How Organized is your Open Innovation?
A Typology of Open Innovative Organizations

Vincent Grèzes, Riccardo Bonazzi
Entrepreneurship & Management Institute
University of Applied Sciences Western Switzerland
HES-SO Valais-Wallis
Vincent.Grezes@hevs.ch, Riccardo.Bonazzi@hevs.ch

Abstract
The purpose of this paper is to propose a conceptual framework dedicated to analyzing organizations regarding their settings to support or hinder open innovation and to propose a way to find best innovation strategy. We elaborate on the settings to take into consideration to successfully undertake an open innovation journey, such as process as vectors of opportunities and capacities as assets to seize the opportunities. We deepen our understanding by studying the most recent typologies and maturity models of open innovation strategies. Then we discuss the personal and institutional factors that can support or hinder open innovation success, such as absorptive capacities and cultural awareness. Finally, we considered the settings allowing entrepreneurs and organizations to evaluate their open innovation maturity regarding their settings and management conditions regarding their open innovation process and capacities allowing to manage the open innovation related knowledge. This paper allows organizations' managers, employees and students, to identify an organization's maturity in terms of open innovation activities and knowledge management awareness.

Keywords: typology, open innovation, learning organization, absorptive capacities, innovation culture, strategic management

Introduction

New types of innovation are needed by the organizations. According to Rothwell (1994), the current generation of innovation respond to a significant change in the market such as economic growth, industrial expansion, intensification of the competition, resource constraints, etc. Nowadays, this fifth generation of innovation is based on the networking model, allowing flexibility and customized activities and constant and rapid innovation. Indeed, accession to resources to innovate are strongly limited regarding the high cost or the high specialty that specific resources required. This situation improves the need and the use of networking and partnering. For example, access to a large and safe online storage space, or computing power, can be very expansive to develop in-house. Companies which are not specialized in those activities, will be well advised to externalize those activities. This new generation of innovation is completed by practices of companies capturing ideas in several process of open innovation (Chesbrough, 2003), such as *outside-in*, *inside-out* or *coupled innovation* (Gassmann & Enkel, 2004), moreover forms of open innovation could be defines as open ecosystems, open innovation through acquisitions, open patent systems or open sourcing (Bogers et al., 2019). Among those best examples, most of innovations are based on dynamic capacities such as sensing, seizing, and transforming the opportunities of innovation (*ibid*). Companies must develop internal conditions to be able to identify and capture value from open innovation (Vanhaverbeke and Roijakkers, 2015).

The purpose of this study is to analyze open innovation vectors that companies can take into consideration and propose a conceptual framework of analyzing organizations regarding their specific capacities settings to support or hinder open innovation. Moreover, our aim is to propose mechanism able to shift from a low level to a high level of expertise.

State-of-the-art

In order to identify pertinent research about open innovation vectors in general and related capabilities in particular, and the assessment of the maturity of firms, to finding theories, existing typologies and empirical studies, the

researchers adopted two search strategies. On the one hand, they conducted a narrow search in Web of Sciences with the terms: "open innovation" AND (typology OR maturity) AND (capability OR absorptive). This search returned 43 results of which almost 50% (21 results) were published since 2019, and more than two thirds since 2017 (29 results). This demonstrates the current interest in the research topic. A selection of relevant articles was made by analyzing the abstracts of the articles. Finally, a group of 10 articles was selected: 6 articles particularly relevant regarding open innovation typologies (Pihlajamaa, 2021), (Evald, Clarke, & Boyd, 2021), (Santosoa, Prijadib, & Balqiahc, 2019), (Li-Ying, 2018), (Brunswicker & Vanhaverbeke, 2015), (Gianiodis, Ellis, & Secchi, 2010), and 4 articles regarding the maturity models in the field of open innovation (Enkel, Bogers, & Chesbrough, 2020), (Enkel, Bell, & Hogenkamp, 2011) (Podmetina, Petraite, & von Zedtwitz, 2019), (Edgar Serna, 2012) and (Carroll & Helfert, 2015) who summarizes organizational capability maturity models

To complete the results, a broader search in Google Scholar was performed with broader search terms: ("open innovation" AND "absorptive capacity"), ("open innovation" (techniq* OR method*)), ("open innovation" AND activities), ("open innovation" AND "state-of-the-art"), (absorptive capacity business performance in SMEs), ("open innovation maturity"), (collaborative maturity model). A keyword filtering of the first pages of results was performed by analyzing the abstracts of the articles.

