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Article abstract

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ABSTRACT

This special issue looks at partnership approaches to innovation thanks to recent developments in ICT, which enable the acquisition and transfer of skills, thus changing the processes and organization of firms. It is therefore essential to understand how ICT is used to establish internal and external collaborations for innovation. For this reason, we first examine the ICT used for innovation collaborations and how they contribute to the innovation process. The five articles then examine the effectiveness of ICT in three internal collaborations and two innovation partnerships. Finally, we propose a number of avenues for further research to better understand how ICTs and their use modify the way innovation takes place and the underlying organizational processes.

Keywords: collaboration, partnership, innovation, organization, ICT, knowledge, R&D

Résumé

Ce numéro spécial se penche sur les approches partenariales de l'innovation grâce aux récents développements des TIC, lesquels permettent l'acquisition et le transfert de compétences, modifiant ainsi les processus et l'organisation des firmes. Il est donc essentiel de comprendre comment les TIC sont utilisées pour établir des collaborations internes et externes en matière d'innovation. C'est pourquoi nous examinons tout d'abord les TIC utilisées pour les collaborations en matière d'innovation et la manière dont elles contribuent au processus d'innovation. Les cinq articles examinent ensuite l'efficacité des TIC dans trois collaborations internes et deux partenariats d'innovation. Enfin, nous proposons quelques pistes de recherche pour mieux comprendre comment les TIC et leur utilisation usages modifient la manière d'innover et les processus organisationnels sous-jacents.

Mots-clés : collaboration, partenariat, innovation, organisation, TIC, connaissance, R&D

Resumen

Este número especial examina los enfoques asociativos de la innovación gracias a los recientes avances de las TIC, que permiten adquirir y transferir competencias, modificando así los procesos y la organización de las empresas. Por lo tanto, es esencial comprender cómo se utilizan las TIC para establecer colaboraciones de innovación internas y externas. Así pues, examinamos en primer lugar las TIC utilizadas para las colaboraciones de innovación y cómo contribuyen al proceso de innovación. A continuación, examinamos la eficacia de las TIC en tres colaboraciones internas y dos asociaciones para la innovación. Por último, proponemos algunas vías de investigación para comprender mejor cómo las TIC y su uso modifican la forma en que se lleva a cabo la innovación y los procesos organizativos subyacentes.

Palabras Clave: colaboración, asociación, innovación, organización, TIC, conocimiento, I+D

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Recent developments in Information and Communication Technology (ICT) have significantly influenced partnership approaches to innovation in practice, opening up a new field of study in management science (Bigliardi *et al.*, 2020). ICT tools play a crucial role in enhancing both product and process innovation. They allow for co-learning and better knowledge management within firms but also with their external partners, particularly in companies such as Zara, where ICT-driven innovations lead to quick product redesign and efficient production strategies (Coadour *et al.*, 2019).

Indeed, ICT has become a vital enabler of partnership-based innovation strategies, fostering internal and external collaborations, enhancing knowledge sharing, and improving innovation outcomes across industries. Innovation collaborations and the organizational forms they take differ depending on whether they remain internal to the company or include external members, even if ICTs are increasingly blurring this boundary, and also making it possible to be free from geographical constraints. Historically, innovation collaborations between companies have been geographically based, giving rise to innovation ecosystems. The most famous and prolific of these remains Silicon Valley, due to the access to human, technological and financial resources that it offers to entrepreneurs (Ahluwalia *et al.*, 2024). Access to innovation platforms, virtual communities and funding platforms mainly enables firms to free themselves from this geographical constraint and develop new forms of collaboration with their stakeholders, leading to new organizational forms (Sahut *et al.*, 2021). The adoption of partnership approaches, facilitated using collaborative platforms and virtual communities, has become a crucial strategy for companies to boost their innovation capacity. By leveraging the collective creativity, diverse perspectives, and complementary expertise of a broader network of partners, companies can stay ahead of the curve, more effectively adapt to changing market dynamics, and maintain a strong competitive edge. These partnership approaches enable firms to accelerate their innovation processes, gain access to new technologies and ideas, and capitalize on synergies that would be difficult to achieve through independent efforts alone (Pinelli *et al.*, 2024).

