

Editorial: Technology innovation, fourth industrial revolution and science commercialization: fostering dialogue among scientists, researchers and innovators

Introduction

EU and other regions and nations are funding research and innovation in crucial areas like AI, circular economy, cybersecurity, digital health, quantum computing and other critical areas (European Commission, 2026a, b, c, d). Additionally, it is important to regulate new technologies (European Parliament, 2024). These areas are key to boost productivity, generate new jobs, accelerate the green and digital transitions, build more resilient economies and societies and pave the way for a more sustainable future (Do *et al.*, 2026; Hong *et al.*, 2026; Khan and La Torre, 2021; Liang and Zhu, 2026; Zhang *et al.*, 2024, 2023).

In the case of the EU, through its key funding programme for research and innovation -Horizon Europe- it “empowers researchers, businesses and innovators to turn their ideas into reality, transforming knowledge into practical solutions that benefit citizen” (European Commission, 2026a). The research and innovation policy goals are to foster breakthrough technologies, accelerating the green and digital transitions, fostering medical innovation, investing in key technologies and promoting global cooperation. The main areas of action are artificial intelligence (AI) in science, bioeconomy, energy, environment, food systems, health, industrial research and innovation, social science and humanities and transport (European Commission, 2026b). Horizon Europe allocates more than €53bn for Pillar II “Global challenges and European industrial competitiveness”, which includes topics like 1) health, 2) culture, creativity and inclusive society, 3) civil security for society, 4) digital, industry and space, 5) climate, energy and mobility, 6) food, bioeconomy, natural resources, agriculture and environment and finally 7) nonnuclear direct actions of the Joint Research Center (European Commission, 2026c).

Cluster 4 of Horizon Europe -Digital, Industry and Space- aims to “shaping competitive and trusted technologies for a European industry with global leadership in key areas” and create a “competitive, digital, low-carbon and circular industry, ensure sustainable supply of raw material” (European Commission, 2026d).

This discussion of challenges and risks for research and innovation funding and actions, raises important questions for companies, governments and citizens in a globalized economy. Therefore, we would like to invite scientists, researchers and innovators to join this debate on the future on innovation and technology in the digital age.

Contents of the issue

Issue 6 of the *Journal of Science and Technology Policy Management* features a regular collection of 8 papers that address crucial issues for companies and nations such big data, Forth Industrial Revolution, government R&D programs, innovation management, supply change management and sustainability. The issue discusses empirical evidence focused on Indonesia, Pakistan and South Korea.



Let's briefly examine the contents of each paper of this issue.

The paper titled "*Navigating the technological landscape: A comprehensive bibliometric analysis at the intersection of innovation and technology management in the era of the fourth industrial revolution*" (by Tashakori and Sobhanifard) presents the results of a study that "aims to comprehensively analyze the intersection of technology management and innovation management amidst the fourth industrial revolution, uncovering evolving trends and influential contributors. Using the Bibliometrix R-package, this pioneering research conducts a bibliometric analysis to delve into innovation and technology management literature, quantifying scholarly output and identifying thematic breakthroughs. The study reveals quantitative insights into the progression of innovation and technology management research, offering guidance on evolving trends, thematic breakthroughs and influential contributors. The findings offer valuable insights for practitioners and managers, guiding them through emerging trends and recommending a dual focus on fundamental principles and emerging areas for strategic decision-making. By fostering active engagement with evolving trends, this research contributes to the ongoing technology and innovation management discourse, potentially leading to societal benefits and advancements."

