

BENEFITS AND DISADVANTAGES OF USING OPEN INNOVATION IN INDUSTRY

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Abstract. This paper presents a study on the benefits and challenges of applying an open innovation model to industrial enterprises. A characteristic of the open innovation model and paradigm has been made and its essential features have been derived. First, an analysis of the benefits of applying this model in the industrial environment has been conducted. On the other hand, the main potential disadvantages and challenges to the implementation of the model in practice have also been analyzed. The challenges and limitations of the model are effectively classified into five groups based on the aspect of the undertaking's activities that they affect. Some recommendations have been made on how to overcome them or mitigate their negative effects.

Key words: open innovation, industrial enterprise, industry, management, innovation model

Introduction

Since the advent of Industry 4.0, which encompasses automation, intelligent systems, robots, cloud computing, innovation accelerators, the Internet of Things (IoT), and agility, innovation has become more widely recognized as the driving force behind the knowledge society. Indeed, "Industry 4.0" refers to the intelligent networking of industrial machinery and processes through the use of information and communication technology. Industry 4.0 is a concept that grew from a German manufacturing project ('Industrie 4.0') and has since evolved into a globally recognized term. It is a new phase in the development of the industrial value chain process. Industry 4.0 is focused on transformation of business models and processes. The aim is to increase profit, reduce costs, improve customer experience and satisfaction, improve customer loyalty, and increase competitiveness. The trends point to growth and development through innovations in every aspect.

Now, the digital transformation of manufacturing is a reality, and new technologies, technological possibilities, and innovation are beginning to play a significant role. In today's rapidly changing economic and social environment, the search for and discovery of an appropriate and efficient business model is a critical success factor for the development of industrial businesses. The innovation model, on which the enterprise creates and implements innovations in all crucial activities, is an integral part of this business model. It is undeniable and proven by practice that in the current crisis conditions, innovation is an unavoidable factor in overcoming negative effects and adverse business circumstances. In this regard, open innovation is a relatively new model that is only now being imposed on industrial enterprises for the purposes of innovation development and innovation management. It is becoming increasingly important in industrial production and activity due to its benefits and the need to find new ways to generate ideas, create new products and services, and improve processes and operations. As a result, managers are becoming more interested in the model's abilities, and more and more businesses are looking into whether and how they can use it in their innovation processes.

This research focuses on the study and analysis of the model's advantages, potential disadvantages, and limitations in its application in industrial enterprises. It is based on a critical review of basic theoretical productions, an analysis of previous practice in Bulgarian enterprises, and the results of a survey conducted in forty enterprises. On this basis, the main benefits and beneficial effects of using the model are summarized. They are developed and classified into five groups based on various criteria, potential challenges, and limitations in the model's application.

Nature and characteristics of open innovation

The essence of open innovation is based on the concept of bridging and blurring organizational boundaries in order to generate more quality ideas that can lead to the generation and development of ideas as well as the realization and implementation of innovations. The concept of "open innovation" was introduced to distinguish it from the more traditionally created and widely used "closed innovation". As a result, at the start of the twenty-first century, open innovation was presented as a new paradigm for innovation management that broke the link with closed innovation and completely changed the view of innovation models and their content [2, 3, 4, 5, 6]. The premise of open innovation is that businesses can and should broaden the scope, the aim, the effects and the participants in the innovation process. In order to advance technologically and economically, they should combine external ideas with internal ones, as well as internal and external routes to the market [2, 3, 4, 5, 6]. Ideas are therefore at the heart of the concept of open innovation, regardless of how they are born and their approach to problem solving.

Open innovation is defined as a relatively new business model for managing innovation. Collaboration and mutual exchange of knowledge, skills, experience, and resources within and outside the enterprise are encouraged through its application to create innovation in the most widespread, effective, and rapid way possible. As a starting point,

Chesbrough's definition of "open innovation" [5] is used in explaining the concept. It states that open innovation is the use of targeted internal and external flows of knowledge to accelerate internal innovation and correspondingly expand markets for external use of the innovation [5]. The open innovation model is non-linear and decentralized, which allows for a lot of ideas to be looked at and chosen, before one is chosen and used.