Then 10 articles were selected for their relevance to maturity models, types of absorptive capacity effective in supporting open innovation, including research about capacity-based framework for open innovation (Lichtenthaler & Lichtenthaler, 2009), dynamic capabilities perspective of open innovation (Cheng & Chen, 2013), (Bogers, Chesbrough, Heaton, & Teece, 2019), absorptive capacities (Zobel, 2017), and examples of open innovation processes and drivers (Geum, Kim, Son, & Park, 2013), (McLaughlin, 2014), (Ghisetti, Marzucchi, & Montresor, 2015), (Legenvre &

Gualandris, 2018), (Marullo, Martelli, & Di Minin, 2021), (Lazzarotti, Manzini, Nosella, & & Pellegrini, 2017).

These two strict and broad approaches yielded accurate results with Web of Sciences and some complementary results with Google Scholar.

To illustrate our solution, we have analyzed the existing body of knowledge for guidelines based real examples of business model innovation in situation of crises by using the keywords *"organizational resilience" "business model innovation" heuristics "case study"*. The results from 21 articles found show that no study offers a structured analysis based on multiple studies.

Open Innovation Maturity Models
Many maturity models have been proposed for strategic capabilities (see the synthesis proposed by Carroll & Helfert, 2015). However, there are fewer maturity models in the field of open innovation. Our literature research strategy enabled us to identify three main models proposed for distinct phenomena:

- Measure of effectiveness of open innovation (Enkel, Bell, & Hogenkamp, 2011)
- Measure of quality of organizational process (Podmetina, Petraite, & von Zedtwitz, 2019)
- Measure of the degree of organization openness (Enkel, Bogers, & Chesbrough, 2020)

The model of Enkel et al (2020) proposes an evolution of the openness of firms correlated with the provision of dynamic capabilities (see Illustration 1 below).

Illustration 1: Maturity framework of open innovation (Enkel et al., 2020)
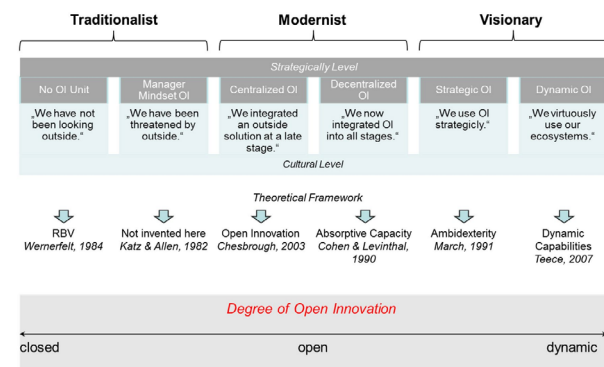
Zahra, Sapienza, & Davidsson (2006) sought to put *managerial choices* at the center of the definition of dynamic capabilities and proposed a causal model of dynamic capabilities as a condition for the performance of the firm (see Illustration 2 below). According to the authors, the first step is entrepreneurial activities as opportunity identification and exploitation activities. The model describes the activities influencing the choice of resources and skills as well as the processes involved in gathering external information when a new situation occurs. Choices create new substantive capabilities and change the knowledge base of the organization. Thus, according to the authors, capabilities and processes are the basis for the organization's ability to adapt to a changing environment, and ultimately the necessary explanatory conditions for the evolution of the firm's performance.

Illustration 2: A stylized model of capability formation and performance (Zahra, Sapienza, & Davidsson, 2006)
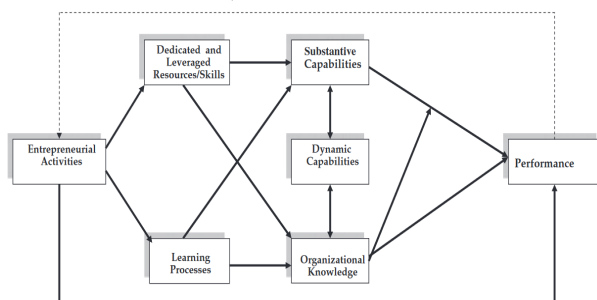
Then dynamic capabilities constitute an ability of management in reconfiguring the resources of the organization to adapt to a changing environment. To deepen this understanding, Lichtenthaler & Lichtenthale (2009) tent to identify the specific types of capabilities useful for open innovation management. The authors propose an integrative vision of dynamic capacities, absorptive capacities and knowledge management in order to consider the exploration, retention and exploitation of knowledge inside and outside of the firms.

