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## Editorial

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Digital transformation is revolutionising various aspects of society, including the way individuals and organisations operate in working contexts, the possibility to communicate and connect with each other, a real time access to information, as well as new means for teaching and learning activities (Vial, 2019). Overall, digitalisation is producing a profound impact on various aspects of human beings, bringing both advantages and challenges that should be deeply managed to benefit individuals and society as a whole.

Focusing on the adoption of technologies in organisations and working context, it has produced many positive effects. Digital technologies have facilitated the automation and the improvement of many operations, making them faster, more efficient in terms of productivity and cost-effectiveness (Frey and Osborne, 2017). Moreover, it has promoted the diffusion of new activities and practices, such as methods for data collection and analysis, leading to improved decision-making and resource allocation (Alcácer and Cruz-Machado, 2019). Additionally, digital technologies have boosted collaboration and communication channels, enabling novel approaches for team working and knowledge-sharing, overcoming physical boundaries (Kuusisto, 2017).

Digitalisation has also led to increased complexity under the organisational and managerial perspective. The management of digital tools and platforms to ensure a proper operability requires significant investments in technology and infrastructure, as well as specialised workers with knowledge and skills to handle systems and applications (Sousa and Rocha, 2019). Organisations may experience difficulties in integrating new technologies with existing systems, resulting in operational inefficiencies and disruptions, similarly it can be difficult to find and retain a skilled workforce (Chiarello et al., 2021). All these elements require developing a comprehensive understanding of the organisation's operations and identifying areas where digital technologies can be integrated effectively (Kane et al., 2015; Tabrizi et al., 2019).

Such disruptive and transformative phenomena are obviously impacting innovation processes, creating opportunities for new products and services, as well as new business models and processes (Nambisan et al., 2019). The fast-changing context pushes them to adopt more agile and flexible approaches to innovation. The shift to a digital reality creates new virtual market space, fostering the development of new customer segments. Moreover, the ability to collect and analyse large amounts of data enables organisations to quantitatively analyse current trends, to identify new market opportunities, and to develop products and services tailored to customer needs. Notwithstanding, it also creates tensions that organisations must navigate to achieve successful innovation outcomes. One of the key tensions of digitalisation is the need to balance speed and agility with risk management (Ostmeier and Strobel, 2022). Digital technologies enable organisations to innovate quickly, but this can also increase the risk of failure and lead to a lack of rigor in the innovation process (Lanzolla et al., 2021). Another critical element is the need to balance innovation and exploitation (ambidexterity) in the digital transformation process, for not just applying novel digital technologies but especially enabling integration in production and business processes (Mahmood and Mubarak, 2020).

Digital technologies not only improve internal communication and collaboration, as previously mentioned, but also allow organisations to collaborate more effectively with external partners in new products and services development. In this sense, digitalisation is enabling new ways to manage innovation processes. One of the key impacts of digitalisation on innovation management is the shift towards digital open innovation and ecosystems (Chiarello et al., 2023).

Open innovation is a concept that has gained significant attention in recent years due to its potential to drive innovation and growth in organisations (Dahlander and Gann, 2010). This concept involves engaging with customers, suppliers, and other stakeholders in the innovation process, towards the creation of ecosystems that enable collaboration and knowledge-sharing (Miller et al., 2016; Etzkowitz and Leydesdorff, 2000). In this way, organisations can access a broader range of expertise (Ghezzi et al., 2016, 2018), as well as reducing – by sharing – the costs and risks associated with innovation (Teece et al., 2016). Such collaborations on one hand may be much more effective in digital environments. Digital technologies play a central role also in enabling more proactive and resilient open innovation processes (Chiarello et al., 2023). On the other hand, these technologies present numerous challenges to be managed in innovation processes. In fact, digital technologies allow to overcome physical barriers, reinforce collaboration mechanisms in the day-to-day routine of the innovation processes, and boost knowledge sharing among organisations (Urbinati et al., 2022). On the opposite side, the same elements can be attention factors for orchestrating the characteristics of the digitally transformed innovation (Urbinati et al., 2022).

Ultimately, digitalisation is a powerful tool for driving innovation and growth, and organisations that effectively manage its tensions and leverage its strengths can be well-positioned for success. In this special issue, we will therefore deepen which are those tensions and strengths in the context of continuous innovation in digital ecosystems. When examining how digitalisation affects open innovation, it may be helpful to consider the various stages of the innovation process and the actors involved in those because of the different drivers that can push towards collaborative projects and ultimately affects tensions and strengths.

For what concerns the innovation process, it can be divided into several phases, from ideation to commercialisation. Open innovation has the potential to tackle one or multiple phases of the innovation process, each with its distinct attributes. We consider the traditional linear process as in the work of Salerno et al. (2015), where four stages of the innovation process are distinguished:

- 1 idea generation
- 2 idea selection
- 3 development
- 4 diffusion.

In 1, organisations identify new opportunities and generate ideas. In 2, the ideas are refined and developed into prototypes to test feasibility and effectiveness. In 3, products and services are developed. Finally, in 4, they are prepared for the launch in the market and commercialised.