This special issue looks at partnership approaches to innovation driven by recent developments in ICT. This is leading to changes in company processes, and more generally at the organizational level. The goal of this introduction is to review and assess recent research on the use of ICT to develop collaborative approaches to innovation. The remainder of this paper is presented as follows. In Section 1, we discuss the foundations of the literature on this topic, and in Section 2 how the selected articles for this special issue contribute to it. Avenues for future research and concluding remarks follow in Section 3.

The foundations: which ICT is best for collaborative innovation?

In today's dynamic and competitive business landscape, companies are constantly seeking ways to enhance their capacity for innovation such as to stay ahead of the curve and meet the evolving demands of the market. The two key strategies that companies develop to innovate are to draw on their internal skills and resources or to develop partnerships with external parties (customers, suppliers, competitors, public organizations, etc.).

Partnership development is greatly facilitated by ICTs, which enable skills to be acquired and transferred, particularly through collaboration platforms and virtual communities (Jonash, 2005). It is therefore important to understand the role of ICTs and their uses in the development of internal and external innovation collaborations. Therefore, we explore the ICTs used for internal and external collaboration on innovation and show how they contribute to the innovation process.

Internal company collaboration

ICT-based internal collaboration within companies has been a significant focus in management science research. These forms of collaboration leverage ICT to improve coordination, knowledge sharing, and innovation across different organizational units, departments, and teams. Based on the literature, we have defined nine types of ICT-based internal collaboration in companies.

1. Enterprise social media platforms

Enterprise social media platforms enable employees to share information, collaborate on tasks, and build social connections within the organization. These platforms mimic public social networks but are tailored for internal communication and collaboration (Leonardi *et al.*, 2013). Their objective is to facilitate informal knowledge sharing, enhance team cohesion, and enable cross-departmental collaboration. Their role is to provide real-time communication, file sharing, and discussion threads. Examples of such platforms include Microsoft Yammer, Slack, and Workplace by Facebook.

2. Collaborative workspaces and document sharing platforms

Collaborative workspaces (e.g., Google Workspace, Microsoft Teams, SharePoint) enable employees to work on shared documents, manage tasks, and track project progress. These platforms provide a centralized space for internal collaboration (Faraj & Sproull, 2000). Their objective is to facilitate teamwork by enabling simultaneous editing, file sharing and communication within the platform. The role of ICT is to integrate a variety of functions (e.g. messaging, document sharing, task management) into a single platform, thereby enabling employees to collaborate in real time regardless of their physical location. The advantages of this approach are manifold. It enhances efficiency in the management of tasks, the control of document versions and the communication of teams, thereby increasing productivity and reducing the formation of silos.

3. Virtual teams and remote collaboration tools

With the rise of globalized workforces and flexible work arrangements, virtual teams—groups of employees who work together from different geographic locations—are increasingly common. ICT tools such as video conferencing (Zoom, Microsoft Teams), chat applications, and cloud-based project management tools enable remote collaboration

(Cascio, 2000). The objective is to facilitate the seamless collaboration of distributed teams despite geographical barriers. The role of ICT is to provide real-time communication, project management tools and document sharing, thus supporting teams in coordinating activities and sharing information virtually.

4. Intranet and knowledge management systems

Intranets and knowledge management systems are internal networks which allow employees to access company resources, share knowledge, and collaborate on organizational initiatives (Alavi & Leidner, 2001). Their objective is to facilitate the storage, management, and distribution of knowledge throughout the organization, thereby enhancing decision-making and problem-solving processes. They serve as a repository for organizational documents, best practices, and lessons learned. The platform enables employees to access training materials, corporate news, and other knowledge resources. The centralization of information facilitates enhances knowledge transfer, organizational learning and collaboration, as it ensures that all employees have access to the same information.

5. Enterprise resource planning (ERP) systems

ERP systems integrate different business functions (e.g., finance, HR, supply chain) into a single unified system. They promote collaboration by providing all departments with access to the same data and streamlining cross-functional processes (Leroux *et al.*, 2011). Their aim is to improve interdepartmental collaboration by facilitating real-time visibility of data and supporting cross-functional workflows. Their role is to act as a central platform that integrates data and processes across departments, facilitating efficient information sharing and collaboration. It reduces the need for repetitive tasks, improves coordination and ensures that all parts of the organization are aligned with the overarching business objectives.