Depending on the internal or external provenance of the knowledge and the stage considered (knowledge exploration, knowledge retention or knowledge exploitation), the authors identified six knowledge capacities critical to the open innovation process: inventive, absorptive, transformative, connective, innovative, and desorptive capacity. According to the authors, the model helps to

explain the heterogeneity of economic performance in innovation because it specifies several types of knowledge management capacities regarding the boundary of the firm and the step in the innovation process.

Illustration 3: Capability-Based Framework for Open Innovation (Lichtenthaler & Lichtenthaler, 2009)

	Knowledge exploration	Knowledge retention	Knowledge exploitation
Internal (Intrafirm)	Inventive capacity	Transformative capacity	Innovative capacity
External (Interfirm)	Absorptive capacity	Connective capacity	Desorptive capacity

To analyze open innovation vectors that companies can take into consideration and to support organizations in improving their performance we selected the maturity criteria that allow the organization to improve its ability in managing open innovation: capacities and processes as proposed by Podmetina, Petraite, & von Zedtwitz (2019) who built on the above-mentioned studies.

Open Innovation Typologies
Among six identified typologies related to open innovation, researchers focused particularly on specific strategies of open innovation (Gianiodis, Ellis, & Secchi, 2010), on the types of external knowledge sourcing, based on an inductive hierarchical and non-hierarchical cluster analysis techniques in sequential manners when other studies are based on deductive design methods (Brunswicker & Vanhaverbeke, 2015), on the types of outside-in innovations (Li-Ying, 2018), on the type of organizational configuration as a platform able to encourage open innovation (Santosoa, Prijadib, & Balqiahc, 2019), on the types of open innovation projects (Evald, Clarke, & Boyd, 2021), and on the managerial types regarding open innovation (Pihlajamaa, 2021).

An analytic summary of those research presenting the main topic of the typologies, the variables taken into consideration and the proposed ideal types is presented in the table 1 below. Based on this analysis, we identified the following gap in the literature: the authors do not propose mechanisms able to shift from a low

level (ideal type I) to a high level of expertise
(ideal type IV).

Table 1: Open innovation typologies' descriptions

References	Typologies' descriptions
(Gianiodis, Ellis, & Secchi, 2010)	**Topic**: Open innovation strategies **Variables**: Innovation sources, organizational attributes, mechanisms used to facilitate inter-organizational exchange, and primary outputs **Types**: Innovation seeker, Innovation provider, Intermediary, Open innovator.
(Brunswicker & Vanhaverbeke, 2015)	**Topic**: Strategic types of external knowledge sourcing **Variables**: Direct and indirect customer sourcing, supplier sourcing, universities sourcing, network partners sourcing, innovation success, income from innovation, investments, innovation strategy and development processes, innovation project control **Types**: Minimal searcher, Supply-chain searcher, Technology-oriented searcher, Application-oriented searcher, Full scope searcher.
(Li-Ying, 2018)	**Topic**: Outside-in innovations **Variables**: Distinct ways of boundary spanning: whether an innovation idea is created internally or externally and whether an innovation process relies on external knowledge resources **Types**: Totally Closed Innovation, Complementary Learning, Total Outside-in, Focused Sourcing.
(Santosoa, Prijadib, & Balqiahc, 2019)	**Topic**: Open innovation mechanisms about strategic fits between an open innovation strategy and user crowds in a digital ecosystem **Variables**: Organizational open innovation strategy regarding knowledge, resource, or innovation flow, and users/crowds new product development or new service development capabilities **Types**: Listener Platform, Co-Creator Platform, Franchisor Platform, Coring
(Evald, Clarke, & Boyd, 2021)	**Topic**: Project typology of generic open innovation approaches **Variables**: Firm's strategic logic of exploration and exploitation, openness logic such as inbound and outbound open innovation **Types**: Inbound-exploration project, Inbound-exploitation project, Outbound-exploration project, Outbound-exploitation project.
(Pihlajamaa, 2021)	**Topic**: Inbound open innovation strategies **Variables**: Managerial attention (proactive/reactive), locus of innovation (internal/shared/external) **Types**: Reactive sourcer of ideas and knowledge, Reactive co-creator of innovations, Reactive sourcer of ready-to-market innovation, Proactive sourcer of idea and knowledge, Proactive co-creator of innovations, Proactive sourcer of ready-to-market innovation.

