Open Innovation Practices and Open Innovation Culture in the Life-Sciences Clusters. The Case of AstraZeneca

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ABSTRACT

The study contributes to the emerging debate on the open innovation ecosystems by sharing insights and knowledge on the open innovation practices in life sciences sector, using the example of Cambridge cluster and its linkages with AstraZeneca. The authors applied descriptive data analysis and case study method. The study shows that decentralisation of corporate R&D process and investments into building an open innovation culture enabled AstraZeneca to exploit its local knowledge and information more effectively. The example of AstraZeneca allows to understand better the phenomenon of open innovation and shares some of the open innovation instruments, which could be adopted by other firms.

Keywords: Cambridge, Life-sciences, Open Innovation, University, AstraZeneca.

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I. INTRODUCTION

The concept of “open innovation” refers to the idea that firms can and should use both external and internal sources of knowledge. Originally, the concept was explained by Henry Chesbrough, who claimed that companies should utilize both external and internal ideas and resources in order to create value and build its paths to market (2006; 2003). Moreover, he emphasized that the open innovation is a complex function of value creation, in which both - tangible (such as R&D investments, infrastructure, knowledge acquisition and competence development) and the intangible factors (such as social and cognitive skills) play role.

The ongoing Covid-19 pandemic revealed the importance of open innovation collaboration in the search for innovative and affordable therapies for complex diseases. Yet, other reasons, like declining productivity of the pharmaceutical industry, limited access to venture capital and R&D financing as well as the chances of duplication of numerous public programmes efforts are equally important causes to further explore open innovation collaboration models and practices.

The following study aims to contribute to the emerging debate on the open innovation ecosystems by sharing some insights on the open innovation practices and open innovation culture in the life sciences sector. More particularly, it attempts to answer how open collaboration models are developing in life sciences by taking a real case of the Cambridge cluster and its linkages with AstraZeneca. The authors applied a descriptive data analysis and case study method.

The paper is divided into four sections. The first two sections of the paper present the literature review and the theoretical framework of open innovation concept and open

innovation ecosystem. The third section discusses the open innovation practices in the biopharma sector. Finally, the fourth section discusses the selected case study and the open innovation practices using the example of the AstraZeneca. The paper ends with final conclusions and policy implications.

II. OPEN INNOVATIONS – CONCEPTUAL FRAMEWORK AND EMPIRICAL STUDIES

As The Innovation is the creative process which transforms new ideas into a real value. Therefore, the innovation capacity is an ability to continuously transform knowledge and ideas into new products, processes, and systems, for the benefit of both, business organizations and its socio-economic environment. There are different approaches, methods and concepts applied for managing and advancing this interactive innovation process. In general, the concept of “open innovation”, popularized initially by Henry Chesbrough (2003), refers to “the use of purposive inflows and outflows of knowledge to accelerate internal innovation processes” and expand the market opportunities for external use of innovation. recent studies have focused on the “open innovation models” as the predominant way to increase the interaction external partners (e.g., Chesbrough, 2003; Laursen, Salter, 2006; 2014; Hagedoorn, Zobel, 2015). The main difference between the two – closed and open – innovation models is that the first is internally focused, whereas the second one includes externally focused elements within particular organization’s innovation model. The open innovation model is therefore a two-way process, in which companies and other related organizations, have both “inbound process” (in which they bring in ideas,

technologies, or other resources needed to develop their own business or R&D capacity) and an “outbound process” (in which they out-license or sell their own ideas, technologies, and other resources) (Krause *et al.*, 2012). Thus, open innovation is a more than a simple correlation between R&D inputs and innovative output of single organization.

In the open innovation model, enterprises can initiate and nurture innovations within their own organizational boundaries, while at the same time bring ideas to the market and to benefit from external knowledge (De Jong *et al.*, 2008) (Fig. 1).

Fig. 1. Closed innovation vs. open innovation process.
Source: Rahman and Ramos (2010).

Open innovation can take such forms as licenses, patents, purchase of know-how, implementation of R&D contracts, cooperation with universities in the introduction and implementation of new solutions or purchase of university spin-offs, etc. As a result, firms and research institutions introducing open innovation practices leverage better their innovative potential (research and learning processes), team productivity and stimulate innovations, technological advancement in the fields that are at early growth of their technology cycles, technological converge with other industries or that may have high potential to solve critical societal challenges.

In sum, there are many advantages of engaging in open innovation process, including: resolving shared challenges within the innovation process; seeking economic and time efficiency benefits; seeking common needs for widely accepted tools and standards; better addressing challenges of broad societal and global significance. The open innovation benefits spread beyond the benefits to individual participants. In fact, they can be referred as systemic benefits to the entire innovation ecosystem. More importantly, open innovation

can reduce the cost of failure by avoiding duplication, promoting cross-sector collaborations and technological convergence, encouraging risk-taking and sharing best practices.