6. Collaborative innovation networks (CoINs)

Collaborative Innovation Networks (CoINs) involve using ICT tools to connect employees across different departments or divisions to work on innovative projects. CoINs promote decentralized collaboration, enabling employees to contribute ideas and work together on innovation initiatives (Gloor, 2006). They encourage creativity and idea generation through cross-functional collaboration and knowledge sharing. ICT platforms like wikis, forums, and idea management tools (e.g., IdeaScale, Spigit) facilitate the exchange of ideas and collaboration on innovation projects. They help organizations tap into the collective intelligence of their workforce and accelerate innovation by fostering collaboration across departments and hierarchies.

7. Internal communication and messaging tools

Instant messaging platforms such as Slack, Microsoft Teams, and internal chat systems enable employees to communicate in real time, facilitating quick decision-making and problem-solving (Cameron & Webster, 2005). Their objective is to enhance day-to-day communication and reduce the necessity for formal meetings or protracted email exchanges. Their role is to facilitate instant messaging, group chats, and notification systems, thereby enabling expedient and informal communication.

8. Collaborative project management tools

ICT-based project management tools (e.g., Asana, Trello, Jira) enable teams to plan, track, and collaborate on projects. These tools provide visibility on project timelines, task assignments, and progress, fostering collaboration across teams (Kudaravalli *et al.*, 2017). Their objective is to enhance project coordination, optimize resource allocation and streamline task management across departments or teams. Their role is to provide functionalities such as task tracking, Gantt charts and real-time updates to facilitate collaboration and accountability in project execution.

9. Digital learning platforms

Many companies now use ICT-based digital learning platforms (e.g., Moodle, Coursera for Business) to provide internal training and development opportunities. These platforms allow employees to learn collaboratively by taking courses, participating in discussion forums, and sharing knowledge (Bersin, 2004). Their objective is to facilitate continuous learning and skill development within the organization. Their role is to provide a digital environment wherein employees can access training materials, participate in virtual classrooms, and collaborate on learning projects.

ICT-based internal collaboration in companies spans various tools and systems, from enterprise social media platforms and collaborative workspaces to virtual teams, ERP systems, and knowledge management tools. Each of these technologies plays a crucial role in improving coordination, enhancing knowledge sharing, and fostering innovation within organizations. By leveraging ICT, companies can break down silos, increase efficiency, and promote a culture of collaboration across teams and departments. However, most companies do not have all the human and organizational resources to develop innovation projects on their own, so they need to seek external collaboration. In particular, they need to acquire new knowledge, which raises the problem of sharing and transferring knowledge between members of different organizations that they don't control (Ben Arfi *et al.*, 2018).

External company collaboration

Multifaceted information sharing in inter-organizational networks is well known. Numerous studies have shown how knowledge sharing boosts creativity, teamwork, and work efficacy (Chesbrough, 2003). Open innovation research also recognizes that external players are necessary for information sharing and that cross-firm collaborations are crucial to innovation (Moellers *et al.*, 2020). The innovation endeavor requires knowledge sharing and ICT tool development, such as platforms for digitizing processes (Verhoef *et al.*, 2021). This type of partnership can provide organizations with possibilities, but it also entails risks (Marullo *et al.*, 2020). Due to the rise of digital platforms that engage open innovation players, promoting information exchange by individuals to achieve the desired innovative outcome is questionable. Previous research has shown a different view on ICT use by cross-functional virtual teams. The potential benefits of open knowledge sharing for innovation have been extensively documented, especially in the context of innovation platforms that have increased virtuality, particularly among actors with diverse professional backgrounds (Moellers *et al.*, 2020). However, other research has observed barriers to tacit knowledge exchange among team members, especially when they are physically distant. According to this research, ICTs can improve understanding of inter-organizational networks, organizational learning, and knowledge conversion. Socialization may be neglected because people are geographically scattered and engage remotely, preventing them from forming common mental representations and routines (Natu and Aparicio, 2022). Most crucially, the closeness of organizations' knowledge bases affects their ability to perceive and acquire external knowledge. The lack of a

standard language for productive interactions continues to hinder cross-corporate knowledge acquisition (Ben Arfi *et al.*, 2023). Indeed, the types of technologies and interactions used in innovation partnerships define the codification, exchange and acquisition of knowledge. It is therefore important to understand this interaction between ICT tools and the forms of innovation partnerships. We present hereafter a summary of ten key types of ICT-enabled innovation partnerships, based on insights from scientific literature.