Source: Authors' contribution

Open Innovation and resilience

In order to identify pertinent research about open innovation and resilience, the researchers conducted a narrow search in Web of Sciences with the terms: ("open innovation" AND resilience). The use of open innovation to support resilience has been explored in different forms, including interorganizational coworking spaces (Hysa & Themeli, 2022) or innovation hubs (van der Meer, 2017), but scarce are the literature analyzing empirical studies regarding mechanisms of open innovation and resilience.

Therefore we studied how companies innovated during the worst period of covid-19 regarding containment and supply disruption: between March 2020 and August 2021.

Research methodology

We followed a design science research process which follows six steps (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007): problem identification, definition of the objectives of a solution, design and development, demonstration, evaluation, communication. In the step of design and development, we have created a theoretical model under the shape of a typology (Hevner et al., 2004; Holmström et al., 2009).

Based on the previously identified constructs, we propose a typology, as a "complex theoretical statements that should be subjected to quantitative modeling and rigorous empirical testing" (Doty, 1994). The construction of our typology enable us to elaborate ideal-types of open innovation organizations regarding, on the one hand, the vectors of open innovation, and on the other hand, their capacities.

Regarding the data collection, and to identify the best examples of companies able to adapt sustainably to changes in their environment, we adopted a longitudinal approach.

The sampling methodology we adopted is organized as follows. The first voluntary sampling methodology for qualitative data collection (Palinkas, et al., 2015) is a very useful method for identifying and selecting information-rich cases in a context of limited data sources with an opportunistic approach in a multi-stage strategy, where a second stage completes the sample by focusing on variation or similarities. The sampling strategy was based on several data access methods in order to identify best practices. The data collection and observation periods took place between 25 March and 14 May 2020, with an initial stage of searching for companies from all sectors that had adapted their business to the lockdown. The data was complemented by a second stage of collection in October 2020 on the criterion of variation in the tourism sector with the tourism organization that adapted its activity to the protection of health, such as the ban on gatherings and the restriction of people in public spaces. This approach identified a total of 51 businesses (n=51).

The methodology of the second round of data collection provided data for the longitudinal observation of the behavior of innovative companies. To carry out the longitudinal analysis, we observed the evolution of the 51 companies identified in the first stage, in order to identify which innovations were maintained, which were suppressed, and which new innovations were developed, with or without maintaining the first innovations. This second data collection was carried out between 24 and 25 August 2021, 17 months after the first data collection point. One company in the panel was absorbed, bringing the total number observed to 50 (n=50).

Results

In this section, we elaborate the conceptual framework of the open innovating organization regarding their settings and management conditions of innovating regarding their capacities and their processes.

Construction of the conceptual framework

Based on the previous constructs, we propose a typology (Doty, 1994) of open innovating organization ideal types regarding, on the one hand, the vectors they have put in place, and on the other hand, their capacities.

Previous research show that varying innovation performance of organization and entrepreneurs, are related to their ability to develop dedicated process and dedicated capacities for open innovation management. Those settings are based on the one hand, on process that are established by organizations, and on the other hand, on the capacities of the firms. Finally, the correlation of these two variables allows us to build an institutional typology for an international perspective of academic entrepreneurship in higher education (see Illustration 4 below). Our artefact comes in the shape of a typology. According to Doty and Glick (1994, p.232) a typology is "[…] typology, refers to conceptually derived interrelated sets of ideal types.

Unlike classification systems, typologies do not provide decision rules for classifying organizations. Instead, typologies identify multiple ideal types, each of which represents a unique combination of the organizational attributes that are believed to determine the relevant outcome(s). […] Typologies are intended to predict the variance in a specified dependent variable be- cause the organizational types identified in typologies are developed with respect to a specified organizational outcome. »

Constructs in the typology. We have two constructs as independent variables: the process maturity level and the capacities maturity level.

