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Introduction to the thematic issue on digitalisation, big data, and artificial intelligence

Digitalisation, big data, and artificial intelligence (AI) are the buzzwords of our time. During recent years the topic has attracted much attention which seems to have reached its climax at this moment. The number of publications went up from 20 publications annually in the 1990s and the first decade of our century to more than 1,000 in the 2020s. However, most of the articles in the media did not meet their scientific claims. Thus, the more the number of publications increased the more the questions to be answered increased leaving room for much speculation. Therefore, the editors decided that it is time for an intensive scientific analysis of the problems linked to the three buzzwords and their implications for economic theory, economics, and business.

The worldwide diffusion of information and communication technology has led to an implementation of these technologies in all parts of human existence. This phenomenon is described from a sociopolitical point of view as **digitalisation**. **Digitalisation** has led to the emergence of digital products such as software, transmission technology in communication (email, Internet, transfer of data) and consulting and other services related to these products (Petersen, 2020, p. 12). New consumer concepts emerged such as the share economy represented by well-known examples such as Airbnb or Uber. A platform economy has evolved.

Digitalisation was largely linked to the use of **big data**. The term refers to a huge volume of data, to a variety of different, non-standardized data such as text, video and audio files which can be analysed at a higher speed compared to traditional software tools of data banks. The concept of big data is closely linked to the concept of **artificial intelligence (AI),** which gives computers and machines the capability to handle cognitive activities such as problem solving, decision making and learning in a rather autonomous way. Three different stages of the development of AI can be distinguished:

1. **Relatively weak AI** which characterises the capability of steering clearly defined and structured processes.
2. **Strong AI** which is understood as the skill of AI to learn autonomously and to advance independently cognitive capabilities.

3. This form of machine-driven learning may be developed further by **deep learning** which is based on the imitation of the human brain endowed with an artificial neural network.

At present the fast development of AI has achieved the second stage. Although this development dates back many decades it is only in the recent past that the existence of all three forms, which are intertwined and cannot exist without each other, has been noticed by economists. Real, intensive discussion on the impact of AI has just started with relatively few scientific publications such as in the series of Springer on Advanced Information and Knowledge Processing (Marwala & Hurwitz, 2017; Moloi & Marwala 2020) or by the publications with Edward Elgar Publishing (du Boulay et al., 2023; Carayannis et al., 2023).

Most of the publications up to now cope with the issue in a very general and speculative way e.g., forecasting the monetary impact on the GDP.[1] However, many questions which arise with the intensive analysis of AI and its impact on economic theory, economics and business still wait for sound elaboration. The closer digitalisation, big data and AI is looked at the more questions come up. This refers especially to areas such as labour markets, international economics, the green economy, the political economy of AI, macroeconomic implications of AI on productivity, growth, inequality, educational consequences, effects on public health (care), implications for developing countries, innovation, property rights, industrial organization, banking and finance, governance, geo-economic implications, and ethical issues, etc. This list may be even further lengthened. The present issue of *Economics and Business Review* focuses today for the first time on a few aspects related to the field of digitalisation, big data, and AI.

Following a call for papers many articles were submitted from which a few were selected to kick start serious discussion on the phenomena of digitalisation, big data, and AI. The following articles are included in this edition EBR.

Starting with a general introduction to the topic Tim Orchard and Leszek Tasiemski present their paper on **The rise of Generative AI and possible effects on the economy**. They give an up-to-date review on the role of the Generative AI (GAI) technologies and the potential of business applications on the economy and focus particularly on the labour market. According to their analysis, GAI may be regarded as a disruptive technology as was seen with the start of industrialisation. Consequently, GAI has a significant impact on the economy leading to new risks and misuses due to the problems of the use of the appropriate big data and the problems of hacking. Moreover, they refer to the huge energy consumption and the enormous computational cost.

[1] Malaney (2023) projects the global market for the LLM ChatGPT at $267 billion by 2027. McKinsey proclaims in a report based on the expertise of Shen et al. (2022) that the next frontier for AI in China could add $600 billion to its economy.

Finally, they discuss the legal aspects and the impact on intellectual property rights (IPR) when using GAI.

