Redefining the Skills Required on the Labour Market in the Context of the Development of Artificial Intelligence Systems. Case Study on Finnish Universities

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Abstract
The rise of AI technology across different sectors has drastically influenced jobs and employment overall. This paper's goal is to identify and redefine the fundamental skills that are needed in the job market in relation to the massive application of artificial intelligence. The methodology used includes a case study and document analysis. The case study is centred on the Finnish universities that have implemented a project to connect academic training and professional requirements in the era of artificial intelligence. The results of this paper suggest a radical shift from the usual and well-known labour-oriented competencies to a far more complex cognitive and interdisciplinary array of skills like complex problem-solving, emotional intelligence, and flexibility. Most importantly, the case study that this paper brings forward underscores that the educational process and innovation must be sustained in the job market because technology can never be stagnant and is continuously redrawing the boundaries of the job's responsibilities. In a nutshell, the competencies required in the labour market will have to be recast with the integration and development of artificial intelligence systems. Such developments need proactive actions from stakeholders, especially educational institutions, through which a proper channel is established for the smooth coexistence of the workforce in the future headed by artificial intelligence.

Keywords: artificial intelligence, labour market, innovation, skills, case study, Finland

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1. Introduction

The incorporation of artificial intelligence (AI) systems across many industries has initiated a paradigm shift, yielding significant ramifications for the worldwide workforce. Recent scholarly investigations have generated valuable insights into the diverse and complex effects of artificial intelligence on the skill sets and competencies demanded by the modern labour market. As an example, research conducted on the labour market in Czechia formulated a model to assess the impact of AI on job categories. The findings of the study indicate that within a span of five

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years, AI has the potential to substitute over 50% of the necessary skills in approximately 11% of occupations (Fatun and Pazour, 2021). A separate study conducted in Denmark underscored the diverse implications of AI on skill demands, shedding light on the possibility for AI to enhance abilities in occupations that need advanced expertise while simultaneously having negative consequences for other types of jobs (Holm and Lorenz, 2021).

Going further, it is important to mention that the development related to AI does not only relate to automating jobs and the elimination of some jobs. It involves new abilities and skills required to perform appropriately in contemporary labour markets (Joamets and Chochia, 2020). Rapid technological development, coupled with growing employment in artificial intelligence, has raised concerns about the adequate preparedness of existing education systems to respond well to these changing demands.

While studies like the ones mentioned above have begun to explore the changes brought by AI in the labour market, a comprehensive understanding of AI's impact on redefining the skills required in this market remains elusive.

This paper contributes to a deeper understanding of the connection between the development of AI and the skills required on the labour market by using two qualitative methods: the case study and the analysis of documents. The case study focuses on five universities in Finland that have implemented a digital ecosystem designed to match their educational offerings (courses, modules, etc.) with the skill and labour needs of the job market.

The results suggest a shift from the clichéd labour-oriented competencies to a far more complex cognitive and interdisciplinary array of competencies.

The paper starts by reviewing the scientific literature. Afterwards, the methodology used is described, and the results and discussions are detailed. The final part of the paper consists of important conclusions drawn from this research.

2. Review of the scientific literature

According to Haenlein and Kaplan (2019), artificial intelligence is called the technology of the future. It can also be defined as a system's ability to receive external data, grasp it properly, and then employ that knowledge to set and achieve objectives and do tasks with minimum human intervention. Moreover, AI entails a machine's capability to function in a way that simulates human beings and conducts tasks requiring judgement, reasoning, studying, preparation, and creativity (European Parliament, 2023).

It is interesting how we have advanced from the 1.0 industry, the first industrial revolution in the 18th century, to the 5.0 industry, featuring automation, robots, and AI. It is an evolution from electrification to "cognification" by AI. Even though

some of these technologies have been in practice for over 50 years, the major progress in AI has appeared in recent years because of enhanced capability computing approaches, data's abundance, and original algorithms. AI in general is an important element in digital society's transformation, as well as a top EU and global priority on the subject matter (European Parliament, 2019).

