Industry 4.0 and human resources management

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Abstract: A theoretical analysis of Industry 4.0's effects on human resources management (HRM) is provided in this article. It looks at the potential and difficulties presented by the digital revolution, emphasizing the necessity of Smart HR 4.0. Workforce planning, job design, hiring, and staff development in response to emerging technologies like AI and big data are some of the major issues that have been studied. The significance of Education 4.0 in educating the labor force for jobs of the future is also emphasized in the essay. It emphasizes the necessity of HRM methods that change to meet Industry 4.0's changing demands.

Keywords: INDUSTRY 4.0, MART HR 4.0, DIGITAL TRANSFORMATION, WORKFORCE PLANNING, JOB DESIGN

1. Introduction

Industry 4.0 will strongly impact the work environment, organization, and workforce through enhanced collaboration, software importance, and evolving technologies. HR research aims to understand these effects and develop strategies for shaping the future workplace, qualifying workers, and building digital capabilities [1].

These changes affect everyday life and work since enterprise systems depend on people. HR management (HRM) encompasses planning, recruitment, hiring, training, assessment, remuneration, career management, compliance, compensation, redundancy, termination, and negotiations [2]. Rapid technological changes create a gap between workforce skills and job requirements, necessitating new HR development approaches. Addressing these changes involves focusing on Smart HR 4.0, Education 4.0, and the future workplace [3].

2.   Materials and Methods

2.1. Smart HR 4.0 Грешка! Източникът на препратката не е намерен.

In the 21st century, through Industry 4.0, new innovations are taking place in the form of smart business or smart factories [4]. Human resource management is not immune to this phenomenon, so there is considerable pressure to adapt. Smart Human Resources 4.0 (SHR 4.0) portrays a vibrant can- vas for digital transformation across the various functions of human resource management. Thus, SHR 4.0 represents a new concept that is evolving during the fourth industrial revolution and is characterized by innovations in digital technologies such as the Internet of Things, Big Data and analytics, artificial intelligence, high-speed data networks such as 4G and 5G to effectively manage next generation workers.

SHR 4.0 provides a set of implementation challenges and a set of benefits, which are summarised in the table below.

Table 1: Implementation challenges and benefits of Smart Human Resource 4.0

Challenges of SHR 4.0	Advantages of SHR 4.0
Choosing the right combination of new technological tools.	Attracting, developing, and retaining the next generation of talents.
Modification of the existing organizational culture.	More efficient and faster HR operations.
Managing multi-generational work-force expectations.	Building leaner human resources departments.

Traditionally, HR departments manage the entire employee lifecycle from recruitment to exit. Although HR plays a crucial role in corporate growth, many departments are limited to operational tasks due to inefficient processes and outdated technology. The solution is precisely the introduction of the SHR 4.0 concept, which is driven by emerging technologies and next-generation workers [5], with the aim of attracting, developing and retaining multi-generational workers, and satisfying HR processes with leaner departments with error-free data, and easily accessible in an ongoing interactive format.

SHR 4.0 is driven by emerging technologies and a next-generation workforce with the potential to transform human resource management processes covering all aspects from onboarding talent through to offboarding. After an extensive literature review, we agree with Sivathan and Pillai's proposed conceptual framework for SHR 4.0, which we enrich with additional insights from the field of human resource management.
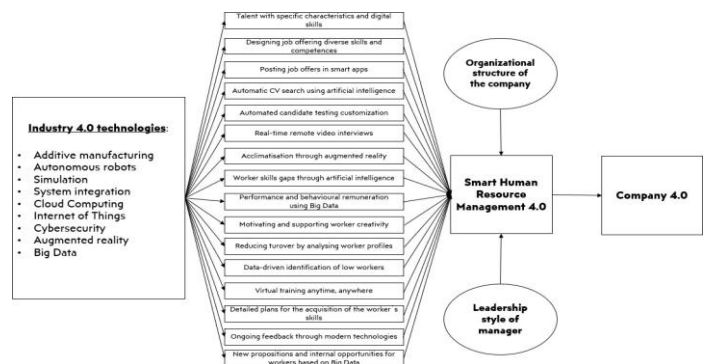

Fig. 1 Smart HR 4.0 diagram

Human resources planning

Automation and connected systems drive workforce transformation, requiring businesses to attract, retrain, and upskill resources for new technologies. Strategic workforce planning in Industry 4.0 focuses on acquiring skilled workers for new roles and adapting existing jobs to new methods. Training and development become key for workforce evolution and development. Chinachoti [6] suggest reducing reliance on human resources in planning and assessing the necessary skills for optimal job performance. Familiarity with technology and information systems is crucial.

