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## OPEN INNOVATION AS A NEW PARADIGM IN RESEARCH AND BUSINESS

**Abstract:** *In order to gain the competitive advantage on the market, companies need to seek for ways for improvement of their process and products in continuous manner. The real improvement comes with innovation. Innovation is explained as the application of new ideas to the all aspects of activities that companies perform. In order to clarify the phenomena of innovation, this paper explains new paradigm in the business – open innovation, benefits and shortcomings of this concept, relation with quality, as well as set of different accompanying terms (crowd sourcing, off-spin) and dimensions of openness (inbound, outbound). Having in mind that defense industry sector is not staying immune to this concept, its innovative approach is explained also in an example. Findings in this paper relays on variety of articles and reports published to support this new paradigm.*

**Keywords:** *open innovation, quality and innovation, defense and innovation, crowd sourcing, spin-off.*

### 1. Introduction

In order to compete at the market, companies need to respond to changing environment and customer needs in fast manner. Only way to achieve this is to have distinctive and excellent products.

Since the companies have become consistent in delivering a certain level of quality, they need to find another source of competitiveness. Nowadays, companies need to be more innovative in their products and business. Intense global competition and technology development have made innovation as a spurce of competitive advantage (Popa et al., 2010).

Innovation can be seen from different perspectives: functional source of innovation (functional relationship between innovator

and innovation, user, supplier, manufacturer, distributor, insurer, etc), economic expectations, quality, measuring innovation, stages of innovation, etc.

From the quality perspective, a quality improvement of business process and products is necessary. For the improvements, innovation is solution and can be applied in different company areas like technology, products, process (Anttila, 2016).

Innovation is explained as the application of new ideas to the all aspects of activities that companies perform, (Greenhalgh and Rogers, 2010). On the other hand, the European Commission (2016) explain that open innovation can not be define precisely, and hence better explanation for open innovation is as follows: “there is a range of context-dependent innovation activities at different stages, from research, to

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development trough to commercialization, where some activities are more open than others.”

For a long time it has been assumed that product innovation belong only to the manufacturers. Series of literature studding and explaining phenomena innovation reveals something different. It appears that source of innovation vary significantly, (Lassman, 2008). Namely, high cost of R&D, short product life cycle and increase global competition force companies to look for external knowledge and collaborate with other companies, institutions or individuals. Also, this does not mean that they give up of internal innovations, (Saebi and Foss, 2015).

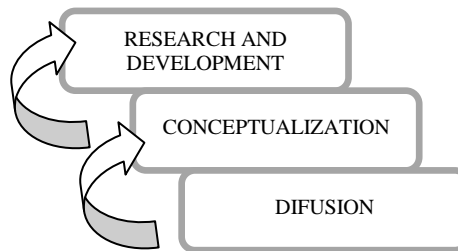
First chapter of this work start with explanation of differences between invention versus innovation, types of innovation and stages in innovation process. Second chapter is dedicated to new paradigm - open innovation, explains differences between closed and open innovation, inbound and outbound elements and reveals the role of EU in this concept. Third chapter reveals some details how open innovation concept is applied in governmental organization. Current approaches and perspectives in EU, role and responsibility of European Defense Agency as well as Serbian defense sector innovation approach, are also presented in this chapter. In conclusion, after short review of presented information, some proposition for further work on this topic is given.

## 2. Stages in innovation process

With the intention to get to the innovation we must first have invention (occurrence of an idea for a product or process that has never been made before). In order to become innovation, products must be introduced to the market and hence adopted by different users. But before being presented to the market innovation need to go through several innovation stages.

An innovation process may be decomposed

to tree phases (Popa et al., 2010) which is presented if figure 1. R&D phase compromise several steps and starts from basic research, through applied research which ends with inventions or blueprints that are then transformed into the functional model or prototype.



**Figure 1:** Stages in innovation process

After series of tests and functional probes prototype eventually get license to enter into the serial production. This marks the end of the R&D phase and enter into the commercialization phase. With the adoption of the market and users, product now became the innovation. Diffusion process characterize market penetration and start using of the products.

Between each of the phases there are feedbacks. Consumers during the use of the product sometimes find some faults or mistakes and fail a complaints. This complains is useful for doing incremental innovation on the products. Incremental innovation is a series of small improvements to an existing product or product line that usually helps maintain or improve its competitive position over time.