- *Process Maturity variables* encompasses knowledge exploration, retention and exploitation processes, knowledge sharing processes, cross-functional coordination of knowledge sourcing and absorption, etc.

- *Capacities Maturity variables* regroups education and training, reward systems and motivation culture, leadership, structures, tools and methods, etc.

Illustration 4: Open innovation learning organization maturity model

		Process maturity	
		Low	High
Capacities maturity	Low	**1: Novice**	**3: Lean**
	High	**2: Effectual**	**4: Master**

Source: Authors' contribution

This construction enables us to propose the following four ideal types: Novice, Effectual, Lean, Master.

Relationships among constructs. To describe the strategy over time, we use two measures, the number of new products at t1 and the number of new products that are maintained at t2.

We assume that the number of new products at t1 is the result of the search capabilities of the firm. For sake of simplicity, we define this level as mainly dependent on the capacities of the firm. Accordingly, the formula we use is:

*Search for opportunities = #Prod (t1) = Mat level Proc + 2*Mat Level Cap*

We assume that the number of new products at t2 is the result of the sustain capabilities of the firm. For sake of simplicity, we define this level as mainly dependent on the capacities of the firm. Accordingly, the formula we use is:

*Sustain innovation = #Prod(t2) = 2*Mat level Proc + Mat level Cap*

Falsifiability. In order to test our typology, we collected data from 50 enterprises and tried to assign each firm to one ideal type (see Table 2 below).

Table 2: Theoretical illustratory instanciation

Ideal-types	Processes	Capacities	# Develop New Prod (t1)	# Maintain Prod (t2)	# Develop New Prod (t2)	TOT (t2)
Novice	Low	Low	-	-	-	0
Effectual	Low	High	0,67	0,33	0,67	1
Lean	High	Low	0,33	0,67	0,33	1
Master	High	High	1,00	1,00	1,00	2

Source: authors contribution

Illustratory instantiation

We analyzed 50 enterprises, and we selected four companies to give an example of our observation method in this paper, because they have some commonalities among each other: **PixMob** (link) and **Texner SA** (link) are two firms, which decided to create new products (masks) in a new market. **Pur Vodka** (link) and **Morand SA** (link) are two firms, which decided to create sell and existing product (alcohol) in a new market (disinfectant).

PixMob and Pur Vodka are in a big country in North America (Canada), whereas Texner SA and Morand SA are located in a small country in Europe (Switzerland). Since web pages change over time, instead of using the link to the company web pages, we have analyzed the web page saved on Wayback Machine[1], an initiative of the Internet Archive, building a digital library of Internet sites and other cultural artifacts in digital form. Wayback Machine allows to have static image of each page over time, and to share them online to allows other scholars to replicate our results. For example, PixMob is a firm that produced protection masks in 2020, but it removed that product from its website in 2021 and offered instead lights to create entertainment events in empty buildings (illustration 5). Instead, Texner changed its offering protection masks by offering them in tissue and added complementary products for

---

[1] Online access: https://web.archive.org/

winter with the protection mask included (illustration 6).

Illustration 6: The web page of Texner in 2021

Illustration 5: The page of PixMob in 2021
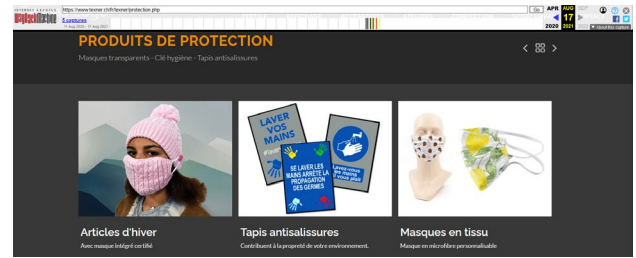

Source: Wayback Machine

Source: Wayback Machine

By observing the behavior of the innovative firms in our panel, we divided the actions into deletion strategies: the pruning variable (1) and addition strategies: the branching variable (2).