A new generation of workers, the so-called millennials, is entering the labor market. Their specific characteristics will shape the future of businesses through competition for high potential in the upcoming years [7, 8].

Jobs design

The emergence of advanced technologies in Industry 4.0 impacts human resource practices, including job design [9]. Industry 4.0 principles influence job design and practices in companies. Designing jobs in SHR 4.0 should focus on flexibility and openness to accommodate continuous change, facilitate teamwork and collaboration, and require a diversity of skills. Effective job design in Industry 4.0 human resource management processes is visible when operations successfully transform through automation [10]. However, the lack of empowerment can hinder Industry 4.0's development. Therefore, enrichment approaches in job design are recommended to align with Industry 4.0 principles [10].

Recruitment and employee selection

The rise of smartphones has led to smart apps, with Generation Y and Z receiving job ads based on their profiles. Big Data and AI automate resume searches and candidate preferences, saving time and effort. Interviewing now includes automated and customized testing, improving predictions of future job performance. Faster networks (4G/5G) enable remote interviews through real-time video, shortening the recruitment cycle [5].

AI chatbots interpret and verify candidate responses in real-time, narrowing down interviewees and automating the assessment process, including scheduling interviews and checking references. Only 10% of businesses currently use AI, expected to increase to 36% soon. AI has improved the entire hiring process, giving HR professionals more time for strategic human resources tasks. Challenges remain, including staff training and concerns about losing administrative jobs due to automation.

Augmented reality/virtual reality (AR/VR) could assist new hires with onboarding and track productivity from day one.

Employees development

Workforce development is crucial in HR management for navigating Industry 4.0 uncertainties. Trained workers can adapt to frequent job changes in the uncertain Industry 4.0 environment. Innovative workers work smart, overcome uncertainties, and stay competitive [4].

Training is essential in HR practices for upskilling workers in roles transformed by automation and high technology. SHR 4.0 aims to develop workers' skills and capabilities for Industry 4.0. Sivathanu and Pillai [5] stress the importance of increasing knowledge and skills for today's competitive environment.

AI identifies worker knowledge gaps based on market demands. Generation Y and Z seek targeted training to achieve their professional goals. Faster networks enable virtual training from anywhere. Staff morale and productivity greatly influence learning and development. Training programs boost worker morale and are a major investment for successful businesses [11]. Training aids career advancement, reduces absenteeism, and increases worker satisfaction and commitment.

Career management and planning

Ordinary human capital will no longer drive the workforce; individuals who can think critically and innovate will be the most valuable assets. The National Career Development Association's Facilitating Career Development guide [12] encourages career professionals to help clients find new career paths that match their existing or potential skills.

Mowlaee [13] suggests that as part of career planning, individuals should assess their knowledge, set clear goals, and prioritize activities. They should identify new skills that align with strategic business priorities and leverage technology to enhance their career, including acquiring analytical skills and utilizing data through smart systems and analytics in real-time to improve processes. Becoming IoT experts also supports maximizing Industry 4.0's potential within a digital culture.

Performance evaluation and management

In Industry 4.0, performance evaluation should prioritize workforce development through outcome-based and behavior-based methods to promote learning and innovation [4]. Workers need regular feedback and objective evaluations using quantitative metrics. The process involves setting standards, measuring performance, comparing results, discussing feedback with employees, and taking corrective action as needed [8].

Management by objectives (MBO) is a popular evaluation method in Industry 4.0 [4]. It involves setting and assessing mutual goals based on specific objectives. For participative decision-making, managers and workers determine goals through mutual discussion and consensus. Each goal has a defined deadline, and feedback allows managers and workers to monitor activities and take corrective measures when needed [8].

Remuneration

Due to the lack of skilled workforce in Industry 4.0, HR management must develop an effective remuneration system to retain and develop existing workers and attract new talent [9]. Innovativeness and willingness to learn support remuneration systems in enterprises. Adjusting rewards preemptively can help reduce turnover.

