

A proposed typology of organizational forms of collaboration for innovation

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ABSTRACT: The purpose of this paper is to examine organizational forms of collaboration for innovation, and develop a clearer typology that reflects the practical realities of modern business. After a thorough review of literature, we draw on the three core processes – outside-in process, inside-out process, coupled process – introduced by Gassmann and Enkel in 2004 to conceptualize our typology of organizational forms of collaboration. This research reveals seven organizational forms of collaboration, each form is described in terms of three organizational and functional characteristics (governance mechanisms, work organization and interactions, and intellectual property rights). The findings of this study will provide managers with a more comprehensive understanding of the various organizational forms of collaboration that can be adopted to conduct innovation activities. This typology specifically addresses collaborations for innovation. The findings might not be generalizable to other collaboration goals.

KEYWORDS: typology, innovation, collaboration, functional mechanisms, intellectual property, work organization.

1 INTRODUCTION

To survive in a competitive global market, organizations must improve their performance, acquire new knowledge and know-how, and seize new opportunities. They must introduce products and services in large volumes, at low cost, and with short delivery times [1]. Moreover, given ever briefer product life cycles, strategic actions aimed at introducing innovations and a timely response to market opportunities are critical [2]. Innovation becomes a prerequisite for organizations to cope with these challenges. Today's firms must not only be innovative; to succeed, they must be more innovative than their competitors and introduce innovations constantly [3]. Knowledge today is generally dispersed; consequently, all the resources required for innovation are not necessarily available within a single company [4]. Companies seek to form partnerships to develop knowledge and innovations ([5], [6]). Innovation implies a complex interplay among a multitude of actors, not only within the company (e.g., production, R&D), but externally as well (e.g., customers, universities). Practitioners agree that business partners (39%) and consumers (36%) can generate ideas that are as significant for organizations as those proposed by their employees (41%) [5].

The ways that companies innovate have also changed. The creative locus for innovation has expanded beyond the company's boundaries [7]. In many cases, innovation has evolved from a closed to an open process [8] and now to a dynamic process enabled by digital technologies [9]. Collaborative innovations have become increasingly important for organizations, particularly small and medium enterprises (SMEs). Organizations collaborate to share R&D costs and risks, accelerate products time to market, access additional resources, and hasten technological growth ([7], 10). However, although collaborations are increasingly prevalent and their importance is recognized by all, many of them fail. Approximately 50 percent of strategic alliances fail and their average lifetime is from three to four years [11]. Reasons for failures include lack of trust, deception, strategic incompatibility, divergent goals, and lack of communication [13]).

The literature contains various studies on organizational collaborations ([14]; [15]; [13]). Many collaborative structures have been proposed, but the absence of real consensus among them impedes the knowledge from being integrated into a cohesive whole [16]. In addition, researchers have largely neglected to define the organizational structures and the mechanisms for achieving innovation. More precise definitions could provide practitioners and business managers with clear guidelines for adopting structures that are appropriate for their needs. This article addresses the collaboration forms that organizations use for collaborative innovation. The aim is to develop a typology of organizational arrangements for collaborative innovation.

The research question may be defined as follows: How can we characterize organizational forms of collaboration for innovation? To answer this question, the following specific questions must be addressed:

- What are the main collaboration forms for innovation?
- What are their functional mechanisms?
- How is the work organized within each form?

The remainder of this article is organized as follows. The next section presents the research method. This is followed by a review of the literature on current collaboration forms. Then the paper presents our proposal for a new typology of collaborative arrangements. The following section addresses the organizational and functional mechanisms for each collaboration form, and the last section discusses the implications and directions for further research.

2 RESEARCH METHOD

This study was conducted using an integrative literature review approach. Research papers about collaboration forms for innovation were retrieved from Web of science, ScienceDirect (Elsevier), Wiley Online Library and Emerald databases. Because several terms may potentially refer to interorganizational collaboration and to ensure a broader coverage of the literature, we combined terms “collaboration, alliance, cooperation, relationship, partnership, arrangement” to terms “type, typology, taxonomy” without quotes to obtain the keywords. The retrieval was based on Boolean searches on several combinations of these terms as keywords, according to the objectives of the research. Papers were retained first for their relevance as indicated by their title and abstract, and secondly by examination of the paper. We limited the selection of papers to journals dealing with innovation, management, marketing and information technology, and to papers written in English and containing the term “innovation”.

For the governance mechanisms and intellectual property literature review, the same databases and journals as mentioned above were used. The main searching terms were *governance mechanism, collaboration mechanism, coordination mechanism, intellectual property, patent and license*. We also limited the selection to papers containing the term “innovation”. The time span covered in this study runs from 2000 until 2022. The results of the literature reviews were cross-examined, criticized and synthesized to obtain a new typology of collaboration forms for innovation.