The specific way in which the R&D process is viewed and organized and the innovations themselves are created is a key feature of open innovation. The most significant difference between the two models – the open and the closed one – stems from R&D's role and place in the creation of innovation itself. R&D is not a strictly centralized, one-way process in the open model [7]. Thus, R&D can be organized across multiple undertakings, enterprises, or organizations that are not based in the same country or region. On the one hand, R&D outputs can come in from outside the enterprise, and on the other hand, internal R&D outputs can leave the enterprise to generate revenue before their final completion for their creator, as well as to gain the opportunity for further development and commercialization by other enterprises [1].

The open model is associated with the targeted use of knowledge inputs and outputs to accelerate internal innovation and, as a result, to expand external innovation markets [2]. This intensifies communication with consumers, suppliers, researchers, partners, and industrial enterprises, non-profit organizations, and even competitors, whose behavior serves as a barometer of the market state, trends, attitudes, and the direction of business and innovation development. The open innovation model is based on the belief that useful knowledge, resources, ideas, and experience are widely distributed rather than concentrated [8]. The generation of innovation should not be limited by place and time, which means that it should take place in a variety of geographical and temporal locations. To that end, a decentralized, flexible, and non-linear approach is used so that this knowledge can be aggregated and used in a targeted and effective way to generate innovation and, thus, economic benefit for the enterprise. Several groups of actors are involved in the process, and the potential future innovation affects them both directly and indirectly.

Inside and outside the enterprise, knowledge flows. It should be used to the enterprise's advantage by sharing knowledge, experience, and resources gained and obtaining those from other partners in order to generate added value. Opening up to an outside perspective on the process of generating ideas and turning them into innovations gives industrial businesses a new perspective and horizons. All participants in this process, by definition, should actively seek, receive, and exchange information that flows freely across enterprise boundaries. There are many ways to share ideas and solutions as well as work together to achieve open innovation. This is the result of all the different types of collaboration between partner organizations, universities, research institutes, government representatives, start-ups and spin-off companies, freelance experts from all over the world, as well as non-profit organizations.

In a complex, dynamic, highly competitive, and risky external environment, open innovation provides a new conceptual framework for innovation management in the process of innovation idea emergence, development, implementation, and market realization. Taking this into account, open innovation can be thought of in the following ways:

- as a complex activity, the integrity of which is based on a series of different activities with a common goal: to create a scientific and technical innovation that is feasible in practice and subject to market interest and demand;
- as a series of distinct phases that may occur sequentially or concurrently, as practice allows;
- as an end result, tangible or intangible in nature, depending on the innovation itself, in the form of a good or service.

The current paradigm shift necessitates fundamentally new positions and modes of thought. According to open innovation, it is not necessary to rely solely on innovation and research to reap economic benefits. Other things being equal, increasing the number of sources broadens the scope and range of direct and indirect benefits of innovation. The emphasis is shifting from who and where knowledge, skills, innovation potential, and intellectual property are created to how they are purposefully used for business.

Analysis of the advantages of open innovation

Open innovation, along with its various practical modalities, is being put into practice based on its benefits. In this way, open innovation could help the enterprise build a positive image of being more transparent, open, and flexible in how it manages new ideas and makes them happen. Because open innovation is so flexible, it could help the company build a good reputation.

For the purposes of this study, the opportunities and potential benefits of implementing an open innovation model are analyzed and summarized based on a review of theory, an examination of Bulgarian and international practice, a survey of business representatives, and the use of a case study approach. They are numerous and diverse in their directions, extending beyond an innovation's economic, managerial, technological, and social aspects. The following potential opportunities and benefits have been identified:

- transferring knowledge from research to production in order to get a finished product and speed up the transfer of technology;
- quick access to additional or fundamentally new knowledge, ideas, skills, and experience that are not a result of previous enterprise activities and will be obtained externally but used within the organization;

