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Research Article

The Role of Technology In Human Capital Management

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Abstract
This research aims to analyse the role of technology in Human Capital Management (HCM) with a focus on efficiency, effectiveness, and challenges in implementing the technology. The research uses a qualitative method with a literature study approach. Data were collected from various secondary sources such as books, scientific journals, and relevant reports, which were analysed descriptively qualitatively to understand the contribution of technology to HCM. The results show that technologies, such as Artificial Intelligence (AI), Machine Learning (ML), Big Data, and Internet of Things (IoT), have improved the efficiency and effectiveness of various HCM functions, from recruitment, training, to performance management. These technologies enable more accurate and faster data-driven decision-making, supporting adaptation to changing work environments. However, the research also found challenges such as the risk of reliance on automated systems, data security, and workforce skills gaps. The implications of this research emphasise the importance of balancing technological automation and human elements in HCM to avoid dehumanisation. Practically, companies are advised to improve employee skills through continuous training and strengthen data security policies to maximise the benefits of technology in human resource management.

Keywords: Competitiveness, Human Capital Management, Technology

1. Introduction

Technological developments have brought significant changes in various aspects of life, including in human resource management (HRM). Human Capital Management (HCM) is a strategic approach in managing employees to support the achievement of organisational goals. Along with the increasingly complex demands of the world of work, the role of technology in HCM is increasingly important to create efficiency and effectiveness in various HR processes. One of the main impacts of technology on HCM is in the recruitment process. With digital platforms and artificial intelligence (AI), companies can speed up the search for candidates that match their needs. Technology also helps reduce selection bias, allowing organisations to source more qualified and diverse candidates.

In terms of e-government implementation, ASEAN countries show varying degrees of progress. According to the 'e-Government Development Index (EGDI) 2024' released by the UN, Singapore leads the region with an EGDI score of 0.9150 (ranked 7th in the world), followed by Malaysia (0.8130), Thailand (0.7565), Brunei Darussalam (0.7130), and the Philippines (0.6782). Indonesia ranked 6th in ASEAN with an EGDI score of 0.6345, slightly below the regional average of 0.6408. Despite the improvement in EGDI scores in all ASEAN countries compared to 2020, gaps in the dimensions of online services, telecommunications infrastructure, and human capital are still a challenge in the implementation of inclusive and equitable e-government in the region (United Nations, 2024).

In addition, technology also plays a big role in employee development. With e-learning platforms and other learning technologies, companies can provide flexible and accessible training at any time. This allows employees to continuously improve their skills, which in turn supports career progression

and improved organisational performance. In terms of performance management, technology makes it easier to monitor and evaluate employee performance more accurately and in real-time. Technology-based performance management systems allow for faster, more transparent and data-driven feedback, which is critical to improving employee motivation and productivity.

In the context of increasingly fierce global competition, effective HCM is key in driving employee development, engagement, and retention. Key HCM practices include training and development to enhance skills and adaptability, performance appraisal to align individual and organisational goals, and recruitment and selection to find the best talent that fits the organisation's culture. In addition, clear career management and mentoring opportunities also play an important role in improving employee satisfaction and retention. Technological developments, such as data processing and artificial intelligence (AI), also have a significant impact on HCM decision-making, although they cannot replace the role of HR managers (Chopra, 2023). Ineffectiveness in HCM can lead to huge financial losses, one of which is the cost of up to 30% of wages paid on poor HR practices (Chopra, 2023). Effective HCM practices can also provide competitive advantage and contribute to organisational efficiency (Poishchuk, 2024), and support long-term development in line with the company's strategic objectives (Poishchuk, 2024).

Technology also enables more effective data management. By using people analytics, organisations can identify trends and patterns that can aid in strategic decision-making. It also allows organisations to plan future workforce needs more precisely, as well as optimise payroll and benefits management. Finally, technology also simplifies HR administration that was previously time- and labour-intensive. Automation of routine tasks, such as managing attendance, payroll, or leave requests, reduces the administrative burden and allows HR departments to focus on more strategic initiatives. Overall, the role of technology in HCM is immense in improving the efficiency, accuracy, and competitiveness of companies in the ever-evolving labour market.