3 LITERATURE REVIEW OF COLLABORATION TYPOLOGIES

In the literature, the terminology used for collaborative arrangements is inconsistent, and there is no consensus on the concepts, which precludes the development of a clear accepted typological framework [14]. Forms of collaboration vary according to the context, including the adopted strategies [17], the degree of commitment among partners [13], and the nature of the cooperation [14]. This inconsistency is manifest in the interchangeable use of the terms: collaboration, alliance, cooperation, and partnership. Moreover, the terms horizontal integration, horizontal alliance and horizontal collaboration are used to mean collaborations between organizations situated at the same level in the supply chain [18], [19]).

In their literature review, [16] identified 25 typologies and four taxonomies of interfirm relationships. Relationship types rely on one, two or multiple dimensions; classification criteria include information exchange, relationship sustainability and governance structure. Among other contributions, [20] proposed a five-level hierarchical structure for a taxonomy of collaborative network. However, the authors limited the system to collaborations between geographically distributed autonomous entities that interact exclusively through data networks. Similarly, [14] suggested a typology that relates strategic business objectives to adopted collaborative structures. This framework does not completely do away with ambiguity, because some concrete cases of collaboration meet the criteria for more than one collaboration form. Reference [15] proposed an integrative framework of open innovation collaboration which includes five levels of relationship: intra-organizational, organizational, extra-organizational, inter-organizational, and societal levels. Such framework allows a multi-level understanding of open innovation but fails to capture the interconnections between different relationship levels to capture innovation collaboration that fit into many levels.

Although the literature on organizational relationships is extensive, the findings are piece-meal, and hence do not allow a comprehensive understanding of the issues. Most of the collaboration types are intuitive, and do not accurately reflect day-to-day firm realities. There is no consensus among types and criteria used. Consequently, it is difficult to derive useful information from them to assist firm decision makers in developing collaborative approaches. The purpose of this study was to propose a typology that could serve to guide decision makers in choosing the suitable collaborative structure. This typology would include the functional mechanisms, the organization and exchange characteristics, and the intellectual property (IP) issues associated with each collaborative form.

4 TYPOLOGY OF ORGANIZATIONAL FORMS OF COLLABORATION FOR INNOVATION

This section presents our typology which builds on the three core innovation processes identified by [21]:

1. The *outside-in* process: enriching the company's internal innovation process by integrating external knowledge, technologies, and IP
2. The *inside-out* process: transferring unused technologies and IP to the outside environment by bringing them to market
3. The *coupled* process: coupling the *outside-in* and *inside-out* processes by working in alliances with other organizations.

This framework was selected because it takes the flow of knowledge, technologies, IP and interactions between partners, and the locus of creation into account. Each core process is related to some collaboration forms. Thus, the core process is selected according to the company's strategic objectives, and the suitable collaborative form can be identified according to specific criteria.

Little research has been devoted to these core processes simultaneously. Indeed, [22] reviewed 165 articles about open innovation, of which 118 articles concerned inbound innovation, 50 concerned outbound innovation, 70 articles concerned coupled innovation, and only 11 addressed the three processes simultaneously.

Under the outside-in process, technologies and know-how are acquired externally and used internally. To do so, the company must develop an adequate internalization strategy and absorptive capacity. Two collaboration forms are associated with the outside-in process: **internalized collaborative innovation** and **collaborative innovation with customers and users**. In the first case, companies directly integrate actors such as customers, universities and suppliers into their innovation activities. In the second case, they choose to acquire knowledge from a broader public via information and communications technologies (ICT).

In the inside-out process, the use of the developed innovation is external to the company, but the creation locus can be both within and outside the company's boundaries. Two collaborative modes can be adopted: **externalized collaborative innovation** and **immersive collaborative innovation**. In the first case, the company could license patented technologies to other companies to conduct joint innovation activities. Alternatively, it could conduct innovation activities internally as an outsourcer for an external partner, with the partner directly involved in the innovation process.

In the coupled process, the creation locus can be both within and outside the company's boundaries. Three collaboration modes are possible: **strategic innovation alliances**, **semi-open collaborative communities**, and **open innovation collaboration**. The first refers to innovation activities carried out by members of an alliance, with no external links. The second refers to innovation as a community effort, in which external actors may participate by invitation or through innovation contests. The third refers to open innovation, where anyone who desires may contribute. Figure 1 presents our seven-category typology.

