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Towards an Effective Rapprochement Between Artificial Intelligence and Medical and Pharmaceutical Research

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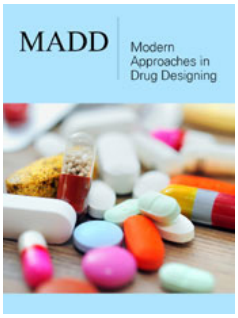

Qeis Kamran[1,2]* and Berit Schumann[1]

[1]Department of International Management, Germany

[2]Department of Design, Production and Management, The Netherlands

***Corresponding author:** Qeis Kamran, International School of Management, Dortmund, Germany

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Abstract

The contemporary era of technological advancement enhances pharmaceutical and medical research to investigate the benefits of AI in drug design and development. The complexity of its globalized nature attaches risks and yet unknown challenges for businesses but can simultaneously provide many solid opportunities for urgent drug trials and designs as well as public health issues as experienced during the current Covid-19 pandemic. This review demonstrates potential benefits from the evolution of market dimensions for pharmaceutical companies, using the case of BioNTech during the Covid19-pandemic, accelerating drug design and distribution by enhancing a unique design proposition and design dominant logic. A model will be introduced which allows companies to revolutionize their ways from unique selling propositions to unique meaning and unique design propositions.

Keywords: Artificial intelligence; Machine learning; Deep learning; Complexity; Drug discovery; Design dominant logic; Creating shared value

Introduction

The introduction of the in-silico era in drug design and clinical trials opens new possibilities for pharmaceutical and medical research [1]. While the contemporary pandemic has caused a huge number of loss of human life and global economic productivity, the solid response from medical and pharmaceutical firms has been a great moment of human ingenuity. The review looks at the BioNTech case and how it could design a vaccine in a such a short time. In addition, the model is highlighted in a manner that managerial implications thereof are explained, and a possible future model based on management is introduced.

Discussion

The contemporary Anthropocene age is challenged by the exponential rise of technology; in particular the potential and risks that Artificial Intelligence (AI) presents [2]. While the methods towards aligning AI with drug discovery date back over two decades, their ubiquitous applications however in medical chemistry, is only a recent phenomenon [3] with the power to pivot towards changing drug designing capabilities fundamentally [4].

There are many reasons for this rapid pivot of medical and pharmaceutical applications towards AI, Machine Learning (ML) and Deep Learning (DL) today [5]. As attrition rates in drug trials are high, using conservatory methods, financial resources and time-consuming procedures can be tailored to promising biological compounds in drug design [6]. Some macro dimensions are the rise of globalization and global interconnectivity, which are amplified by the digital transformation, but moreover based on a phenomenon called the

globalization of totality [7]. Thus, it is embracing the intertwined nature of a complexity that embeds the rise of global migration, globalization of pandemics, globalization of distrust and anger towards public institutions driven by fake news spread via social media [8], globalization of fundamentalism of the far-right [9] and globalization of culture [9] especially in the post-PC-era of mobile communications [10]. This evolution of complexity of the contemporary era of modernity enhances the challenges of the global risk society, which it has to cope with [11].

In addition, the necessity to react in an unprecedented very short time towards a global health crises of such a proportion [12] and the rapid development and blitzscaling of production and global supply of a vaccine for the Covid-19 pandemic of this scale (total infection cases 272,919,418 and death toll 5,336,647[13,14]), where Pfizer and BioNTech would supply the European Union (EU) with up to 1.8 Billion doses of COMIRNATY within 6 months of launching the research project to discover a new vaccine, makes the rapprochement between AI, ML and DL technologies a highly vibrant field for research and practice.

Figure 1 illustrates the different revolutions within the diverse spheres of evolution of technology. The y-axes accounts for the constant rise of complexity for organizations and societies, such as: financial crises, global pandemics, war in Ukraine, the climate change, and the rise of global anti-democratic tendencies. The x-axes illustrate the notion of time as an important strategic currency, in finding adequate responses to the prolifering complexity such as: the discovery of a working vaccine for the contemporary Covid-19 virus within the earliest possible time span.

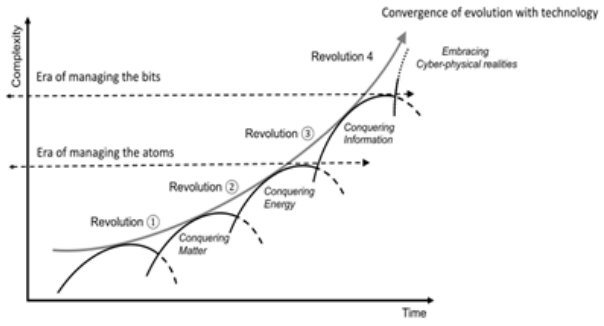

Figure 1: Diverse technological evolutions in human history [15].

