Acta Universitatis Danubius
ŒCONOMICA

Economic Development, Technological Change, and Growth

The Role of Artificial Intelligence (AI) in Productivity & Economic Growth in Nordic Welfare States

Junaid Sattar Butt[1]

Abstract: The Nordic welfare states have long been admired for their robust social welfare systems and high standards of living. However, as these economies face challenges posed by demographic shifts and global economic competition, the role of artificial intelligence (AI) in driving productivity and economic growth becomes increasingly pertinent. This research explores the multifaceted relationship between AI, productivity, and economic growth in the context of Nordic welfare states. Drawing upon existing literature and empirical evidence, this study explores how AI can enhance worker capabilities by automating routine tasks, increase productivity across various sectors including manufacturing by optimizing resource allocation, public administration and driving innovation. Additionally, it investigates the mechanisms through which AI adoption influences economic growth, considering factors such as innovation, efficiency gains, and the creation of new industries and employment opportunities. Moreover, the study delves into the unique characteristics of Nordic welfare states, such as strong social safety nets and emphasis on human capital development, and assesses how these factors interact with AI-driven productivity and economic growth. Furthermore, the study examines policy implications, including the need for adaptive regulatory frameworks, investment in AI infrastructure and research, and strategies for up-skilling the workforce to ensure inclusive growth and social cohesion. By offering insights into the role of AI in shaping productivity and economic growth within Nordic welfare states, this research contributes to a deeper understanding of the opportunities and challenges presented by AI adoption in the context of advanced social welfare models. The study emphasizes the significance of social safety nets in Nordic welfare states and the need for re-skilling and up-skilling to prevent job displacement. It also explores the potential of AI adoption in these states, aiming to inform policymakers and stakeholders on strategies to maximize the benefits of AI while maintaining social cohesion.

[1] Master of Laws (LL.M), Postgraduate Institute of Law, the University of Lahore, A.H.C & Member District Bar Association Kotli, Pakistan Occupied Jammu & Kashmir, Pakistan, Tel.:+92 333 427 0989, Corresponding Author: junaidsattarbutt@yahoo.com, ORCID: https://orcid.org/0009-0000-0530-962X.

Keywords: Artificial intelligence; Economic growth; Nordic States; Social safety; Income equality.

1. Introduction

The Nordic welfare states, including Denmark, Finland, Iceland, Norway, and Sweden, are known for their high living standards, welfare systems, and social safety nets. The Nordic model[1] of social citizenship emphasizes universal rights and autonomous negotiations between employees and employers. The Nordic Model, a blend of capitalism and welfare, is a key economic concept in Nordic nations. It includes an open market economy, universal benefits, high labor force participation, active labor market policies, welfare systems, and egalitarianism, resulting in prosperous and happiest societies (GmbH, 2024). Belgium is ranked eighth in the EU for the diffusion of AI among businesses, with slightly over 10% of companies utilizing at least one AI technology. It is evident that countries like Denmark and Sweden experienced significant economic growth and prosperity before the implementation of welfare states (Matthews, 2023). Nordic countries such as Finland and especially Denmark show a much higher share of firms deploying at least one AI technology. In April 2021, Norway's Ministry of Local Government and Modernization released a White Paper on the Data-driven Economy, presenting the government's policy for value creation using data as a resource (Reutter & Åm, 2024, pp. 1-21). Although Denmark is the top performer with a percentage of 24%, this percentage is still higher than the 8% average for Europe (Piton, The economic consequences of artificial intelligence: An overview, 2023). Finland has a stronger state role in working-life issues, but historical factors like low-trust elements and employers' hegemonic position hinder the development of broader social citizenship in industrial working life (Kettunen, 2001). Further, Finland, with its powerful Lumi supercomputer and quantum technology companies IQM and Bluefors, is focusing on leveraging its strengths in quantum computing, high-speed wireless networks, health data, cybersecurity, and artificial intelligence. A transformation of global labor markets and workplaces takes place and reshapes workplaces since more functions previously performed by human resources are passed on to intelligent machines (Schäfer, Koloch, Storai, Gunkel, & Kraus, 2023, pp. 1-14). The countries must simplify technology use, protect industrial automation, and develop competitive AI language models for global success (Lehtonen, 2023). However, the integration of Artificial Intelligence (AI) technologies has significantly impacted their economic landscape, prompting a comprehensive study on its impact on productivity and economic growth within these progressive societies. AI's potential to boost productivity and growth is uncertain, with potential to widen disparities and impact job roles and sectors. While it offers opportunities for problem-solving,

[1] The Nordic model is a term coined by economists to describe the unique social policy-mix of countries like Denmark, Sweden, Norway, Finland, and Iceland.

decision-making, and economic growth, its wide applicability makes its effects on economies and societies uncertain (Ilzetzki & Jain, 2023). AI is a wide spectrum of technologies designed to enable machines to perceive, interpret, act, and learn with the intent to emulate human cognitive abilities. Its potential to amplify disparities is uncertain, especially in labor markets, where AI could amplify worker productivity and labor demand in some sectors, while pave the way for significant job displacements in others. The societal acceptability of AI may vary depending on job roles, with some professions seamlessly integrating AI tools, while others may face resistance due to cultural, ethical, or operational concerns. AI's advanced algorithms can now augment or replace high-skill roles, potentially exacerbating inequality across and within occupations. The amount of data captured, collected, and used globally along with AI-applications continues to increase rapidly (Taylor, 2023), exploiting data and such technology is becoming an increasingly important asset for governments and enterprises. In efforts of meeting global standards on quality, technology, sustainability, and pricing, leveraging data and Artificial Intelligence (AI) seems to be a continued growing key ingredient of Industry 4.0 (Singh, Goyat & Panwar, 2023). This research explores the relationship between AI adoption, productivity enhancements, and economic growth in Nordic welfare states. It aims to understand the mechanisms through which AI-driven innovations influence various sectors, such as manufacturing and healthcare, and uncover opportunities and challenges associated with embracing AI technologies. The study aims to provide policymakers, industry leaders, and stakeholders with actionable insights to harness AI's transformative potential effectively. The significance lies in its potential to inform evidence-based policymaking and strategic decision-making processes across Nordic welfare states. The research focuses on the implications of AI on employment patterns, income distribution, and social equity, aiming to foster inclusive growth and mitigate potential disparities arising from technological disruption. The research is structured around four key pillars: Understanding the Foundations of AI in Nordic Welfare States, Assessing the Impact of AI on Productivity Enhancement, Exploring the Economic Implications of AI Integration, and Charting a Path Forward: Policy Recommendations and Strategic Imperatives. The research aims to unravel the transformative potential of AI in fostering sustainable development and prosperity within Nordic welfare states, paving the way for progress, innovation, and inclusive growth in the Nordic region.

2. Research Questions

What are the specific sectors within Nordic welfare states where AI adoption has had the most significant impact on productivity and economic growth?