A. Drivers and Barriers of Open Innovation Ecosystems in Empirical Studies

Given the still relatively new phenomenon of open innovation there still not many studies investigating open innovations from the perspective of the systemic interlinkages in the open innovation ecosystem. The studies by Cattacin and Zimmer (2016) and Arocena *et al.* (2017) provide some successful examples of learning integration and academia-industry collaboration in the context of university-based LLs initiatives in Sweden, Denmark, Italy, Germany, and Spain, and at the cross-border Nordic-Baltic examples. More specifically, Arocena *et al.* (2017) bring example of role of Danish universities as drivers of local innovation, sustainable development, and regional innovation policy consultants. The authors conclude that engaging students in collaborative knowledge creation with external partners (including SMEs) can be important driver for regional innovation. Zaphiris and Ioannou (2018) demonstrate how online networking sites and crowdsourcing platform allow students, faculty, and other staff create and evaluate ideas for innovative processes, services, and products. Nevertheless, some earlier studies i.e., by Florida and Cohen (1999), Cohen and Noll (1994), Blumenthal *et al.* (1996), Brooks and Randazzese (1999) and others pointed to a possible detrimental impact of combining academic research and business-related activities and a lack of synergies between both activity realm. The conflicting nature of normative principles that guide academia and business sectors were at the base of these conflicts and concerns. This idea of conflicting nature has been also at the roots of the so-called “corporate manipulation thesis” (Mazza *et al.*, 2008). There are however very few studies examining the structure, drivers, and developments of university open innovation linkages with firms in the biopharma industries. The survey conducted by Florida and Cohen (1999) at the US university-industry research centres, suggested that research centres that valued the mission of improving industrial products and processes devoted relatively less R&D. Furthermore, studies by Cohen and Levinthal (1990) show that higher absorptive capacity of firms, driven by their active R&D activities, fosters their innovative potential development as well as higher ability to insource the external knowledge. On the other hand, intensive internal R&D activity, would supply companies with a lot of product ideas and new technologies, and the need for acquiring the external knowledge would decrease.

Moreover, legal, institutional, and socio-cultural factors may have large effects on the behaviour of firms and research organizations with respect to their engagement in open innovation practices. The legal or intellectual property rights (IPR) factor, relates to the costs of intellectual property (IP) protection and the procedure of claiming the IP. Chesbrough *et al.* (2006) suggest that strong IPR protection encourages disclosure and promotes efficient trade on various markets for technology, whilst weak IPR protection implies widespread existence of knowledge externalities (Malerba, Orsenigo,

1993). Consequently, having weak appropriability of IP regime means that each individual firm or R&D organization will have less incentive to conduct in-house R&D.

Last but not least, Dwyer *et al.* (2005) suggest that social and cultural factors have an influence on the diffusion of innovations and open innovation practices. The positive attitude toward open innovation is not something obvious and natural. The studies of the collaborative innovation projects demonstrate that successful open innovation partnerships require a cultural, social, and behavioural foundation (Herzog, Leker, 2010; Witzeman *et al.*, 2006). Chesbrough and Crowther's (2006) concluded that in order to conduct successful collaborative innovation firms must overcome "not-invented-here" syndrome. Whereas Herzog and Leker (2010) finds out that employees in open innovation units more readily accept ideas from the outside and are more open to risks. Several other studies by Dhanarag and Parkhe (2006), Zaphiris and Ioannou (2018), Harris and Lyon (2013) and Pomponi *et al.* (2015) highlight that openness, interaction and communication does not always come naturally and is linked to the people's beliefs, attitudes to open innovation and mutual "collaborative trust". For example, people who do not

contribute proactively to open innovation are often afraid of becoming too dependent on collaboration partners.

III. FROM TRADITIONAL LINEAR TO OPEN INNOVATION MODEL IN THE LIFE SCIENCES

The study by Niedergassel and Leker (2009) reveal that in the 1990s over 90 per cent of life sciences research companies located in the United States were collaborating with academia. There were also nearly 1500 alliances between pharmaceutical and biotechnology companies. However, as the Pigott *et al.* (2014) emphasize the latter collaborations were based mostly on the linear or transactional model. In such model each player had its role and is largely confined to it. In this sense, academia received R&D funding from governmental and non-profit organisations for conducting research and publishing new results, whereas industry (SMEs or bigger pharmaceuticals) turned these results into patented drugs and other healthcare products. In such healthcare system users or recipients were passive to what the industry develops and launches (Fig. 2).

Fig. 2. Towards open innovation in life sciences. Source: Pigott *et al.* 2014.