2.1 Transition from industry 4.0 to industry 6.0

On another note, AIF (Allied ICT Finland) is already talking about the transition from industry 4.0 to industry 6.0 in concrete steps. The AIF organisation stands as the largest Nordic alliance dedicated to research, development, and innovation, being a national cluster that bridges the gap between research and the business sphere. Comprising 19 universities and more than 1000 technology-specialised companies, AIF is at the forefront of cutting-edge advancements. A comparison between industries 4.0, 5.0, and 6.0 can be observed in the table below (table no. 1).

Table 1. Comparison between industries 4.0, 5.0, and 6.0

Industry 4.0	Industry 5.0	Industry 6.0
1. Leveraging the *Internet of Things* (IoT) to establish connections and build intricate physical and cybernetic systems. 2. A production-centric approach with a primary focus on the supply side. 3. Manufacturing is driven by intelligent technologies. 4. Ensuring interoperability among machinery, digital tools, and human operators. 5. Digital Twin 1.0 involves capturing, organising, and synchronising product data from conception through design, manufacturing, deployment, usage, maintenance, all the way to disposal and recycling. 6. Incorporating data from diverse sources. 7. Promoting transparency in information and decentralising decision-making. 8. Providing technical support to enhance individuals' ability to visualise information.	1. Collaboration between humans and machines in cyber-physical systems for personalised production. 2. Balancing demand and supply dynamics in the production process. 3. Putting people at the centre of focus in this collaborative setup. 4. Enhancing interaction and synergy between humans and intelligent systems. 5. Tailoring production to meet specific individual needs. 6. Embracing a circular economy approach. 7. Aim for zero waste and zero emissions in the production cycle. 8. The concept of Digital Twins 2.0 involves creating a digital representation resembling a real product.	1. Being omnipresent, focused on consumers, and creating antifragile production. 2. Enhancing the connectivity of factories and creating dynamic distribution systems. 3. Utilising digital twin technology to link various stages of the manufacturing process. 4. Significantly altering the responsibilities and contributions of individuals in the production cycle. 5. Companies having the capability to sell their computational capabilities. 6. Optimising production efficiency through artificial intelligence to optimise production processes, ensuring sustainability and resilience. 7. Implementing the "Lot Size One Production" concept for versatile manufacturing. 8. Transitioning from mere electrification to "cognification" through AI.

Source: Allied ICT Finland, 2021, pp. 28-29.

According to AIF's perspective, the shift from industry 4.0 to industry 6.0 will be achieved through: the optimal utilisation of disruptive technologies (such as 5G, already accessible, and anticipated 6G technology around 2030, alongside artificial intelligence); blockchain adoption; promoting digital transformation for all companies, regardless of their scale (embracing production methods like lot size one and adopting a circular economy approach); flawless production processes; and the seamless integration of both industry 5.0 and industry 6.0 solutions into existing infrastructure systems and production lines (Allied ICT Finland, 2021).

In this context, we can ask ourselves how these changes will impact future perspectives and what can we do to adapt in order to be aligned with economic trends? These aspects will be explored in the following section.

2.2 Megatrends in the labour market of the future

As per the predictions, the upcoming wave of technology is prompting us to adopt new approaches to survive in a heavily tech-driven market across various sectors, including health, transportation, banking, administration, public services, education, business, agriculture, food, and others. Creativity has reshaped the competitive landscape into a boundless realm, and technological and digital literacy, alongside cognitive and analytical capabilities, have become essential competencies in this paradigm. Furthermore, the fusion or convergence of ideas stands at the heart of this evolving economy. The notion of utilising insights and expertise from various sectors to avoid redundant efforts in creating something that already exists is a common subject, especially in the context of product innovation. Nevertheless, this principle is broadly applicable (Stankosky, 2019).

The labour market will look different in the coming years, considering the trends and needs of the technologized world in the future. Job offerings will emphasise the human and digital components significantly. The COVID-19 pandemic has accelerated the process of digitalization, and current studies show that one in five companies is aiming to automate jobs and replace employees with robots (Milken Institute, 2021). In this context, 86% of companies intend to incorporate new technologies, such as digital platforms and applications, into their operations within the next five years. Approximately 75% of businesses are anticipated to adopt e-commerce and digital trade. Following closely in implementing priorities are education and workforce technologies, with 81% of companies aiming to embrace them by 2027 (World Economic Forum, 2023).

