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ARTIFICIAL INTELLIGENCE
BENEFITS, APPLICATIONS, RISKS AND COSTS

ABSTRACT

AI is not a novel, unprecedent, revolution in human experience. Other innovations, such as spoken language, writing, electricity, the steam engine, telecommunications, have previously extended our capacities. At the beginning, predictions as to the impact of AI were very different as from different sources. This can be largely justified by the fact that the consequences of AI are indeed manifold. Its applications are numerous, spacing from early diagnosis of diseases in healthcare to a range of financial applications – like early detection of fraud in financial institutions, auditing, anti-money laundering and AI-managed portfolios – education (for changing the way of learning of people, the use of AI in media, such as in The Associated Press' use of automated insights; producing earning reports stories; personalised learning; written language translation and speech translation technology to convert one language's spoken words into another). Together with positive applications, however, many risks derive from AI, such as: lack of transparency, bias and discrimination, privacy concerns, ethical dilemmas, security risks, concentration of power, etc.
Circumstances influencing the nature of effects of AI on growth and employment depend to a large extent on institutions and policies.

Keywords: Labour Economics; Agriculture; Human Resources; Industry; Education
JEL Classification: I21; J01; J43; O14; O15

RIASSUNTO

L'Intelligenza Artificiale. Benefici, applicazioni, rischi e costi

L'intelligenza artificiale (IA) non è una rivoluzione nuova e senza precedenti nell'esperienza umana. Altre innovazioni, come il linguaggio parlato, la scrittura, l'elettricità, la macchina a vapore, le telecomunicazioni, hanno già ampliato le nostre capacità. All'inizio, le previsioni sull'impatto dell'IA erano molto diverse a seconda delle fonti. Ciò può essere ampiamente

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giustificato dal fatto che le conseguenze dell'IA sono davvero molteplici. Le sue applicazioni sono numerose, spaziando dalla diagnosi precoce delle malattie in ambito sanitario ad una serie di applicazioni finanziarie – come la rilevazione precoce delle frodi negli istituti finanziari, l'audit, l'antiriciclaggio e i portafogli gestiti dall'IA – all'istruzione (per cambiare il modo di apprendere delle persone, l'uso dell'IA nei media, come nell'uso di insight automatizzati da parte dell'Associated Press; la produzione di storie di report sugli utili; l'apprendimento personalizzato; la traduzione di lingue scritte e la tecnologia di traduzione vocale per convertire le parole parlate da una lingua in un'altra). Insieme alle applicazioni positive, tuttavia, dall'IA derivano molti rischi, come: mancanza di trasparenza, pregiudizi e discriminazioni, problemi di privacy, dilemmi etici, rischi per la sicurezza, concentrazione del potere, ecc. Le circostanze che influenzano la natura degli effetti dell'IA sulla crescita e sull'occupazione dipendono in larga misura dalle istituzioni e dalle politiche.

1. Is AI a novelty in important innovations?

Before dealing with consequences of AI and as a way of presenting them, we must recognize that AI is not a novel, unprecedent, revolution in human experience. In fact, as Bryson (2019: 27) says, spoken language, writing, electricity, the steam engine, telecommunications and other innovations have previously

"extended our capacities, altered our economies, and disrupted our social order – generally though not universally for the better". It must be recognized that AI "first and foremost extends and enhances what it means to be human, and in particular our problem-solving capacities", which may require "radical innovations in the way we govern, and particularly in the way we raise revenue for redistribution".

2. The effects

At the beginning, predictions as to the impact of the new technology were very different as from different sources. There were doom and gloom predictions of it, but they all proved to be utterly wrong, similarly to what had happened in the past for other epochal innovations, such as those taking place in the industrial revolution. Broader questions as to the effects of AI should be raised according to Ekelund (2024). In his view, one should first ask whether all of our needs are satisfied today and if AI can fill the remaining part, then, whether an increase in demand for

products and services will lead to new jobs, and, finally, if policy makers can facilitate the dynamic creation and rotation of the labour market towards new jobs.

As to the specific effects, we first deal with employment, in terms of quantity, quality, substitutions and new types of occupations. In general, the speed of development of the effects is unprecedented and nearly every sector and employment seem to be affected by AI.

3. Benefits deriving from AI

The consequences of AI are indeed manifold. Let us focus at the beginning just on an abstract issue, that of correct reasoning, by argumentation. The formal study of this

"is very relevant to current research in explainable AI, which is the subfield of AI that studies how the behaviour and results of AI algorithms, often non-transparent, can be explained to humans" (Prakken, 2024).