So, the above-described historical partnership was largely "closed" R&D and innovation system, which efficiency was not questioned until relatively recently. The inefficiency of this closed system was discussed by several authors, including Pigott *et al.* (2014), who pointed out that the "failure to integrate payer and patient views into the drug discovery process at an early stage has led to costly, late-stage failures" at which "developers were not reimbursed

appropriately for drugs while patients failed to adhere to their medications". Over the last two decades the life sciences industry has increased its "openness". Many biotechnology and biopharma companies have turned to mixed innovation models - adopting both closed/traditional and open corporate R&D models, by sourcing innovative ideas, knowledge, and new technologies from outside of their organizations. During the last two decades, many biopharmaceutical industry

companies have shifted their basic research operations from “trial-and-error” drug discovery approaches to a more science-based deductive method of searching for new discoveries. This led to the process of decentralization of the corporate R&D networks. The decentralisation process characterized by the steady loosening up the strong links between the company headquarters (i.e., central research laboratory) and its subsidiaries that do not co-publish. Instead, each R&D laboratory co-publishes with other companies or organizations usually geographically co-located (Medina *et al.*, 2007).

In fact, biopharma and biotechnology is one of the pioneering industries in applying open innovation practices along with the software, electronics, and telecommunications industries (Gassmann *et al.*, 2010). For example, the study by the Organisation for Economic Co-operation and Development (OECD) showed that in 2003 biopharma and biotechnology companies filed over 13 per cent of the European Patent Office’s (EPO) applications with multiple applicants, compared to the chemical industry, which filed only around 8 per cent of such applications (Backer, 2008; Pigott *et al.*, 2014). According to more recent survey study by the Deloitte company (<https://www2.deloitte.com/2014>) conducted among 281 biopharma companies during 1988-2012 there is a three-fold probability of later-phase clinical success when drugs are sourced with the open innovation model. In the new open innovation model (Fig. 2) industry – academia partnerships are no longer restricted in scale and scope, and therefore established across multidisciplinary areas. Many biopharma consortia cover multiple therapy areas and comprise a wide range of expertise and capabilities (Pigott *et al.*, 2014). Nevertheless, adopting the open innovation R&D model requires new way of thinking, which depends on the general socio-cultural context of the life sciences ecosystems. Adopting the new OI model requires working closely with different partners, aligning at least two different organizations strategies and cultures, which can be extremely difficult.

IV. THE SOCIO-CULTURAL CONTEXT OF THE PRECLINICAL RESEARCH IN THE LIFE SCIENCES

Inherent cultural differences between academia, industry, healthcare providers and other organization groups can be a barrier to open innovation. In general, academics are motivated by more publications and not commercial relevance of research projects. Whereas industry participants can be reluctant to share know-how and therefore suffer more from the “not invented here” syndrome. Healthcare providers can be more reluctant to engage and often aren’t incentivized to innovate. Research charities and patient organizations are becoming more active in the search for new treatments and are increasingly holding other participants to account.

In order to access new talent and technologies, significant investment is being made by life sciences companies in building relationships with research labs and academia. Companies offer doctoral and post-doctoral research funds at leading universities worldwide in order to take steps in the active recruitment of core scientific bioinformatics, and analytical talents (Runiewicz-Wardyn, 2020). This diversity, interdisciplinarity and connectivity make some high-

technology clusters natural environments for the life sciences development. These clusters have created social and institutional mechanisms allowing new ideas to move from one domain to another. Furthermore, the research done by Steinfield and Scupola (2008) concludes that ICT use appears to strengthen the life sciences cluster in Denmark and Sweden (Medicon Valley), and that firms located within the cluster appear to gain some unique advantages from their ICT usage that are not necessarily available to firms outside the cluster. Moreover, the authors concluded that small firms would not gain as much from the use of the ICT infrastructure if not located in a cluster with a strong reputation. Their study emphasized the key role of clusters in creating innovation-friendly ecosystems in the life sciences sector. The “innovation ecosystem” is defined here as “dynamic, purposive community with strong relationships based on collaboration, trust and co-creation of value and sharing complementary technologies or competencies” (Durst, Poutanen, 2013). Yet, strong trust-based relationships are not easily built in the case of such different stakeholders as industry and academia. In fact, researchers from the industry and researchers from the academia work in a different culture and cognitive norms. One example may include the fact that the academic reward for scientific discovery consisting of quality publications or grant/research council funding is highly rank-conscious and individualized. In contrast, pharma industry researchers are salaried as contributors to a team effort aimed at helping invent marketable drugs. Thus, academic science researchers do not routinely operate with levels of collaborative interaction and cross-disciplinary teamwork environment, which is essential to drug discovery and the challenges of applying basic research to address therapeutic/medical needs (Janero 2015). The academic scientists are not equally trained in such matters as decision theory, collaborator relations, or risk and project management. Thus, preclinical university-industry discovery alliances can have discord over the fundamental laboratory findings, i.e., the overvaluation of procuring knowledge by university scientists and undervaluation of new knowledge by industry professionals whose expertise and vision are down the critical path toward market. Such organizational, social, and cultural distinctions pose a challenge to discovery research collaborations between university and industry sectors, e.g., lack of a trust and adequate commitment of partners, different goals and motivations, unclear expectations and requirements (Runiewicz-Wardyn, 2020; Brocke, Lippe, 2015). Establishing common ground for the university-industry discovery collaboration depends critically on the individuals involved, who can break institutional barriers and inculcate focus, cooperation, inclusion, and trust among its participants.