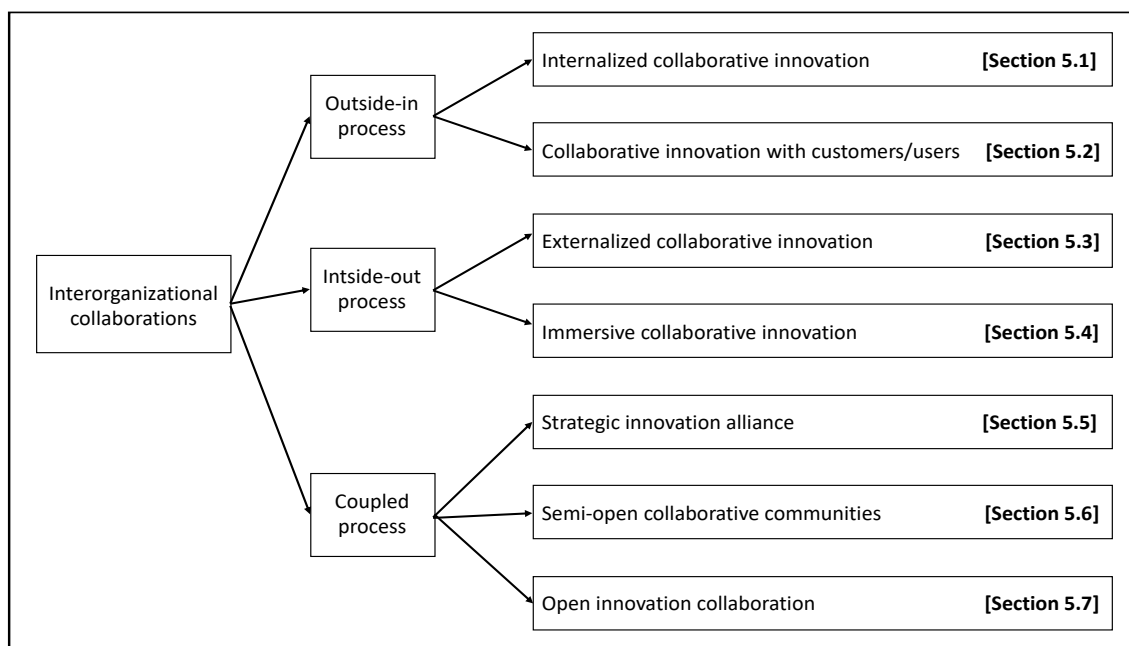


Fig. 1. Typology of seven organizational forms of collaboration for innovation

5 ORGANIZATIONAL AND FUNCTIONAL MECHANISMS OF COLLABORATIVE ARRANGEMENTS

This section presents the functional mechanisms and main characteristics of each form, along with the ways in which collaborative work is organized between the partners. Each collaboration form is described in terms of the three following criteria:

- Governance mechanisms;
- Work organization and exchange structures;
- Intellectual property (IP) rights.

The governance mechanisms define the rules for coordination and problem solving within the cooperative relationship, as well as the ownership and use of private and collective outcomes [23]. These mechanisms can be hierarchical or market-driven, closed or open, centralized or decentralized, formal or informal ([24], [25]). Their effects can be measured in terms of criteria such as coordination, trust, incentive measures, and responsibility [26]. With respect to the work organization and exchange structures, we describe how the partners can interact and organize the innovation creation processes. The notions of division of work, idea generation, and interaction are addressed. We then describe who provides the initial IP required to set up the collaboration and how the participants collaborate to share, use, and protect that IP.

5.1 INTERNALIZED COLLABORATIVE INNOVATION

This collaboration form is based on the hypothesis that most essential innovations would be developed within the company's boundaries. However, to improve its innovative potential, the company may occasionally draw on external contributors such as customers and suppliers to contribute to its internal innovation process ([24], [27]).

GOVERNANCE MECHANISMS

This collaborative approach is closed and innovation is created within the company's boundaries. The company retains control over the innovation process, as well as ownership of the outcomes. The innovation activities are managed with hierarchical governance mechanisms and communication channels are horizontal and vertical. External partners may be invited to participate in various phases of the internal innovation process. This is the case for Stellantis, which solicits suppliers and startup companies for ideas and solutions to meet the demands of today's industry and boost manufacturing efficiency [28]. To maintain confidentiality, participants agree not to disclose knowledge acquired during their immersion in the company by entering into contracts that include confidentiality clauses. Among other things, these agreements allow the company to control the IP distribution during and after the collaboration [29]. For example, medical device companies agreed to long-term contracts with their customers and suppliers to codevelop more innovative products [30].

WORK ORGANIZATION AND EXCHANGE STRUCTURES

The company makes strategic decisions, coordinates activities, allocates tasks and determines partners' roles. It selects its partners according to its needs, and their number is restricted. For instance, Orange Group targets specific agile technology startups that were selected following calls for projects, depending on its needs, before integrating them into its startup acceleration program called Orange Fab. Ideation can come from inside (e.g., marketing, customer service) or outside (e.g., customers, suppliers) the company. The partners bring their knowledge, technologies, and complementary IP to fuel the innovation process. To illustrate, Boeing leveraged supplier expertise and specialized knowledge to design and manufacture the 787 Dreamliner [31]. Innovation tasks are handled by the company's project teams, within the design and research departments. The company provides the resources (e.g., offices) required for the innovation process and is responsible for adopting the innovations, with the partners' recommendations. Thus, the company retains decision-making power over the objectives, planning, and outcomes of the collaboration; the partners provide an advisory function.