As to the effects of AI on strictly economic facts, on the one side, some OECD surveys reported that two in five workers in manufacturing and finance expressed worries for a decrease in wages in their sector in the next 10 years due to AI adoption. However, specialised AI skills are important and their lack is a barrier to using AI at work. At the same time, almost two-thirds (63%) of workers reported an increase of job quality and of their enjoyment at work. In fact, the biggest impact highlighted by the literature so far has been on job quality. However, AI raises

"serious ethical challenges for data protection and privacy, transparency and explainability, bias and discrimination, automatic decision making and accountability" (OECD, 2023).

4. Applications of AI

Applications of AI are numerous (see Acocella, 2024; Wikipedia, no date). Among them there are:

- early diagnosis of diseases in healthcare through analyses of patterns and data to predict when/how a patient is likely to develop a specific disease, such as cancer or delivering a HIV prognosis or identifying genomic pathogen signatures of novel pathogens, and tailoring therapies to individuals in personalized medicine/precision medicine and assisting blind people;

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it is also important for clinical training and helping in surgery; finally, AI has a novel important application for drug creations;

- handling simple and common requests, and helping route requests to human resources for more complex tasks;

- finance, for a range of applications like early detection of fraud in financial institutions; more generally, AI can help in detection of fraud, auditing and anti-money laundering, AI-managed portfolios;

- creation of predictive analysis for helping possibilities of a business project to realize, helping to prevent poor decisions and support strong ones;

- education, for changing the way of learning of people, by: the use of AI in media, such as in The Associated Press' use of automated insights; producing earning reports stories; personalised learning; written language translation and speech translation technology to convert one language's spoken words into another;

- customer services, for providing the industry with data-driven tools bringing meaningful insights to customers and providers; AI can predict the rating or preference a user would give to an item; at the same time, it is used to target web advertisements to those most likely to click or engage in them;

- tools in the form of chatbots and virtual assistants powering the customer service industry; similarly, search engines are based on AI;

- transportation, such as for: automated machinery such as tractors and harvesters, self-driving cars and AI travel planners, traffic management in a way to reduce waiting times, energy use, and emissions by as much as 25%; maritime transport, for which neural networks are used by situational awareness systems in ships and boats and autonomous boats have been created. Smart traffic lights have been developed at Carnegie Mellon since 2009;

- facial recognition instruments, very useful for a number of applications, especially for checking the identity of people;

- writing and reporting to obtain computer-generated news and reports, which summarise sporting events or financial reports and real estate analyses;

- visual art: AI has been used to produce visual images generated from inputs such as text or other images;

- deep-faking, which can be used for comedic purposes but are better known for fake news and hoaxes; a program has been developed to help journalists and researchers in detecting fake

documents;
- economic and social challenges: AI has been used for addressing problems such as those of homeless and, more generally, for identifying high poverty areas;
- in agriculture, where AI is used to help farmers identify areas that need irrigation, fertilization, pesticide treatments or increasing yield, also taking the right decisions as to the quantity and kind of nutrients, water, and pesticides needed;
- for environmental monitoring, done by autonomous or AI-driven satellite data analysis, passive acoustics, etc.;
- for sensors, as for at-home water quality monitoring;
- games against humans, as for chess; creation of toys such as a domestic robot in the form of a robotic dog with intelligent features and autonomy or AI-enabled toys that "understand" conversations, give intelligent responses, and learn;
- music, where AI has been used to compose various types of music;
- archaeology, history and imaging of sites, for helping to restore and attribute ancient texts and to investigate genomes to uncover genetic history.

AI has an unequal impact on different industries and professions, i.e., it impacts more on employees like secretaries, as 1/3 of their tasks could be performed by AI, and manual jobs. AI also has a large impact on manufacturing. On the side of positive effects, jobs like machine learning specialists and information security analysts have risen.

AI will have a favourable impact in the future in a number of ways, mainly through improved business administration, deriving from: increased automation for many businesses, e.g., in handling simple conversations with customers and answering basic queries from employees; acceleration of the decision-making process due to the AI's ability to process massive amounts of data; availability for 24 hours along the whole week; unbiased decision-making; use for repetitive – and, possibly, noisy jobs; cost reduction, since AI can work around the clock and optimal process existing capacity. In addition, AI algorithms can help process higher volumes of complex data, making it usable for analysis.