V. OPEN INNOVATION COLLABORATION AT THE TIMES OF COVID-19

It should be mentioned that Covid-19 pandemic has become both a challenge for the R&D co-operation between the companies, universities, and other entities in the whole biopharmaceutical R&D, as well as the opportunity to join R&D potential in the new biopharma–university alliances. Biopharma–university cross-industry alliances and public-

private partnerships alliances significantly increase the chances of creating better medical therapies for patients as it allows higher synergy effects, as well as speed and agility. Opening up mobilizes scientific human capital available in the world, as well as enriches the access to the existing physical capital (such as labs and equipment) to offer better diagnostics and treatment of Covid-19 patients as well as produce new drugs and vaccines. Moreover, biopharma companies involved in the R&D cooperation with academic institutions based on the model of open innovation alliances, can significantly reduce the risk and cost of R&D process (which involves resources, technology, knowledge, and competencies of different partners). Last but not least, open innovation alliances between variety of stakeholders (public, non-profit and private) can prepare us better for potential pandemics in the future. Both, in the sense of the preparedness and response to outbreaks, as well as the socioeconomics and infrastructural readiness to transport and distribute of vaccines to millions of people.

VI. THE CAMBRIDGE LIFE SCIENCES ECOSYSTEM: THE CASE OF ASTRAZENECA

The case study seeks to demonstrate how open innovation model is implemented in the university-based cluster ecosystem, using the example of Cambridge life-sciences cluster and its collaboration with AstraZeneca. More particularly, it intends to discuss in which way open innovation culture supports the acquisition of internal and external knowledge, by AstraZeneca example. The company is one of the few big biopharma companies, whose one of the aims is to build its growth and scientific leadership through open innovation. In fact, one of the companies's strategic priorities is to build up R&D system through "innovation and distinctive science supported by co-location of its teams and better access to globally recognized science clusters" (drawn from www.astrazeneca.com/media-centre on Thursday, 21 March 2013). It is therefore the selected case study of AstraZeneca provides useful resource on how to build the open innovation business model in order to create value. The case study attempts to provide the answers to following questions: *How do R&D partnerships and open innovation practices with local universities, help the company to change its business model and decentralize its R&D system? What advantages for the drug discovery and development processes result from the co-location of the company with the academic institutions? How the company sustain and maintains open innovation culture in the local university-based ecosystem?* All information on the AstraZeneca company was gathered from the company's website, annual reports, newspapers and magazines as well as researchers' previous study (Runiewicz-Wardyn, 2020).

A. General Description of the Life Sciences Environment at Cambridge University

The University of Cambridge ecosystem in the UK is one of the oldest and most successful in the world. The institution cantered around one of the world's leading academic and research establishments in the life sciences in the 12th century when academics and students settled in the city and gradually gained official status (Runiewicz-Wardyn, 2020). Cambridge

Consultants, the forerunner of today's Cambridge Cluster, was founded in 1960 (Home, Cambridge Consultants, 2021). The foundation began improving the connection between university intellectuals and business. Though Cambridge was considered a small rural town by many, it already had a few well-established engineering firms, including the Cambridge Scientific Instrument Company, the Pye Group, and the Marshall of Cambridge (Business and enterprise | University of Cambridge, 2021). The group began to develop rapidly when Trinity College (Trinity College Cambridge, University of Cambridge, 2021) founded Cambridge Science Park in 1970, with 39 start-ups between 1960 and 1969 and 137 more in the 1970s week averages. Cluster and is considered a member of the "Golden Triangle", which includes the largest European cluster for life sciences, London-Cambridge-Oxford. The more than 1,500 technology-based companies in the region employ more than 57,000 people and have combined annual sales of more than £ 13 billion (Research, University of Cambridge, 2021).

This place's success is strongly intertwined with the institution. In the region, the University is a substantial employer, a provider of technology, and a source of information and skills. The University is divided into six schools, with three ones dedicated to the life sciences: the School of Biological Sciences, the School of Clinical Medicine, the School of Physical Sciences, and the School of Technology. Apart from these schools and faculties, 31 colleges enable students to reside and interact. The schools offer special programs for the undergraduates, enabling both supervision and informal small group teaching sessions. In total, Cambridge has a staff of about 10,000 people who assist over 18,000 students from all around the world. As for the 2021, some 4,000 of the university's students came from more than 120 foreign countries. In addition, the university's International Summer Schools provide 150 courses to foreign students. In complement to the Science Park, the University and its Colleges, such as St John's Innovation Centre, Peterhouse Technology Park, and the Cambridge Judge Entrepreneurship Centre (including Accelerate Cambridge), have been critical to the crowd's continued growth (Runiewicz-Wardyn, 2020).