How do AI technologies contribute to enhancing efficiency and innovation in public service delivery and governance within Nordic welfare states?

What are the key drivers and barriers influencing the adoption and diffusion of AI technologies among businesses and organizations in Nordic welfare states?

To what extent do AI-driven automation and augmentation affect employment dynamics, workforce composition, and skill requirements in Nordic welfare states?

What policy interventions, regulatory frameworks, and skill development strategies are needed to maximize the benefits of AI for productivity and economic growth while ensuring social inclusivity and equitable distribution of gains in Nordic welfare states?

These research questions aim to delve into various aspects of AI's role in productivity and economic growth within Nordic welfare states, ranging from sector-specific impacts to broader societal implications and policy considerations.

3. Literature Review

This literature review explores the impact of Artificial Intelligence (AI) on productivity and economic growth in Nordic welfare states. It examines existing studies on AI adoption and theoretical perspectives, focusing on the unique characteristics of these nations. The review aims to provide a conceptual framework for understanding AI's role in driving productivity and economic growth in Nordic welfare states. The research by ***Tupasela*** (Tarkkala, Snell, & Tupasela, 2020) seen Nordic countries as pioneers in both digitalization and datafication and numerous other studies have investigated the relationship between AI adoption and economic outcomes across various contexts. ***Colonna*** (Colonna, 2020, pp. 13-18) in Nordic Yearbook of Law and Informatics suggested that Laws and context-adjusted components form complex, flexible regulative regimes for AI. Understanding the extent of ethical codes and regulations is crucial for AI management, requiring gap analysis and inventory of existing legal doctrines. Research studies by ***OECD (2023)***[1], ***Albanesi*** (Albanesi, Da Silva, Jimeno, Lamo & Wabitsch, 2023), ***Hatzius*** (Hatzius, 2023) adopt a cross-country approach; ***Gmyrek*** (Gmyrek, Berg & Bescond, 2023) undertake a comprehensive review of emerging market economies and find less exposure to AI than in advanced economies. The study by ***Abban*** (Abban, et al., 2023) analyzed the impact of renewable energy on CO2 emissions across 29 European economies from 1990 to 2019. It found a significant negative relationship

[1] Organisation for Economic Co-Operation and Development. (2023). OECD employment outlook 2023: Artificial intelligence and the labour market. Organization for Economic. Accessed on 12-03-2024 from https://scholar.google.com/scholar_lookup?title=OECD+Employment+Outlook+2023%3A+Artificial+Intelligence+and+the+Labour+Market&publication_year=2023#d=gs_cit&t=1710520608319&u=%2Fscholar%3Fq%3Dinfo%3AICxTXofPMcYJ%3Ascholar.google.com%2F%26output%3Dcite%26scirp%3D0%26hl%3Den.

between renewable energy and CO2 emissions, with a 1% increase in renewable energy leading to a 0.208% decrease in emissions. The study also found a feedback effect of 3.365%, suggesting that the initial decrease in CO2 emissions from renewable energy use may further incentivize renewable energy adoption. The findings support the notion that renewable energy is crucial for mitigating CO2 emissions in Europe and emphasize the importance of promoting renewable energy policies for long-term environmental sustainability. Further studies by ***Nureen*** (Nureen, Sun, Irfan, Nuta & Malik, 2023, pp. 78168–78181) suggests that companies in emerging economies should focus on environmental technologies and environmental standards to enhance their financial performance. It also suggests increasing investment in closed-loop cleaner production. Emerging economies are more adaptable in adopting green supply chain management practices, but often use these practices for compliance or customer expectations. The study emphasizes the importance of understanding the potential of these practices beyond compliance or customer expectations. The study by ***Cazzaniga*** (Cazzaniga, et al., 2024, pp. 1-39) states that the AI adoption could significantly impact labor markets, with advanced economies better positioned to leverage it. Women and educated workers may benefit, while older workers may struggle. Further studies by ***Awoke*** (Awoke, Tesfalem, & Takele, 2024, pp. 1-12) explores that artificial intelligence (AI) is a crucial and appropriate technology for managing livestock farms worldwide. AI lessens the workload of managers and farm staff, optimizes resource use and efficiency, and addresses the challenge of feeding a growing global population by resolving resource shortages. Importantly, AI and machine learning are seen as tools to enhance human effort rather than replacing it entirely. The study by ***Waage*** (Waage, Weinbach, & Larsen, 2024, pp. 187-202) shows a slightly greater understanding and ambition for AI investment in SFJ enterprises, with concrete plans to tackle future technological challenges. However, data utilization is not necessarily a priority. A new BN survey and qualitative interviews are needed for more accurate information. The study by ***Lisa & Heidrun*** (Lisa & Heidrun, 2024) reveals a lack of single problematic or justification for datafication initiatives, with a network of documents justifying policy action. This lack of collective governance in the data economy is surprising in the Nordic context, where values like solidarity, equality, openness, and de-commodification are strong. The research study by ***van der Marel*** (Van der Marel & Bjørn, 2023) suggest that Europe's economic growth and productivity are falling behind global trends due to a net outflow of human capital for AI implementation, particularly in STEM fields. High-skill firms drive AI adoption, and policymakers must prioritize investments in human capital for future growth. Similarly, the works by ***Fossa*** (Fossa, 2023) and ***Peng*** (Peng, Zhen, & Huang, 2023) indicate that the age of intelligent machines just started. Therefore, machine technologies are characterized by moderate automation, retaining their dependence on human resources. Study by ***Tyson & Zysman*** (Tyson & Zysman, 2022, pp. 256–271) emphasize that the internet, cloud computing, platforms, and,