AI has a number of shortcomings too. First, it has a costly implementation, especially for certain applications. In addition, a disadvantage of AI is that it lacks the human ability to use the emotion and creativity needed for certain decisions, just because it finds applications for

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repetitive tasks. This shortcoming is particularly important if one wants to look for new solutions and find a remedy for the degradation of AI machines over time. The lack of creativity also means that AI can't create new solutions to problems or excel in any overly artistic field. AI's use for repetitive tasks implies that after some time, as the AI application begins to be obsolete, workers using it must be retrained for new occupations. In addition, in most cases AI applications cannot improve, learning from their experience and mistakes, or can do that only at a high cost, in the case of an AI that can learn on its own. The negative effects that AI can have on sustainability, climate change and environmental issues (e.g., AI models could raise carbon emissions by as much as 80%), which contrast the positive ones that it can have by making supply chains more efficient, carrying out predictive maintenance and other procedures to reduce carbon emissions. Finally, AI raises a number of ethical problems, as it can infringe consumer data privacy, by gathering data on people even without having direct access to personal information. In 2022 privacy issues have led the U.S. Administration to develop an AI Bill of Rights listing data privacy as one of its core principles. Other ethical problems range from the unemployment question to legal responsibility, and more.

As noted by Manyika *et al.* (2017), AI is changing the job market, creating new types of jobs. With 20-50 million new jobs expected by 2030, AI is creating and enhancing jobs in healthcare, pharmaceuticals and other industries. However, the increasing adoption of AI systems also raises concerns about their environmental impact, particularly in the context of climate change. There exist best practices for sustainable AI deployment, including eco-design, lifecycle assessment, responsible data management, and continuous monitoring and improvement. These concerns should then be addressed by developing energy-efficient AI models.

"The adoption of green computing practices, and the integration of renewable energy sources are discussed as potential solutions" (Ueda *et al.*, 2024).

However, there are, in particular, some well-paid occupations that will be threatened (Acemoglu and Johnson, 2023). In fact, there were two major strikes in the United States during 2022 due to the consequences of implementing AI, which will eliminate millions of current jobs, by hitting in particular jobs such: customer service representatives, car and truck drivers and travel advisors, computer programmers, research analysts and customer service representatives. However, at the same time, AI is changing the job market as it also creates new types of jobs or

adds to the existing ones. Many millions of new jobs are, in fact, expected by 2030 in various industries, and in particular some professions will certainly draw a benefit, such as those of teachers, nurses, social workers, therapists, writers and artists (Urwin, 2024).

As a matter of fact, Shen and Zhang (2024) report that AI technology, as represented by industrial robots in Chinese enterprises, has increased the number of jobs and has had a positive impact on job quality. However, there are opposing effects of AI on work intensification.

Bughin (2023) develops a game between workers and firms, where the latter have a strategic incentive to cooperate with their workers. The prediction of the game is that there is a rise in employment following adoption of AI technology, and that this result ultimately depends on AI's contribution to success in innovation and competition. Employment grows with the maturity of AI adoption as well as its bias toward AI-based product innovation.

Cazzaniga *et al.* (2024) find that almost 40% of global employment is exposed to AI, which affects income and wealth inequality. AI displacement risks extend to higher-wage earners, whereas in previous waves of automation the strongest effects were on middle-skilled workers. The effects on labour income inequality largely depend on whether and to the extent to which AI displaces or complements high-income workers.

Rayner (2023) is doubtful about the employment benefits of Generative AI, which is estimated to eventually automate millions of jobs. The conditions for a rise of jobs are that: AI drives job creation; businesses prioritize AI skills; and tasks are augmented rather than automated by AI. Employment gains are expected to be higher

"in the automotive and aerospace industry, where 73% of companies expect employment gains. The research, design and business management services, information and technology services and electronics sectors follow closely behind" (Rayner, 2023).

As suggested by Coursera Staff (2024), AI will certainly augment human performance rather than fully supplanting it. Its most important applications are for:

- Automating a number of repetitive tasks, such as cutting down on waiting times in call centers, grading certain kinds of school assignments, and extracting, merging, and managing data from multiple sources.

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- Quickly analyzing big data sets that many companies don't succeed in managing. An example of this is health care[1].
- Improving decision making by suggesting insights for making impactful decisions, which again has an application in health care.
- Quickly generating new material, which can be useful in composing simple web copy, creating basic designs, and implementing elementary codes.
- Reducing operational costs, by helping organizations reduce their operational costs through automation of certain repetitive but advanced tasks, as is done for educational purposes.