The place of AstraZeneca in the Cambridge university-based life-science ecosystem Cambridge and AstraZeneca currently collaborate on over 100 ongoing research projects across 23 departments. Another essential aspect of the connection is AstraZeneca's support for the work of promising young researchers, with its financing for more than 70 PhD students at Cambridge (Strategic partner: AstraZeneca, 2021). AstraZeneca is one of the top 15 pharmaceutical firms in the world, according to Statista (AstraZeneca R&D expenditure 2006-2020, Statista, 2021). In 2020, the company spent almost \$6 billion on research and development (Fig. 3).

It's been more than two decades, scientists at AstraZeneca, one of the world's most successful pharmaceutical corporations, have collaborated with the University of Cambridge. During that period, the combination of Cambridge's ideas and AstraZeneca's drug development skills proved to be a constructive mixture. AstraZeneca relocated its worldwide headquarters to Cambridge in 2016 to strengthen its collaboration with the University and the

other academic institutions, hospitals, and companies that comprise Cambridge as the most successful life-sciences cluster in Europe. The driving reason behind a successful partnership is the collaborative dedication to creating novel medicines, which will make a genuine impact on patients' lives. Also, there's a widespread belief that this can only happen if scientists are free to follow their instincts (Strategic partner: AstraZeneca, 2021). According to Schuhmacher *et al.* (2018), centralized R&D method is preferred and essential in disease areas where extensive and protracted clinical trials are required. A decentralized R&D organization may have an advantage over a central R&D system if an R&D activity is sole and autonomous because the firm has the chance to imitate the science-based biotech business model. As a result, pharmaceutical firms are rapidly moving away from internal R&D models and toward more open and collaborative R&D patterns based on the open innovation paradigm. With AstraZeneca, this surge in externally sourced innovation corresponded with numerous examples of substantial R&D department cutbacks (Chesbrough, 2003; Staton, 2015).

B. AstraZeneca Clinical Trials in Cambridge Life Sciences Innovation Ecosystem

One of the issues confronting the current pharmaceutical industry is that medication development is getting increasingly expensive. The three stages make up a clinical trial (Fig. 4). The first phase involves a limited number of healthy people, with the primary objective of determining whether the medication is safe. The researchers analyse the drug's effectiveness in the second phase by testing it on individuals with the condition it is supposed to cure. In addition, experts consider the dangers and side effects before deciding whether to proceed to the third phase. The medication is tested on a higher number of patients with the condition in the third phase, allowing researchers to establish that it is safe for humans and effective for the disease. This phase takes the longest and is the costliest. If a medicine fails in the last round of clinical testing, the company loses roughly \$200 million. One obvious way to avoid this is to enhance the capacity to forecast whether or not medication will work (Atterfors, Farneman, 2012; Strategic partner: AstraZeneca, 2021).

Fig. 3. Research and development spending at AstraZeneca from 2006 through 2020 (in million U.S. dollars).
Source: Statista (AstraZeneca R&D expenditure 2006-2020 | Statista, 2021).

Fig. 4. Drug discovery and development process.
Source: Atterfors and Farneman (2012); (Clinical Trials, PhRMA, 2021).

While though, it requires professionals to conduct Phase 1 studies in volunteers, the initial stage in producing medications for patients. Currently, there are relatively few individuals in the UK that are licenced to do this. However, the Experimental Medicine and Immunotherapeutic (EMIT) Division at Cambridge University comes in. Under the direction of Professor Ian Wilkinson, it is collaborating with AstraZeneca and other prominent pharmaceutical firms to innovate training that will equip a new generation of doctors and medical scientists with the skills required to conduct these types of patient studies (Strategic partner: AstraZeneca, 2021).

The vigour of Cambridge's life sciences cluster is one of the city's more apparent draws for a multinational pharmaceutical business. Cambridge gives AstraZeneca access to world-leading research, a large professional talent pool, the potential to interact with other firms, and, most importantly, the ability to absorb some of the city's legendary entrepreneurial spirit (Strategic partner: AstraZeneca, 2021). Since the University of Cambridge and AstraZeneca collaborated with GSK to utilize artificial intelligence (AI) to produce medical discoveries, expedite the development of precision medicine, and create novel therapies, Bridging the gap between the diverse and complicated disciplines of AI and medicine needs simultaneous development on both sides. CCAIM (Cambridge Centre for AI in Medicine) brings together a broad group of top Cambridge scientists and clinicians with backgrounds in machine learning, engineering, mathematics, medicine, computer science, genetics, computational biology, biostatistics, clinical research, and healthcare policy, among other fields (New Cambridge Center to connect AI, medicine, and life sciences sector, EurekAlert! Science News, 2020). It has been several years since the Company has effectively collaborated with other mega-corporations and organizations Cancer Research UK Institute, Microsoft, Google, Abcam, and ARM.