most recently, the application of artificial intelligence have provided a new infrastructure that resembles the Industrial Revolution infrastructure of railways and steam engines. However, the economic impact of AI adoption is contingent upon various factors, including institutional frameworks, industry structure, and labor market dynamics. For instance, Author ***Garritzmann*** (Garritzmann, Häusermann & Palier, 2022) suggested that the growth strategy is associated with inclusive social investment and the expansion of higher education to promote economic specialization in innovation, the digital economy, and higher education as drivers of growth. The study ***Ključnikov*** (Ključnikov, Popkova & Sergi, 2023) argue the importance of human resources in enhancing labor productivity during the Fourth Industrial Revolution, advocating for effective management of human resources in private entrepreneurship over state regulation. It emphasizes the ongoing relationship between machine technologies and human resources. Moreover, study by ***Mustosmäki*** (Mustosmäki, Reisel, Sihto & Teigen, 2022, pp. 1-9) has highlighted the role of social norms and stereotypes in gender segregation in the labor market and how welfare state services and labor market regulation are not enough to address this. The study of capitalism by ***Anke Hassel*** (Anke & Bruno, 2023, pp. 347-368) reveals the diverse economic models across OECD countries, evolving over time. Growth regimes involve supply- and demand-side approaches, interconnected through policies and institutions. Recent crises, climate change, geopolitical tensions, and digital business models challenge existing capitalist models. Governments must adopt new growth strategies, focusing on balanced regimes. Future research should consider energy mixes, climate vulnerabilities, and environmental risks. In the context of Nordic welfare states, theoretical frameworks such as institutional theory and social contract theory offer valuable insights into the dynamics of AI adoption and its socio-economic implications. Within Nordic welfare states, the strong emphasis on social welfare and egalitarian principles may influence the deployment of AI technologies to prioritize societal well-being and mitigate potential disparities. Social contract theory, on the other hand, emphasizes the role of social norms and agreements in governing the relationship between individuals and the state (Rousseau, 1762). In Nordic welfare states, the implicit social contract revolves around the provision of universal welfare services and the redistribution of wealth to ensure equitable outcomes for all citizens. Against this backdrop, AI adoption is likely to be guided by principles of inclusivity, sustainability, and social cohesion, reflecting the values inherent in the Nordic model. Nordic welfare states are characterized by a combination of high social spending, progressive taxation, and extensive public services, which distinguish them from other economic models. These nations prioritize investments in education, healthcare, and social protection, thereby fostering human capital development and social cohesion. In summary, this literature review explores the relationship between AI adoption, productivity, and economic growth in Nordic welfare states. It highlights the opportunities and challenges of AI integration,

emphasizing the unique characteristics of Nordic societies that influence its adoption. The review suggests further research is needed to understand the implications of AI adoption for inclusive growth, social cohesion, and sustainable development in Nordic welfare states.

4. Research Methodology

The research aims to explore the role of Artificial Intelligence (AI) in productivity and economic growth in Nordic welfare states. This research will employ a mixed-methods approach, combining quantitative and qualitative data analysis, to gain a comprehensive understanding of the multifaceted relationship between AI adoption, productivity, and economic growth in Nordic welfare states. Data collection methods include structured surveys, interviews, and secondary data analysis. Surveys gather quantitative data on AI adoption rates, investment levels, perceived benefits, and challenges, while interviews provide qualitative data on experiences, perspectives, and opinions. Sampling techniques include stratified random sampling, purposeful sampling, and snowball sampling. Data analysis procedures include descriptive statistics, inferential statistics, thematic analysis, content analysis, and triangulation. The research aims to provide a comprehensive understanding by combining quantitative analysis with qualitative insights and using various data collection methods and sampling techniques.

5. AI and Productivity Enhancement in Nordic Welfare States

Nordic countries are embracing AI technologies, leveraging their digital infrastructure, skilled workforce, and commitment to innovation. Machine learning, natural language processing, robotics, and computer vision are being deployed across various sectors to automate tasks, streamline processes, and enhance decision-making capabilities. Over half of Nordic organizations use AI, with Finland having the highest usage (61%), followed by Norway (52%), Denmark (48%), and Sweden (45%). The most common use is text generation (31%). AI is typically used for operational purposes like automating processes or improving products and services. However, only 15% have developed a strategy for its use[1]. Government initiatives and strategic investments have fostered collaboration between academia, industry, and policymakers to drive AI innovation and adoption. In recent years, the adoption

[1] Think Tank Mandag Morgen (Monday Morning), ADD project, DI Digital, Digital Dogme, EY, Finansforbundet, HK, LinkedIn, Microsoft, & Netcompany. (2023). Project management and case-study articles. In M. Beck-Nielsen, J. K. Sørensen, & S. Gisselmann (Eds.), Data processing of questionnaire responses and report writing (D. H. Jensen, T. N. Kjølbye, R. A. Wagtmann, & M. L. Arlaud, Trans.). Accessed on 15-03-2024 from https://finansforbundet.dk/media/2z4mgccl/ai-i-norden_engelsk.pdf.

of Artificial Intelligence (AI) technologies has become increasingly prevalent across various sectors in Nordic welfare states. Nordic software demand has grown by 9% annually, from $14 billion in 2017 to $21 billion in 2022, while revenues from software companies have grown by 16% annually, reaching $44 billion in 2022. These trends are expected to continue in 2023, with the Nordic software industry potentially triple revenues by 2030, reaching an output three to four times its local consumption (Bjørndalen, Dahlström, Lundberg & Torres, 2024). The Technology Industries of Finland is investing ten million euros to boost AI usage in Finland. The investment aims to boost AI adoption at Finnish technology companies, boost applied research, and attract AI experts. The Centennial Foundation will donate EUR 3.2 million for Aalto University's AI research Centre (Mannonen, 2023). The investment will support recruitment of top experts, fund AI projects, and establish a business-driven AI network. AI can enhance productivity, profitability, and create new business models. This has sparked investor interest in the region, making it Europe's fastest-growing software funding hub. In manufacturing, AI-driven automation and predictive analytics are revolutionizing processes, enabling predictive maintenance, quality control, and supply chain optimization. In healthcare, AI-powered diagnostic tools, personalized treatment algorithms, and analytics are improving patient outcomes, optimizing resource allocation, and enhancing operational efficiency. In education, AI-based adaptive learning platforms, virtual tutors, and educational analytics are tailoring learning experiences, identifying individual needs, and enhancing student engagement. In public administration, AI applications include intelligent process automation, citizen service chatbots, and predictive analytics for policy-making and resource allocation. Empirical studies and industry reports demonstrate tangible productivity gains achieved through AI adoption in Nordic welfare states, including increased output per labor hour, cost savings, improved service quality, and enhanced innovation capabilities across various sectors. The integration of AI technologies in Nordic welfare states has significant potential for productivity enhancement and economic growth. By embracing AI-driven innovations and sector-specific applications, Nordic countries can become global leaders in AI-powered productivity. Artificial Intelligence (AI) could significantly impact Nordic economies, but to fully benefit, Nordic economies must reverse the trend of a growing distance to the AI frontier and become more attractive for AI human capital. Countries at the frontier of technological change often have a head start in developing human capital, which attracts high-skilled, efficient human capital. However, countries behind or catching up often develop a handicap, as human capital often leaves for work in regions where other human capital is already located. To reap bigger growth benefits from AI developments, Nordic leaders need to focus on policies that attract and build up more AI human capital.