As technology advances rapidly, the skills and competencies required by the workforce are changing, which creates various problems in HR development. One of the main issues is inadequate employee preparation. Many employees lack the skills needed to adapt to new digital technologies, leading to skills gaps. This makes it difficult for organisations to retrain and upskill their workforce in the face of rapidly evolving technological demands (Boikivska, 2023). Moreover, the digital divide further exacerbates social inequalities, as not all employees have equal access to digital resources and training opportunities. The risk of job displacement due to automation also disproportionately affects low-skilled workers, which is a significant economic issue (Patil, 2024). Ethical and legal challenges also arise with the integration of technology in the workplace, such as concerns regarding employee surveillance and data privacy. HRMs must be able to navigate the complex legal framework regarding the use of technology in the work environment (Challenges for Human Resource Management in the Era of Dynamically Changing Technology: A Quantitative Investigation, 2023). While technology presents major challenges, it also opens up opportunities to improve HR management through innovative training methods and better workforce management strategies.

2. Literature Review

2.1. Definition of Human Capital Management

In the Era of Globalisation, national boundaries are increasingly unclear and even tend to form a borderless world. The need for Information Communication and Technology (ICT) Investment and Resources is increasing. All supported by the rapid advancement of Communication and Information Technology. In the global era with advanced technology, people all over the world are connected

without barriers. The beginning of the twenty-first century has already seen indications. With this facility can communicate with people around the world more effectively and efficiently. Human Resource Management has a very important (significant) meaning, not only seen in the context of humans as the most important factor in management in any organisation or institution (government, private or NGO) but and especially seen in the affirmation of the power qualifications (energy) inherent in these humans who have the ability (competency) to build towards positive progress (forward-positive) (Suparjiman et al., 2023)

Human Resource Management is management that is expected to be integrated into the development and development of human strength or usability, so that it provides positive benefits for the people concerned, the organisation and society (Hasibuan, 2008). Meanwhile, the definition of HRM according to (Terry, 2021) is the process of humanely utilising human beings as a workforce, so that their physical and psychological potential functions optimally for the achievement of organisational/institutional/business entity goals.

It can be concluded that the rapid development of Information and Communication Technology (ICT) has blurred national boundaries and created a world without barriers. These technologies enable more effective and efficient global communication, thus increasing the need for investment in technology and human resources. Human capital management (HCM) is becoming increasingly important because of its role not only as an organisational driver, but also as a crucial factor in ensuring people have competencies that support positive progress for the organisation and society (Naninsih et al., 2023).

HCM focuses on developing human capabilities in an integrated manner, maximising their physical and psychological potential in order to contribute optimally to organisational goals. According to GR. Terry, HCM is a process that focuses on managing the workforce in a humane manner, so that the potential of workers can be utilised to achieve the best results. Through proper management, HCM not only brings benefits to individuals but also supports the achievement of the organisation's vision and the welfare of the wider community.

2.2. Human Capital Management Information System

Every organisation, especially companies, requires real data from every level of management. The data is compiled and managed in an information system. One of the most important information systems in the company is the Human Resources Information System (HRIS). Definition of HRIS Human Resources Information System (HRIS) is a computer application program that organises the governance and management of HR management in companies to support the decision-making process or commonly referred to as the Decision Support System by providing various information needed (Kabul, 2024). According to wikipedia.com, HRIS is a form of intersection / meeting between the fields of human resource management (HRM) and information technology. This system combines HRM as a discipline that mainly applies the field of information technology to HRM activities such as planning, and compiles a data processing system in a series of standardised steps and is summarised in an enterprise resource planning (ERP) application (Mazka, 2023).

Overall, ERP systems aim to integrate information obtained from different applications into one universal database system. The linkage of the financial calculation module and the HRM module through the same database is a very important thing that distinguishes it from other forms of applications that have been made before, making this application more flexible but also more rigid with its rules.