However, Coursera also notes the possible cons. In fact, there are:

1. Potential job losses of the order – according to Goldman Sachs – of approximately 300 million full-time jobs in the US and Europe. It is true that these losses will be counterbalanced by new jobs, but that needs new training and education, which would require time and costs.
2. There can be biases and skewed perspectives in AI programs, which would lead them to make decisions or generate content which is biased rather than based on objective facts.
3. Lack of creativity deriving from the statistical models used to produce outputs based on AI prompts. This can be in contrast with the creativity and refinements derived from the action of skilled professionals.

Together with positive effects on jobs, AI has similar effects on the level of GDP. Indeed, as Ilzetzki and Jain (2023) note, use of AI for the day-to-day tasks has increased and AI has revealed to be an engine of productivity and growth. It will increase global economic growth by 4–6% per annum in the upcoming decade, even if not affecting employment rates in high-income countries.

Kanungo (2023) deals with the rising concern about the negative impact on the environment of AI and notes that society can effectively address concerns about it, in order to strive for a sustainable future.

[1] However, usage of AI in sensitive fields such as medical practice has been criticized, due to unawareness of the reasons behind the results of these methods. "*To address this issue, eXplainable Artificial Intelligence (XAI) emerged, aiming to shift to a more transparent AI … XAI methods enable users to gain insight into how a model arrives at its predictions*" (Nicolau *et al.*, 2024).

Lu (2021) develops a three-sector endogenous growth model, from which he derives that under certain conditions AI can increase economic growth but reduce household utility in the short run, if the increase in the accumulation of AI is due to the rising use of AI to replace human labour. In the long-run too there can be a reduction in household utility.

Thomas (2024) indicates a number of ways in which AI will influence our lives.

5. Risks deriving from AI

Many authors have dealt with the risks deriving from AI. ChatGPT, released in 2022, is an easy-to-use tool, automatically performing

"a wide range of prompted tasks, from writing to graphics to computer programming", which has threatened some types of jobs. However, "a recent open letter by prominent technologists called for an immediate pause on giant AI experiments like ChatGPT, citing 'profound risks to society and humanity'" (OECD, 2023).

Concerns were also raised about the possibility that ChatGPT and GenAI tools

"would be used by students to cheat on their assignments, thus undermining the value of learning assessment, certification and qualifications" (UNESCO, 2023).

This led some educational institutions to ban the use of ChatGPT. In addition, GenAI raises concerns about safety, data privacy, copyright, and manipulation. UNESCO recommends that also this new technology

"should be introduced into education on the basis of evidence showing that it would be appropriate, equitable, scalable and sustainable" (UNESCO, 2023).

Marr (2021) indicates up to 15 risks. These run from lack of transparency, bias and discrimination, privacy concerns, ethical dilemmas, security risks, concentration of power, dependence on AI, job displacement, economic inequality, legal and regulatory challenges to AI arms race, loss of human connection, misinformation and manipulation, unintended consequences, existential risks.

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6. Circumstances influencing effects

Aghion *et al.* (2019) argue that the nature of effects of AI on growth and employment depends to a large extent on institutions and policies. In fact, if an effect of AI labour can be replaced by capital or not, it depends on labour market and education policies, on the one side, and competition policy, on the other.

Georgieff and Hyee (2021) note that in general there seems to be no effect on employment growth depending on the exposure to AI. However, in jobs where computer usage is high, there is higher employment growth. This depends on the fact that AI leads to an increase in labour productivity that counteracts the direct displacement effect deriving from automation, for workers with good digital skills, due to the fact that the increase in labour productivity and output counteracts the direct displacement effect of automation. However, the opposite could happen for workers with poor digital skills.

7. Conclusions

The introduction of AI has been an impressive innovation. It has had a number of applications in different fields ranging from sciences – such as medicine, physics, chemistry and geosciences – and education to manufacturing and services. Many beneficial effects in terms of cost reduction, time saved, new insights derive from these applications. The nature of effects of AI on growth and employment depends to a large extent on institutions and policies. Together with positive effects there are, however, also the initial costs for devising AI solutions and implementing this innovation which can be huge. In addition, high risks can derive from widespread adoption of AI, such as lack of transparency of the way AI can obtain certain results, privacy concerns, ethical dilemmas, security risks, concentration of power, job displacement, economic inequality, legal and regulatory challenges. Therefore, AI is no doubt an epochal innovation that must be understood, helped and regulated.

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