C. New "Open Innovation" Model of AstraZeneca: Open-minded Culture

The AstraZeneca has been expanding its locational advantage in Cambridge by building new headquarters in close proximity to Cambridge University campus Osbourn (2018). The Company expects to boost its growth by building new R&D partnerships and commercializing the latest R&D findings. The new campus, which spans over 170 acres to the south of the city and its world-renowned university campuses, accounts for a large portion of the city's £2.9 billion contributions to the British economy in the life sciences. Scientists working on small compounds, heavy molecules, and biologics are located under the same roof at AstraZeneca's worldwide headquarters and the Company's Research & Development Centre, which could accommodate around 2,000 personnel. Cambridge's greater ambition is to bring together specialists and top minds from many disciplines in a world-class innovation ecosystem where sharing ideas becomes second nature and the university's biomedical innovation output rises (Osbourn, 2018). Scientists from the UK's Medical Research Council Laboratory of Molecular Biology are already collaborating with AstraZeneca counterparts, and they are going to have offices in the new building combining the scientific

intelligence and knowledge available throughout the city. For the first time, co-located scientists working on chemistry and small molecule drug development are going to work with scientists working on biologics, giant molecules, and protein-based treatments in lab-based environments. AstraZeneca's strategy is to drive diverse types of collaboration across Cambridge campus. It opens new avenues for thinking creatively about drugs and how to leverage crossover approaches from chemistry and biology to further scientific understanding. The Company steady shifts away from single product development specialization towards a more comprehensive approach to understanding illness physics and mechanics and converting them into patient benefits. The Company hopes that collaboration with other local firms, institutes, and academics would lead to new avenues of discovery (Osbourn, 2018). Clinical Compound Bank comprising patient-ready "live" and discontinued small molecule compounds and biologics that have demonstrated evidence of human target coverage and tolerance in clinical trials is one of AstraZeneca's Open Innovation programmes. These are available for cutting-edge clinical and translational research (AstraZeneca launches 'Open Innovation' initiative, Pharmaphorum, 2014). Moreover, the AstraZeneca has been promoting the open or "sharing ideas" culture through building proper infrastructure stimulating physical encounter and exchange of ideas between various stakeholders. The unique circular construction is part of the Cambridge Biomedical Campus, which houses several world-class academic institutions with pharma and biotech firms. Anyone who wishes to communicate with the Company's scientists are able to do so in an open patio and cafe. A teaching lab is being built to increase outreach and to educate visiting students on the firm's cutting-edge science (Osbourn, 2018). When it comes to AstraZeneca's open innovation culture the Company emphasized not only the need to innovate, but also to learn how to innovate and seek out fresh ideas. AstraZeneca is always studying other companies' tactics and approaches to innovation are implemented and achievement. AstraZeneca's staff tours outside of the pharmaceutical business regularly to learn about what others are doing and what may be learned.

D. AstraZeneca - Cambridge Open Innovation Alliance Against Covid-19

Since the beginning of the Covid-19 pandemic, AstraZeneca has been actively collaborating with the Cambridge networking organization (<https://www.cambridgenetwork>), GSK and researchers from the University of Cambridge on their efforts to tackle Covid-19 and apply science-led approaches to developing testing and treatment for the disease. AstraZeneca, GSK, and University of Cambridge established testing facility at the University's Anne McLaren laboratory to support the broader UK government Covid-19 screening programme. This facility is used for high throughput screening for Covid-19 testing and exploring the use of alternative chemical reagents for test kits in order to help overcome current supply shortages (www.cam.ac.uk/news). The event shows the critical role of social partnership with AstraZeneca in orchestrating the Cambridge global response to the pandemic. Yet, the sources of current success of AstraZeneca's efforts

against Covid-19 go back to the past R&D collaboration partnerships between the AstraZeneca and Cambridge University researchers. Here are just some of such examples. In 1989, three of Cambridge University faculty members – Greg Winter, David Chiswell and John McCafferty – established a spin-out company called Cambridge Antibody Technology (CAT) to develop the phage display technologies. In 2006, the company was acquired for £702 million by AstraZeneca and merged with US-based MedImmune, also acquired by AstraZeneca. Today, AstraZeneca uses the CAT experience in phage display technologies and applies it the Covid-19 treatments. Another, more recent example includes the establishment of Cambridge Centre for AI in Medicine (CCAIM). In 2020, a year prior to the spread of pandemic University of Cambridge announced a five-year agreement with AstraZeneca and GSK to fund the establishment of CCAIM. The Centre, aimed to combine world-class academia with the real-world industrial challenges by developing cutting-edge AI to transform the way we discover and develop medicines. As the Covid-19 pandemic spread Addenbrooke's Hospital in Cambridge have used artificial intelligence (AI) to predict COVID-19 patients' oxygen needs (<https://www.cam.ac.uk/research/news/world-first-for-ai-and-machine-learning-to-treat-Covid-19-patients-worldwide>).