INTELLECTUAL PROPERTY (IP) RIGHTS

Generated IP rights are owned by the company, which can fully benefit from them to develop new products and services. For example, Apple signed contracts with Taiwan Semiconductor Manufacturing Company (TSMC) to design and manufacture exclusively its custom chips, thereby securing its rights over any generated IP. This model provides the company with maximum IP protection, while restricting the partners from exploiting the IP externally. However, the protection of confidential information is not governed by IP rights, but instead by the moral obligation of good faith that underlies the relationship of trust between the partners [32].

5.2 (VIRTUAL) COLLABORATIVE INNOVATION WITH CUSTOMERS AND USERS

This collaboration form is seen mainly in upstream phases of innovation and is related to customers who collaborate with the companies on developing new products and services.

GOVERNANCE MECHANISMS

This collaboration form is open to users of the company's products. They interact with the company individually or in groups, known as communities. The company's role is to capture the enthusiasm of these users and harness their knowledge to improve its product offer. For example, Lego seized an opportunity to collaborate with its customers on developing voluntary programs of product development, including Lego Ambassador [33]. The company must maintain a win-win relationship with its customers to retain their commitment. To illustrate, in the Lego Ambassador program, Lego gains access to more ideas, technologies, and business partners. In

return, the volunteer partners can exert some influence over Lego's strategic decisions and product development [33]. No membership fees are required to participate. Lego users are generally passionate about their hobby, and they collaborate more for the enjoyment than for financial reward.

The company coordinates innovation activities and interactions with communities. For attaining successful collaboration, both partners must agree on the rules for participation. The Lego experience demonstrates that project expectations must be clearly spelled out so that users fully comply with safety and quality standards [33]. Within the user communities, coordination is generally handled by volunteer members selected by their peers. In the Lego Ambassador program, the user groups chose new representatives every 6 months [33]. Furthermore, to encourage user participation, the company must set up incentive measures, for instance, online creativity contests. These attract users' suggestions for ideas and products, providing the company with a wide range of potential solutions. Ducati used this strategy to co-create with its users, and those whose contributions were accepted were recompensed [34].

WORK ORGANIZATION AND EXCHANGE STRUCTURES

The company provides the resources required for the innovation activities and for interacting with users and communities [24]. Interaction is essentially made via ICTs, through collaboration platforms. This was the case for Lego, which provided its users with digital platforms, including Lego Digital Designer, so they could design virtual Lego models [27]. The locus where ideas are generated is usually situated outside the company's boundaries, originated from isolated users or communities. The company must have the capacity to detect lead users and communities with strong creative potential. For example, Lego set up the Cuusoo platform in 2011, so that users could submit their ideas (e.g., photos, drawings) and then vote on them. An idea that received over 10,000 votes had a good chance of being produced [33]. Users could contribute additional resources for the benefit of the community. For instance, Lego used the architectural expertise of the artist Adam Reed Tucker to develop a product range based on real architectural principles [35].

INTELLECTUAL PROPERTY (IP) RIGHTS

The company and sometimes its users contribute their IP to the innovation process. For example, John Barnes was a user who contributed IP in the form of high-tech sensors, which were used to develop 12 different types of advanced sensors for the Lego Mindstorms NXT robots [33]. Once the collaboration is completed, the company benefits from the outcomes. When innovations are based on the user's work, the user receives a compensation in exchange for the IP rights. In the case of Lego Cuusoo, after Lego approves and develops an idea, the designer receives 1% of the sales returns [27]. Frequently, users do not agree to give up their IP rights, and try to use them for their own purposes, or else sell them. To illustrate, some members of Lego sites decided to sell their innovations as individual kits, explicitly stating that they were the inventors and held all the IP rights over the models [35].

5.3 EXTERNALIZED COLLABORATIVE INNOVATION

In this collaboration form, the company provides the IP rights over products and technologies so that other entities can exploit them to carry out joint innovation activities.

GOVERNANCE MECHANISMS

Externalized collaborative innovation involves both the company and its partners, but the creation locus is on the partners' premises. Innovation activities are managed with a hierarchical system, with company representatives involved in the partner's innovation processes. For example, Medtronic, a major medical technology company, decided to provide a public access to its mechanical ventilation technology during the COVID-19 pandemic, allowing other companies to exploit the IP rights and partner with them for joint innovation activities.

The stakeholders (the company and its partners) handle the coordination of innovation activities and decision making, usually based on equity. The company makes the most important strategic decisions when it has greater investment in the partnership. For instance, Apple has developed and imposed on its suppliers a controlled environment for access to and integration of hardware, software, and applications. Using this strategy, Apple was able to convince these companies to comply with its own standards. The stakeholders enter into agreements that define the rules for participation and the roles for each party.