The characteristics of the information prepared in the Human Resource Information System are:

1. Timely
2. Accurate
3. Concise
4. Relevant
5. Complete

Managers in a company need information that has the above characteristics in order to make a decision (a decision making). The Internet of Things or IOT is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people equipped with unique identifiers or UIDs (Unique Identifiers) and the ability to transfer data over a network. The Internet of Things can be defined as the evolution of technology that has become the talk of many people in developing the use of the internet in daily activities. At this time Broadband internet has been widely used by all people of the world, more and more internet users, the creation of WiFi that can connect smartphones with internet access and later the Internet of Things will be widely used by the international community in their activities. The definition of Internet of Thing or known as IoT, according to experts, are;

1. Mouha (2021) defines Internet of Thing is defined as a mature concept in which objects have the ability to transfer data over a network.
2. IoT is part of the application of technology that allows control, communication, cooperation with various hardware, data through the internet network. So it can be said that the Internet of Things (IoT) is when we connect things that are not operated by humans (Shah & Yaqoob, 2016).

3. Methods

This research uses qualitative research, which aims to provide an in-depth understanding of the role of technology in Human Capital Management (HCM). The approach used is a literature study. This approach involves in-depth analysis of relevant sources, such as books and scientific articles related to HCM topics, both from reputable and non-reputable journals.

The research was conducted by collecting data from various literatures to analyse the theory and application of technology in HRM. Data were collected through literature review, including books, scientific articles, and reports relevant to the theme of HCM and technology. The data used is secondary, which is obtained from various documents, journals, and books that are already available. Data analysis was conducted descriptively qualitatively, by interpreting the results of the literature review to understand the contribution of technology to the efficiency and effectiveness of HCM. This analysis also considers the challenges and opportunities that technology presents in HR management.

4. Results and Discussion

4.1. The Role of Technology in Managing Human Capital Management

The use of technology in human life acts as a tool that supports users to simplify their work. However, the successful application of technology is highly dependent on two main aspects, namely the ability of the user and the purpose of using the technology. User capabilities include mastery of operations as well as understanding the working principles of the technology used. On the other hand, the purpose of use focuses on certain outcomes that individuals or organisations want. These two aspects support each other to achieve efficiency and effectiveness in work (Turq et al., 2013).

In the past two decades, advances in internet technology have expanded its role in everyday life. The COVID-19 pandemic became a pivotal point that accelerated the adoption of technology, especially in supporting remote work policies implemented in various countries to prevent the transmission of

the virus. This situation increases the need for tools and technologies that allow remote activities to continue, including communication and collaboration without physical meetings. The internet is the main pillar that enables this connectivity, resulting in many new innovations in the way we work and live (Carillo et al., 2021).

In the context of human resource management, the use of internet-based technology has greatly helped organisations overcome the constraints of remote working. For example, employees who were previously required to be present in the office with certain working hours can now work from home. This challenge requires companies to ensure that productivity is maintained, work reports are delivered properly, and supervision of employee performance is maintained. Thanks to technology such as work management platforms and online communication, these obstacles can be overcome more efficiently, cost-effectively and quickly (Wang et al., 2021).

Technology integration in Human Capital Management (HCM) has become a major catalyst in improving the efficiency and effectiveness of organisational operations. With the application of technologies such as Artificial Intelligence (AI), Machine Learning (ML), and Big Data analytics, human capital management processes have become more data-driven, enabling the optimisation of functions such as recruitment, training, and employee engagement. These technologies not only accelerate administrative processes but also empower HR professionals to play a more strategic role in supporting long-term business goals.

Improved decision-making is one of the main benefits of technology integration in HCM. The use of predictive analytics, for example, provides deep insights into employee performance and potential, while helping organisations identify future workforce needs and devise more effective recruitment strategies (Alaghbari et al., 2024). In terms of training and development, technology enables more effective human capital formation, especially through continuous learning platforms that support lifelong skills development, helping employees adapt to the rapidly changing world of work (Melnychuk et al., 2022).

In addition, the integration of technologies such as E-HRM has changed the traditional approach to HR management to a more strategic one. E-HRM improves communication efficiency and aligns with the organisation's strategic goals. As such, HR professionals can focus more on strategic workforce planning and managing talent effectively (Kerwin, 2022). However, challenges such as the risk of over-reliance on automated systems cannot be ignored, as this can override the essential human element in holistic management (Pramanik, 2024).