VII. CONCLUSIONS

The development of new medicine and biopharma products is a complex, very costly, time consuming, highly risky, and potentially rewarding endeavor. Thus, the decision of the firms in the life sciences sector to transit towards more open innovation or more particularly decentralized R&D model, really depends on what are their long-term strategies, e.g., pioneering research (by investing in basic and non-specific R&D), exploring new markets, or meeting the immediate medicine needs. The decentralization of corporate R&D process by AstraZeneca and encouraging open innovation culture enabled the Company to exploit its local information and knowledge more effectively. Moreover, decentralized research process turned out to better align with the immediate needs of the AstraZeneca medicine discovery. The case of AstraZeneca helps to understand better the open innovation phenomenon as well as shares some open innovation instruments, which can be adopted by other firms. The further research is needed to understand better in which way decentralization affects knowledge spillover across Company's divisions, both in its scale and scope as well as what challenges related to the management of open innovation process may hinder innovation or even lead to collaboration failure.

The life-sciences sector (including pharmaceutical, biotechnology and medicine devices industries) has experienced an accelerated growth during the past decade, driven by the intensive R&D investments, rising competition, new business operations and corporate R&D strategies, technological change, and digitalization processes as well as most recent healthcare challenges such as Covid-19. Since the beginning of the Covid-19 pandemic, AstraZeneca has been

actively collaborating with the Cambridge networking organization, GSK, and researchers from the University of Cambridge. The event showed the critical role of R&D partnerships and open innovation alliances with AstraZeneca in orchestrating the Cambridge global response to the pandemic.

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REFERENCES

- Uthman, Arocena, R., Goransson, B., Sutz, J. (2018), *Developmental Universities in Inclusive Innovation Systems. Alternatives for Knowledge Democratization in the Global South*, Palgrave Macmillan.
- ADNER, R. (2016), *Ecosystem as Structure: An Actionable Construct for Strategy*. *Journal of Management*, 43(1).
- AstraZeneca R&D expenditure 2006-2020 | Statista (2021). Available at: <https://www.statista.com/statistics/266556/expenditure-on-research-and-development-of-astrazeneca-since-2006/> (Accessed: 16 June 2021).
- Atterfors H. and Farneman, S. (2012), *The Role of Open Innovation: Focus on the Pharmaceutical Industry*. p. 68. Available at: [https://azcollaboration.sharepoint.com/sites/Innovation/Study of OI in AZ.pdf](https://azcollaboration.sharepoint.com/sites/Innovation/Study%20of%20OI%20in%20AZ.pdf).
- Backer, K.D. (2008), *Open Innovation In A Global Perspective: What do existing data tell us?*, OECD: Paris.
- Blumenthal, D., Campbell, E.G., Causino, N. (1996), *Participation of life-science faculty in research relationships with industry*, *New England Journal of Medicine*, 335, 1734-1739.
- Business and enterprise, University of Cambridge (2021). Available at: <https://www.cam.ac.uk/business-and-enterprise> (Accessed: 13 June 2021).
- Chesbrough, H. W. (2003) *Open Innovation the New Imperative for Creating and Profiting from Technology*.
- Clinical Trials | PhRMA (2021). Available at: <https://www.phrma.org/Advocacy/Research-Development/Clinical-Trials> (Accessed: 16 June 2021).
- Home | Cambridge Consultants (2021). Available at: <https://www.cambridgeconsultants.com/home> (Accessed: 13 June 2021).
- Brocke, J., Lippe, S. (2015), *Managing collaborative research projects: A synthesis of project management literature and directive for future research*, *International Journal of Project Management*, 33(5).
- Chesbrough, H., (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.
- Chesbrough, H. (2006), *Open innovation: A new paradigm for understanding industrial innovation*. In H. Chesbrough, W. Vanhaverbeke, J. West, (Eds), *Open innovation: Researching a new paradigm*, Oxford: Oxford University Press, 1-12.
- Chesbrough, H., Crowther, A.K. (2006), *Beyond high tech: Early adopters of open innovation in other industries*, *Journal of R&D Management*, 36 (3), 229-236.
- Dhanaraj, C., Parkhe, A. (2006), *Orchestrating Innovation Networks*, *Academy of Management Review*, 31(3), 659-669.
- Hertzog, P., Leker, J. (2010), *Open and closed innovation – different innovation cultures for different strategies*, *International Journal of Technology Management*, 52 (3-4), 322-343.
- Fasnacht, D. (2018), *Open Innovation Ecosystems: Creating New Value Constellations in the Financial Services*, In: *Open Innovation Ecosystems*, 5, Springer, 131-172. <https://www.researchgate.net/publication/329037798>.
- Kozierkiewicz, B. (2020), *Life Sciences Clusters in Poland: Drivers, Structure and Challenges*.
- In: Runiewicz-Wardyn, M. (Ed.) *Social Capital in the University-Based Innovation Ecosystems in the Leading Life-Science Clusters*:

Implications for Poland, Warszawa. Poltext.