WORK ORGANIZATION AND EXCHANGE STRUCTURES

Interactions between the stakeholders are close, with a direct involvement of the company's representatives in the partners' innovation process. Joint innovation activities are conducted in the partners' research teams. This was the case for many academic research and innovative startups in fields such as biotechnology and medical devices, which were integrated into Johnson & Johnson's Innovation Centers. Their expertise contributed to the Johnson & Johnson's research teams to develop high-quality solutions [36]. Interactions with organizations outside the collaborative network are limited to guarantee the exclusivity of innovations. The

stakeholders were the generators of ideas and use their own resources to operate effectively. For example, in innovation centers, Johnson & Johnson combines its global resources and expertise with cutting-edge technologies from its partners to accelerate innovation and stay connected with the latest trends and technologies.

INTELLECTUAL PROPERTY (IP) RIGHTS

The stakeholders provide the IP to feed the innovation process. However, the company licenses technologies to partners so they can conduct joint innovation. For example, Medtronic shared the IP rights for its mechanical ventilator, which stimulated widespread innovation and collaboration during the COVID-19 pandemic. The innovation outcomes and IP are shared according to the agreements signed between the stakeholders, usually equitably. For instance, Procter & Gamble collaborated with the U.S. Environmental Protection Agency (EPA) through a Cooperative Research and Development Agreement (CRADA) to enhance Biological Relevance in Toxicity Testing by further developing and applying a liver metabolism method developed at EPA, and the two parties share the IP rights for the developed products¹.

5.4 IMMERSIVE COLLABORATIVE INNOVATION

In this collaboration form, the company conducts innovation activities within its own boundaries on behalf of another organization, the latter actively participating in the innovation process.

GOVERNANCE MECHANISMS

Participation and membership in this collaboration type are restricted to the company and a partner. The governance structure is hierarchical, the company carrying out the work for its partner. Power sharing between the stakeholders can be equitable or non-equitable [37]. The partner entity usually takes a leading role in strategic decisions-making. For example, Dell clearly conveys to its suppliers its expectations of flexibility for a long-term commitment [38]. The two entities ensure coordination of innovation activities. Operations must be strongly integrated, within each entity (internal integration) and between entities (external integration). This presupposes good management of the relationships between functions within and across the companies. For example, for its externalized IT activities, Andersen Consulting provides the requirements for a structured project system and then relies on its partners to convert these into an applicable digital code [39].

WORK ORGANIZATION AND EXCHANGE STRUCTURES

Immersive collaborative innovation is characterized by long-term business relationships between independent organizations. This requires commitment by the concerned parties. Interactions and exchanges between the entities are facilitated when they have good communication and coordination systems [40]. The creation locus is situated inside the company's boundaries, through interactions between project teams of the two entities. Regular meetings and workshops (face-to-face or online) are held between the entities to guide the innovation activities. These meetings allow the partner company to monitor externalized work. For example, the company Pipal Research, which conducts customized research work, meets with its clients for each project to define common knowledge to ensure project success [39]. Meanwhile, ideation can come from various sources. However, the initial ideas for collaborative activities are generally contributed by the partner entity. For example, Dell gathered ideas from secondary sources and its suppliers to adapt its products [38].

INTELLECTUAL PROPERTY (IP) RIGHTS

The IP required for launching innovation activities are provided by the stakeholders. For example, in Thailand's automotive industry, the manufacturers share their IP with their suppliers before launching joint product development programs [41]. The IP obtained is used by the stakeholders according to contract clauses defined prior to establishing the collaboration. Under the work-for-hire model, the partner entity retains ownership and exclusive rights over all developed IP [29]. However, when the company contributes the IP and uses its technical capacities to conduct a project, it may retain rights on the IP generated. An example is provided by the company Outsourcing International (OI), which develops software applications for Big Product Co. (BPC). In their agreement, BPC retains ownership of any improvements made to its existent IP. However, if OI invents an entirely new application, it retains the IP rights and provide a user license to BPC [42].

¹ See <https://www.epa.gov/ftta/epa-and-procter-gamble-company> (accessed September 12, 2025).

5.5 STRATEGIC INNOVATION ALLIANCES

Strategic innovation alliances are the most traditional collaboration form. This study model includes R&D alliances, joint R&D, R&D consortia, R&D cooperations ([14], [43], [44]) and coopetition networks [45].