6. The Impact of AI on Economic Growth in Nordic Welfare States

AI has the potential to significantly impact productivity growth in various industries, such as manufacturing, services, and innovation. AI can impact productivity boost in various industries, such as manufacturing, where robots and automation can increase efficiency and reduce human labor. In the services sector, chatbots and virtual assistants can handle routine tasks, freeing up employees for more complex work. AI-driven big data analysis can also aid in informed business decisions, resulting in increased productivity and growth (Piton, 2023). ***Andersson*** (Andersson, et al., 2021) explored the potential impact of AI on the medical physics profession in Sweden. The impact of AI on economic growth in Nordic welfare states is multifaceted, characterized by its transformative effects on innovation, efficiency gains, and the creation of new industries and job opportunities. In the Nordic context, where innovation and technological advancement are central to economic development, AI serves as a catalyst for driving productivity and competitiveness. AI will significantly influence power dynamics, economic value distribution, and political legitimacy. However, there is limited knowledge about global AI regulation, influential interests, and how emerging arrangements can manage AI's consequences in a just and democratic manner. Research on AI governance is in its early stages, despite its rapid expansion (Schmitt, 2022, pp. 303–314). By leveraging AI technologies, Nordic countries have witnessed significant efficiency gains and cost reductions across various sectors, leading to improved resource allocation and higher output per labor hour. Moreover, AI-driven innovations have spurred the emergence of new industries and business models, contributing to economic diversification and resilience. A comparative analysis with other economic models highlights the distinct advantages of the Nordic approach to AI adoption. While some economies prioritize rapid technological advancement and scale-driven growth, Nordic welfare states emphasize sustainable development, human-centric innovation, and social inclusivity. This balanced approach not only fosters economic prosperity but also promotes societal well-being and equitable distribution of benefits. Furthermore, the collaborative ecosystem in Nordic countries, characterized by strong public-private partnerships and investments in education and research, creates a conducive environment for AI-driven entrepreneurship and job creation. In contrast to models solely focused on efficiency gains and cost reductions, the Nordic welfare model prioritizes long-term sustainability and societal values, ensuring that the benefits of AI are shared equitably among citizens. By embracing AI as a tool for enhancing human capabilities and addressing societal challenges, Nordic welfare states position themselves as global leaders in the pursuit of inclusive and sustainable economic growth. However, ongoing investments in AI infrastructure, workforce development, and ethical frameworks are essential to navigate potential challenges and maximize the positive impact of AI on economic growth and societal well-being.

7. Challenges and Opportunities

The adoption of AI in Nordic welfare states presents both challenges and opportunities. Technological barriers, ethical considerations, human capital development, and regulatory and policy challenges are significant. Despite the country's robust digital infrastructure, implementing AI technologies often requires significant investments in hardware, software, and data infrastructure. Ensuring interoperability across systems poses technical challenges, especially in sectors with legacy IT systems. To overcome these barriers, strategic investments in research and development, collaboration between public and private sectors, and capacity-building initiatives are necessary. Ethical considerations are crucial in Nordic welfare states, where values like transparency, accountability, and privacy are deeply ingrained. Concerns about algorithmic bias, data privacy, and job displacement require careful regulation and oversight. By proactively addressing ethical and social implications, Nordic countries can mitigate risks and build trust in AI technologies, fostering responsible innovation and inclusive growth. Investments in education, vocational training, and lifelong learning programs are essential to empower individuals to adapt to evolving job roles and technological advancements. In conclusion, AI adoption presents significant opportunities for economic growth, societal advancement, and human well-being. By acknowledging the challenges and capitalizing on the opportunities presented by AI, Nordic welfare states can harness this technology to achieve sustainable economic growth while fostering a future that is both socially inclusive and ethically responsible.

8. Policy Implications

The role of AI in productivity and economic growth in Nordic welfare states is crucial. Developing adaptive regulatory frameworks is essential to promote responsible AI adoption, foster innovation, and protect societal interests. These frameworks should address concerns like data privacy, algorithmic bias, and ethical AI principles. Fostering international collaboration and standards-setting initiatives facilitates cross-border data sharing and interoperability, promoting AI ecosystem growth while safeguarding human rights and democratic values. Strategic investment in AI infrastructure and research is critical to building a competitive advantage in the global AI landscape. Nordic welfare states can allocate funding for AI research institutions, innovation hubs, and technology incubators, incentivizing private sector investment in AI startups and scale-ups. This fosters a vibrant AI ecosystem, attracting talent, investment, and partnerships, driving economic growth and technological leadership in key sectors. Workforce development initiatives are vital to address the skills gap and prepare the labor force for the AI-driven economy. Nordic welfare states can implement comprehensive training programs, upskilling initiatives, and lifelong learning opportunities to equip workers with the

competencies required for AI-related jobs. Collaboration between governments, educational institutions, and industry stakeholders facilitates the development of curricula tailored to emerging AI technologies and industry needs. Ensuring inclusive growth is central to leveraging AI's potential to enhance productivity and economic growth in Nordic welfare states. Policy interventions should prioritize closing the digital divide, expanding access to AI technologies, and fostering social dialogue and stakeholder engagement. Implementing targeted measures to support vulnerable groups ensures the benefits of AI adoption are shared equitably across society. In summary, adaptive regulatory frameworks, strategic investment in AI infrastructure and research, workforce development initiatives, and strategies for ensuring inclusive growth are essential policy implications for leveraging AI's role in productivity and economic growth in Nordic welfare states. By implementing these policies in a coordinated and holistic manner, Nordic countries can harness AI's transformative potential to build resilient, inclusive, and sustainable societies. By implementing these policy measures, Nordic welfare states can foster a responsible and inclusive approach to AI adoption, maximizing its potential for economic growth while mitigating potential risks and ensuring that the benefits of this transformative technology are distributed equitably across society.

9. Case Studies

This research involves conducting case studies to gain insights into how AI adoption impacts productivity and economic growth within Nordic welfare states. These case studies examine various sectors, such as healthcare, manufacturing, finance, and public services, to understand the diverse applications of AI and their implications for different aspects of the economy. By analyzing real-world examples and experiences, researchers can identify the key factors influencing the successful integration of AI technologies, including organizational readiness, investment strategies, regulatory frameworks, and skill development initiatives.

1) Norway:

The Norwegian Directorate of Health established TISK IKT to assist citizens, health professionals, and authorities during the Covid-19 pandemic. The digital compensation scheme was designed to support Norwegian businesses during the pandemic, ensuring quick, efficient, and relaunch-able payments. The Ukraine war led to improvements in digital services for refugees, with a focus on end user needs and an un-bureaucratic organizational model. The municipality of Larvik developed Service Shop, an online booking and calendar solution that allows service recipients to determine the time of receiving municipal services based on their own calendar and wishes. The Asker Welfare Lab is a service delivery concept centered on citizens, aiming to improve living standards and quality of life. The service concept

is based on findings from two previous studies in social housing in Sarpsborg, which showed fragmented and complex municipal services and lower homeless rates. The project Way Home aims to improve these services and improve housing conditions, focusing on the citizen's needs and improving the quality of life for individuals and families.