The first revolution illustrates human conquering matter by cultivating the ability of making tools by using stones, wood, fire, and water to enhance its possibility of survival. Furthermore, during the second revolution as energy was brought under the control of man such as extracting energy from steam, fossil fuel, nuclear and renewable energies and during the third revolution, a vital era of leaving the atomistic universe was shifted towards managing the bits, hence, by starting to control information as a medium of navigating towards a ubiquitous global network connectivity was established.

The fourth revolution breaks the boundaries between the cyber and physical realities, it paves the way for the unity of both realities of the universe and the metaverse. The metaverse is the unique space, where the unity of all essential technological evolutions such as AI, ML, DL and blockchain technologies with cultural artifacts are in concert via the notions of experience innovation and immersive, and embodied design search spaces. The velocity of these innovations was strongly enhanced by the diverse lockdowns during the contemporary pandemics, as they raised the rate of acceptance of man-machine interface and thus paving the way for a hybrid cyber-physical reality [15].

While, the successes of BioNTech and InstaDeep represent the start of new era of rapid human responses to the necessities of the age of Anthropocene and the ubiquity of the rising crises thereof, however only until recently the applications of the AI-driven technologies in comparison to experimental high-throughput screening, combinatorial chemistry, and other technological drivers were only subpar, and it was yet beyond comprehension that AI-algorithms would actually generate novel chemical entities with desired properties ab initio, hence even better than human experts [3,12]. The notion of coping with nonlinearity such as unknown multi-dimensional structure-activity relationships, governing the pharmacokinetics and-dynamics of drugs is an essential and rising field for how AI-driven technologies could foster drug-designing capabilities into new spheres [5,12] and aligning them with the dimension of social innovation for additional challenges humans have to deal with.

According to BioNTech chief executive Ugur Sahin "we see a significant opportunity at the intersection of AI and immunology by computational design of new precision immunotherapies…" [16]. The collaboration between BioNTech and InstaDeep, which was launched on November 25, 2020, in foundation of a joint AI Innovation Lab has amplified the digital capabilities and optimization of the operations across the BioNTech's global value chain [16].

However, there are many risks to count and the ambiguities resulting from the AI-applications are not yet well known and need to be much further investigated and researched [2]. Hence, what the BioNTech case has illustrated, is that a unique set of combination has contributed towards succeeding within such short time. These conditions were the global emergency created by the Covid-19 pandemic [5], a sense of extreme urgency to address this unprecedented situation, the entrepreneurial spirit of the BioNTech founding duo and their team, the application of dynamic capabilities of the firm to concurrently find a strong partner as Pfizer with its global vaccine capabilities and reach [17] and the joint-venture with Insta Deep to bring AI-capabilities to both machine intelligence research and concrete business deployments (16), were pivotal dimensions contributing to the success of designing a very rapid solution. Furthermore, the cooperation of the EU's regulatory body to fast-track the process of Conditional Marketing Authorization (CMA) for BNT162b2, the COVID-19 mRNA vaccine [18], which was

proceeded under an accelerated timeline, has been foundational for the overall success of the BioNTech's project called Lightspeed [19].

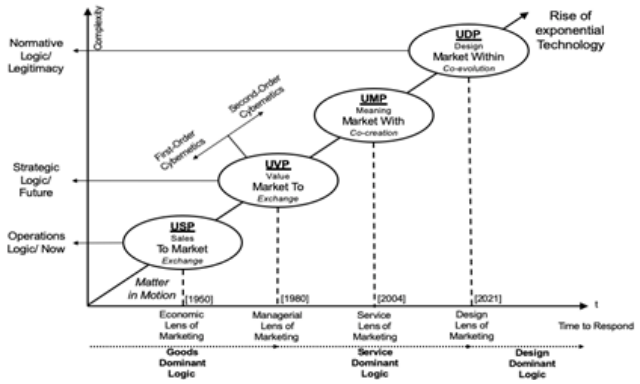

Figure 2: Drug designing and marketing in the age of AI and Anthropocene [15].

In figure 2, we highlight a possible design for moving forward, where unique opportunities for developing Solid Global Value Chains (GVCs) in drug design and supply chains could be paved. In this model a holistic logic aligning the multiple spheres of the firms' logical spheres is proposed. Firms exist with the triad of logical spheres, as within the dimensions of 1) operations; 2) strategic, and 3) normative, which could be combined to enhance the drug design capabilities of the medical and pharmaceutical firms. Furthermore, the model illustrates the contemporary evolutions within marketing science towards a transcendence of a more eco-systemic and co-evolutionary dimension of firms' identity [15].