GOVERNANCE MECHANISMS

Strategic innovation alliances belong to the closed collaboration category. They are based on the principle of the closed source, which results in private investment and protected IP rights [46]. Participation and membership are not publicly open. The alliance is formed in stages, starting with partner selection to the collaborative contract signing. Partner selection is critical for the collaboration success. For example, Boeing conducted a meticulous investigation of potential partners' strategic capacities to ensure that the candidates could enable it to rapidly design and market its products [29]. Once the contract is signed, the number of partners is fixed. The contract stipulates, among other things, the participation rules, the responsibilities, the roles, and the benefits sharing. The governance of strategic innovation alliances is hierarchical, but it is a more open collaborative form of governance than the internalized collaborative innovation. This collaboration form is based more on equity, which allows the partners to protect themselves from opportunistic behavior by other alliance members. Such was the case for the Africa Internet Holding, a joint venture company between MTN, Millicom International Cellular and Rocket Internet, established to develop Internet businesses in Africa, where each company held 33.3% of the shares [47].

WORK ORGANIZATION AND EXCHANGE STRUCTURES

In general, a limited number of members participate in a strategic innovation alliance. Ties are stronger when a reciprocal interdependence exists between the partners, which may end up becoming interpersonal relationships [48]. Interpersonal relationships increase opportunities for informal knowledge sharing, build trust, and facilitate worker mobility [49]. For example, Sony and Honda formed a separate entity in 2022, the Sony Honda Mobility joint venture, combining the strengths of both companies to design and manufacture the Afeela electric vehicle (EV) line [50]. Innovation activities are generally divided up into projects, which are managed by interorganizational project teams [43]. Tasks are planned and allocated among team members, both horizontally and vertically. The alliance entities provide the resources required for the innovation processes. Ideas are generated by the management system and project teams managers, and interactions with external players are limited. Occasionally, outsourcing or external actors may contribute at certain phases of the innovation process.

INTELLECTUAL PROPERTY (IP) RIGHTS

After the commitment phase, IP rights are negotiated between the partners [24]. Initial IP rights required to conduct innovation activities are provided by the alliance members. They enter into mutual exchanges of exclusive knowledge, trade secrets, and other strategic capacities ([51], [48]). When new IP are developed, the ownership rights are shared equitably between the participants, as seen in the Uber and Spotify alliance, where Spotify's music technology and Uber's vast passenger network were combined to enhance the customer experience. The new IP was used for mutual benefit [52]. In the absence of any contractual prohibitions, the partners named in the patent are free to use it and license it to other companies [51]; this can lead to opportunistic behavior. For instance, in the case of the strategic partnership between Amazon and Microsoft to develop game streaming services, Amazon used the partnership to independently develop its own cloud gaming technology, Amazon Luna, in 2020. This action enables Amazon to gain a significant competitive advantage in the cloud gaming market, while Microsoft lost market share².

5.6 SEMI-OPEN COLLABORATIVE COMMUNITIES

This collaboration model involves a large number of entities (e.g., companies, suppliers) that form a community, with the participation of organizations outside the community if requested. It is a style situated between open innovation collaboration and the strategic innovation alliance. It usually occurs within industries where the participating entities wish to create a product monopoly. This is the case of the Android mobile operating system, specified by Google and the Open Handset Alliance in November 2007.

GOVERNANCE MECHANISMS

This collaboration model is a semi-open model. It is not hermetically sealed against entities outside the community, who can participate in the activities on invitation. For example, the members of Blade.org, a collaborative community of more than 250 firms in

² See <https://scoop.market.us/cloud-gaming-statistics/> (accessed September 11, 2025).

the computer server industry, can opt to work with external companies on occasional projects [7]. The leadership in such a community is heterarchical [2]. The community is governed by an agency that oversees control, coordination, and regulation. The control agency's role is to ensure that the community rules are properly adhered to, define responsibilities, rule on members' admission and revocation, and resolve IP issues, among others. For example, Blade.org has a principal office that provides the infrastructures and strategic directions required to maintain a smoothly run community [7]. This collaboration model differs from open innovation collaboration in the sense that membership must be approved by the control agency. In the case of Android, any company that wishes to join the community must register with Google, the project sponsor [53]. The community members do not necessarily participate to the same degree, but they should share similar values and fully engage in projects.

WORK ORGANIZATION AND EXCHANGE STRUCTURES

The collaboration is initiated by a large number of entities. For example, the Open Handset Alliance included 34 members when it was launched in 2007. The community members provide the resources needed to conduct the innovation activities. These resources can be freely used and modified within the community. When resources are lacking, the community can call on external organizations. For instance, Google launched the Android Developer Challenge, a contest in which contributors were awarded for developing mobile apps built on the Android platform, using their own technologies [53]. Innovation projects are mostly conducted by committees or subgroups of members. For example, Blade.org is structured in nine technical committees organized by function, including committees on technology, marketing and membership benefits [7]. Innovations are usually adopted by member consensus. In cases of disagreement, issues are resolved through established mechanisms, such as a final decision by the sponsoring company or a vote by the member entities.