2) Finland:

The Finnish government established the Competence Centre for Sustainable and Innovative Public Procurement (KEINO) in 2018 to provide advisory services to public procurers and promote procurement competencies in public management. The Ministry of Finance aims to make all public services digital by 2023, and the 'Co-designing future digital services' project focuses on providing expert mentoring for public sector organizations to develop high-quality digital services. An innovation addresses bullying in schools by using Google Workspace for Education and digital tools to identify and react to bullying. Quality Tools are available for public sector organizations to evaluate, monitor, and compare service quality and use. Ecosystem School 1.0 was co-created and implemented by Work 2.0 Lab to develop ecosystem thinking and tools for phenomenon-oriented work within ecosystems. A human-centric and life event-based operating model supports the life-event service ecosystem technology, enabling authorities to produce value directly in people's life events through cooperation with other service providers. The Future Mentors program is a reversed mentoring program that allows young people to mentor decision-makers about their city's future. Finland is the first country to allow citizens to manage digital mandates and act on behalf of another person or organization in digital and physical services. Mandates are provided with Suomi.fi-e-Authorizations, which is free to use for public, private, and third sector service providers and end-users in Finland.

3) Denmark:

The Center for Hybrid Intelligence (CHI) has developed an AI-powered game called "Crea.visions" to allow the public to collaboratively create and reflect on future scenarios. This could form a cornerstone in participatory democracy in the digital age. The Innovation Barometer is the world's first official statistics on Public Sector Innovation (PSI), implemented in five countries. It provides innovators and decision-makers with systematic knowledge of what thousands of innovators do. A project improves the quality of life for people with chronical illnesses by integrating digital solutions in their education. CORO, Co-lab, is a local innovation platform that creates sustainable solutions to complex societal challenges through cross-sectorial cooperation between public organizations, academia, civil society, and businesses. The Diverging Diamond Interchange (DDI) in Europe enables more capacity, improved safety, and less congestion. Innovative Complaint Management is changing organizations' understanding of complaints from errors to potential

solutions. The Kolding Municipality's medical benefit system underwent a comprehensive design-driven innovation process in 2015, resulting in a 38% reduction in complaints and 3 million euro saved annually.

4) Sweden:

The article discusses various innovative projects and initiatives aimed at addressing various challenges in various sectors. It highlights the development of GDP forecasting applications, digital maturity assessments, violence early-warning systems, blockchain-based data management, healthcare innovation, sustainability bond with impact-linked return, and the Innovation Guide. The GDP forecasting application uses Explainable Machine Learning (XML) to generate accurate economic forecasts from multivariate time-series data sets. Future by Lund has implemented a new model for innovation ecosystem portfolio tracking (LIEPT), which benefits stakeholders by building strategic competence for scaling solutions and working with innovation portfolios. The Swedish Center for Digital Innovation has created a digital maturity assessment (DiMiOS) that has been used in over 400 public sector organizations, increasing digital maturity in the entire sector. The Violence Early-Warning System (ViEWS) is a publicly available data-driven forecasting system that generates monthly predictions of conflict fatalities up to 36 months ahead, based at Uppsala University and Peace Research Institute Oslo. The article also discusses the integration of different actors into the ecosystem, enabling businesses to control their own data using blockchains and digital wallets. The Primary Health Care Centre has launched an innovation project empowering healthcare professionals to create, innovate, and develop new products and working methods to meet future challenges. The Sustainability Bond with Impact-Linked Return (SBIR) funding model aims to unlock social impact investing and build public sector capacity to tackle various social challenges. The Innovation Guide is an innovation lab for learning and doing within SALAR, supporting public organizations to strengthen their employees' innovation skills and create new public services based on user needs.

5) Iceland:

Patient Centricity is a technology that empowers individuals with their own data, allowing them to control their personal library and access it on demand. The Icelandic Directorate of Health and digi.me have developed a world-first national patient-centric system. Better Reykjavik is a co-creation project that connects citizens and improves trust and policy by offering a platform for crowdsourcing solutions to urban challenges. It includes agenda setting, participatory budgeting, and policymaking, with innovations like a unique debating system and AI-enhanced user experience.

(OECD Observatory of Public Sector Innovation (OPSI)[1])

10. Future Directions for Research

Future research suggested with a focus on long-term economic impact assessment of AI adoption in Nordic welfare states, tracking productivity trends, employment dynamics, and GDP growth over time. Sector-specific analysis is needed to explore AI applications in renewable energy, forestry, tourism, and creative industries, uncovering unique challenges, opportunities, and productivity gains in each domain. Socioeconomic implications of AI adoption should be delved into, including its effects on income inequality, social mobility, and job polarization. Comparative studies comparing AI adoption and economic outcomes across Nordic countries can provide valuable insights into factors influencing AI's role in productivity and economic growth. Areas for further investigation include AI-enabled innovation ecosystems, AI-driven entrepreneurship and startups, and AI and Sustainable Development Goals (SDGs). Emerging trends in AI and economic development include AI-powered green technologies, AI-driven personalized services, and ethical AI governance frameworks. By exploring these future directions for research and emerging trends in AI and economic development, scholars can contribute to advancing knowledge and understanding of the role of AI in productivity and economic growth in Nordic welfare states. By identifying best practices and areas for improvement, policymakers can tailor strategies to maximize the benefits of AI adoption in Nordic welfare states.

11. Conclusions, Policy Considerations & Limitations

AI has the potential to revolutionize industries by automating tasks, analyzing big data, and freeing up employees for more complex work. However, productivity growth in developed countries has lagged, raising questions about whether AI has had the expected impact or if other factors are at play. Factors such as delays in AI implementation, measurement errors, complementary innovations, macroeconomic policies, and the social and economic context can affect productivity growth. Research indicates that more productive firms tend to be more digitalized, and the impact of digital and automation technologies on the labor market and employment is a subject of debate. AI has the ability to outperform humans in certain tasks, such as learning and improving quickly from large data sets, machine translation systems using AI can translate texts more quickly and accurately than humans, and it can

[1] OECD Observatory of Public Sector Innovation (OPSI), Co-funded by the European Commission (2024). Accessed on 15-03-2024 from https://oecd-opsi.org/case_type/opsi/?_countries=denmark%2Cfinland%2Ciceland%2Cnorway%2Csweden

