

Open Innovation as a challenging paradigm in contemporary innovation management - state of the art after decade(s) of development

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Abstract. *Open innovation (OI) is recognized as innovation management paradigm. Basically, it is more complex, particularly from the implementation viewpoint. This paper aim is contributing to state of the art overview, presentation of various approaches to OI implementation and development. It shows implementation through initiating, accepting and practice. Recent papers and studies on this topic are additional indicators, showing trend, as well as a strong institutional support from EU, US and globally. OI also has its challenges, opening new opportunities and risks, bringing a business to an unpredictable outcome, challenging and rewarding simultaneously. OI became a trend and a controversial paradigm.*

Keywords

Open innovation (OI), paradigm, innovation, management development, small and medium enterprises (SME), a competitiveness.

1 Introduction

The paper aims to contribute to OI state of the art description as an innovation paradigm primarily connected to market adaptation. It offers interdisciplinary research opportunities, including economics, organization, technology and science in holistic and systematic approach. Accordingly, this paper goal is to describe and provide an overview and insight into this paradigm state of the art and practice.

During the past decades - since 1960's, particularly the past decade, numerous researchers' papers, particularly the works of prof. Henry Chesbrough, have contributed to this paradigm description, understanding and implementation.

Various disciplines studies - organization, informatics, and related ones, have studied, described and presented OI, so there are various definitions and descriptions.

According to Curley and Salmelin, OI may be described as knowledge input and output exchange,

aiming to improve internal innovation processes, so to ensure successful market appearance. [15]

This is a set of activities that include extreme innovation utilization, through intensified input and output of ideas, knowledge and technologies.

OI is based on knowledge exchange and innovation implementation and development through internal and external innovation connecting and their mutual exploitation. It was initially established and promoted by prof. Henry Chesbrough [14], but the idea itself is few decades older – from 1960s. Chesbrough ensured an insightful overview and description of OI and its relations to contemporary business, market environment social and economic influences, so his studies on OI were usually taken as an establishing start of the OI as the new paradigm. Recent papers and works, researches and business practice opened new questions and topics for discussion, as OI implies also certain business risks.

When considering OI relations to business and innovation management, SME's in IT and high tech are highly relevant. [1, 5] Recent EU policies have given the OI additional importance, ensuring its support. EU Horizon 2020 supports this practice, as well as actual research and innovation policies, due to its strong connection to EU markets. It included also SME development into its strategies. [37]

Contemporary studies are connecting OI to multidisciplinary flexible approach and time frame so to ensure systematic approach, as there are multiple influences and relations from various sciences and disciplines. Growing number of papers and web links leads us to conclusion that OI needs consideration from various viewpoints and to be implemented through various approaches [36]. Van de Vrande, de Jong, Van Haverbeke, and de Rochemont (2008) [76] have performed research upon OI and challenges to its acceptance and implementation, through case study on SME's practice and experiences.

2. Open Innovation

OI is an innovation management paradigm developed on shared value, integrated collaboration principles, expanding technologies, innovation ecosystems and their rapid adoption. It enables organizations to develop their innovativeness and adapt to market changes throughout collaborative and open approach to its customers, competitors and market in general. It is concerned with the sustainable prosperity, shared value creation and well-being improvements. OI ensures opportunities for all kind of organizations, becoming a trend in business practice, but also a research intensive area as the growing number of papers, studies, innovation projects indicated this during past decades. That was continued through institutional support from EU, US and globally [12].

2.1. An innovation management paradigm

Considering OI importance for the SME's business and growing organization practice, Van de Vrande, de Jong, Van Haverbeke, and de Rochemont (2008) [76] considered OI practice, implementation, relations and growing influence in SMEs in different sectors - either industry or service sector, stressing importance of IT and high tech sector. OI adopting organizations were equally represented and medium enterprises share is bigger than small ones. [76] A motivation as one of the most important factors is primarily tied to customers' requests fulfilment, as well as following market competitors. [29] That case study was indicative and opened area for further studies and research projects. Zheng and recent works have ensured new viewpoint to OI in SME's, as well as its influence to organizations competitiveness. [84]