4.2. Internet of Things

The Internet of Things (IoT) is a technology paradigm that allows physical devices to be interconnected through the internet, creating a data communication ecosystem with minimal human intervention. The concept was first introduced by Kevin Ashton in 1999. IoT uses elements such as artificial intelligence (AI), micro electronic devices, and internet networks to enable automatic operation of devices based on pre-designed programmes (Laturkar & Laturkar, 2023). In daily life, the application of IoT covers a wide range of applications, from smart homes to autonomous vehicles, which improve convenience and efficiency. IoT applications cover many areas.

In smart homes, devices such as air conditioners or washing machines can be controlled remotely via smartphones. In healthcare, wearables enable real-time monitoring of health metrics, helping patients and medical personnel in better health management (Laturkar & Laturkar, 2023). Meanwhile, in the transport sector, autonomous vehicles utilise IoT technology to share data and communicate with road infrastructure, improving traffic safety and efficiency.

However, IoT deployment is not free from challenges. Security risks are a major issue as many IoT devices lack adequate security measures, making them vulnerable to cyberattacks. In addition, identity management of massively connected devices poses significant complexity, especially in ensuring that each device has secure authentication (Payaswini, 2022). Another challenge is data privacy, as large volumes of data raise concerns about how it is used and protected.

IoT devices often have weak security systems, such as less robust authentication and insecure communication protocols (Mittal, 2024; Said, 2024). An interconnected network of devices also increases the risk of cyberattacks as cybercriminals can easily exploit existing vulnerabilities (Jadhav, 2023). On the other hand, interoperability is a crucial issue due to the lack of unified standards and protocols. This causes difficulties in integrating devices from different manufacturers, hindering the optimal functioning of IoT (Krishnamurthi et al., 2019). Technical barriers, such as inadequate infrastructure and coordination challenges, further complicate interoperability efforts (Waqar et al., 2024).

Economic and technical challenges also play an important role. The high cost of implementing IoT, coupled with the complexity of the technology, is a major barrier, especially in sectors such as construction that require large investments (Waqar et al., 2024). Increased funding and more supportive financing schemes are needed to spur wider adoption of IoT (Waqar et al., 2024). In addition, ethical considerations are an equally important issue. IoT collects large amounts of personal data, raising concerns about data ownership, user consent, and privacy. These challenges require a balanced approach between technological innovation and adherence to ethical standards (Jadhav, 2023).

IoT presents great potential for improving quality of life and operational efficiency across a wide range of sectors. However, the adoption of these technologies requires a balanced approach, taking into account ethical aspects such as privacy, security, and regulation. Without adequate regulation, IoT can create problems related to surveillance and data ownership. Therefore, this technological innovation must be accompanied by the development of strong supporting policies and infrastructure so that the benefits can be optimised without compromising ethical aspects and user security.

4.3. The Role of Internet of Things in Human Capital Management

In the last two decades, the use of internet technology has increasingly dominated daily life, especially since the Covid-19 pandemic. Internet-connected devices are increasingly diverse, and their use extends to various fields, including human resource management (HR) in companies/organisations. Technologies such as the Internet of Things (IoT) have helped various HR management processes, such as acquisition, training, performance appraisal, compensation, labour relations, and occupational health and safety.

Internet-based technology allows the integration of management functions, such as planning, organising, implementing, and supervising, in an integrated system. For example, the use of online attendance combined with GPS to monitor employee location, or cameras and screen recorders to monitor remote work activities. In addition, technology is also utilised in internet-based recruitment, where the system automatically selects applicants according to qualifications and notifies qualified candidates.

IoT plays an important role in improving the collection and analysis of real-time data related to employee performance and behaviour. With IoT devices in place, HR teams can gather information in an automated and integrated manner, which can then be used for data-driven strategic decision-making. In addition, combining IoT with big data analytics provides deeper insights into work patterns and workforce needs, helping organisations develop more effective recruitment and retention strategies (Kumar et al., 2023; Zareen & Khan, 2023).