make more informed and accurate data-driven decisions than humans. However, humans have an advantage in understanding emotions, intentions, and communication nuances, as well as in making decisions in uncertain and unpredictable circumstances. Policymakers need to develop a comprehensive strategy for AI that takes into account its potential economic, social, and ethical impacts. This strategy could outline priorities for AI research and development, investment in infrastructure and talent, and a regulatory framework. Support for innovation in AI could be made a policy priority, by providing funding for research and development, promoting collaboration between industry and academia, and providing incentives for companies to invest in AI. The study **Butt, Junaid** (Butt, 2023, pp. 7-25) explores the use of Artificial Intelligence in administrative decision-making is a complex issue requiring ethical and legal considerations. While it offers benefits like improved efficiency and cost savings, it also poses risks. Comparative studies can inform policymaking, ensuring transparency, accountability, and respect for privacy and human rights. AI adoption is expected to significantly impact labor markets, with cross-country differences and uncertain implications. The study by **Khan** (Khan, Dong, Nuță, & Khan, 2023, pp. 108005–108022) examining EU countries found that green growth strategies, environmental taxes, and eco-innovations all contribute to reducing CO2 emissions and supports the idea that sustainable development can achieve environmental goals. The findings suggest that policymakers should prioritize green growth and encourage eco-innovations in renewable energy for a more sustainable future. The digital divide and global income disparity may widen due to increased exposure to AI, while older workers may face challenges in reemployment and adapting to new technologies. AI will also reshape wealth and income distribution, with capital deepening and productivity surges driving wage incomes for a broad range of workers and total income. The trajectory of labor income inequality depends on how well AI complements tasks undertaken by high-income professionals. Advanced and emerging market economies are well-positioned to harness AI due to their high exposure and preparedness, while low-income countries and emerging market economies may struggle due to inadequate infrastructure, workers' lack of skills, and lack of institutional frameworks. Advanced and developed economies should launch regulatory frameworks to optimize AI use and invest in complementary innovations. Low-income countries and emerging market economies should prioritize digital infrastructure and human capital to address skill shortages, expand healthcare and education provision, and improve productivity and competitiveness. Policymakers must promote the equitable and ethical integration of AI and train the next generation of workers. To avoid skill shortages, policymakers could foster the development of AI talent by investing in education and training programs that teach skills needed to work with AI, such as data analysis, programming, and machine learning. Ethical and regulatory challenges associated with AI could also be addressed by developing a framework for responsible development and deployment of AI.

The study on AI's economic impacts in Nordic countries has limitations, limiting its generalizability to other regions with different economic and environmental factors. It discusses the complexity of measuring AI's impact on productivity growth, challenges of reliable data collection methods, future uncertainty due to unknown societal and economic effects, global disparity in AI adoption impacts, and the lack of comprehensive assessment of policy approaches. The recommendations are centered on policy solutions, but the research may not provide a comprehensive evaluation. Continuous research is needed to assess the long-term economic impact of AI, its societal implications, and emerging trends like AI platforms and human-AI collaboration. Successful integration of AI in Nordic countries requires a comprehensive approach that balances innovation with ethical considerations, prioritizes human capital development, and fosters a collaborative environment for sustainable economic growth and societal well-being.

12. Summary of Key Findings

Nordic countries are embracing AI technologies to boost innovation and economic development. AI offers potential for productivity gains through automation and efficiency improvements. With strong social safety nets and a focus on education and upskilling, Nordic countries can navigate potential job displacement and ensure a smooth workforce transition and are implementing AI initiatives to boost productivity, streamline processes, and stimulate economic growth in various sectors. However, challenges like technological barriers, ethical considerations, and skills gaps need to be addressed. Adaptive regulatory frameworks, human-centric design, and workforce development are crucial. Emerging AI trends, such as green technologies, personalized services, and ethical governance, offer promising opportunities for sustainable economic development in Nordic welfare states.

What are the specific sectors within Nordic welfare states where AI adoption has had the most significant impact on productivity and economic growth?

R: The adoption of Artificial Intelligence (AI) has significantly impacted various sectors within Nordic welfare states, contributing to increased productivity and economic growth. Healthcare is being revolutionized by AI technologies, improving administrative processes, diagnostics accuracy, and personalized treatment plans. Applications like medical imaging analysis, predictive analytics, and virtual health assistants are enhancing efficiency and effectiveness in healthcare provision. Manufacturing is being transformed by AI-powered automation and predictive maintenance, optimizing production schedules, minimizing downtime, and enhancing product quality. In finance, AI is driving innovation in fraud detection, risk assessment, algorithmic trading, and customer service automation. AI-powered predictive analytics and optimization algorithms enable real-time tracking of

shipments, efficient route planning, and demand forecasting, leading to reduced transportation costs and faster delivery times. Public services are also being transformed by AI adoption, including education, social services, and government administration. AI-powered chatbots, virtual assistants, and predictive analytics tools are improving citizen engagement, automating routine administrative tasks, and optimizing resource allocation in public service organizations, leading to increased efficiency, responsiveness, and cost-effectiveness in service delivery. In conclusion, AI adoption has had a profound impact on various sectors within Nordic welfare states, driving productivity gains, cost reductions, and economic growth across the board. By leveraging AI technologies effectively, Nordic countries have positioned themselves at the forefront of innovation and competitiveness in the global economy.

How do AI technologies contribute to enhancing efficiency and innovation in public service delivery and governance within Nordic welfare states?

R: AI has revolutionized various aspects of public service in Nordic welfare states. It has enabled the automation of repetitive administrative tasks, such as data entry and document processing, thereby improving efficiency and service delivery. It has also enabled the use of predictive analytics for informed decision-making, enabling policymakers to anticipate trends and address issues like healthcare demand and resource allocation. AI also enables personalized services, tailored to individual citizens' needs and preferences. This data-driven approach enhances citizens' experience and satisfaction with public services. AI also aids in optimizing resource allocation and budget planning, ensuring efficient delivery of public services and maximizing societal benefits. Furthermore, AI facilitates improved citizen engagement in governance processes through chatbots, virtual assistants, and online platforms. These tools provide accessible channels for communication, feedback, and interaction, fostering transparency, accountability, and collaboration, leading to more responsive and inclusive decision-making. Overall, AI technologies contribute to enhancing efficiency and innovation in public service delivery and governance within Nordic welfare states by enabling automation of administrative tasks, facilitating data-driven decision-making, providing personalized services, optimizing resource allocation, and improving citizen engagement. By leveraging AI effectively, governments can streamline operations, enhance service quality, and promote societal well-being in the pursuit of welfare state objectives.

What are the key drivers and barriers influencing the adoption and diffusion of AI technologies among businesses and organizations in Nordic welfare states?

R: The adoption and diffusion of Artificial Intelligence (AI) technologies among businesses and organizations in Nordic welfare states are influenced by various drivers and barriers. Key drivers include government support and policies,

technological advancements, economic competitiveness, access to skilled talent, and industry collaboration and partnerships. Government-led initiatives promote innovation, research, and development in AI, while rapid advancements in AI technology make them more attractive for implementation in various sectors. Economic competitiveness drives businesses to adopt AI solutions to enhance efficiency, reduce costs, and drive innovation. Skilled AI professionals, researchers, and developers in Nordic welfare states facilitate AI adoption. Collaboration among industry players, academia, and research institutions promotes knowledge sharing, technology transfer, and innovation in AI adoption. However, key barriers to AI adoption include data privacy and security concerns, lack of AI skills and expertise, high implementation costs, regulatory and legal uncertainty, and resistance to change and cultural factors. Data privacy and security concerns pose significant challenges for businesses in Nordic welfare states, while the lack of AI skills and expertise hinders their ability to leverage AI effectively. High implementation costs, regulatory ambiguity, and cultural factors also impede AI adoption and diffusion. In summary, the adoption and diffusion of AI technologies among businesses and organizations in Nordic welfare states are driven by factors such as government support, technological advancements, economic competitiveness, talent availability, and industry collaboration. However, challenges related to data privacy, skills shortage, implementation costs, regulatory uncertainty, and organizational resistance pose barriers to AI adoption and require concerted efforts to overcome.