2.2. Research and challenges

This paper focus is on state of the art regarding OI. Due to a need for data support from organizations and institutions databases (Ministries, Agencies, Chambers of economy etc.) [76], for data collecting, processing and analysing, any research focused to OI have to be representative for each sector, stakeholder and market segment. When considering cooperation of employees and customers inclusion to OI, there are specific differences, depending on specific sector, production is more focused onto technology, services are more focused onto entrepreneurship. [17]

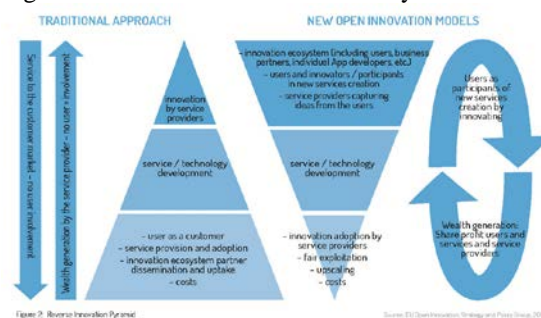
Van de Vrande, de Jong, Van Haverbeke, and de Rochemont (2008) case study [76] have shown that medium enterprises were more opened to OI adoption than the small ones. Motivation was mostly market influenced - adaptation, users' needs and inclusion.

Each practice have specific motivation: technologies integration, entrepreneurship, users' inclusion, networks' development and market trends following [72]. There are issues like ownership, corporate culture, external participation and R&D outsourcing issues in joint ventures, communication and responsibility delegation risks, resources allocation and time management issues. [76]

3. Open innovations paradigm

Innovation management methodology is a part of strategies and programs with growing importance. Considering future research activities, we may need potential guidelines such as initiatives connecting to strategies and projects, networking experiences and feedback, periodical results analysis, new practices motivation analysis, a research platform building. [18]

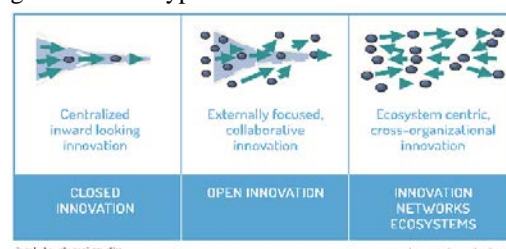
Figure 1 shows Reverse Innovation Pyramid



Source: Curley, M., Salmelin, B. Open Innovation 2.0: A New Paradigm OI 2 Conference Paper EU Open Innovation Strategy and Policy Group [15]

There is distinction between new models and traditional approach, so organizations open to OI need more information support, as there are challenges and issues, as well as potential benefits and opportunities in such a practice. When discussing upon OI types and relations, we are mostly focused on OI processes, implementation, new adopters and followers practice, as well as openness to future changes.

Figure 2 shows types of innovation



Source: Curley, M., Salmelin, B. Open Innovation 2.0: A New Paradigm OI 2 Conference Paper EU Open Innovation Strategy and Policy Group [15]

OI practice is strongly influenced by the following:

1. Globalization,
2. R&D outsourcing growth,

3. Early supplier integration,
4. User's participation to innovation processes,
5. External technology commercialization. [13, 14]

4. Related works and references

OI and innovation management development are recognized on organizational level and in political institutions. In order to support new initiatives, the EU Horizon 2020 presented a holistic perspective for RD&I - Research, Development, and Innovation. [37] The European Internet Foundation's report on Digital World in 2025, as well as 2014 edition and Digital World report in 2030 [48, 56, 57] identified mass collaboration as the leading trend. The EU's Open Innovation Strategy and Policy Group (OISPG) aims to integrate industrial groups, governments, scientific society and individuals to support OI [75, 57].

Russell et al (2011) [67] have described innovation ecosystems. The Living Labs (2006) [48] created by the EU Commission and Finnish EU Presidency, are great example of an innovation ecosystem.

Hartmann and Trott (2015) [35] presented critical overview of Chesbrough and recent findings upon OI.