By 2030, 800 million jobs will be eliminated due to automation, as indicated in the 2019 report conducted by the McKinsey Global Institute. Many other professions will transform, either slowly or drastically. The World Economic Forum predicts that 85 million jobs will be taken over by robots by 2025, and at the same time, 97

million jobs will be created as humans, robots, and algorithms collaborate (Masterson, 2022).

As per the 2020 Future of Jobs report released by the World Economic Forum, 50% of the employees will require retraining to acquire the essential skills for future employment. These skills encompass:

- Analytical thinking and innovation
- Active learning and learning strategies
- Complex problem-solving
- Critical thinking and analysis
- Creativity, originality, and initiative
- Leadership and social influence
- Technology use, monitoring, and control
- Technology design and programming
- Resilience, stress tolerance, and flexibility
- Reasoning, problem-solving, and ideation
- Emotional intelligence

Recognising the challenges posed by skills gaps in the local job market, businesses are giving top priority to investing in on-the-job learning and training. This approach is seen as a highly effective workforce strategy to achieve their business goals. Hence, crafting effective reskilling and upskilling strategies for the upcoming years is vital for maximising business performance.

In the authors' opinion, the shift to a new digital era powered by AI advancements will reshape the labour market, emphasizing technical proficiency, adaptability, human-machine collaboration, ethics, creativity, and innovation.

Starting with the fundamental skills needed in the job market considering the pervasive application of artificial intelligence, this paper will further analyse, on one hand, the implications of the shift towards cognitive and interdisciplinary skills and, on the other hand, the proactive actions that stakeholders, especially educational institutions, can take to facilitate the coexistence of the workforce with artificial intelligence in the future job market.

3. Research methodology

In this paper, two methods of qualitative research were used: the case study and the document analysis method, to understand what the implications of the rise in artificial intelligence would be on the labour market in terms of a skills revolution.

The use of the case study approach facilitates a comprehensive examination of a particular situation within a practical setting. Within this framework of study, the competencies demanded on the labour market with regards to artificial intelligence-based system development are redefined. The case study has provided the authors with the opportunity to examine an initiative to bridge the gap between academic training and professional requirements in the era of artificial intelligence.

The authors picked out five Finnish universities for analysis because Finland is renowned for its well-developed education system. Most of the of the information was collected from the websites of these universities. Moreover, the case study entails a discussion about the impact of the platform known as "Artificial Intelligence in Continuing Education" (AICE) on the skills required on the labour market, given the fact that it facilitates the direct contact of Finnish students with AI.

The process of document analysis entails a methodical examination and assessment of various types of documents with the aim of extracting significant and relevant information. The utilisation of this approach is of utmost importance in comprehending the wider framework associated with the subject matter under investigation.

In the authors' research, a comprehensive examination was conducted through the analysis of various articles related to education, workforce challenges, and AI. Using this method, the research was able to establish a solid foundation in existing knowledge while simultaneously pinpointing similar points of view.

4. Results and discussion

Artificial intelligence is a considerable driving force of change that has far-reaching implications for global labour geographies. Finland, a well-known country for the education it provides, recognises that artificial intelligence has the potential to transform the labour force and has accomplished an excellent job at putting in place the necessary systems to promote AI education in Finnish universities.

Changes in the funding model for Finnish universities and universities of applied sciences to support the growing need for life-long learning and the developing nature of occupations, particularly in relation to artificial intelligence, were implemented by the Ministry of Education and Culture. According to Tani et al. (2019), the new model, which went into force in January 2021, boosted the proportion of funds for continuing education to 9% for schools of applied sciences and 5% for all other universities.

To take advantage of this opportunity, a unique project was undertaken by five Finnish universities of applied sciences, specifically the Haaga-Helia University of

Applied Sciences, the Häme University of Applied Sciences, the Laurea University of Applied Sciences, the Metropolia University of Applied Sciences, and the South-Eastern Finland University of Applied Sciences. These five higher education institutions agreed to work together in the development of an AI digital climate with the intention of integrating their programme offers, such as classes and modules, into the job market's skill demands and employment needs.