The specific aspect of defining the correct amount of data is analysed by Alexandra Bogner and Jürgen Jerger in their paper on **Big data in monetary policy analysis—a critical assessment**. They present a survey on how the concept of big data which is a precondition for the use of AI must be defined. Since big data refer to many areas, they choose to concentrate on one eminent field of economic theory and policy: the field of monetary policy. They look at the different elements of big data for monetary policy analysis and set out the problems stemming from the lack of precise definitions of the various elements in these specific big data. Thus they address the problem of big data in monetary policy analysis and point out that the use of big data is accompanied also by new problems and pitfalls.

The article on **Artificial intelligence—friend or foe in fake news campaigns** presented by the team of Krzysztof Węcel et al. focuses on the problem of the impact of large language models (LLM) on the fake news phenomenon. They designed and conducted experiments to test whether LLM, especially ChatGPT, can detect fake news. They come up with the disappointing conclusion that at present ChatGPT can only serve as a support in fact-checking but that it is not able to verify claims against fake news with complete certainty.

The use of GAI also poses the question for universities as to how this will impact on the future way of higher education. Krzysztof Walczak & Wojciech Cellary cope with this important question in **Challenges for higher education in the era of widespread access to Generative AI.** According to them GAI models such as ChatGPT-4 or DALL-E constitute a paradigm shift in information acquisition and learning. They discuss the advantages and potential threats of using GAI in education and the impact on restructuring curricula. They conclude that it will be necessary to foster digital literacy and sensitise the students in the ethical use of AI.

The main problem of the paper **Judgements of research co-created by Generative AI: Experimental evidence** written by Pawel Niszczota and Paul Conway is related to the acceptance of generative AI (Large Language Models, LLM) used in scientific co-works. The problem is relatively new as vast applications of AI are relatively novel as well. A linear mixed-effects model was estimated (with the use of R packages) based on answers obtained from a group of participants. The experimental findings agree with expectations; people have strongly negative views of delegating any aspect of research to LLM, e.g., ChatGPT compared to junior human scientists. The paper concludes that delegating research to LLM is immoral, more untrustworthy and results are less accurate or of a lower quality.

During the last decade two significant transitions have taken place which have changed the pricing landscape: value-based pricing and machine learning-powered price optimization. Price optimization allows professionals to re-

act swiftly to changes in demand. Interactions between new computational techniques and value-data pricing altered some exchange parameters. Jacek Wallusch concentrates in **Pricing and data science: The tale of two accidentally parallel transitions** on the perception of price elasticity, value-driver estimation and contract opportunity analysis. The data concerning second-hand Jaguars F-Pace cars illustrate his thoughts.

Artificial neural networks (ANN) have been widely used to forecast over the past few decades. The main advantage of ANN is its ability to produce forecasts without going into the structure generating the processes. The paper **Forecasting realised volatility through financial turbulence and neural networks** by Hugo Gobato Souto and Amir Moradi analyses the ability of long short-term memory (LSTM) of ANN to forecast realised volatility of the S&P index. The accuracy of forecasts of four different models is compared. The one based on LSTM ANN turned out to be the best.

The paper **How to fly to safety without overpaying for the ticket** of Tomasz Kaczmarek & Przemysław Grobelny presents an example of the application of recurrent artificial neural networks (ANN) to portfolio management. Deep Target Volatility Equity—Bond Allocation is used to allocate capital between equity and treasuries, e.g., when risk reduction is recommended. It is shown in the paper that this concept which employs Artificial Neural Networks (ANN), allows the creation of portfolios that reveal comparable characteristics, reduce treasury allocation, and outperform the S&P500 Index.

Concluding from the current worldwide discussions and the articles presented we can observe that digitalisation, big data, and artificial intelligence are already disrupting the economy and the way economics and finance build and test their theories and models. AI requires particular attention since it captures, employs, and integrates vast opportunities stemming from digitalisation and big data. Therefore, *Economics and Business Review* will keep its pages open for further submissions in the domains of economics and finance focused on the development and implications of this technological trend.

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Horst Brezinski
Witold Jurek
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Aims and Scope

The **Economics and Business Review** is a quarterly journal focusing on theoretical, empirical and applied research in the fields of Economics and Corporate and Public Finance. The Journal welcomes the submission of high quality articles dealing with micro, mezzo and macro issues well founded in modern theories and relevant to an international audience. The EBR's goal is to provide a platform for academicians all over the world to share, discuss and integrate state-of-the-art Economics and Finance thinking with special focus on new market economies.

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