Chesbrough, (2008, 2013) [11, 12] successfully presented research on OI, OI in Photonics, and in his earlier work (2003) [12] presented OI contribution to technology development.

Wayman et al. (2014) [82] quoted Neils Bohr upon prediction: "Prediction is difficult, especially about the future."

Keeley et al. (2013) [42] stressed out crucial importance of implying the full spectrum innovation idea and Doblin's taxonomy of innovation IO types.

Cheng and Huizingh (2014) [10] investigated three types of strategic orientations in OI: entrepreneurial, market and resource orientation.

Busarovs (2013) elaborated recent works and interest of researchers concentrated on open innovation. [8]

Curley (2013) [17] noted that active role of the user have to be ensured from the very beginning.

Pearce (2012) [58] described open source appropriate technology or OSAT, technology that provide for sustainable development, while being designed in the same fashion as free and open source software.

Huizingh, (2011) has described OI concept as a rich one that can be implemented in many different ways, and stressed out OI context dependency. [38]

Porter and Kramer (2011) [62] used the shared value shifting idea from optimizing financial performance to corporate performance and social conditions.

Penin et al. (2011) [59] have presented innovation shapes and stakes: a portrait of open innovation as a promising phenomenon.

Lee et al. (2010) [45] tied presence and influence of OI in SMEs to industry.

Bonner (2010) presented interactivity between customer and new product performance. [6]

Dahlander and Gann (2010) [20] have discussed on openness of influence enterprises' ability to innovate and appropriate benefits of innovation.

Dodgson, Gann and Salter examined the role of innovation technology. (2008) [21]

Marais and Schutte (2010) [68] described innovation process as an excellent vehicle for driving quest for competitiveness on product, process or strategic level.

Van de Vrande, de Jong, Van Haverbeke, and de Rochemont (2008) [76] have studied on OI case study and its implementation in SME's they provided intensive research on open innovation practice and challenges to its acceptance and implementation.

Hansen and Birkinshaw (2007) [34] have described innovation processes may be described through 3 phases: 1. Idea generation, 2. Idea development, and 3. Developed concepts diffusion.

Gassmann (2006) [27] has analysed the knowledge that facilitates technologies' leveraging through the incubation process and defined 4 incubator types: 1) fast profit incubators, 2) market incubators, 3) leveraging incubators and 4) insourcing incubators. He presented findings on customer innovation (2005, 2006), [28, 29], and works on organization of global scale industrial R&D (1998) [30] and virtual R&D teams. (2003) [31] He noted that OI often starts with outsourcing to contract service organizations, followed by strategic modes of OI. [27, 38]

Von Hippel and von Krogh have analysed the importance of 'free revealing'. (2006) [80] Von Hippel (1986, 1998, 2002, 2005, 2006) [77, 78, 79, 80, 81] has shown the changes and processes of evolution during past 30 years that influenced the OI.

Piller and Walcher (2006) [60] discussed web-based toolkits designed to create users' ideas competition.

West and Gallagher (2006) summarized the lessons learned from open source software development regarding the managing OI challenges. [83]