Haaga-Helia University of Applied Sciences, or Haaga-Helia, available online at https://www.haaga-helia.fi/en, is based in Helsinki, and it is one of Finland's most famous polytechnic-oriented universities. Haaga-Helia provides business programmes at all levels, from bachelor's to master's grees. It is distinguished by its practical orientation since studying at Haaga-Helia usually involves working on various types of projects with companies. In turn, the partners in the field can provide students with internships, networking possibilities, or actual job offerings due to the many connections that Haaga-Helia possesses. Consequently, this university educates professionals that the business world is interested in.

Häme University of Applied Sciences, or HAMK, available online at https://www.hamk.fi/en/, is based in Hämeenlinna, and it offers a range of over 20 programmes under seven fields of study. HAMK took a proactive approach by organising education on artificial intelligence as a part of engineering programmes. Apart from theoretical knowledge regarding artificial intelligence, HAMK students also get to experience cutting-edge AI tools and technology and practically apply it to fields such as production and healthcare. The programmes that HAMK offers produce professionals that are in high demand since artificial intelligence is the future of most fields and encourages innovation and the growth of local enterprises.

Laurea University of Applied Sciences, or Laurea, available online at https://www.laurea.fi/en/ and based in Uusimaa, is known for its unique operational philosophy, Learning by Developing (LbD). Laurea has operations programmes and game-winning ideas programmes, as well as bachelor's and master's programmes in administration and social services. With the Learning by Developing system, students get to improve practical skills and knowledge by working on real projects.

Metropolia University of Applied Sciences, usually known as Metropolia (https://www.metropolia.fi/en), can be found in the Helsinki Metropolitan Region. The education provider is the biggest university of applied sciences in Finland. Metropolia University of Applied Sciences offers a hefty number of education paths that cover several disciplines, which include technology, healthcare, business, and culture. The influential University of Applied Sciences has close cooperation with the world of business, and thus its studies are based on the needs of the present-

day business environment. For instance, the institution's business pathway provides its students with opportunities to become consultants at local businesses. More active students can cooperate with even more companies, learn from real-world tasks, and expand their professional network. Metropolia's close ties with the world of healthcare similarly allow medical technology students to participate in joint research and find placements. Both experiences prepare the students for the workplace immediately upon graduation.

South-Eastern Finland University of Applied Sciences, or XAMK, available online at https://www.xamk.fi/en/education/why-choose-xamk/, is the host of two main campuses, namely Mikkeli and Kotka, which formed after Mikkeli University of Applied Sciences and Kymenlaakso University of Applied Sciences merged. Many full courses provided by the second University of Applied Sciences are confirmed with a professional bachelor's degree, such as technology, culture, and social services. The highest priority activities of XAMK are research, development, and innovation (RDI) activities. XAMK's RDI work includes regional projects that create innovative, smart, and ecologically sustainable energy systems with companies in the vicinity. Several regional companies have completed the planned carbon sinks, which are renewable energy systems developed as a part of this project. Not only does this provide clean energy, which benefits the area and the population, but it also confirms XAMK's position as a leader in the field.

"Artificial Intelligence in Continuing Education" (AICE) is an education platform for individuals who wish to further develop and enhance their skills. The platform allows people to take part in courses provided by the five AICE universities. One of AICE's objectives is to ensure that students are getting connected to specific courses, while another is to see that the curriculum is up-to-date with the requirements of the modern labour market, thus ensuring that graduates will be completely equipped to keep up with AI and other innovation advancements that are now offering many opportunities to develop.

The universities' research and projects indicate a departure from traditional labour-oriented competencies and skills. In addition, the convergence of cognitive skills and disciplines is emerging, largely based on advanced proficiencies such as complex problem-solving, soft skills, emotional intelligence, and adaptability.

Moreover, it is opportune to emphasize that in his report, McDonnell (2019) also raises the issue of the creation of effective transition programmes that would reduce the mismatch between academic education and the needs in practical terms of the AI era. This idea correlates with the Finish approach to developing a better linkage between educational institutions, governmental institutions, and business.

From the study conducted by Lincoln and Kearney (2019), one should observe the overlap of critical thinking and creativity with traditional educational paradigms. In particular, they find instruction in imagination, creativity, critical thinking, and autonomous learning increasingly important for school education because students should be well-positioned to live a dynamic life in modern society with rapid advancements in artificial intelligence.