- R&D costs are lower because research is done collaboratively and with the assistance of other partners, rather than spending time and resources to ensure organizational capacity;
- accelerating processes and reducing time to market (as a result of the innovation process) through the involvement of various actors and the distribution of activities and tasks;
- improved stakeholder communication management;
- improving process efficiency and effectiveness through a division of labor among partners based on their competitive advantages;
- because users were involved in the process and came up with ideas to solve problems that they found, user satisfaction rose;
- combining resources to compensate for organizational flaws and increase the potential for innovation;
- establishing the enterprise as an open, accessible, and transparent organization, alongside the creation and development of a brand identity, a strong image, and the expansion of innovation potential and capacity;
- risk allocation and risk management are accomplished by sharing or transferring risks among various actors in the innovation process;
- collaboration provides the enterprise with access to new innovative technologies and machinery that the enterprise does not have and cannot afford;
- access to and/or participation in the development of know-how, manufacturing experience, and show-how, all of which are required for the creation of marketable products;
- faster technological development, thanks to collaboration with other organizations and exposure to the outside world and its opportunities;
- gaining more competitive advantages through shared resources than if the enterprise did not use an open innovation model and a strategy of collaboration and leveraging others' advantages;
- gaining experience through participation in large projects with a large number of participants;
- a higher level of openness and adaptability allows for greater flexibility and adaptability in management strategy, models, methods, and techniques;
- increased transparency and decentralization, allow for a more adaptable process of idea generation and the realization of innovations.

In light of these benefits, the use of open innovation as a development path in the field of innovation for large industrial enterprises is a potential development path due to its higher capacity. They can easily transition from putting the model into practice or combining it with a closed model.

It should also be noted that the adoption of the model by industrial enterprises does not automatically result in the resolution of all issues related to innovation, such as taking an active investment stance, low innovation activity, and building and developing innovation capacity. However, the model is a chance to make up for some shortfalls. These are insufficient organizational capacity, resources, experience, knowledge, and ideas that can be sought and obtained from outside sources through broad-based collaboration in solving common or similar problems. Strategies for combining open and closed models are feasible and acceptable if the specifics of the field and subject of activity, the specifics of a enterprise's business model, and the opportunities, realities, and desires of managers are considered. The model, in general, can be modified to meet the needs and goals of the business. It can also be tailored to the objective and focus of the enterprise itself.

Analysis of the difficulties and constraints to open innovation

Based on a critical examination of theoretical frameworks and practical perspectives on the subject, it is necessary to analyze not only the potential opportunities, but also the challenges and constraints that businesses may face during implementation of the model. The goal is to identify these, group them together, and look for ways to deal with or mitigate them so that the benefits are realized to the greatest extent possible while also making the innovation process as efficient as possible.

Based on the study of theory, analysis of Bulgarian and international practice, conducting a survey among business representatives, and analysis of case studies from practice, the challenges that businesses may face when implementing an open innovation model are highlighted. They are divided into several groups based on the type of innovation and the issue being addressed. The most important ones are classified on the basis of the aspect of the activity to which they apply, as follows:

- economic difficulties;
- difficulties in management, strategy planning and administration;
- legal difficulties and ambiguities;
- technological and technological difficulties;
- social, cultural, and psychological difficulties.

Economic difficulties

The process of open innovation requires the provision of a diverse variety of resources, which implies expenditures associated with their timely acquisition. This fosters financial and economic challenges. Securing sufficient resources,

determining the role of one or more players, and allocating the expenses they will spend versus the co-benefits they will receive are all crucial steps in the innovation process.

Economic and financial risk, as well as an inability to get steady finance, can all be cited as significant hurdles to the implementation of open innovation in industrial firms. Due to the engagement of multiple parties, concerns have been raised regarding securing adequate and timely funding for innovation-related initiatives. Financing open innovation can be challenging due to the involvement of multiple parties and the need to obtain consensus on crucial financial and investment concerns, financing sources, and distribution.

Because financing is a necessary requirement for innovation, it serves as the pivot around which all those participating in the process of innovation will need to pose questions and seek solutions. Additionally, the state and its institutions should promote broad and open dialogue that supports corporate innovation.

Difficulties in management, strategy planning and administration

Open innovation requires the involvement of a varied range of actors throughout the innovation process. This enables the formation and escalation of a variety of management, strategic, and administrative challenges. There may be conflicts of interest, collisions of expectations, visions and decisions, strategies and objectives, and guiding principles for management and resource allocation.

Uncertain or inconsistent goals that do not crystallize around the end result, innovation, can also lead to innovation process difficulties. While the decentralized management of open innovation has demonstrated benefits, it is not without downsides and hazards. They are possible under certain environmental and internal conditions.