- Schrage in his interview on Innovation (2004) [51] have recognized “peer review notions of innovation”
- Johansson (2006) has introduced De-Medici Effect, where intersectional OI (the one that spans disciplines and cultures) generates breakthrough results. [39]
- Miotti and Sachwald, (2003) [49] have analysed energy sector, focusing on investment in R&D, R&D activities and cooperation for innovation.
- Brockhoff (2003) presented customers’ involvement in new product development as a successful strategy and tactic to improve new product success. [7]
- Dahan and Hauser (2002) [19] have described information technologies role in new capabilities adding for the rapid and inexpensive customer input to the product development (PD) process.
- Lilien et al. (2002) [46] have focused on lead user in idea-generation process for new product development.
- Carr (2007) in his review on open source contribution emphasized open source model for an important role in innovation, but reminded on its limitations. [9]
- Rigby and Zook (2002) [65] have discussed upon the academic community initiative on opening of the enterprises’ to adopt innovation.
- Sobrero (2002) [71] discussed upon the role of contractual and organizational arrangements for the governance of supplier-manufacturer relationships in new product development projects.
- Olson (2001) [54] described user's role in the new product development process as limited or non-existent in many high tech firms, despite evidence that customers are an excellent data source for new product ideas with great market potential.
- Fritsch and Lukas (2001) [26], analysed the propensity to maintain different forms of R&D cooperation with customers, suppliers, competitors and public research institutions.
- Porter and Stern (2001) [63] noted that innovation and knowledge external sources are increasingly relevant.
- Takeishi (2001) [73], described how a firm could outperform others in managing the division of labour with a supplier in product development.
- Quinn (2000) [64] presented strategically innovation outsourcing, by using the most current technologies and management techniques can put a company in a sustainable leadership position.
- Kaufman et al. (2000) [41] have analysed strategic networks and linkages, as well as supplier typology in collaboration analysis.
- Shapiro (1999) [69] systematically explained the concepts and strategies for successful navigation through the network economy.
- Dyer and Singh (1998) [22] outlined a theory for considering dyads and networks of firms as a key unit of analysis for explaining superior firm performance.
- Nonaka (1994) [53] proposed a paradigm for managing the dynamic aspects of organizational knowledge creating processes.
- Hagedoorn (1993, 2002) [32, 33] have analysed motivation and circumstances impact to the rationale of strategic technology partnering and inter-organizational R&D cooperation, cooperation modes and specific sector differences.
- Kodama (1992) [43], has described the technology fusion and its impact to R&D.
- Pisano (1990) [61] described boundaries of R&D and shown its influence growth.
- Cohen and Levinthal (1990) [18] have described enterprise potential for knowledge recognition and its absorptive capacity.
- Teece (1986) [74] explained on profiting from technological innovation, why innovating firms often fail to obtain significant economic returns from an innovation, while customers, imitators and other industry participants benefit.
- Metcalfe and Boggs, 1976 [50] have described critical elements in distributed packet switching for local computer networks.
- Solow (1957) [72] had found innovation and technical progress as the main drivers for economic growth.
- Kuhn (1962) [44] presented OI as the second significant paradigm shift in the innovation history.
- Alexander (1957) [2] in “A Pattern Language: Towns, Buildings, Construction” have ensured innovation management comparisons with the world of building.
- Rogers (1962) [66] has set the stage with his insights into the diffusion of innovation leading to adoption.
- 40 years later (2003), the paradigm shifted to Chesbrough’s first-generation description of OI. [14]
- Considering social innovation we meet questions related to meaning, goals and consequences. [70] The

results of social innovation are all around us. They include fair trade and restorative justice, hospices and kindergartens, distance learning and traffic calming.

5 Innovation development

For the accurate OI description, Curley and Salmelin [16] recognized 20 points:

1. Shared value and vision,
2. Quadruple Helix, by Asplund [4]
3. Innovation Ecosystem Orchestration and Management,
4. Innovation Co-creation and Engagement Platforms,
5. User Involvement, Centricity and Experience,
6. Openness to Innovation,
7. Adoption Focus,
8. 21st Century Industrial Research,
9. Sustainable Intelligent Living,
10. Simultaneous Technical/Societal Innovation,
11. Business Model Innovation Osterwalder and Pigneur's (2010) [55],
12. Intersectional Innovation, according to Frans Johansson, The Medici Effect. (2006) [39],
13. Full-Spectrum Innovation, by Keeley (2013) [42],
14. Innovation Approaches Using Mixed Models
15. Servitization,
16. Network effects,
17. Management of Innovation as a Process or Capability,
18. High-Expectation Entrepreneurship,
19. Social Innovation, by Mulgan (2007) [52],
20. Intellectual and Structural Capital.

The introduction of the European Innovation Scoreboard (EU 2012) [24] included a relative performance measuring of national innovation ecosystems, as well as identifying constraints areas where improvements need to be made leading to improved national performance.

6 Open innovation paradigm – recent development and methods

The central idea of OI is that enterprises can't afford relying exclusively to own R&D based innovations, but should buy or license solutions outside. Additionally, internal inventions not used in a company's business should be "exported" outside.