**Table 1** Map of the contributions hosted in this special issue based on the stages of innovation process and the actors of open innovation ecosystems

Stages of innovation process	Actors		
	Customers	Suppliers	Competitors
Idea generation	(Category 1)	(Category 2)	(Category 3)
	1.1 How can customer feedback be effectively incorporated into idea generation processes using digital technologies?	2.1 How leverage on digital technologies to effectively manage the interplay with suppliers during the idea generation phase?	3.1 Can digital technologies increase the opportunity of collaboration with competitors for generating novel ideas?
	1.2 What are the barriers and challenges arising in intellectual property management when using digital technologies to incorporate customer feedback in the idea generation processes?	2.2 What are the organisational challenges in managing digital technologies dependencies along the supply chain during the phase of idea generation?	3.2 Which technological factors prevent competitors in embracing co-creation initiatives?
	(Category 4)	(Category 5)	(Category 6)
Idea selection	4.1 How can digital technologies assist customer-supplier relations in selecting the ideas proposed within market for ideas?	5.1 How can digital technologies be utilised to facilitate idea selection with suppliers?	6.1 How can digital technologies support competitors in effective knowledge sharing during the idea selection phase?
	4.2 What are the obstacles arising in intellectual property management when using digital technologies to incorporate customer feedback in the idea selection processes?	5.2 What are the key blocking factors that can hinder effective decision making during the collaboration with suppliers and how can they be mitigated?	6.2 How to manage intellectual property concerns that arise during the selection of new ideas for digital innovation products/services in the context of cooperation?
Development	(Category 7)	(Category 8)	(Category 9)
	7.1 How can we measure the added value of the customer contribution in products/services co-development with digital technologies?	8.1 How can digital technologies boost supplier involvement in the products/services co-development?	9.1 How digital technologies can mitigate the risks of knowledge spillover in cooperation during the development phase?
	7.2 Can digital technologies hinder the opportunity of collaboration with customers for developing novel products/services?	8.2 What are the organisational hindrances in managing digital technologies dependencies along the supply chain during co-development?	9.2 How to balance the data accessibility enabled by digital technologies and intellectual property issues in developing products/services with competitors?
Diffusion	(Category 10)	(Category 11)	(Category 12)
	10.1 How can digitalisation paradigms facilitate the development of new open innovation business models that rely on customer relationships?	11.1 How can digital technologies boost intellectual property management in supplier partnerships during the distribution of digital innovation products/services?	12.1 How does the introduction of digital technologies facilitate cooperation in the commercialisation process?
	10.2 What are the inherent tensions in collaborating with customers for the success of novel digital business models?	11.2 What technological factors could cause friction with suppliers during the commercialisation?	12.2 What technological factors can be controlled to tackle the threats arising from the lowered entry barriers in the market facilitated by cooperation?

For what concerns actors, as mentioned above, open innovation ecosystems involve collaboration among customers, suppliers, competitors, and other stakeholders, to co-create and develop new products, services and/or processes. Firms establish different types of relations with the actors to enable an effective collaboration. These relations depend on the characteristics and the expectation of such diverse actors. In fact, the ecosystems can take various relational forms, including innovation networks, clusters and communities. Moreover, we may consider that the actors can be engaged in the different stages of the innovation process, and consequently may have different drivers and interests.

For these reasons, we can inspect tensions and strengths of digital technologies in open innovation in ecosystems considering the different stages of the innovation process and the different actors. In this regard, Table 1 summarises a research agenda presenting a non-exhaustive list of RQs that researchers could address in the future. The rows of Table 1 represent the various phases of the innovation process, while the columns depict the key actors involved. While formulating these RQs, we consider the contributions hosted in this special issue to frame how digital technologies can either facilitate or hinder the open innovation process.

The papers hosted in this special issue address several RQs of Table 1 and employ systematic literature review and qualitative analysis on case studies, companies' interviews, and workshops to address various concepts, including assessment for servitisation, co-creation, coopetition, digital technology, social open innovation and continuous innovation. A summary of each contribution is as provided afterward. Additionally, for each article, we indicate the specific categories in Table 1 that are relevant to the research questions being addressed, using the corresponding category number:

- a 'Dependencies as a barrier for continuous innovation in cyber-physical systems': The paper examines software development in innovation projects for the automotive sector, identifying and defining the types of dependencies, discussing tension and barriers and highlighting the management strategies to address them (categories 1–2).
- b 'Fostering innovations for a better society: the role of markets for ideas': The paper analyses the role of market for ideas (MFI) in fostering social impact of innovation projects, using the case of enterprise Europe network and social innovation projects, providing a theoretical framework on the links between actors in social open innovation projects and the goal of social impact (categories 1–4).
- c 'Investigating manufacturing companies value co-creation approaches during servitisation': The paper conducts interpretive research on 43 Danish companies undergoing servitisation and identifies different co-creation approaches and related interaction mechanisms, providing a framework for companies to assess their servitisation strategies based on internal and external conditions (categories 7–8).
- d 'The untold story of the inherent tensions in the assessment of servitisation success – a conceptual approach': The paper reviews the definition of servitisation and identifies success factors and tensions that can affect its measurement, ultimately identifying five paradoxes that emerge from the perception of servitisation success (categories 10–11–12).

- e ‘Exploring the opportunities of blockchain-enabled coopetition: learnings from the wind turbine industry’: The paper uses an Italian wind turbine industry case study to explore the relationship between digital integration and coopetition, highlighting arguments on how blockchain-based information management can enhance coopetition by enabling greater flexibility, transparency, and trust among collaborators (category 12).

All of them can advance the research agenda as a catalyst for continuous innovation in digital ecosystems.

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