The paper titled "*A nexus of multiple integrations and business performance through supply chain agility and supply flexibility: a dynamic capability view*" (by Rashid, Rasheed, Ngah and Marjerison) affirms that "manufacturing capability is a crucial component of every nation's economy and pharmaceuticals are frequently a significant part of the manufacturing sector. Pharmaceutical supply chains are essential to health-care systems, contributing to living quality and shorter hospital stays. This study aims to examine the role of multiple integrations on business performance (BP) through supply chain flexibility (SCF) and supply chain agility (SCA). Data was collected from 198 supply chain professionals in the pharmaceutical sector of the developing economy of Pakistan. The sample was collected based on a nonprobability purposive sampling approach. A five-point Likert-scale survey was used and analyzed with the PLS-SEM technique using SmartPLS 4. This study found that process integration (PI) does not affect SCA, whereas relationship integration and measurement integration positively affect SCA. SCA positively impacts BP. In contrast, all integrations significantly influenced supply flexibility and BP except for PI. Finally, SCF significantly mediates the relationship between all integrations and BP. This study examined the relationships of multiple integrations on BP, directly and indirectly, through SCF and agility. The theory of dynamic capabilities has been applied and extended to increase the comprehensiveness of the findings. A developing economy's pharmaceutical industry supply chain was examined, producing empirical evidence of the results."

The paper titled "*The role of big data analytics in the footwear supply chains: a multiple case study perspective*" (by Arshad and Ramish) studies "the importance of big data analytics (BDA) and supply chain analytics for sustainable supply chain management in all types of enterprises in the footwear industry. The importance and implementation of BDA in supply chain management have been discussed in this research paper, and a conceptual framework is proposed for the implementation. The previous research indicates that the application of BDA and supply chain analytics is the key point to establishing sustainable supply chain management. Even though there are several types of research on the implications of BDA, there is still a gap in practical implications in organizations. For a better understanding, comparison of frameworks has been done for literature support. Further, 11 in-depth, semistructured interviews have been conducted with four organizations from the footwear industry, and a conceptual framework has been proposed. This research demonstrates an important gap in the literature through a thorough investigation of how firms can improve operational efficiency and productivity through the framework application and whether it is feasible to apply this within the global footwear industry

or not. In conclusion, the research has denoted that despite lack of understanding related to sustainability agendas and not having proper ERP or BDA systems, the organizations operating in Pakistan still met some standards of sustainability and are moving toward achieving more. The research has pointed out the importance of the integration of all stakeholders in the supply chain through a proposed framework that aligns and guides the stakeholders so that the policies and other constraints may be taken into consideration while revising sustainable supply chain strategies.”

The paper titled “*Factors affecting the performance of government R&D support programs in pharmaceutical enterprises*” (by Kim, Kwon, Kim and Kim) states that “the government support for research and development (R&D) initiatives in the pharmaceutical sector has been declining. The purpose of this study is to analyze factors influencing the efficacy of government R&D support programs directed at pharmaceutical enterprises in South Korea, aiming to provide valuable insights for policymakers responsible for resource allocation in the pharmaceutical industry. The study uses data from 490 R&D projects conducted by 106 pharmaceutical enterprises between 2018 and 2020, sourced from the National Technical Information Service and Drug Approval Research and Technology repositories. The data were analyzed using negative binomial regression analysis operated by the Statistical Package for the Social Sciences. Applied research, cooperative research and the number of doctoral researchers positively impact both the quantitative and qualitative performance of the papers. The number of doctoral researchers, government research funds and the ratio of private investment to total R&D investment positively impacted the quantitative and qualitative performance of patents. However, enterprise age negatively affected patent performance. Notably, sales were significantly associated with patent qualitative performance but not with patent quantitative performance. While previous studies have primarily focused on specific types of government R&D support or individual sectors, this study provides a broader perspective by incorporating a variety of variables, to examine the overall performance of government R&D programs in the pharmaceutical sector.”