Two OI conferences were held in Dublin (May 2013, June 2014), and the most recent in Espoo, Finland, in June 2015 [56]. During the 1st Dublin conference, leading innovation experts have created the Dublin Innovation Declaration [57] a document for future innovation policies, a sort of OI manifesto.

OI models such as Product platforming are oriented towards developing and introducing a partially completed product, in order to extend the product's functionality platform by increasing the product overall value. Examples, like software development kit (SDK), or an application programming interface (API) are topic relevant. [26] Idea competitions assume implementing encouraging system for competitiveness among contributors by rewarding successful submissions (hackathon events and similar competitions). That will ensure minimum-cost access to innovative ideas and insight into the customers' needs. [26] Customer immersion involves extensive customer interaction through the host organization employees. Customer input may be incorporated, allowing their involvement in product management cycle and the design process itself. Collaborative product design and development ensures enterprises more control through ensuring the planned product development timely and reducing the cost of R&D. When considering new concepts in OI, we may take into consideration innovation networks - a concept that brings a design process contributors' network, by offering a various forms of reward. There are also various opportunities for organizations:

- 1) Revealing - sharing resources with other partners, without a direct instant financial reward.
- 2) Selling - a type of OI commercialization through selling or licensing technology to a third party.
- 3) Sourcing - using external knowledge freely available, as a source of internal innovation.
- 4) Acquiring - buying innovation from partners through licensing, involving reward for particular external knowledge

OI and open source are not exclusive, participating enterprises may donate patents to an independent organization or grant free license use to anybody, as in the IBM's Eclipse case, where competing firms cooperate inside an open-innovation network. [23]

7. Conclusion

Open innovation as a concept, became a controversial topic, a contemporary innovation management practice and a paradigm, attractive both for practical business reasons and academic research. The argument for this claim is based upon the significant increase in number of organizations opened to innovation management and research papers, scientific and professional publications, leading to additional interest for innovation management, as well as for open innovation, and it is important to know that those trends are mostly related to contemporary management.

Innovation management was developed through few past decades and opened area for various specific

ways and paradigms, so researchers needed specific approach, in order to satisfy specific needs of the topic or the study.

Since the beginning of the past decade and previous works from prof. Chesbrough, [13] we have clear picture upon OI basics and definitions, as well as upon trend of growing number of organizations accepting this practice.

There are still unclear parts and lessons not learned, as we still don't know what consequences and issues we will face in the future regarding this practice.

Less innovative and following oriented organizations are not always opened to innovations, or at least are in need for new environment adaptation. Additionally, there are issues on experiences transfer and implementation in new environment. New studies and papers are ensuring insight into concept, practice and opportunities for quantitative studies and research.

Case studies, the one from prof. Chesbrough and past decade works (Huizingh, Huston and Sakkab, 2006; Chesbrough and Crowther, 2006) are more descriptive and need further research upon OI – not only early adopters experiences [38] need to be discussed and considered, as there are so many organizations in follower position, so their experience is also precious and necessary for the further works. Huizingh noted that OI practices are more common at SME's during the latter innovation phases, as Lee et al. (2010) observe. [38, 45] He noted that there is additional need for normative research and large scale quantitative studies, so to analyse complex models and influences related to OI implementation and following. Also, he asks on future of OI and doubts whether “the term will fade away. Not because the concept has lost its usefulness, but, on the contrary, because it has been fully integrated in innovation management practices.” [38]

West and Gallagher [83] presented the fact that OI incorporates essential component to the traditional innovation and accelerates collective learning and value creation. Marais and Schutte [68] have described innovation processes as a vehicle for competitiveness driving quest on a product, process or a strategic level. They have considered OI advantages, such as cost reduction, productivity improvements, customers' inclusion, synergism and marketing potentials, as well as disadvantages, such as information management risks, protection risks, identification and controlling risks, as well as eternal changes risks, not only for the strategies, but also for operative level.

Open innovation has become one of the controversial and intensively studied topics in innovation management. A Google Scholar search on open

innovation” [36] 5 years ago provided over 2 million hits. Few days ago [36] those figures exceeded 3 million and number of articles still grows.

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