The extent to which one or more actors are involved in the process, their inappropriate selection, how control and coordination are exercised, how feedback is given and reflected on, how outputs and intermediate outcomes are monitored, how processes are effective and efficient, and how they are administered are all critical. They are a challenging field, and as such, they might act as a barrier in the innovation process. There may be inconsistencies in the structure, stages, processes, operations, models, methods, and tools employed, resulting in organizational, administrative, and operational concerns with the processes, their management, and control.

Managers should prioritize integrating the various stages of innovation and the actions of various partners. The primary impediments to open innovation in industrial enterprises in this direction are the process's complex organization and management, determining the optimal approach to peer networks, administering a process involving numerous actors, and striking a balance between competitive and cooperative relationships. Additionally, the evaluation of main and secondary data revealed a lack of a clear direction toward positive transformation. It is critical to have staff on hand who possess the necessary expertise, knowledge, skills, and competence to contribute to innovative processes.

As a result, it is vital for management and staff to share a common attitude and concepts, as well as to place a premium on knowledge, creativity, and innovation. Addressing these issues requires significant management capacity, capability, strategy, and tactics in order to develop and implement a balanced approach to managing the many stages, the use of intermediate and final process outputs, and communication among all stakeholders. To ensure a smooth transition to open innovation, it is vital to incorporate open innovation into enterprise strategy and business models, as well as to identify and apply the management influences necessary for innovation development.

Legal difficulties and ambiguities

Legal concerns generally revolve around intellectual property rights and their protection. As demonstrated by surveys and conversations with company leaders, the question of intellectual property and its protection becomes crucial during a partial or complete shift to an open innovation paradigm. Increased demand for goods and services is resulting in increased technological sophistication and complexity, which results in a diverse range of intellectual property rights. Industrial firms increasingly rely on third-party intellectual property rights to innovate.

Collaboration and cooperation of a diverse range of players are required to produce novel solutions, which raises concerns about intellectual property. According to academic research, widespread adoption of open innovation in practice involves the creation and implementation of novel intellectual property protection mechanisms. The new models should provide managers with greater assurance and clarity regarding collective bargaining results.

It must be ensured that the advantages outweigh the work expended. This is still a key issue, and it is one of the reasons we are refusing to switch to an open innovation model, in whole or in part. In this regard, it is critical to thoroughly investigate and clarify the issues of intellectual property protection and enforcement, as this will provide greater clarity and certainty for business representatives and alleviate their concerns about sharing or co-creating ideas, experiences, know-how, and show-how.

As the methods and approaches by which intellectual property is created and used change fundamentally as a result of open innovation, the question of and perspective on intellectual property changes inexorably. Over the last few decades, innovation has evolved into a collective and collaborative endeavor. Intellectual property and the protection of intellectual property rights are the primary impediments to open innovation in industrial firms. These three factors serve as the foundation for implementing open innovation.

An assessment of the current legal environment finds that no formal legal framework exists to regulate and guide collaboration between firms, organizations, and institutions in the area of innovation. This is an obstacle to implementing an open innovation paradigm in business practice. Legislation must be amended on a timely basis to

reflect current practice and developing trends. To encourage the adoption of such models, the legal structure and rules must be more definite and transparent.

Technological and technical difficulties

Because multiple actors are active in various phases of the process concurrently, open innovation has a substantially higher level of technological complexity. Numerous autonomous entities operate individually, but also in coordination and collaboration, to accomplish a shared goal: the creation of an innovative product. A unified innovation strategy is crucial in this regard and should bring them together. The critical role of technology in industrial enterprises demonstrates the critical role of innovation, which is impossible without it.

According to this perspective, potential barriers to activity include a lack of technology and equipment, as well as inequality and/or technological inequalities between partners. Due to the fact that the open innovation approach requires the use of a platform, its selection and relevance are crucial. However, in an era of rapid technological advancement, adopting an open innovation approach may assist organizations in acquiring new technologies and identifying new ways to enhance the technological and innovation environment.

Technological improvements, such as artificial intelligence, are unavoidable in the future, and businesses must brace themselves to improve their positions and defend against competitors [9]. Their aim to acquire cutting-edge technology in order to create convertible items with a high market value is rational and justified. The primary impediments to open innovation in industrial enterprises in this direction are the following:

- limited access to scientific and technological advances;
- relatively limited technology transfer;
- a lack of a strong link between science and business, as well as a limited exchange of useful ideas and knowledge that can move from theory to practice;
- the absence of a clearly defined strategy for pursuing partnerships and participating in innovation and business networks.

