. Descriptive statistics and regression analysis were utilized to examine the correlations among digitalization, data science, HR functions, and employee performance. SPSS 20 facilitated an in-depth examination of essential elements, including the utilization of digital tools, data-informed decision-making, and employee involvement. The analysis sought to evaluate hypotheses concerning the influence of digitalization and HR strategies on employee performance, as well as the moderating impact of HR functions within this relationship.

4.5 Ethical Considerations

Ethical considerations were rigorously observed throughout the data collection and analysis process. Participants were guaranteed confidentiality, and informed consent was secured before their involvement in the survey. The research was executed with transparency and regard for participants'

privacy, guaranteeing that their responses were utilized exclusively for academic purposes.

4.6 Final Assessment

This study utilizes research methods to investigate the impact of data science and digital technologies on employee performance and to evaluate the moderating influence of HR functions in this context. The utilization of a substantial sample, pre-testing of the questionnaire, and sophisticated data analysis methods using SPSS 20 guarantees the reliability and validity of the results. The study's findings will offer significant insights for organizations aiming to leverage digital tools and data-driven strategies to enhance performance in the digital age.

The demographic information is given below:

Table-1: Demographic information

Factor	Segmentation	No. of respondents
Gender	Male	167
	Female	146
Age	Under 30	49
	30-40	132
	41-50	99
	Above 50	33
Department	Finance	71
	HRM	140
	Marketing	34
	Production	48
	Others	20
Work experience	2-4 years	120
	5-7 years	125
	8-10 years	68
Education	Bacherlors'	189
	Masters'	93
	Doctoral	31

Source: Author's construction based on the conducted survey

5. FINDINGS AND ANALYSIS

To test the accuracy of data, Principal Component Analysis has been used and the following results are found.

Variable	Items	Factor loading	KMO Test of Adequacy	Bartlett's Test of Sphericity	Sig.	Cronbach Alpha
DS	Q1	.832	0.789	263.169	.000	0.756
	Q2	.707				
	Q3	.690				
	Q4	.896				
	Q5	.749				
	Q6	.775				
	Q7	.849				
Digi	Q8	.763	0.748	280.091	.000	.862
	Q9	.826				
	Q10	.735				
	Q11	.876				
	Q12	.718				
	Q13	.670				
	Q14	.701				
	Q15	.789				
HF	Q16	.745	0.795	344.560	.000	0.863
	Q17	.863				

	Q18	.742				
	Q19	.738				
	Q20	.892				
EP	Q21	.763	0.853	355.633	.000	0.761
	Q22	.710				
	Q23	.693				
	Q24	.790				
	Q25	.849				

Extraction Method: Principal Component Analysis
Source: Field survey, 2024
Source: Author's construction based on the spss data results

The Kaiser-Meyer-Olkin (KMO) test of adequacy for individual variance is 0.500 or higher in each case, indicating that there is sufficient correlation between the items of each variable and certifying the data set's suitability for further analysis. Bartlett's sphericity test confirms the correlation matrices' significance, with α close to zero. Reliability testing is critical in scientific research to determine the consistency of measurements. In this study, Cronbach alpha values for all constructs are above 0.6, indicating good internal consistency

Independent Variable	**Dependent Variable**	**R**	**F**	**Sig.**	**t-test**	**Sig.**	**D**	**Beta**	**Moderating effect**
Data Science	Employee Performance	.899[a]	259.163	.000	3.635	.000	1.883	.475	Full
Digitalization					8.709	.000		.266	Partial

The result of F-test (table 3) shows that all independent variables have joint significant positive impact over the Employee performance. The level of significance is also near to zero. The D test shows that there is no autocorrelation problem exists in this analysis. The standard deviations are also reasonable which refers data is more concentrated. Hypotheses' testing has done by generating T-Statistics for significance testing. The significance level for two-tailed t-test was 5% and the path coefficient will be significant if the T-Statistics is larger than 1.96. All the hypothesis has significant individual impact on employees' intention to stay. Also HR function as a moderating variable has full and partial impact on the positive result.

Regression model has been drawn by SPSS analysis. The significance level for two-tailed t-test was 5% and the path coefficient will be significant if the T-Statistics is larger than 1.96. Here all the hypothesis has accepted and has significant positive relationship with dependent variable

6. CONCLUSION

In conclusion to providing compelling evidence that data science and digitalization are essential for improving employee performance, the study also demonstrates that the human resources function plays an essential part in moderating the effects of these two factors. If an organization wants to improve employee outcomes through the utilization of digital tools, it must prioritize human resource strategies that are in line with technological advancements in order to make the most of the potential benefits of these tools. By highlighting the significance of investing in digital tools, data literacy, and human resource functions, the findings highlight the importance of maintaining a competitive edge in the digital era.

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