To what extent do AI-driven automation and augmentation affect employment dynamics, workforce composition, and skill requirements in Nordic welfare states?

R: The impact of AI-driven automation and augmentation on employment dynamics, workforce composition, and skill requirements in Nordic welfare states is a complex issue that requires a thorough examination of various factors. Employment dynamics can be affected by the shift towards more cognitive tasks, while workforce composition may be reshaped by AI technologies. Some occupations may become obsolete due to automation, leading to a growing demand for workers with skills in areas like data science, programming, and human-centered design. Skill requirements are also impacted by AI-driven automation and augmentation. Workers in Nordic welfare states may need to acquire new skills or upgrade existing ones to remain competitive in the labor market. Skills such as digital literacy, problem-solving, critical thinking, and adaptability become increasingly valuable in an AI-driven economy. Upskilling and reskilling initiatives, supported by governments, educational institutions, and employers, play a crucial role in ensuring workers have the necessary skills to thrive in the evolving job market. Socio-economic implications are also significant. Automation can increase productivity and economic growth, but it may also exacerbate inequalities by disproportionately impacting certain demographic groups or regions. Policies promoting inclusive

growth, such as social safety nets, lifelong learning programs, and income support mechanisms, are essential to mitigate the adverse effects of AI-driven changes on vulnerable populations. In conclusion, AI-driven automation and augmentation have significant implications for employment dynamics, workforce composition, and skill requirements in Nordic welfare states. Proactive measures are needed to harness the potential of AI for inclusive and sustainable economic development.

What policy interventions, regulatory frameworks, and skill development strategies are needed to maximize the benefits of AI for productivity and economic growth while ensuring social inclusivity and equitable distribution of gains in Nordic welfare states?

R: The Nordic welfare states can maximize the benefits of AI by investing in research and development, utilizing AI for public good initiatives, and investing in reskilling and upskilling programs. The Universal Basic Income (UBI) could provide a safety net for those whose jobs are disrupted by AI, allowing for smoother adaptation and retraining. Regulatory frameworks include robust data privacy regulations, algorithmic bias mitigation, and taxation policies that incentivize responsible AI development and adoption. Skill development strategies include STEM education, lifelong learning programs, fostering soft skills, and promoting digital literacy. Nordic countries have strong social safety nets and an emphasis on equality, making them well-positioned to implement these strategies. Collaboration between governments, businesses, educational institutions, and labor unions can ensure that AI benefits all members of society and promotes inclusive economic growth. Continuous evaluation is essential to ensure the effectiveness of these policies and adapt them as AI technologies and their impact on society evolve. This list provides a starting point for discussion on how Nordic welfare states can navigate the opportunities and challenges presented by AI.

13. Implications for Theory and Practice

This research contributes to understanding the role of AI in economic development, emphasizing contextual factors, collaborative ecosystems, and ethical considerations. It can inform AI adoption strategies in Nordic countries, prioritizing investment areas and designing policies promoting responsible and inclusive AI development, thus enhancing theoretical understanding and practical application. Nordic case studies provide valuable insights into successful AI adoption strategies, emphasizing collaboration, ethical considerations, and human capital development. These findings can inform theoretical frameworks for understanding AI's relationship with economic growth and societal well-being in welfare states. Policymakers and industry leaders can use these insights to design effective AI governance frameworks and prioritize responsible AI development.

14. Recommendations for Policy and Practice

Governments and the private sector should collaborate to invest in AI infrastructure and research, equipping the workforce with necessary skills for the AI-driven economy. Workforce development programs should be developed to equip the workforce with data analysis and AI literacy. Developing flexible regulatory frameworks is crucial to address AI's evolving nature while mitigating risks and prioritizing ethical considerations. Promoting inclusive growth through robust social safety nets and equitable access to AI-driven opportunities is essential for fostering economic growth. The study suggests that Nordic welfare states can leverage AI to boost productivity, economic growth, and societal well-being, positioning themselves as global leaders in the AI-driven era. It recommends developing adaptive regulatory frameworks that balance innovation with ethical considerations, investing in workforce development to address skills gaps, fostering cross-sector collaboration to stimulate AI innovation, and prioritizing research in AI-enabled green technologies and ethical governance frameworks. These recommendations aim to promote transparency, fairness, and accountability in AI development and deployment.

Acknowledgment

The author expresses his sincere gratitude to the learned editorial board headed by **Hon'b Dr. Prof. Anca Gabriela Turtureanu** and **Hon'b Dr. Prof. Florian Marcel Nuţă, Danubius University of Galati, Romania** both from Danubius University of Galati, Romania, for their invaluable support during the research publication process. The author also express their deepest gratitude to their late father, **Mr. Abdul Sattar Butt**, for his unwavering guidance and encouragement throughout the journey. His wisdom, patience, and dedication have been a constant source of inspiration, shaping the author into the person he is today. The author is profoundly grateful her mother **Mst. Nighat Firdous** for her endless support and her sacrifices and lessons, and for her love and devotion, which have been a beacon of strength. Her presence in the author's life is a blessing beyond measure.

References

Abban, O. J.; Xing, Y. H.; Nuţă, A. C.; Nuţă, F. M.; Borah, P. S.; Ofori, C. & Jing, Y. J. (2023). Policies for carbon zero targets: Examining the spillover effects of renewable energy and patent applications on environmental quality in Europe. *Energy Economics*.

Albanesi, S.; Da Silva, A. D.; Jimeno, J. F.; Lamo, A. & Wabitsch, A. (2023). New technologies and jobs in Europe. *National Bureau of Economic Research*. Retrieved March 11, 2024, from https://www.nber.org/system/files/working_papers/w31357/w31357.pdf.

Andersson, J.; Nyholm, T.; Ceberg, C.; Alm´en, A.; Bernhardt, P.; Franssong, A. & Olssond, L. E. (2021). Artificial intelligence and the medical physics profession - A Swedish perspective. *Physica Medica*, pp. 218–225.

Anke, H. & Bruno, P. (2023). Same Trend, Different Paths: Growth and Welfare Regimes across Time and Space. *Annual Review of Political Science*, pp. 347-368.

Awoke, M.; Tesfalem, A. & Takele, S. (2024). The Influence of Artificial Intelligence Technology on the Management of Livestock Farms. *International Journal of Distributed Sensor Networks*, 12.

Bjørndalen, A. J.; Dahlström, P.; Lundberg, T. & Torres, A. (23 January, 2024). *What's driving the Nordic countries' software export surge?* Retrieved from McKinsey & Company: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/whats-driving-the-nordic-countries-software-export-surge.