1. Strategic alliances and joint ventures

Strategic alliances and joint ventures represent formal partnerships between firms, where ICT is used as an enabler of knowledge sharing, collaborative innovation, and joint development of products and services (Gomes *et al.*, 2016; Ding *et al.*, 2024). We can cite the following examples: co-development of software platforms, telecommunication infrastructure projects, or collaborative R&D in high-tech industries.

2. Open innovation networks

Open innovation partnerships enable firms to collaborate in an open environment, utilizing ICT to crowdsource ideas, share intellectual property, and co-develop innovations (Santoro, 2018). Through open innovation, firms can interact and "collaborate" with their environment from different perspectives, leading to the acquisition and exploitation of external technologies, as well as the sharing of their core competencies with other companies (e.g., the use of digital platforms for co-creating new products, leveraging innovation ecosystems as in the "Siemens Innovation Ecosystem"). The benefits of such partnership approaches are well-documented across various industries, including computers, semiconductors, telecommunications equipment, and biotechnology.

3. Digital platforms and ecosystems

Digital platforms serve as a base for multiple firms to collaborate, share resources, and innovate. These platforms facilitate multi-sided markets where firms and third-party developers can co-create value (Lissillour and Sahut, 2022). As a technological foundation, they provide application programming interfaces (APIs), cloud services, and data-sharing mechanisms that facilitate collaborative innovation. Notable examples of such collaborative innovation include Apple's App Store, Amazon Web Services marketplace, and Google's Android platform, where firms engage in joint efforts to develop and innovate on a shared digital platform.

4. R&D consortia

Firms, particularly in high-tech sectors, form R&D consortia where ICT enables collaborative research and the co-development of technologies (Hagedoorn, 2002). The objective is to combine resources to tackle large-scale R&D projects that require the pooling of knowledge and resources from multiple firms. The role of ICT is to facilitate communication, data exchange and collaborative problem-solving among geographically dispersed teams (e.g. semiconductor industry alliances, like SEMATECH, where firms collaborate on technology standardization and innovation using digital communication platforms).

5. Supply chain innovation partnerships

ICT has enabled firms to collaborate across supply chains to innovate in areas such as product design, process optimization, and logistics management. These partnerships focus on using ICT to enhance supply chain transparency and efficiency (Vachon & Klassen, 2008). In the automotive and manufacturing industries, for instance, firms collaborate with suppliers using ICT to co-develop products or optimize production processes: digital platforms facilitate data sharing, blockchain technology enables supply chain tracking, and the Internet of Things (IoT) provides real-time monitoring.

6. Innovation clusters and digital hubs

Innovation clusters are regional concentrations of firms and institutions wherein ICT enables collaboration and knowledge exchange. The objective is to leverage geographical proximity. Digital hubs foster interactions between firms, startups, research institutions, and other actors in specific industries (Porter, 2000; Sahut *et al.*, 2021). They provide a collaborative environment, offering access to shared resources such as cloud computing and facilitating communication between cluster members. Notable examples of such ecosystems include the Silicon Valley in the United States and Germany's Industry 4.0 hubs.

7. Public-private partnerships (PPP) in digital innovation

Governments and firms often form PPPs where ICT plays a crucial role in innovation projects, particularly in sectors like smart cities, healthcare, and infrastructure (Kivleniece & Quelin, 2012). These in turn drive initiatives like smart grid technologies, digital public services, or e-governance platforms.

8. Virtual teams and collaborative innovation networks

Firms are increasingly using ICTs to enable virtual teams and collaborative innovation networks with partners who may be involved at different stages of the innovation process. These involve geographically dispersed teams of different organizations working together using ICT for real-time collaboration (Gloor, 2006; Ben Arfi *et al.*, 2023). ICT tools, including video conferencing, project management software, and collaborative platforms, have the potential to enhance cross-border teamwork such as Slack, Microsoft Teams, and cloud-based project management software.

9. Collaboration with customers through branded virtual communities

Collaboration with customers through branded virtual communities has become a key strategy for organizations seeking to improve their competitive advantage, foster innovation, and increase customer loyalty in today's fast-changing business landscape.