Human resources practitioners should adopt the SHR 4.0 concept to analyze workers' performance, activities, and evaluations to predict and prevent departures [14]. Motivating employees to communicate expectations can reduce stress and the desire to leave [13]. Remuneration should motivate skilled workers, in material or non-material form, to promote human capital creativity in Industry 4.0 [13].

Work environment

In the coming years, the massive adoption of digitalization will shape enterprise work environments [15]. Workers will face new demands in digital competence, problem solving, and human-machine communication [10]. The 2016 Future of Jobs report notes that almost all modern workplaces will require mathematical and interpersonal skills [15].

Frey and Osborne's study on the future of jobs found that nearly half of the jobs analyzed in America will be threatened by digitalization in the next 10 to 20 years [16]. In Germany, experts noted that technical automation's impact cannot be equated with changes in employment rates. While machines may change workplaces, they don't replace all affected jobs. Digital transformation could create many new jobs, such as those in new technologies. The working environment will change significantly, and companies must develop an effective HR management strategy as part of their corporate strategy to navigate these changes [10].

Employee offboarding

Analyzing a worker's profile can predict their intention to leave, allowing HR to proactively retain high-performing employees through better internal opportunities. Low performers can be identified through ongoing annual evaluations rather than just supervisors' assessments. Programs to encourage worker performance should be tailored to individual skill gaps. Though implementing Smart HR 4.0 seems promising, HR should also consider changes in leadership styles and organizational structures [5].

Credit Suisse, employing over 48,000 people worldwide, implemented SHR 4.0 to reduce employee exhaustion and turnover rates by 1%, saving $75-100 million in a year [14]. Companies should adopt SHR 4.0 to navigate Industry 4.0's transformation, automating HR processes for more efficient and leaner HR teams. Effective implementation requires timely responses to changes in organizational structure and leadership style, enabling HR to take a strategic role in organizational growth [5]. Schaar et al. [8] note that Industry 4.0 implications will reduce HR team sizes, allowing HR departments more time for strategic tasks.

2.2. Education HR 4.0

Although the concept of Industry 4.0 is based on modern technologies, the human factor will remain at the centre. This fact is strictly emphasised in the German government's High-Tech Strategy, which states that the philosophy of Industry 4.0 is not based on an industry without humans, but on a human-centered change based on the principle that technology should serve people. Technological trends will undoubtedly continue to bring radical changes within education as well as to other areas of life. Therefore, it is essential to anticipate the impact of technology at every stage of education and take the necessary actions [9].

Education 4.0 represents a desirable approach to education that is aligned with the emerging industrial revolution [14]. A new model of education that responds to the requirements of Industry 4.0 should take into account: linking networks of systems and easy access to knowledge; artificial intelligence, automation, and robotic systems; new media and big data; the speed of innovation; the development of new skills and continuous knowledge [17].

The relationship between the industrial and educational ongoing period leads to the emergence of new professions that require certain specific skills. With this in mind, it is essential that educational institutions are structured to meet the requirements of the highly skilled workforce of the ongoing dynamic transformation process [16].

Cyber-physical systems are being integrated into various industries, which affects the hard and soft skills requirements of the workforce. The World Economic Forum [15] prepared a report examining these changes. The table below shows the most important skills that employers consider essential by 2025.

Table 2: Top 15 skills by 2025.

Top 15 skills	
Analytic thinking and innovation	Resilience, stress tolerance and flexibility
Active learning and learning strategies	Reasoning, problem solving and ideas generation
Complex problem solving	Emotional intelligence
Critical thinking and analysis	Troubleshooting, and user experience
Creativity, originality, and initiative	Service orientation
People leadership and social influence	Systems analysis and evaluation
Use of technology, monitoring, and control	Persuasion and negotiation
Technology design and programming	

We agree with the World Economic Forum [15] report that Education 4.0 is about evolving along the time, and for higher education institutions it is a commitment to understand what is required of their future graduates in practice. Technology also allows us to be constantly connected, and as a result, job roles are gradually becoming more flexible and adaptable.