INTELLECTUAL PROPERTY (IP) RIGHTS

The community members provide the initial IP rights when activities are launched. In the case of Android, the initial members ceded part of their IP to the project [53]. IP is shared among the community according to the clauses in effect, and generally equitably. At Blade.org, the committee on membership benefits sets the rules for IP ownership and sharing for each project [7]. In most cases, the members who participate in a project are co-owners of the IP and the other members are licensed to use it. The rights for external partners are set by the control agency. In addition, the community can agree to release certain IP rights to create a need for and to encourage other organizations to adhere to its standards.

5.7 APPROCHE ET PARTICIPANTS

This collaboration model embraces any entity that acquires knowledge and freely shares it with others to develop it rapidly. It includes the Open Source movement, which has gained momentum in the business world.

GOVERNANCE MECHANISMS

This collaboration form is organized outside the boundaries of the traditional company [4]. The functioning mechanisms are completely open and market-driven [9]. Membership is open to all, and anyone is free to leave the community at any time. The participants form a self-directed community, with no formal authority over members ([54], [55]). This was the case for Linux, a decentralized model with no central administrative authority for negotiation [56]. Nevertheless, there may be some coordination between certain projects. For example, developers of Linux Ubuntu, which is based on Linux Debian, must coordinate with those of Debian to ensure Ubuntu works [57]. To offset the lack of stability, open innovation collaborations use certification processes to ensure products quality, for instance, peers review. This encourages contributors to produce good-quality products so that they can earn renown and reputation among their peers ([58], [59]). The entire community oversees that the common project runs smoothly. The participants are usually volunteers, who use their own resources to develop products which are later made publicly available for adoption [5]. To illustrate, Linux developers voluntarily contributes to a shared source code, and in return gain rewards such as peer recognition and sense of belonging to a community [7].

WORK ORGANIZATION AND EXCHANGE STRUCTURES

Ideas and technologies are provided by the members, freely exchanged, and accessible to everyone. Innovation activities are conducted by project teams, and are often divided into modules [54]. To develop the core software for Linux (Core, TinyCore, and CorePlus), the work was conducted by teams at various sites, each working on a specific aspect of the source code [60]. This type of parallel work on a number of interdependent projects can result in rapid progress and unexpected innovations. The use of ICT is crucial for maintaining relationships among the participants [61]. For example, the Linux community uses the kernel.org platform as a common infrastructure to develop new solutions, request assistance and share solutions [7].

INTELLECTUAL PROPERTY (IP) RIGHTS

Open innovation projects often generate substantial IP. They belong to the entire community, which has the right to use and modify them. The only restriction is that the innovations based on the common good, must be made available to third parties. For example, in the Automotive Grade Linux (AGL) project, the open source software produced must be use and distributed as free software [62]. However, certain organizations that initiate open innovation projects ultimately intend to appropriate the results and retain the IP for themselves. This happens when a business develops a proprietary version of free software packages, for example, commercial distributors of Linux products such as Red Hat and SuSE.

6 DISCUSSION

It is undeniable that all collaboration forms are not the same. Numerous studies have sought to characterize them using various criteria and approaches ([14], [17], [15]). Our study suggests that, despite valiant efforts, progress has been hindered by the presence of various distinct concepts, typologies, and taxonomies, as well as the lack of an inclusive framework that could consolidate this body of knowledge. By drawing on the three core innovation (outside-in, inside-out, coupled) processes introduced by [21], we have developed a detailed typology of organizational forms of collaboration for innovation. This typology is a first step toward a unifying framework for the collaboration forms for innovation. Table 1 summarizes the organizational characteristics and basic principles of the seven collaboration forms.

When a company adopts an outside-in approach to procure knowledge and technologies, it can do so in two distinct ways. By opting for internalized collaborative innovation, the company retains complete control over the innovation process, which are conducted within its boundaries. In contrast, collaborative innovation with customers is a more open approach, whereby the partners participate voluntarily. Innovations are created through indirect interactions, via ICT platforms [61]. Both the company and users coordinate the innovation process. Although the company generally exploits the innovative results, in certain cases (when the innovation is developed by a user), the company must acquire the IP rights from this user, usually for some kind of compensation.

By choosing the inside-out approach, a company can use its technologies to either attract external companies that need this expertise and then conduct innovation activities on their behalf (immersive collaborative innovation), or it can develop its expertise externally by participating in innovation activities conducted by external companies (Immersive collaborative innovation). In the two cases, the organization and governance mechanisms are very similar, the main difference being the locus of the innovation activities. The company and its partners jointly coordinate the innovation activities and share the benefits of innovation. Interactions are structured, with one party directly involved in the innovation process of the other. In the case of the coupled approach, the company collaborates with complementary partners in a give-and-take process [21]. First, the company has the choice between three models: the strategic innovation alliance, in which innovation is conducted within a restricted and closed circle of partners; the open innovation collaboration, in which the innovation activities are open to all; and the semi-open collaborative communities, a hybrid model that combines aspects of the two previous models and is not completely closed to community members.