The literature defines virtual communities as online venues where people with similar interests, experiences, or aspirations may interact, share, and establish relationships (Misra *et al.*, 2008). These branded virtual communities are growing in several areas, including sports and gaming, and interact usually via the firm's website or dedicated platform (Hetet *et al.*, 2022). Collaboration through virtual communities has many benefits. First of all, virtual communities allow patients to discuss their experiences, seek peer support, and actively engage in product or service development. These communities also enable information exchange, learning, and cooperation, helping firms to understand customer requirements and preferences. However, virtual community installation is difficult. Virtual communities can improve customer service and interactions, but they can also spread unwanted information that could damage an organization's brand. To reduce these threats, firms must carefully handle virtual community ethical and technological problems including identification, privacy, and secrecy (Demiris, 2006). Even with these drawbacks, virtual communities may help companies connect with customers in important ways.

10. Crowdfunding platform to finance disruptive innovation

In forms such as ICOs, the crowds are not just investors; they can participate in the co-development of the innovation and its success (Cumming & Johan, 2020). The contribution of the crowd to the innovation process is very similar to that of branded virtual communities.

ICT-enabled innovation partnerships span a wide spectrum, from formal alliances to open innovation ecosystems, digital platforms, and public-private collaborations. These partnerships leverage ICT tools to enhance knowledge exchange, joint development, and co-creation, leading to accelerated innovation in various industries. Each type of partnership plays a different role in the innovation process, and the role of ICT is central in facilitating communication, collaboration, and coordination across organizational boundaries.

However, the adoption of partnership approaches and the use of collaborative platforms and virtual communities to boost innovation capacity may not be without drawbacks. While these strategies can provide companies with access to diverse perspectives, expertise, and new ideas, they also come with their own set of challenges.

One key concern is the potential for loss of control and intellectual property. By opening up the innovation process to external partners, companies risk exposing their core competencies and proprietary information, which could lead to competitive disadvantages if not managed properly. Additionally, the coordination and alignment of multiple stakeholders with different agendas and priorities can be a complex and time-consuming process, potentially slowing down the innovation timeline.

Furthermore, the reliance on virtual communities and digital platforms may limit the depth and quality of collaboration, as face-to-face interactions and physical proximity can be important for fostering the trust and understanding necessary for effective partnership. The lack of direct oversight and control over the collaborative process could also introduce risks related to data security, privacy, and the reliability of the information shared within the network.

While partnership approaches can offer significant benefits, companies must carefully weigh the potential risks and challenges before embracing these strategies. Effective governance (Mbaduet *et al.*, 2019), intellectual property protection, and the development of strong interpersonal relationships within the collaborative network are key to ensuring the successful implementation of these approaches and maximizing the innovation capacity boost.

Selected articles

The enablers derived from ICTs are numerous. The papers gathered in this special issue allow us to differentiate concerns about the conditions for the effectiveness of ICT for internal use from those that serve external collaborations.

The prerequisites to foster internal collaboration using ICTs

ICTs are enablers of internal collaborations. While they appear to be necessary conditions for increasing the efficiency of these collaborations, the authors of the papers presented in this special issue agree in pointing out that the implementation of these facilitators is not a sufficient condition for their effectiveness. The motivation of collaborators, the means of their coordination, and even the structure of the ICTs implemented are investigated.

First, Arzumanyan, Tessier, Angué and Wieder (2024) examine the impact of motivational factors on commitment to Virtual Communities of Practice. Starting from the Self-Determination Theory developed by Deci and Ryan (2000), the authors underline the roles of three core needs influencing participation in such communities. The desire to gain skills and knowledge (competence), the willingness to make choices and take initiative (autonomy) as well as the need to belong to a group with shared values (relatedness) guide the commitment to Virtual Communities of Practice. Beyond this classical presentation of workers needs, the authors highlight additional motivational factors for encouraging participation in Virtual Communities of Practice, and, therefore, their efficiency. Hence, the goal of creating a positive impact, especially in reshaping and industry (Ismael, 2014), is differentiated from access to unique learning opportunities within the community. Also, an energizing leadership may inspire and guide members effectively and help them to overcome the challenge of aligning their professional and personal lives with community activities.

While Self-Determination Theory focuses on the intrinsic needs for competence, autonomy, and relatedness, these additional motivational factors provide a broader framework for understanding participation in virtual communities. The paper taps into the intrinsic human desire for purpose and meaning. Also, it explores the exclusive resources and activities providing instrumental benefits that enhance members' skills and knowledge, reinforcing the competence need in SDT. Finally, the paper describes how energizing leadership influences participants' sense of relatedness and autonomy by creating a supportive, inspiring environment.