3. Results and Discussion

3.1. The future of jobs

Many workers fear losing their jobs to robots. While robots may replace manual tasks, workers can adapt by learning to control and optimize robot use, discovering new applications. Human-robot interaction may be challenging initially, but proper training can help. Learning about how a robot works, its capabilities, roles, requirements, limitations, benefits, and placement in the system is very important, especially for older workers who are not as tech-savvy as the younger generations Y and Z [17]. The "Future of Jobs 2020" report by the World Economic Forum [15], states that employers expect the share of increasingly redundant jobs to fall from 15.4% to 9% (a 6.4% decline) by 2025 and that the number of new occupations will rise from 7.8% to 13.5% (a 5.7% increase) of the total workforce. On the basis of the above data, it is estimated that by 2025, 85 million jobs may be replaced by a change in the division of labour between humans and machines, while 97 million new jobs may be created that are more adapted to the new division of labour between humans, machines and algorithms. The survey was carried out across 15 sectors and 26 economies.

Jalali and Singh [14] report that Sophia, a Hanson Robotics robot, is the first to receive Saudi citizenship and predict AI could reduce jobs by 27% in less than 20 years, affecting routine roles like drivers and factory workers. Surprisingly, jobs like CEOs, mergers and acquisitions experts, and publicists may also be impacted. Hanson Robotics CEO Jeanne Lim suggests current trends could increase communication with AI as younger generations interact more with devices than humans. Schneider [1] questions the mass production of robots that may take jobs essential for people's survival.

While many manual jobs will be automated, occupations such as barber, handyman, farm worker, cleaner, cook, gardener, repairman, carpenter, and caregiver will likely remain stable due to their complex manual and intellectual skills [16]. Around 19% of workers in OECD countries are employed in these complex manual jobs, a number expected to remain stable [18]. The World Economic Forum's "The Future of Jobs" [15] report highlights jobs with increasing and decreasing demand across various sectors.

Table 3: Jobs with increased or decreased demand across sectors

Increasing demand	Decreasing demand
Data analysts and scientists	Data inputters
Artificial intelligence and machine learning specialists	Administrative and executive secretaries
Big Data specialists	Accountants
Digital marketing and strategy specialists	Accountants and auditors
Process automation specialists	Assembly and factory workers
Business development specialists	Client information and customer service workers
Digital transformation specialists	General and operational managers
Information Security Analysts	Material and warehousing and stock control clerks
Software and application developers	Financial analysts
Internet of Things specialists	Postal service workers
Project managers	Sales representatives, wholesale, and manufacturing
Data base and network experts	Relationship managers
Robotics engineers	=Bank tellers and similar clerks
Strategic consultants	Door-to-door
Management and organisation analysts	´´Electronics and telecommunications installers and repairers
FinTech engineers	Human resources specialists

Human capital will need to interact with robots through special mobile devices, using software and knowledge bases tailored to each enterprise [14]. Communication with co-workers via special social networks fosters social relationships and boosts workers' internal motivation. When workers feel motivated and satisfied, they won't feel redundant in an automated environment [12].

Robot-robot interaction is becoming crucial in Industry 4.0. Robots can analyze production processes, make decisions, plan resources, and alert human controllers with suggestions for corrective actions [7]. Robot-robot communication automates

process planning and logistics, but human supervision is essential to ensure automation is beneficial and not harmful [5].

Critics of Industry 4.0 predict unprecedented job losses and unemployment as smart machines replace human labor in business processes. Full-time jobs may shift to uncertain work arrangements, requiring businesses to constantly restructure management practices to manage workforce diversity. This could negatively impact workers' job security and self-esteem [6].

4. Conclusions

Both research and practice highlight risks in the digital workplace, such as job insecurity and technological anxiety, potentially leading to social isolation [17]. Constant learning and challenges in separating work and non-work activities may cause stress and burnout for those unable to adapt. Negative consequences could hinder creativity and critical thinking, as workers may be confined to narrow tasks controlled by machines' pace and rhythm [3].

Reskilling will become routine as new jobs demand higher qualifications. Workers must continually acquire new skills due to shifts in expectations with computers, digitization, and automation in work. To stay competitive, lifelong learning must be prioritized. OECD research [18] recommends investing in skills, improving schools, teacher quality and pay, supporting adult learning, and fostering entrepreneurial skills.

3. Acknowledgments

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