Innovation stages have been an area of interest for many researchers. How innovation is defined within organization will definitely influence what activates are going to take place in company. An innovation process may be analysed trough several stages (Popa et al., 2010): stage of knowledge gathering, stage of persuasion,

stage of decision-making, adoption, stage of confirmation.

The similar for both mentioned approaches is recognition of “adoption steps” which actually separate invention and innovation, and it is primary or basic characteristic of innovation, meaning that is not changing in any other approaches.

### 3. Open innovation

Researchers have realized that innovation can not be perform in isolation, so they are looking option for collaborative research and team work. Closed innovation will not disappear but trends such as digitalization, mass media, information technology and networking created environment for integrated collaboration (Curley & Salmelin, 2013).

These new trends have lead to the emerging of new paradigm – open innovation. First definition of concept of open innovation is linked to the Henry Chesbrough who stated that “Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Vanhaverbeke and Chesbrough, 2014).

Main components of this concept is presented on the figure 2, according to (Chesbrough, 2006).

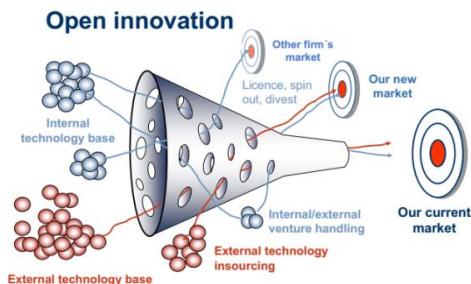


Figure 2. Open innovation concept

Figure 2 shows the knowledge flows from the company to the market and vice versa. Further in the text there are the explanations for terms presented at the figure. As new emerging concept, it was expected that open innovation had to improve almost everything that exist in R&D process characterized with traditionally closed innovation concept.

Benefits are enormous and comprehensive comparisons could be summarized in a variety of forms (Lukić, 2014; European Commission“, 2015) and for the purpose of this research, they are presented in Table 1.

Table 1. Closed/open innovation comparison

CLOSED INNOVATION
Employment of the best and smartest people in the field of company area of operation
Company conduct by itself whole process (discover, research and development, marketing)
Being first on the market with innovation means to win the competition
Control of IP so that competitors do not profit from our IP
OPEN INNOVATION
Working with people best in the business inside and outside the company
Combination of internal innovation effort with external knowledge
Better business model actually win the competition not model itself
Win the competition with best use of internal and external ideas, not just to come up with best or most ideas
Consideration of buying other company Intellectual property whenever it advances our business model

#### 3.1. Inbound and outbound innovation

After the introduction of this concept from Chesbrough, wider science communities have started to pay attention and studied it. In order to clarify and avoid the possible misunderstandings about the open innovation approach, Dahlander and Gann (2010) have made distinctions of inbound and outbound innovation and further divided it trough pecuniary versus non-pecuniary

(2x2 matrix) as presented in Table 2.

**Table 2.** Different forms of openness

	INBOUND INNOVATION	OUTBOUND INNOVATION
PECUNIARY	Acquiring	Selling
NON PECUNIARY	Sourcing	Revealing

Furthermore, the same authors explain outbound innovation as process of revealing internal resources to the external environment (either selling or revealing) while the inbound process (acquiring, sourcing) is opposite to this.

Additionally to previously mentioned, revealing is process where companies “reveal” its internal resources (design, performance, study) to the market but financial rewards come later. Depending on how company treated ownership rights (patent, copyright, product sometimes is not protected) other companies will decide whether and how to cooperate. Selling is explained as process of commercialization of products or licensing out resources for fully leveraging its investment in R&D. Spillover effect is typical for this process meaning that excess and unused patents are sold or license out of the company.

Prior to initialization of R&D process companies should look for ideas outside. If it is available, it does not just mean that it needs to be collected and apply, additional assessment is required and maybe some adjustment too for the incorporation within company project/product.

The table 2 could be extended in a manner of wider and comprehensive explanation of different forms of openness (Lukić, 2014), using same differentiation to inbound and outbound practices. Within the inbound practices author has listed: consumer and customer co-creation, information networking, university research grants, publicly funded R&D consortia, contracting with external R&D service providers, idea and start-up competitions, intellectual property in-licensing, supplier innovation awards, crowd-sourcing, specialized services

from open innovation intermediaries.

What is crowd-sourcing? In order to solve problems, generate new ideas or carry out time consuming and labor extensive work (in ICT means, which can not be done by small group of researchers) it is necessary to establish communication with citizens, particularly those who are not the member of science communities (Lichten et al., 2018). Digital technology and networks have enabled this to be done easily and on benefits of both sides.