Secondly, Husser and Goujon-Belghit (2024) present the changes in coordination mechanisms induced by the introduction of ICTs. According to the authors, ICTs affect coordination in six different ways. ICTs transform communication methods. Instead of primarily oral and interactional communication, exchanges are increasingly carried out through digital means (emails, file management platforms, etc.). This leads to asynchronous communication, allowing team members to coordinate remotely and with delays. Digital tools centralize information, facilitating access to essential data for various stakeholders (middle managers, executives). Also, ICTs modify knowledge management and information flows. Knowledge management becomes more formalized and organized through ICTs. Technical and administrative knowledge is stored, managed, and shared via digital information systems, enabling wider and faster dissemination of knowledge. ICTs require middle managers to adapt to more standardized and regulated management processes, which directly affects how they coordinate tasks and share information within their teams. Furthermore, ICTs introduce automation mechanisms, such as task planning and client journey tracking via computerized systems. This reduces the reliance on direct interactions between actors and increases efficiency in large-scale client management. Task coordination is now conducted through tools that enable the remote monitoring of clients (online follow-ups, automatic reminders), thereby reducing the need for constant physical interaction. Additionally, ICTs alter coordination by creating a form of cognitive dissonance among middle managers, who must reconcile the management of traditional human interactions (client-centered) with administrative and digital management (focused on financial and legal reporting). This tension influences how they coordinate teams and disseminate knowledge within departments. They must juggle between old interactional practices

and new digital practices, which alters the structure and dynamics of daily task coordination. Finally, ICTs introduce a different temporal dimension into management. Time management takes on new importance with ICTs. Coordination is no longer carried out solely in real-time and urgently, but also through delayed processes (e.g., financial reporting, administrative data management). According to the authors, middle managers must therefore learn to manage this hybrid temporality (Husser, 2014), where knowledge is disseminated at different rates depending on its nature (immediate for tasks, more extended for financial or legal aspects).

Thirdly, Lantz, Lacaze, Braune, and Sahut examine the structure of networks enabled by the development of ICTs (Lin, 2017). The study of co-inventor networks of the 30 most innovative companies in the field of AI enables the authors to distinguish networks characterized by the encapsulation of information and knowledge from those facilitating broader access to both (Tsouri, 2022).

The results of the study on the structure of co-inventor networks in the artificial intelligence (AI) sector provide important insights into how these networks influence patent productivity and innovation. The encapsulation of information and knowledge refers to how co-inventor networks are structured into relatively autonomous subgroups, wherein information circulates rapidly within each subgroup but rarely between them. This structure creates pockets of rich and diverse knowledge within the subgroups but limits the overall diffusion of information within the network. This type of structure favors internal specializations, with a high level of specific knowledge in each cluster but makes access to this information more difficult for members outside the subgroup. Accessibility to information and knowledge is linked to inventors' ability to quickly access information within the network. Inventors in central positions in the network (i.e., those with direct links to many other inventors) can quickly access new information and varied knowledge. This could improve R&D productivity as information and knowledge flow more freely and rapidly in these networks.

The study shows that the structure of co-inventor networks varies depending on the geographic origin of the companies (Turkina & Oreshkin, 2021; Abbasiharofteh *et al.*, 2023). This means that location influences not only how networks are organized but also their effectiveness in terms of innovation. For example, American companies are characterized by strong accessibility to information and knowledge, with inventors occupying central positions in their co-inventor networks. This structure promotes a rapid flow of information, which accelerates the development of new innovations. In contrast, Chinese companies, despite their growing role in the AI field, have relatively less diversified and accessible co-inventor networks, with a tendency toward centralizing information. This could explain why some Chinese companies are less productive in terms of patents filed, as information does not flow as freely in their networks.

It appears that the most innovative companies must face a strategic trade-off between rapid access to information and the diversity of knowledge encapsulated within their co-inventor networks. Companies must choose between a strategy aimed at maximizing inventors' centrality (and thus rapid access to information) or strengthening the diversity of knowledge within more encapsulated networks. Each strategy has its advantages and disadvantages, and the optimal choice depends on the company's innovation objectives and the characteristics of its competitive environment.