- Krause, W., Schutte, C., DU Preez, N. (2012), Open Innovation in South African Small and Medium-Sized Enterprises, Proceedings of the International Conference on Computers & Industrial Engineering (CIE42), Cape Town, South Africa, CIE & SAIIE 2012, 201-210.
- Laursen K., Salter, A. (2006), Open for Innovation: The Role of Openness in Explaining Innovation Performance Among U.K. Manufacturing Firms, *Strategic Management Journal*, 27(2), 131–150.
- Gasmann, O, Enkel, E, Chesbrough, H (2010), The Future of Open Innovation. Blackwell Publishing Ltd. Open Innovation 2.0, European Commission, <https://ec.europa.eu/digital-single-market/en/open-innovation-20>
- Pomponi, F, Tafuri, S., Fratocchi, L. (2015), Trust development and horizontal collaboration in logistics: A theory based evolutionary framework, *Supply Chain Management*, 20(1).
- Runiewicz-Wardyn, M. (2020), *Social Capital in the University-Based Innovation Ecosystems in the Leading Life-Science Clusters: Implications for Poland*, Warszawa. Poltext.
- Runiewicz-Wardyn, M. (2016), *Innovations and Emerging Technologies for the Prosperity and Quality of Life*, Warsaw, PWN.
- Runiewicz-Wardyn, M. (2013), *Knowledge Flows, Technological Change and Regional Growth in the European Union*, Contributions to Economics, Springer.
- Roper S., Vahter P., Lovec, J. H. (2013), Externalities of openness in innovation, “*Research Policy*”, Volume 42, Issue 9, November 2013, 1544-1554.
- Stenninger, S. (2014), Open Innovation and Barriers to Adoption: A Case Study in the Construction Industry, Chalmers University of Technology, <https://odr.chalmers.se/bitstream/20.500.12380/204671/1/204671.pdf>.
- Sznyk, A., Karasek, J. (2016), Raport innowacyjność w sektorze ochrony zdrowia w Polsce, Warszawa: Instytut Innowacyjna Gospodarka.
- Trzmielak, D. (2013), *Innowacje i komercjalizacja w biotechnologii*, Warszawa.
- Torkelli, M. T., Kock, C. J., Salmi, P. A. (2009), The “Open Innovation” paradigm: A contingency perspective, *Journal of Industrial Engineering and Management*, 2(1), 176-207
- Witzeman S., Slowinski, G., Dirkx R., Gollob, L. (2006), Harnessing External Technology for Innovation, *Research Technology Management*, 49(3), 19-27.
- Niedergassel, B., Leker J. (2009), Open innovation: chances and challenges for the pharmaceutical industry, *Future Medicinal Chemistry*, 1(7), 1197–1200.
- Chesbrough H.W., (2003), Open Innovation: the new imperative for creating and profiting from technology. Harvard Business School Press.
- AstraZeneca launches ‘Open Innovation’ initiative, Pharmaphorum (2014) Pharmaphorum. Available at: <https://pharmaphorum.com/news/astrazeneca-launches-open-innovation-initiative/> (Accessed: 16 June 2021).
- Medina, C.C., Tijssen, R. (2007). Research cooperation within the biopharmaceutical industry: Network analyses of co-publications within and between firms. *Scientometrics*.
- New Cambridge Center to connect AI, medicine and life sciences sector | EurekAlert! Science News (2020). Available at: https://www.eurekalert.org/pub_releases/2020-11/uoc-ncc111120.php (Accessed: 16 June 2021).
- Osborn, J. (2018), AstraZeneca: building a new “open innovation” pharma company, PMLiVE. Available at: http://www.pmlive.com/pharma_intelligence/AstraZeneca_building_a_new_open_innovation_pharma_company_1255460 (Accessed: 13 June 2021).
- Research, University of Cambridge (2021). Available at: <https://www.cam.ac.uk/research> (Accessed: 13 June 2021).
- Schuhmacher, A. (2018) Open innovation and external sources of innovation. An opportunity to fuel the R&D pipeline and enhance decision making?, *Journal of Translational Medicine. BioMed Central Ltd.* doi: 10.1186/s12967-018-1499-2.
- Staton, T. (2015), Merck tallies 36,000 job cuts in 5 years of restructuring, FiercePharma. Available at: <https://www.fiercepharma.com/corporate/merck-tallies-36-000-job-cuts-5-years-of-restructuring> (Accessed: 16 June 2021).
- Strategic partner: AstraZeneca (2021). Available at: <https://www.cam.ac.uk/business/astrazeneca> (Accessed: 13 June 2021).
- Trinity College Cambridge, University of Cambridge (2021), Available at: <https://www.trin.cam.ac.uk/> (Accessed: 13 June 2021).