Butt, J. (2023). Legal Considerations and Comparative Study about Countries Already Incorporated AI for Administrative Decisions. *Acta Universitatis Danubius. Juridica*, pp. 7-25.

Cazzaniga, M.; Jaumotte, F., Li, L.; Melina, G.; Panton, A. J.; Pizzinelli, C. & Mendes Tavares, M. (2024). Gen-AI: Artificial Intelligence and the Future of Work. Staff Discussion Notes. *International Monetary Fund*, pp. 1-39.

Colonna, L. (2020). Law in the Era of Artificial Intelligence. *Nordic Yearbook of Law and Informatics*, pp. 13-18.

Fossa, F. (2023). The high road. Driving automation, human values, and artificial agency. *Ethics of Driving Automation: Artificial Agency and Human Values*.

Garritzmann, J.; Häusermann, S. & Palier, B. (2022). The World Politics of Social Investment. *Welfare States in the Knowledge Economy*.

GmbH, S. (2024). *Nordic Model*. Retrieved March 11, 2024, from StudySmarter GmbH: https://www.studysmarter.co.uk/explanations/macroeconomics/macroeconomics-examples/nordic-model/.

Gmyrek, P.; Berg, J. & Bescond, D. (2023). Generative AI and jobs: A global analysis of potential effects on job quantity and quality. *ILO Working Paper*. Retrieved from https://www.econstor.eu/bitstream/10419/278614/1/1857683005.pdf.

Hatzius, J. (2023). The Potentially Large Effects of Artificial Intelligence on Economic Growth (Briggs/Kodnani). *Global Economics Analyst*, 1-20. Retrieved from https://static.poder360.com.br/2023/03/Global-Economics-Analyst_-The-Potentially-Large-Effects-of-Artificial-Intelligence-on-Economic-Growth-Briggs_Kodnani.pdf.

Ilzetzki, E. & Jain, S. (2023). *The impact of artificial intelligence on growth and employment*. Retrieved from VoxEU. org: https://scholar.google.com/scholar_lookup?title=The+Impact+of+Artificial+Intelligence+on+Growth+and+Employment&author=E.+S.+Ilzetzki+Jain&publication_year=2023.

Kettunen, P. (2001). The Nordic Welfare State in Finland. *Scandinavian Journal of History*.

Khan, H.; Dong, Y.; Nuță, F. M. & Khan, I. (2023). Eco-innovations, green growth, and environmental taxes in EU countries: a panel quantile regression approach. *Environmental Science and Pollution Research*, pp. 108005–108022.

Ključnikov, A.; Popkova, E. G. & Sergi, B. S. (2023). Global labor markets and workplaces in the age of intelligent machines. *Journal of Innovation & Knowledge*.

Lehtonen, K. (2023). Unlocking the full potential of digitalization and the data economy – including in the EU. *Fair data economy*.

Lisa, R. & Heidrun, Å. (2024). Constructing the data economy: tracing expectations of value creation in policy documents. *Critical Policy Studies*.

Mannonen, M. (2023). *Why is Technology Industries of Finland making a big investment in artificial intelligence?* Retrieved from https://teknologiateollisuus.fi/en/ajankohtaista/news/why-technology-industries-finland-making-big-investment-artificial-intelligence

Matthews, L. (2023). Taking a Closer Look at the Vaunted Scandinavian Welfare States. *Mises Wire*.

Mustosmäki, A.; Reisel, L.; Sihto, T. & Teigen, M. (2022). Gendered Labor Market (dis)advantages in Nordic Welfare States. *Nordic Journal of Working Life Studies*, pp. 1-9.

Nureen, N.; Sun, H.; Irfan, M.; Nuta, A. C. & Malik, M. (2023). Digital transformation: fresh insights to implement green supply chain management, eco-technological innovation, and collaborative capability in manufacturing sector of an emerging economy. *Environmental Science and Pollution Research*, pp. 78168–78181.

Peng, C.; Zhen, X. & Huang, Y. (2023). Human-automation interaction centered approach based on FRAM for systemic safety analysis of dynamic positioning operations for offshore tandem offloading. *Ocean Engineering*.

Piton, C. (2023). The economic consequences of artificial intelligence: An overview. *National Bank of Belgium Economic Review*.

Reutter, L. & Åm, H. (2024). Constructing the data economy: tracing expectations of value creation in policy documents. *Critical Policy Studies*, pp. 1-21.

Schäfer, B.; Koloch, L.; Storai, D.; Gunkel, M. & Kraus, S. (2023). Alternative workplace arrangements: Tearing down the walls of a conceptual labyrinth. *Journal of Innovation & Knowledge*, 1-14. Retrieved March 12, 2024, from https://www.sciencedirect.com/science/article/pii/S2444569X23000483.

Schmitt, L. (2022). Mapping global AI governance: a nascent regime in a fragmented landscape. *AI Ethics*, pp. 303–314.

Singh, M.; Goyat, R. & Panwar, R. (2023). Fundamental pillars for industry 4.0 development: implementation framework and challenges in manufacturing environment. *The TQM Journal*.

Tarkkala, H.; Snell, K. & Tupasela, A. (2020). The Nordic data imaginary. *Big Data and Society*.

Taylor, P. (2023). *Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025*. Retrieved from Statista: https://www.statista.com/statistics/871513/worldwide-data-created/

Tyson, L. & Zysman, J. (2022). Automation, AI & work. *Daedalus*, pp. 256–271.

Van der Marel, E. & Bjørn, B. (2023). Artificial Intelligence and the Clustering of Human Capital: The Risks for Europe. *ECIPE Occasional Papers*.

Waage, M.; Weinbach, B. & Larsen, Ø. (2024). Digital and AI Maturity of Enterprises in Sogn Og Fjordane, a Rural Region of Norway. *AI, Data, and Digitalization. Communications in Computer and Information Science*, pp. 187-202. Norway: Springer.

Books

AI Needs You: How We Can Change AI's Future and Save Our Own, Verity Harding.

Algorithms for the People: Democracy in the Age of AI by Josh Simons.

Are Nordic organizations ready for AI? The effect of AI on how organisations think about their digital transition and skills 2023 by Mette Beck-Nielsen, CEO director, Digital Dogme, Jakob Kaastrup Sørensen, independent management consultant, Søren Gisselmann, independent consultant.

Guardrails: Guiding Human Decisions in the Age of AI by Urs Gasser and Viktor Mayer-Schönberger.

The Importance of Being Educable: A New Theory of Human Uniqueness by Leslie Valiant.

The Nordic Economic, Social and Political Model Challenges in the 21st Century by Anu Koivunen, Jari Ojala, Janne Holmén.

The Nordic Model: Scandinavia since 1945 by Mary Hilson

Viking Economics: How the Scandinavians Got It Right-and How We Can, Too by George Lakey.