How ICTs influence external collaborations

The articles collected in this special issue show that ICTs facilitate the sharing of information between exchange partners. This information sharing helps to highlight lead users and opinion leaders who are likely to play key roles in product development. It also leads to a reduction in information asymmetry between a provider and its potential funders. This transparency improves the financing conditions of start-ups through initial coin offerings.

First, Abbes, Hallem, and Hikkerova (2024) identify creative profiles in user-innovation-promoting virtual communities (Mathwick *et al.*, 2008). Communities are not flat organizations due to their granularity, according to the authors. Creative profiles promote open innovation by involving users in company innovation (Chesbrough, 2003). Creative profiles are divided (Béji-Bécheur and Gollety, 2007).

According to Hamdi-Kidar *et al.* (2019), lead users (LUs) are innovative consumers who can solve early-stage problems. Lead users anticipate market-wide needs. They can spot product or service flaws before most users. They are crucial to innovation because they can predict user needs. LUs benefit directly from innovations. They want solutions that greatly improve their user experience. They innovate because they will benefit from the improvements, unlike regular users who wait for external solutions. These users often lead technology or market trends, so their ideas can predict sector developments. Lu are usually experts or have extensive experience with the products they want to improve. Deep product knowledge helps them innovate by understanding how and why certain aspects work or fail. Current market solutions dissatisfy lead users. Dissatisfaction drives them to create alternatives that meet their expectations, rather than complain. Innovation comes from their ability to imagine and design solutions to address their frustrations (Yang *et al.*, 2022). While opinion leaders are usually associated with this, lead users can also spread innovations. Many users share their discoveries and creations through online publications, virtual communities, or consumer groups, spreading their ideas. Lead users frequently join online communities and forums. These spaces are where they test ideas, share advice, and innovate. Knowledge sharing enriches and spreads innovation.

In social and commercial communities, opinion leaders (OLs) influence others' choices and behaviors by disseminating and persuading (Vernette, 2002). They influence peers and the wider community. Their input is sought when buying or adopting new products and services. Their ability to persuade and lead makes them key for spreading innovations and trends.

A key trait of OLs is their communication skills. They actively participate in community discussions and spread information (West and Bogers, 2014). Their numerous, well-documented publications often include detailed explanations. They actively share knowledge and experiences, which strengthens their information dissemination role. The OLs are often considered as experts or references. In-depth product or service knowledge or personal experience may explain this expertise. This credibility makes them a trustworthy community source. By giving advice based on personal experience or research, they gain peer trust.

OLs are also often at the forefront of their fields. They are always aware of new trends, innovations, and product launches and test them before sharing them with their community. Their curiosity and thirst for news make them essential market informants.

As they are active online, they often message or answer other users. They often talk and enjoy sharing their thoughts, tips, and advice. They gain community visibility and importance through regular engagement.

OLs are known for their clarity. Their audience likes their clear, detailed, and well-structured messages. They can also connect with others, maintaining an active and influential social network. Their charisma and empathy boost their influence. In addition to spreading information, opinion leaders are often educators. They teach by providing detailed advice, product comparisons, and practical advice. They guide and inform others to empower them to make decisions. OLs are seen as brand-independent in social communities like those studied in the paper. As they offer honest, selfless advice rather than commercial promotion, their independence boosts their credibility in the community. They say what they think about products and services.

Abbes, Hallem, and Hikkerova (2024) show that the LU profile is rare and often inseparable from the OL in virtual communities. Some users may combine both roles (LU-OL). However, while LUs are often dissatisfied with commercial offerings and propose eco-friendly alternatives, OLs share their personal experiences and actively disseminate information within the community. According to the authors, companies could leverage these communities to identify potential innovations, better target their creative users, and recruit LU-OL profiles to co-create innovative products or services

Second, Ftiti, Hamza, Mnif, and Louhichi (2024) examine the success factors of Initial Coin Offerings (ICOs) and post-ICO projects (Belitski and Boreiko, 2022) as an innovative funding channel for start-ups. ICOs are fundraising efforts through the sale of digital tokens (Adhami *et al.*, 2018). Start-ups create tokens and sell them in exchange for cryptocurrencies or traditional currencies to finance their projects. Due to the lack of strict regulation in many countries, the risks of fraud and scams are high. According to the authors, the success factors of ICOs include the quality of disclosure (Benedetti and Kostovetsky, 2018) (e.g., publishing a code on GitHub or a detailed white paper), deal characteristics (Amsden and Schweizer, 2018) (ICO duration, presale, bonuses for investors), and the geographical location of the ICO (Huang *et al.*, 2018) (with some countries having more favorable regulations for ICOs).

