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COLLABORATIVE INNOVATION: A TECHNOLOGICAL PERSPECTIVE

Editorial comment

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Collaborative innovation become one of the most strategy decision across firms and a well-defined phenomenon that became popular among practitioners and researchers (A. S. Cui & O'Connor, 2012; Liu et al., 2017). Many theories were considered to explain collaboration phenomena such as resources-based view, organization theory, strategy, information processing theory, the economic theory of complementarities among others (Barney, 1991; Cassiman &

Veugelers, 2006; Daft & Lengel, 1986; Milgrom & Roberts, 1995; Tushman & Nadler, 1978). However, technology advances provide new variations in collaboration to innovativeness. For example, collaborative activities with suppliers and customers (Karhade & Dong, 2021), community source projects (Liu et al., 2017) or collaboration with distant partners (T. Cui et al., 2020), corporate engagement with startups (Shankar & Shepherd, 2019), innovation networks (Aarikka-Stenroos et al., 2017), and innovation ecosystems (Granstrand & Holgersson, 2020).

Collaborative innovation takes over the existence of an inter-organizational activities executed by people that together perform with high level of interdependence something innovative (T. Cui et al., 2020; Davis & Eisenhardt, 2011). Some authors (Adner & Kapoor, 2010; T. Cui et al., 2020; Rico et al., 2008) highlight that this interdependence is characterized along two dimensions: technological and behavioral. Technological interdependence is linked to knowledge and the exchange of resources for research and development, and behavioral interdependence is associated with the field of communication, social interaction between collaborative actors and the coordination of these relationships to innovate.

Other perspectives in the literature explain and theorize about collaborative innovation as knowledge-sharing trajectories (Majchrzak & Malhotra, 2016; Trkman & Desouza, 2012), or multi-actor collaboration (Torfing, 2019), or building collaborative capabilities (Swink, 2006) among other approaches. In this editorial, we bring some thoughts and idea about collaborative innovation under a technological perspective to incentive researchers to go beyond in innovative technologies research embedded in collaboration.

Collaboration efforts also became a common way of firms to enhance innovations and its technological development with clear determinants about their beneficial effects, and therefore, the literature is well stablished in this subject (Pereira et al., 2018). However, collaboration only succeeds when technological resources and capabilities are combined, and parties define jointly how to enhance and use them accordingly (Snow, 2015).

Collaborative innovation as a new technological paradigm refers to a network innovation model supported by interactions of multiple parties such as enterprises, universities and research institutions as core elements and government, financial institutions, nonprofit organizations, intermediaries as auxiliary elements (W. Zhang et al., 2021). Notwithstanding, collaboration networks operating in different organizational levels are present in various patterns and characteristics of evolution, they require different actors and capabilities in the

network composition to become a remarkable asset in developing technologies to be patented afterwards in some cases (Gomes et al., 2017).

In facing of risks of failures during innovative trajectories, firms invest in collaborative initiatives as an attempt to mitigate cost impacts, share responsibilities and greater technical performance in the process of technology lifecycle development. Thus, technological alliances are useful means to attend these goals (Kim & Song, 2007). Technological alliances are critical to enable digital transformation and innovation. Briefly, Zhang et al. (2021) highlight technological alliance as a voluntary interfirm cooperation involving codeveloping technologies through sharing and exchanging of these technologies to meet business needs (W. Zhang et al., 2021).

The collaborations in various technological domains help to bring heterogenous knowledge, complementary resources, and capabilities for a better innovation performance (Swink, 2006; W. Zhang et al., 2021). Under the perspective that innovation is essentially knowledge creation (Nonaka, 1994), collaborative innovation through a technological perspective may be configured by different activities, processes, or routines of generation, sharing, integration, and utilization of knowledge produced during the innovation process lifecycle (Nonaka, 1994; W. Zhang et al., 2021). Further, this configuration of activities, processes, or routines support the development of evolutionary technological capabilities (Sampson, 2007).

In the field of technological innovations, the evolution now is more collaborative in nature (J. Zhang et al., 2019). Collaboration is a trend for technological prosperity. Analyzing collaborative innovation in the literature is a great challenge even if the focus on technologies is defined because various aspects and applications of collaboration to innovate invade the academic literature in many forms. For instance, Zhou and Ren (2021) analyzed low-carbon technology collaborative innovation in industrial cluster; Shen et al. (2021) studied collaborative innovation in supply chain systems; Wan et al. (2022) highlight that blockchain application intensify collaborative innovation through distributed computing, cryptography and game theory; Li and Zhou (2022) researched on the mechanism of Government–Industry–University–Institute collaborative innovation in green technology; and Fan et al. (2022) pointed out that collaborative innovation also may act as a driver to mobilize and coordinate scientific and technological resources within a city, further promoting innovative development among cities.

On the other hand, technological collaborative innovations has its own dark side for firms: it has been costly, it demands money, efforts, and time (Torugsa & Arundel, 2016; Wegrich, 2019), and, further, it provokes operational adjustments, technological reconfiguration, and legal barriers to overcome to be effective for innovation (McGuire & Agranoff, 2011; Vivona et al., 2022). To address this side of collaborative innovation, Vivona et al. (2022) developed the cost theory to systematize all insights from the literature in four main factors: governance, compactness, reliability, and institutionalization to shed light on a broader range of costs for innovation incurred by collaborative arrangements. Governance refers to relationships in hierarchical level and the number of collaborators involved, reliability refers to relationships' quality; compactness is about the degree of formality in relationships that connect collaborators; and institutionalization that measure what the extent the relationships in practice have been pre-established. This cost perspective may be explored empirically.

The decentralization of technological collaborative innovation, its nonlinear, globalized, and networked form transformed its process to more collaborative approaches among entities (Fan et al., 2020). Lopes and Farias (2022) showed that technology tools support the establishment of relationships of trust promoted by leaders committed to well-established goals, being a characteristic of governance that has a positive influence on collaborative innovation processes. Hwang (2020) mentioned that several countries have implemented policies to facilitate technological convergence by supporting collaborative innovations. The author also mentions that collaborative innovation is a crucial strategy to facilitate technological convergence. In sum, firms have been increased collaboration in technological activities and collaboration works as an enabling to learn about turbulent technological change and uncertainties to enhance the ability to deal with innovations (Dodgson, 1993).

Technological collaborative innovation is considered essential to promote the flow of resources, knowledge, and technology among entities, considering that innovation is no longer a closed and isolated system. The main premise is technologies do not exist in isolation. Only by exchanging materials, energy, and information with the environment the innovation system be renewed and developed. Therefore, the integrator condition of technological collaborative innovation is also conducive to a more comprehensive disclosure of the collaborative mode and overall performance of technological innovation activities (Fan et al., 2020).

Technological collaborative innovation is not a merely coordination of an orderly arrangements of efforts to pursue a common technological purpose (Mooney, 1953), or a merely

cooperation to join agreed-on goals into a share comprehension about design systems or reconfigure technological resources (Gulati et al., 2012). It merges cooperation (commitment towards same end) with coordination (complexity to work together effectively) (Vivona et al., 2022). This view may be much more explored by the researchers to enhance the practical aspects of this perspective.

In general, collaboration itself does not survive in the face of inevitable behavioral problems which requires an establishment of trust characterized by receptive organizational cultures, community of interest, and continually supplement knowledge for the purpose of collaboration in highly successful technological innovations (Dodgson, 1993). Thus, this can be a new chapter for technological collaborative innovations.

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