Within the outbound practices author has listed: Joint venture activities with external partners, selling of market-ready products, participation in public standardization, corporate business incubation and venturing, intellectual property out-licensing and patent selling, donations to commons or nonprofits, spinoffs.

What is spin-off? Spin-off is a process of creating of an independent company from the parent company, throughout the process of sale or distribution of one part of the business to the new company. A spin-off company retains its assets, employees, and intellectual property from the parent company, which gives it support in a number of ways.

### 3.2. The role of European Union in the innovation

European Union is increasing its financial commitment to innovation related projects. One reason for this is that innovations create investment opportunities for new products what eventually lead to competitiveness and employment. Second one is to take a chance to advantage from the benefits that innovation brings to “citizens in terms of tackling societal challenges and boosting business and industry”, (European Commission, 2015).

European Commission aims to ensure appropriate framework to open innovation through three pillars: 1. Reforming the regulatory environment, 2. Boosting private

investment, 3. Maximising impacts.

According to European Commission report (2015), beside the capitalizing on the trends such as digitalization, mass participation and collaboration (inherent for open innovation), European Commission concept of open innovation is characterized also with: combining the power of ideas and knowledge from different actors in order to co-create new products and find solution for social needs and shared economical and social value (including citizen and user-centric approach). The level of success of the innovation ideas and how far they can reach, depend on the environment that create EU in the field of regulation, financing, public support, market access.

From the science point of view and regarding the innovation, it would be worthwhile to mention project call Horizon 2020 which goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation. This is being done through the pairing of research and innovation. One of the program initiatives, in the field of innovation, is to remove obstacles to innovation like expensive patenting, market fragmentation, slow standard-setting and skills shortages.

#### **4. Innovation approaches in defense sector**

According to Muspratt, (2019) the defense sector in the coming period will be shaped by increasing digitization. He also added that “from the increasing risk of peer conflict to the rise of urban warfare, and increasing great power competition, the defense sector faces many challenges that must be approached responsibly. Indeed, government, industry and the military must collaborate to deliver meaningful change to ensure that overmatch is maintained in all areas, over potential adversaries.” With

previously said in mind, one of defense predictions for the forthcoming period is related to improved collaboration between industry and the military. Author going further in his predictions saying that benefits can be in the field of logistics, additive manufacturing and rapid prototyping, and talent management.

In order to achieve mutual understandings and both sides to benefit from this collaboration, the contractors need to inform the government of their true capabilities to help government develop achievable requirements, meanwhile the military needs to ensure industry fully understands what it wants, so, it can focus on developing higher-quality and affordable solutions (Muspratt, 2019).

#### **4.1 European Defense Agency innovation approach**

Main mission of The European Defense Agency (hereinafter EDA) with its 27 Member States (MSs) is improving MSs defense capabilities through European cooperation. EDA acting as an enabler and facilitator for Ministries of Defense of MSs helping them to engage in collaborative capability projects. In its work EDA cooperates with RAND Europe. It is not-for-profit research organization that helps to improve policy and decision making through research and analysis, (European Defense Agency, 2019).

EDA approach to innovation comprises of: development of specific technology watch and foresight tool, establishing of “EDA Defense Innovation Prize” for most innovative ideas and technologies applicable in defense domain, cooperation with several entities (civilian stakeholders, FRONTEX, the Joint Research Center, the European Institute for Innovation and Technology, ESA – European Space Agency, European Commission, etc). Key element of EDA innovative approach is establishment of the

relation with commercial sector. This will help defense industry to keep its technological edge (or bridge gaps were exist), identify advance and emerging technologies and implement them through innovative solution with primary goal to fulfil missing capabilities. This cooperation will for sure enhance current international cooperation to higher level.

In the continuation of this work two examples of innovation approach will be presented. One of them is related to project currently ongoing within EDA responsibility and second one is explanation of France defense sector approach to innovation.

1) In 2017 EDA hired RAND to investigate collaborative opportunities among EDA members and partner countries related to armored vehicles throughout the full life-cycle period of vehicles. Main findings from RAND research were: armored vehicle market has 18 different manufacturers, countries are predominantly focused on domestic or regional countries (only 8 of them exported outside EDA members) what lead to main conclusion that EU market characterize fragmentation and overcapacity, according to (Kepe at all., 2019). Having in mind main goal – “importance of defense collaboration in order to develop full-spectrum of land capabilities”, and through already established mechanism for the EU members” to develop and deploy defense capability jointly” (using mechanism called Permanent Structured Cooperation on security and defense - PESCO) Italy was designated as leading nation in collaborative development of an armored vehicle family. Results still remain to be seen.