Products or services pruning (Johnson & Myatt, 2003) involves abandoning a product or brand in response to declining demand or insufficient financial returns. This strategy allows the company to focus its resources on its best products or brands. On the other hand, the branching strategy refers to the positioning on one or more new business areas in order to ensure the creation of additional cash flow and a better spread of risks. This strategy is related to the ambidextrous organization (O Reilly & Tushman, 2004).

Illustration 7: Preliminary results on the distribution of firms in our typology

Source : Authors' contribution

Table 3: Empirical illustratory instanciation

Ideal-types	Processes	Res	# Maintain Prod (t2)	# Develop New Prod (t2)	# Firms
Novice	Low	Low	-	-	15
Effectual	Low	High	0,33	0,67	11
Lean	High	Low	0,67	0,33	17
Master	High	High	1,00	1,00	7

Source : Authors' contribution

Discussion

Typology and its potential implications

According to previous sections, we can deduce that competitiveness of companies is based on their ability to develop process of innovation and their absorptive capacity to sustain their competence to seize the opportunities as a learning organization. The typology enables to identify four ideal-types:

- *Type-1 "Novice"* is the less developed institution regarding the open innovation vectors and the architectural capacities. This type of organization proposes only vectors that allow a minimal or moderate knowledge exposure and does not dispose of learning processes in order to capitalize upon its learnings.

- *Type-2 "Effectual"* is a relatively weak environment for innovating. It disposes of weak innovation vectors, allowing minimal or moderate new knowledge exposure. Therefore, this type of organization sets up strong ability to reconfigure existing capacities such as coordination capacities through agile management, or also evidence mechanisms to assess employees evolution.

- *Type-3 "Lean"* is a relatively good environment for open innovation regarding their adapted process but will not be able to capitalize upon their learnings. Indeed, this type develops strong process relative to collect and exploit external knowledge but disposes of a weak retention capacity and cannot enrich itself from this context. Settings and accumulated knowledge are dispersed and suffer from a lake of coordination within the organizational units and through the organization.

- *Type-4 "Master"* appears to be the most competitive institutions with strong knowledge exploration and exploitation vectors, allowing different degrees of internal and external knowledge exposure. It develops strong architectural elements of open innovation organization, such as a developed culture of innovation, an improved coordination at the levels of the knowledge sharing units and of the organization-wide, also learning from other elements. This kind of organization will be the most adaptative to its environment and it will offer the most supportive context for open innovation and resilience.

Conclusion

In this paper we firstly presented the process and capacity factors that any entrepreneur must take into consideration in an open innovation management context. We saw that open innovation's success depends on several notions of knowledge management and specific capacities.

Secondly, we discussed settings and conditions that support or hinder the innovation sensitivity of the entrepreneur in the environmental changes context. We saw that the quality of the open innovation process relies on the attitude of the agents. On the one hand, academic entrepreneurs, such as students and staffs, should adopt and ethnorelative attitude, with at least a third level of cultural awareness -a piece of knowledge of the cultural difference. On the other hand, higher educational institutions must adopt architectural elements to develop absorptive capacities to enrich their organizational learning process and then to provide entrepreneurs a continuously improving and suitable environment to encourage and promote academic entrepreneurship.

Then, we considered the conditions and vectors of internationalization and cultural aspects in the context of academic entrepreneurship. We identified several settings that HEI can set up to promote intercultural sensitivity among students and staffs. Those different vectors are variable according to the distance they cover (mobility, non-mobility, and specific cultural distances), the intensity of cultural awareness they allow (minimal, moderate and maximal cultural exposure), the agent they concern and the time they require to transmit them knowledge.

Finally, we proposed a conceptual framework of the academic institutions regarding their settings and management conditions of entrepreneurship related to their internationalization and cultural awareness. The subsequent ideal-types allow university managers, and professors or also students, to identify their organization's maturity in terms of international and cultural awareness towards fostering innovation and entrepreneurship.

References

Bogers, M., Chesbrough, H., Heaton, S., & Teece, D. J. (2019). Strategic management of open innovation: A dynamic capabilities perspective. *California Management Review*, 77-94.

Brunswicker, S., & Vanhaverbeke, W. (2015). Open innovation in small and medium-sized enterprises (SMEs): External knowledge sourcing strategies and internal organizational facilitators. *Journal of small business management*, pp. 1241-1263.