As the pivot from the pure unique sales proposition, which is only embedded in the logic of pure economics, towards a more fruitful journey to the Unique Value Proposition (UVP), embedded in a managerial logic and marketing segmentation is fulfilled, additional more philosophical approaches help to transfer the firms' customer relationships. This dimension could be paved by the implementation of the Unique Meaning Proposition (UMP), founded on the social mandate of meaningfulness that firms with a longer and viable foresight horizon need to capture in market, and the Unique Design Proposition (UDP), cultivating the firms' self-organizing eco-system enhancing their dynamic capabilities and the notion of organizational ambidexterity [15].

The proposed model of Design Dominant Logic (DDL) will enhance, as the case of BioNTech has demonstrated, that the conglomeration of multiple essential entities and partnerships cannot only be left to chance, and it needs to be captured by the scientific-managerial community in terms of designing robust eco-systems and GVCs that actually can absorb the perturbation of the contemporary turbulent, uncertain, non-linear, ambiguous (TUNA) environment. The DDL fosters the firms' technological capabilities and could enable a much more solid integration of AI and additional emerging technological advances. This stage of evolutionary integration of eco-systemic thinking would create a fruitful ground between the entrepreneurial, the corporate and regulatory bodies to address upcoming challenges by joining forces.

Conclusion

The rapprochement between AI and drug designing opens new possibilities for robust business models innovations in terms of models of creating shared value for targeting social challenges and causes as the Covid-19 pandemic has demonstrated. It is only logical that digitalization of data can play supportive roles in modern medicine and marks the rise of exponential technologies throughout research and drug design. The dynamic capabilities of the firms, where time is of essence to cope with the emerging challenges, need to be put into a managerial designerly logic to foster more robust models for the academe and the world of practice. Pharmaceutical companies need to embark on the big data era and use the information it provides for detailed AI analysis of potential drug discoveries break throughs throughout urgent crises as pandemics or additional valuable development strategies for drug designs and more resilient coping with future challenges and emergencies.

References

1. Russo G, Reche P, Pennisi M, Pappalardo F (2020) The combination of artificial intelligence and systems biology for intelligent vaccine design. In Expert Opinion on Drug Discovery 15(11): 1267-1281.
2. Hamet P, Johanne T (2017) Artificial intelligence in medicine. Metabolism 69S: S36-S40.
3. Schneider G (2021) An insight into artificial intelligence in drug discovery: an interview with professor Gisbert Schneider. Expert Opinion on Drug Discovery 16(9): 933-935.
4. Hessler G, Baringhaus KH (2018) Artificial intelligence in drug design. Molecules 23(10): 2520.
5. Keshavarzi A, Arash W, Julia S, Milad C, Emmanuel C, et al. (2020) Artificial Intelligence for COVID-19 drug discovery and vaccine development. Frontiers in Artificial Intelligence 3(65): 1-13.
6. Zhu H (2020) Big data and artificial intelligence modeling for drug discovery. In Annual Review Pharmacology and Taxicology 60: 573-589.
7. Kamran, Qeis (2021) Strategic value chain management. (1st edn), Models for competitive advantage, Kogan Page, London, New York, USA.
8. Tanveer K, Michalas A, Adnan A (2021) Fake news outbreak 2021: Can we stop the viral spread? Journal of Network and Computer Applications 190: 103112.
9. Rodrik, Dani (2021) Why does globalization fuel populism? Economics, culture, and the rise of right-wing populism. Annual Review of Economics 13 (1): 133-170.
10. Adesina AD, Olubunmi A, Hanat RL (2015) Using mobile communication as a tool for national growth and development. International Journal of Computer & Technology 14 (12): 6351-6360.
11. Beck, Ulrich (1992) Risk society. Towards a new modernity. (1st edn), Sage, London; Thousand Oakes, California; New Delhi; Singapore.
12. Alimadadi A, Sachin A, Manandhar I, Patricia M, Joe B, et al. (2020) Artificial Intelligence and machine learning to fight COVID-19. Physiological Genomics 52(4): 200-202.
13. Our World in Data (2021a) Coronavirus (Covid-19) Cases.
14. Our World in Data (2021b) Coronavirus (Covid-19) Deaths.
15. Kamran Q (2021) Managing complexity in marketing: from a design Weltanschauung. University of Twente, Enschede, Netherlands.

16. BioNTech Press Release (2020a) BioNTech and insta deep announce strategic collaboration and form AI innovation lab to develop novel immunotherapies.

17. BioNTech Press Release (2020b) Pfizer and BioNTech announce further details on collaboration to accelerate global COVID-19 vaccine development.

18. EMA (2020) EMA receives application for conditional marketing authorisation of COVID-19 mRNA vaccine BNT162b2.

19. Yvette NL (2021) BNT162b2 mRNA COVID-19 Vaccine: First Approval. Drugs 81(4): 495-501.