2) Good example of innovative and unique approach is France defense sector. Open innovation is seen as option for acceleration of innovation through the combination of operational and technological readiness. To reach this goal transformation and more flexibility in system is needed. First step is forming the Agency, application of system engineering approach, new governance for

defense acquisition programs, flexibility in contracts etc.

Under the main General Directorate for Armament new Agency for innovation in defense has been formed. According to the accessible information they are planning to engage about 100 engineers and specialist to work for agency which budget should be around 1 billion euro. Main mission of this agency will be proactive work in the hunt for new ideas and concepts trough the coordination with institutes, universities, laboratories and networks of competence companies in order to apply these ideas for the defense intension.

Implementation of innovative approach will be applied through four steps: 1) Information gathering, 2) dissemination of gathered information trough appropriate authorities, 3) information study and project proposal, 4) engagement and further implementation.

Concept of work (trough forming of open innovation cell) comprises:

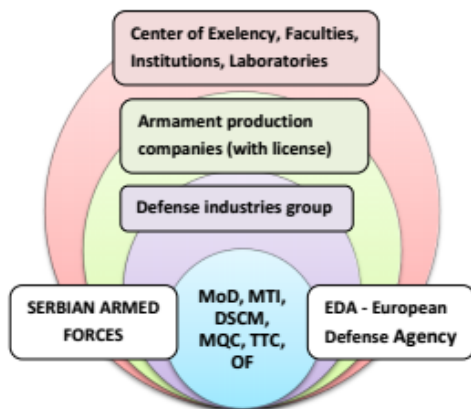
- Defense innovation watches (worldwide benchmark, trends monitoring, defense analysis).
- Adhesion of new concept/ideas from defense partners trough presentation.
- Improving work with business and start-ups.
- Encouraging collaborative innovation.

#### **4.2 Innovation approach in the defense sector of the Republic of Serbia**

Innovation approach in the defense sector of Republic of Serbia refers to the cooperation beetwen the Ministry of Defense as governmental institution (with its subsidiaries) and tree important entities: factories from defense industries group, armament production facilities, and academic and research institutions and international agencies (EDA, etc.).

Figure 3 indicate how this cooperation theoretically look like. In the core is the

MoD institutions (Military Technical Institute – MTI as R&D facilities, Direction for Standardization Codification and Metrology, Military Quality Control, Technical Test Center, Overhauling Facilities) and in cooperation with EDA and other entities try to fulfil requirements of Serbian Armed Forces. This should be done through several steps: R&D process at MTI and in cooperation with civilian institutions, production could be done through sourcing, establishing the cooperation with armament production facilities and through acquiring products at the market – domestic or foreign).



**Figure 3.** Innovation approach in defense sector of the Republic of Serbia

Main benefit of this approach is to further bust and include academic society in the cooperation with MoD for the benefits of both sides: MoD to be acquainted with new and latest innovation and to fulfill its demands and bridge technology gaps, as for academic institutions they would find market for the commercialization of its researches.

## 5. Conclusion

It is inevitable that concept of open innovation has arrived. It became a part of our everyday business and scientific

environment, and it is planning to stay for a long time. We just need to embrace it and profit on benefits that concept bring.

Innovation process has made big steps from being something invented from one researcher, through open innovation process up to ecosystem of networking in which participate individuals, companies, institutions, laboratories etc.

Findings in this papers relays on variety of articles and reports published to support this new paradigm. Main ides was to give brief overview of open innovation concept with accompanied element, including current practice in EU and defense sector.

Other then informative, facts and findings presented here should be encouraging and serve as guide for all those (companies, institutes, researchers) who want to success in their business, guide its own research and development and eventually beat the competition. It looks like that company can not perform this by itself, instead need to cooperate with others (there are examples of cooperation of two rival companies) in order to sell it products and gain profit.

From the science point of view work provide opportunities for researchers to extend current level of knowledge about open innovation trough, application of other levels of analysis, examine other phenomena inherent to this concept, address performance measurement related to open innovation, application of open innovation in services, etc (Joel & Boger, 2017).

Open innovation as new paradigm has changed our thinking about acquiring and commercialization of innovation.

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