Carroll, N., & Helfert, M. (2015). Service capabilities within open innovation: Revisiting the applicability of capability maturity models. *Journal of Enterprise Information Management.*

Cheng, C., & Chen, J. (2013). Breakthrough innovation: the roles of dynamic innovation capabilities and open innovation activities. *Journal of Business & Industrial Marketing*, 444-454.

Doty, D. G. (1994). Typologies as a Unique Form of Theory Building: Toward Improved Understanding and Modeling. . *The Academy of Management Review*, 230-251.

Edgar Serna, M. (2012). Maturity model of Knowledge Management in the interpretativist perspective. *International Journal of Information Management*, 365-371.

Enkel, E., Bell, J., & Hogenkamp, H. (2011). Open innovation maturity framework. *International Journal of Innovation Management (ijim)*, pp. 1161-1189.

Enkel, E., Bogers, M., & Chesbrough, H. (2020). Exploring open innovation in the digital age: A maturity model and future research directions. *R&D Management*, pp. 161-168 .

Evald, M. R., Clarke, A. H., & Boyd, B. (2021). An Open Innovation Project

Typology of Exploration and Exploitation: Managerial Implications and Empirical Applications . *Journal of the Knowledge Economy*, pp. 740-755.

Geum, Y., Kim, J., Son, C., & Park, Y. (2013). Development of dual technology roadmap (TRM) for open innovation: Structure and typology. *Journal of Engineering and Technology Management*, pp. 309-325.

Ghisetti, C., Marzucchi, A., & Montresor, S. (2015). The open eco-innovation mode. An empirical investigation of eleven European countries. *Research Policy*, 1080-1093.

Gianiodis, P. T., Ellis, S. C., & Secchi, E. (2010). Advancing a typology of open innovation. *International Journal of Innovation Management*, 531-572.

Hysa, X., & Themeli, A. (2022). Interorganizational coworking: attenuating complexity, enhancing resilience and fostering open innovation and knowledge cocreation. *Transforming Government: People, Process and Policy*, pp. 244-257.

Lazzarotti, V., Manzini, R., Nosella, A., & & Pellegrini, L. (2017). Innovation ambidexterity of open firms. The role of internal relational social capital. *Technology Analysis & Strategic Management*, 105-118.

Legenvre, H., & Gualandris, J. (2018). Innovation sourcing excellence: Three purchasing capabilities for success. *Business Horizons*, 95-106.

Lichtenthaler, U., & Lichtenthaler, E. (2009). A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity. *Journal of Management Studies*, 1315-1338.

Lichtenthaler, U., & Lichtenthaler, E. (2009). A Capability-Based Framework for Open Innovation: Complementing

Absorptive Capacity. *Journal of Management Studies*, 1315-1338.

Li-Ying, J. (2018). Dual boundary spanning: Toward a typology of outside-in open innovation in the Canadian context. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, pp. 429-443.

Marullo, C., Martelli, I., & Di Minin, A. (2021). The many shades of 'openness': an application of item response theory to open innovation research. *R&D Management*, 127-146.

McLaughlin, S. (2014). Knowledge Management: Assessing a Dynamic Capability. *International Forum on Knowledge Asset Dynamics.*

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, pp. 45-77.

Pihlajamaa, M. (2021). What does it mean to be open? A typology of inbound open innovation strategies and their dynamic capability requirements. *Innovation*, pp. 1-24.

Podmetina, D., Petraite, M., & von Zedtwitz, M. (2019). A capability maturity model for open innovation. *The International Society for Professional Innovation Management (ISPIM).* Manchester.

Santosoa, A. S., Prijadib, R., & Balqiahc, T. E. (2019). Synergizing multi-sided platform firms and crowds: a typology of an open innovation mechanism in a digital ecosystem. *International Journal of Business*, pp. 434-454.

van der Meer, H. (2017). Innovation Hubs; a New Form for Open Innovation in SMEs. *Print*, pp. 661-674.

Zahra, S., Sapienza, H., & Davidsson, P. (2006). Entrepreneurship and Dynamic Capabilities: A Review, Model and Research Agenda. *Journal of Management Studies*, 917-955.

Zobel, A.-K. (2017). Benefiting from open innovation: A multidimensional model of absorptive capacity. *Journal of Product Innovation Management*, 269-288.