The paper titled “*Approximating technology innovation performance with fuzzy approach*” (by Singh) proposes “a framework to evaluate technology innovation performance (TIP) of manufacturing organizations by adopting a fuzzy-based approach. In very short time, the world’s economic order has been reformed by economic globalization, thereby bringing new challenges as well as opportunities for the manufacturing industries. Policy makers encounter different decisions that require the use of various types of data in their decision-making process. These challenges raised the necessity of measuring innovation capability, which is critical issue for decision makers in today’s competitive world. The research results reveal the complexity of the path to technology innovation evaluation, constituting a novel contribution to the literature. It is difficult for decision makers to make appropriate and effective decisions without knowing the innovation capability of companies in a particular sector or a region. As a result, not only on a macro but also on a micro level, an integrated and complete technique of measuring, estimating and even projecting innovation performance is necessary. In light of above mentioned facts, the present study proposes a technology innovation performance evaluation system of manufacturing organizations using fuzzy logic. A model has been developed to be beneficial for any kind of organization where TIP evaluation is important consideration for enhancing manufacturing performance. Fuzzy control is used to determine the overall performance index by combining results of the TIP in selected criteria, which will certainly ensure suitability of the concerned organizations during performance rating calculations.”

The paper titled “*Origin of the Fourth Industrial Revolution: manufacturing predictions preceding Industrie 4.0*” (by Ledford, Hyre, Harris, Purdy and Hedberg) states that “the Fourth

Industrial Revolution is a prominent area of interest in the field of manufacturing that is bringing about revolutionary changes. In this study, the authors sought to determine whether professionals in academia or industry could have predicted the composition of advanced technologies associated with Industry 4.0 before Germany's Industrie 4.0 policy announcement. The purpose of this paper is to use the process for identifying technologies that can be included in industrial policy to improve national competitiveness in manufacturing. Relevant documented research from 2000 to 2012 was identified and captured using a systematic literature review. The significant technological advancements during this period were analyzed to determine how technological innovations may have affected predictions about the future of manufacturing. The identified predictions were analyzed using an open-source natural language processing code that clustered relevant topics in the predictions that indicated common themes. The results were then compared to the ideas within "Industry 5.0." The results of this study showed that an aggregate analysis of manufacturing predictions would have preemptively revealed the Fourth Industrial Revolution and could have been used to inform industrial policy that could accelerate technology adoption. Also, contrary to popular belief, the popular Industry 5.0 is a semantic exemplification of a concept already embedded within the origins of the Fourth Industrial Revolution."

The paper titled "*Enablers and inhibitors of science commercialization: A predictive framework*" (by Tikas) proposes "a conceptual framework for measuring, comparing or predicting the science commercialization capability of academic research-driven organizations. Drawing on extant literature on innovation commercialization, two influential predictors were explored and the nature of their influence was proposed. Based on the theoretical analysis of relevant literature on science commercialization, this conceptual paper proposes a predictive framework along with two critical antecedents – patronage and parochialism. The analysis further reveals their sub-dimensions and provides insights into how patronage and parochialism can be measured within empirical settings. The study concludes with theoretical propositions about how these two constructs influence science commercialization. The study reveals that patronage can positively influence science commercialization and be reflected through mentorship, specialized knowledge-sharing and providing decision-making support to academic innovators pursuing science commercialization. Alternatively, parochialism can positively influence science commercialization and be reflected through academic innovators' perception, purpose and persistence of efforts toward science commercialization initiatives."

Finally, the paper titled "*Technology innovation to improve SMEs sustainability*" (by Gimin, Caska, Indrawati and Yasin) studies "the determinants of small and medium enterprise (SME) sustainability through online marketing technology innovation. The study was conducted through a survey in Siak Regency and Dumai City, Riau Province, Indonesia. The study population is small entrepreneurs doing online marketing. The determination of this survey area is by considering: the use of online marketing technology in this area is relatively more developed than other regions; Siak Regency and Dumai City are very prospective to be used as small business development areas based on online marketing; and the sample was determined by purposive random sampling with the criteria of small entrepreneurs who have tried to do online marketing for at least six months. Based on these criteria, there are 301 small entrepreneurs who conduct online marketing as a sample. The sustainability of SMEs is directly and indirectly influenced by government support, human resource quality, innovation costs, economic conditions and business partners through online marketing technology innovations. Online marketing strategy through targeting, segmentation and positioning marketing strategies. Implementation of online marketing technology innovation models: increased government support; improvement of human

resources; provision of innovation cost allocation; government policies in maintaining economic stability; and increase in business partners.”

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Further reading

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