Given that open innovation is all about technology, it is critical not to disregard technological and technical issues. An analysis of the enterprise's current state, the development and implementation of a partnership and network development strategy, the development and implementation of a business development plan, and the research and selection of financing options for the provisioning and management of communications technologies are all required.

Social, cultural, and psychological difficulties

The open innovation model's implementation is frequently hampered by social, cultural, and psychological challenges. The survey also demonstrated this. Some managers argue that their position is supported by psychological and social factors. Reluctance, fear of change, and adherence to tried-and-true approaches have all been cited as reasons for refusing to revise the model, analyze its potential benefits, and consider whether and how it is applicable in the project at hand. Second, in accordance with the model's principles, communication between all actors involved in the innovation process is essential from beginning to end. This raises the issue of the social, cultural, and psychological aspects of innovation, which are often overlooked as factors in the success or failure of one model or another.

Communication problems and gaps, providing and reflecting feedback, participants' critical and biased attitudes toward the model, a lack of sufficient engagement and motivation for active participation in the process, a lack of trust between partners, and intercultural differences are all potential challenges in this area. Many different participants are involved in one or more stages of their own open innovation, and they may come from various nationalities, ethnicities, religions, beliefs, social attitudes, and professional and life experiences. As a result, social, psychological, and cultural challenges may occur at any point of the process, as participants not only do not belong to the same organization, but also to distinct official and informal groups. Due to their involvement in the process and goal setting, it is necessary for them to reach consensus and continue working in this direction indefinitely, communicate and act pro-actively as a team, cooperate, and achieve a common result based on each participant's competitive advantages against a single specific objective. It is critical to develop and implement model-based management strategies, techniques, and models.

Special attention should be devoted to the communication process and its efficient operation at the corporate and partner network levels. Additionally, it is critical to establish a company culture, way of thinking, and attitudes among management and staff that are oriented toward the systematic pursuit of new discoveries, improvement ideas, and untapped prospects. The open innovation model incorporates all ideas, even those generated from the bottom up.

Management must have a strong commitment to active inclusion, the development and participation in innovation and business networks, and the pursuit of partnership with other firms, institutions, and organizations in order to grow capacity and innovate. In this sense, enforcing an entrepreneurial and innovative culture is the first phase in this gradual process. With a significant level of globalization and integration, network engagement and openness to cooperation are a natural response to the impact of external factors and the objective need for innovation development and change management.

At the moment, the ability of industrial enterprises to adapt to global challenges is essential to their viability. They should invariably adhere to changing economic conditions, a turbulent business environment, the dynamics of consumer expectations and attitudes, and the requirements imposed by the covid crisis. Recently, businesses have begun to

incorporate creative concepts with a variety of origins, characteristics, and applications in order to stay up with their growth.

It is the provision and accumulation of a critical mass of ideas, knowledge, experience, and information from both internal and external sources that contributes to an organization's potential and viability for innovation. Economic growth accelerated logically, resulting in the establishment of an open and externally oriented model that industrial businesses began to prefer and adopt. It has a place in contemporary business practice, which increases research interest.

The progressive move from closed to open innovation is motivated by global realities and the imperative for change, as the closed model is incompatible with the high dynamics and requirements of the economy and society, and some of its problems result from these incompatibilities.

Conclusion

In summarizing the study's findings, it is determined that the rationale for imposing one or more new models is the assumption that they are useful, effective, and adaptable and that they would provide the enterprise with more benefits than negatives. Developing managers' mindsets to be open to and seek out the novel without prejudice or fear is a social, cultural, and psychological challenge. It is possible to overcome it through learning about others' experiences, which should motivate managers to integrate it into their business practices. Many difficulties and barriers can be overcome if enterprises' behavior and strategy are more open and flexible and the managers use agile problem-solving approaches. Under such circumstances, the opportunities to benefit from an open approach to innovation can be fully exploited. This is important because, in today's fast-moving world, looking for and finding new ways to be innovative and improve things increases the chances of getting out of the crisis and making things better for the future.

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