Table 1. Main characteristics of the different collaboration forms

	Governance mechanism			Work organization and exchange structures			IP rights
	Coordination	Governance mode	Participation and membership	Locus of creation	Interactions	Degree of structuration	IP management
Internalized collaborative innovation	Company	Hierarchical	Invitation	Internal	Informal	Structured	Exclusivity
Collaborative innovation with customers/users	Jointly	Market	Voluntary	Internal and external	Formal	Mainly unstructured	Exclusivity and acquisition
Externalized collaborative innovation	Jointly	Hierarchical	Opportunity	External	Informal	Structured	Shared
Immersive collaborative innovation	Jointly	Hierarchical	Commitment	Internal	Informal	Structured	Shared
Strategic innovation alliance	Management system	Hierarchical	Negotiation	Group	Informal	Basically structured	Group
Semi-open collaborative communities	Control agency	Heterarchical and market	Approval	Community	Formal and informal	Relatively unstructured	Community
Open innovation collaboration	Self-managed system	Market	Free	Distributed	Formal	Unstructured	Free

7 IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH

Our study has significant implications for practitioners and academicians. There is a need to understand the complex differences in the various collaboration forms to facilitate the decision-making process. This typology is designed to be helpful to companies keen to choose the appropriate collaborative structure for their business. Once the organization's needs and strategic objectives have been identified, the core innovation processes can be determined. Then, based on more specific criteria, the most appropriate collaborative structure can be chosen.

The analysis of criteria values for the seven collaboration forms reveals a continuum along which these criteria are situated. For example, the locus of creation can be distributed (collaborative innovation with customers, open innovation collaboration), hybrid (strategic innovation alliances, semi-open collaboration communities), or centralized (internalized collaborative innovation, externalized collaborative innovation, immersive collaborative innovation). The criteria are situated on the continuum within limit values representing the open innovation collaboration profile (low limit values) and the internalized collaborative innovation profile (high limit values). Thus, the "coordination" criterion varies from no control to complete control, and the "interaction" criterion from informal to formal (see Figure 2). At this stage of the research, we do not have sufficient information to discretize the criterion values. Nevertheless, this typology seems to be more adequate in categorizing the various collaboration forms for innovation in both theory and practice. Innovation managers are able to better assess the functional mechanisms of each form of collaboration as well as to evaluate their main organizational structure, and the nature and characteristics of their operations. This typology is expected to guide further research which will contribute to the deeper understanding the complex nature of collaboration forms for innovation.

Criteria		Measurement continuum	
Governance mechanism	Coordination	Self-managed	Complete control
	Governance mode	Market	Hierarchy
	Participation and membership	Free, open	Conditional
Work organization and exchange structures	Locus of creation	Centralized	Distributed
	Interactions	Formal	Informal
	Degree of structuration	Unstructured	Structured
IP rights	IP management	Free	Exclusive

Fig. 2. Units of comparison for criteria used

One of the main issues is to determine which of the extremities of a given criterion spectrum is negative (low value) and which is positive (high value). In terms of the "coordination" criterion, for example, would a collaboration in which the partners interact informally be preferable to one in which the interactions are more formal? In addition, for a given criterion, where exactly would a collaborative form with an intermediate value be situated in relation to the two extreme values? These are just some of the key questions to be answered to develop more precise scales, and further studies are needed to pursue this avenue. One potential direction would be to use a Likert scale to represent the degree of intensity of qualitative criteria between the two extreme values, in line with many studies on innovative collaboration ([63], [64]). This would allow conducting an evaluation study of the collaboration forms to determine an order of preference between them, among other things. The findings would be useful for helping managers choose the most appropriate collaboration form for their organization.

Furthermore, the proposed typology does not account for the number of partners, which could influence the profile of each collaboration form. No real distinction has been made between dyadic alliances, involving two partners only ([65], [66]), and multipartner alliances, involving three or more partners ([65], [67]). Reference [68] contends that multipartner alliances are more difficult to manage compared to dyadic alliances. The greater the number of partners in the alliance, the greater the risk for conflict [69], the less efficient the communication and management mechanisms.

8 CONCLUSION

The primary objective of the paper was to examine the extant literature on organizational forms of collaboration for innovation, along with developing a clearer typology that reflects the practical realities of modern business. Numerous forms and typologies of collaborative arrangements have been proposed in the literature, giving rise to considerable confusion for organizations that wish to collaborate, particularly for the first time. In addition, the research has focused on proposing typologies without considering their structural and organizational differences. The typology presented here is based on the core innovation processes described by [21] and identify seven organizational forms of collaboration. The aim was to clarify the collaboration forms and to present their main structural and organizational characteristics. However, this typology requires further research to discretize the retained criteria. This would allow mapping the collaboration forms, with the aim of creating useful decision-making tools to assist managers in choosing the most suitable collaboration form. This study opens the way to further studies on organizational collaborations.

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