IoT technology also contributes to improving engagement and collaboration between employees and management. Smart devices can be used to continuously measure employee satisfaction levels and well-being, allowing management to proactively identify and resolve issues. This approach not only creates a more inclusive work environment but also supports the development of harmonious working relationships (Husen et al., 2024; Sharma, 2023).

The integration of internet-based technologies, such as Artificial Intelligence (AI), Machine Learning (ML), Big Data, and the Internet of Things (IoT), has brought about a significant transformation in Human Capital Management (HCM), improving the efficiency and effectiveness of human resource management across organisations. These technologies are instrumental in streamlining HR processes, accelerating decision-making, and driving increased workforce engagement, ultimately contributing to overall organisational success. In recruitment, automation of processes using AI tools, such as resume screening and candidate engagement, makes recruitment faster and more efficient, which reduces the time it takes to find the right candidate (Kadirov et al., 2024). In addition, Big Data analysis provides valuable insights into a candidate's suitability for the position on offer, allowing organisations to make more accurate and data-driven hiring decisions (Abasaheb & Subashini, 2024).

In employee development and retention, AI plays an important role in personalising training programmes, tailored to the individual needs of employees, so as to enhance their skills effectively (Kadirov et al., 2024). In addition, the use of predictive analytics helps organisations predict the likelihood of employee turnover, allowing them to design more proactive retention strategies (Kadirov et al., 2024). In terms of operational efficiency, IoT supports real-time data collection that enables organisations to improve workforce management and operational responsibilities, making them more responsive to needs and changes in the work environment (Sun & Jung, 2024). Digital technology also contributes to significant cost savings and productivity improvements across HR functions, thereby creating added value for the organisation (Makovoz & Lysenko, 2024). However, while these advancements are promising, challenges remain, such as data privacy concerns and the need to upskill HR personnel to effectively operate these technologies. Overcoming these challenges is critical to maximising the benefits of technology in HCM (Abasaheb & Subashini, 2024).

At the strategic level, IoT serves as a hub to facilitate HR practices that are adaptive and responsive to changing business environments. The integration of IoT with artificial intelligence (AI) is capable of creating innovative solutions to operational and strategic challenges. However, the utilisation of these technologies requires upskilling and training for HR personnel to ensure effective implementation (Abasaheb & Subashini, 2024; Sreya et al., 2023). While IoT provides great benefits in HCM, issues related to data privacy and security remain a major challenge. Organisations must actively address these challenges to ensure secure and optimal use of IoT in support of their human capital management strategies.

5. Conclusion

This research shows that technology, especially through the application of internet-based systems such as Artificial Intelligence (AI), Machine Learning (ML), Big Data, and Internet of Things (IoT), has a very important role in improving the efficiency and effectiveness of human capital management (HCM). These technologies help organisations in various aspects, from the recruitment process, training, performance management, to employee retention. The use of technology allows companies to optimise data-driven decision-making that is more accurate and faster, and simplify administrative processes that were previously time-consuming. However, while technology provides many benefits,

the research also identifies emerging challenges, such as over-reliance on automated systems, data security risks, and skills gaps among employees who have not been trained on the latest technologies. The theoretical implications of this study confirm that the integration of technology in HCM not only improves operational efficiency but also provides significant competitive advantages for organisations. Technology enables better and faster decision-making, while supporting more effective workforce management. However, it should be noted that the use of technology must be balanced with the role of humans in HR management, to avoid the potential dehumanisation that can occur due to dependence on automated systems.

Practically speaking, companies should increasingly pay attention to the integration of technology in HR management to accelerate the process of recruiting, training, and assessing employee performance. Technology can improve transparency and accuracy in performance management, but it is important for companies to provide adequate training to employees so that they can master the technology and utilise it optimally. In addition, companies should also strengthen data security, especially with regard to technologies such as IoT that collect data in real-time, to reduce potential threats to privacy and information security. As a suggestion, companies should focus on developing employees' skills through continuous training so that they can adapt to rapid technological advancements, as well as address any skills gaps that may arise. Improving clear policies regarding the use of technology in HCM should also be considered, while maintaining a balance between automation and human elements in employee management. In addition, the use of IoT in HR management, such as automated attendance and performance monitoring, should be further explored to support real-time, data-driven decision-making.

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