In the context of Initial Coin Offerings (ICOs), ICTs play a central role in several aspects. ICTs, and particularly the Internet, allow start-ups to raise funds on a global scale via online platforms, without relying on traditional channels like banks (Sahut, 2001) or venture capital investors. Thanks to these technologies, start-ups can reach many investors worldwide, increasing their chances of securing funding.

One of the major contributions of ICTs is the use of blockchain and cryptocurrencies in ICOs. Blockchain provides a secure and transparent framework for issuing and selling digital tokens. Transactions are recorded in a decentralized manner, which limits the risks of fraud and improves investor confidence.

ICTs allow start-ups to disclose important information through various digital media. White papers, published on websites or shared via platforms like GitHub, provide details on the project, business model, and team. This reduces information asymmetry between investors and start-ups (Courtney *et al.*, 2017; Mili *et al.*, 2012). Social networks and other platforms (Twitter, GitHub) facilitate ongoing communication between start-ups and investors, maintaining transparency throughout the ICO period and thereafter.

Through ICTs, start-ups can interact directly with investors via social media and messaging platforms, creating a community around their project. These interactions allow investors to ask questions, receive regular updates, and track project development, fostering strong engagement.

Smart contracts, made possible by blockchain, are another important contribution of ICTs. These automated contracts enable certain actions to be executed automatically when predefined conditions are met, such as the distribution of tokens after funds are raised. This increases the efficiency and security of transactions.

ICTs also enable effective post-ICO monitoring. Platforms like GitHub allow for tracking the technical updates of the project, while Twitter accounts and websites provide continuous information on the project's development. This helps investors assess the viability of the project after the ICO phase.

Indeed, an empirical study on a sample of 410 ICOs between 2016 and 2018 shows that the quality of disclosure and the deal conditions have a significant impact on the success of ICOs. Additionally, the success of post-ICO projects depends on several factors, including social media activity, presence on GitHub, and the trust of internal investors.

Therefore, ICTs facilitate the creation, management, and dissemination of ICOs while improving transparency, security, and interaction with investors, thus playing an essential role in the success of ICOs and post-ICO projects.

Conclusion and research avenues

The articles gathered in this special issue provide numerous insights into how ICTs facilitate the development and efficiency of both internal and external collaborations. By highlighting the limitations of their studies, the authors outline avenues for future research that can be synthesized into five key areas.

First, the durability of collaborations supported by ICTs is questioned. Future research could explore the long-term viability of relationships and exchanges developed using ICTs. Better consideration of the study context would help to understand the resilience of such collaborations in dynamic or uncertain environments. This theme includes socially responsible projects and the transformation of innovative ideas into concrete innovations with social impact.

Next, the diversity (such as gender diversity) of partners and the impact of this on the performance of these collaborations deserves further investigation. This area of research should focus on the characteristics of individuals and their role in the success of ICT-driven projects.

Moreover, the study of collaboration networks between inventors, companies, and academic/non-academic institutions is another perspective. It would be relevant to understand the mechanisms promoting collaboration and the boundary conditions for effective innovation, considering social capital and the nature of interactions enabled by ICTs.

The limitations of methodological approaches and the measures used are also highlighted by the authors. A recurring issue concerns the methodologies and proxies of study variables. All suggest that the analysis of collaborations through ICTs requires expansion to other indicators that can better account for the multidimensional nature

of the problem to be solved. Additionally, new methodological approaches could be explored to better reflect the collaboration strategies pursued by organizations using ICTs.

Finally, the importance of the organizational context and the management of ICTs is emphasized by the authors. Studies on ICT management in specific contexts, such as hospitals, could be extended to other public or private organizations. It is arguably necessary to analyze the management of ICTs and virtual communities of practice in different organizational environments in order to better understand the mechanisms of engagement and innovation.

These areas can guide researchers toward investigations that transcend case studies or specific contexts, while addressing questions about the dynamics of innovation, collaboration, and ICT management in various environments.

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