Additionally, Wong et al. (2020) shine a light on the global movement in primary and secondary schools towards AI principles and computational proficiencies. They suggest that the next generation should benefit from early exposure to AI.

Also, artificial intelligence allows for the provision of immediate feedback and personalized suggestions to the students that inform them of their weak spots and provide personalized resources from various websites. This makes a student feel more powerful to learn as he is actively encouraged to do so.

Thus, the experience of Finnish universities of applied sciences illustrates the possibilities of technology to overcome the gap between academic education and the requirements of professional reality, and AI demonstrates the concept of how to implement them in practice. At the same time, the cooperation between universities resulted in the emergence of an environment governed by AI, where the supply of educational services is aligned with the demand on behalf of the labour market. On the other hand, given the practical application of knowledge and tight cooperation with businesses, graduates already have the skills necessary for employment opportunities. Furthermore, certain universities, such as Häme University of Applied Sciences, include AI education in their programs, which contributes to regional development and innovation. The case of Finnish universities shows how utilizing AI universities contributes to training the new generation in a world where knowledge is in line with market demands.

The AICE ecosystem, based on artificial intelligence, can not only ensure the optimal connection of students to the relevant courses but also guarantee that the curriculum remains adaptive to these dynamic demands. The alignment of job demands is likely to become essential with continually changing technology.

Nevertheless, the limitations of the Finnish universities' endeavours to compensate for the effect of artificial intelligence on the labour market might include neglecting some other relevant fields of study, courses, and topics. Ensured coordination between cooperating institutions, the bias of specialized industries, the financial resources needed for a more elaborate program, and the emphasis on advanced versus primary skills are the most comprehensive concerns in the creation of an inclusive, non-hostile, and sustainable AI-related initiative.

5. Conclusions

In conclusion, artificial intelligence is crucial as an element that propels people away from traditional sectors of the economy as well. AI is a critical component in the vast digitalization process. Moving from industry 4.0 to future industry 6.0 illustrates humanity's progress in technology development, with each level emphasizing a different part of the production sector and cooperation. Advanced technologies, including the development of 6G, blockchain, 5G, and other new technologies, will serve as critical enablers of the transition to Industry 6.0.

The current labour market is altered as well, with technology development threatening to eliminate numerous jobs while generating new work opportunities. The pandemic has accelerated transformation and made it evident that the workforce needs retraining. The future labour market will include increased tech mastery possibilities as well as the development of distinctive human characteristics.

The future's shift to new technology, motivated by AI advancements, will revolutionise the workforce. It will also boost demand for digital literacy, adaptability and lifelong learning, collaboration, machine performance, ethics and regulation, creativity and innovation, as well as cybersecurity. Individuals possessing the unique characteristics willing to study and evolve will be able to prosper in the new era of digitalisation.

Finland, in this case, has actively reacted to the revolutionary nature of artificial intelligence on the labour market, integrating AI instruction in the higher education system while altering the funding model to afford continuous learning, particularly in AI-focused fields. The case study in this paper has shown that Finnish universities of applied sciences have proved that an education system of the future has the feature of agility, in which it adapts and reacts to dynamically changing technology. Nonetheless, it requires cooperation from all parties involved, especially the education institutions, to make sure that the future labour force coexists and thrives in the AI-based environment.

Apart from that, the example of the universities described above can also be used by other institutions of higher learning as a benchmark. These universities set a high benchmark for the best practices employed by higher education institutions. Their willingness to advance the field of education by embracing the integration of artificial intelligence, as well as their commitment to ensuring that the education programmes of study are in line with the labour force requirements, sets an optimistic example of best practices on how to adequately prepare the prospective workforce for the era of AI. These are the international best practices that universities worldwide can take up and adapt.

Nonetheless, the case study's main shortcomings, based on potential challenges to coordination among institutions, bias towards certain industries, and potential neglect of foundational skills, could open new research horizons. Further research steps could include a comparative analysis of AI education initiatives and their outcomes in different countries or longitudinal studies tracking graduates' outcomes. It is also an idea to examine the perspectives of various stakeholders, including students, educators, employers, and policymakers, on their experience, needs, and expectations regarding AI education and workforce preparation.

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