THE ROLE OF THE STATE AND UNIVERSITIES IN GENERATING INNOVATION

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Abstract

It can not be denied that innovation is a process that is happening continuously and in every sector of the economy. This is why the question who is the main force behind innovation appeared. Some scholars think that the private sector does the job, while others believe that the university and the public sector play a big role in creating innovation. Even so, as this qualitative research shows, neither actor is more important than the other, as they all contribute to generating innovation. Moreover, the Entrepreneurial State theory by M. Mazzucato and the Triple-Helix Model by Etzkowitz H./Leydesdorff L. come to explain that the state and university has a significant role in innovation, similar to the private sector. On top of it, the Triple-Helix Model suggests that the innovation of nowadays is a result of interconnections between the university-industry-government and it can not develop without the other. Thus, this leads to the idea that innovation is happening because of more factors that need to be properly commercialized and made visible to the public in order to change the misunderstanding created.

Keywords: innovation, industry, university, government, Triple Helix, Entrepreneurial State.

1. Introduction

In today's fast moving world, innovation can be seen in almost every sector, from services to agriculture. However, who is the main player when it comes to innovation, who is the force behind innovation is still a debatable topic among the scholars. Some support the idea that the private sector in the main driver of innovation, while others say that the public sector is the one that funded the most innovative technologies that we have nowadays. Furthermore, universities cannot be omitted from the innovation process either. Therefore, this research paper will address question whether the role of state and universities is similar to the role of private sector in creating innovation. Understanding the topic and the forces behind innovation is highly important as this could be a solution to economic crisis, as well as achieving more economic gains in the long-run. Additionally, the right approach to innovation could mean more well-being, social inclusion/cohesion, as well as sustainability.

The literature review and the main theories of the research paper cover such authors as Mazzucato M., Etzkowitz H., Leydesdorff L. and other like-minded scholars, and explain the innovation driven by the university-industry-state. Among the theories that contribute to answering the research question mentioned above, is the one that state and university, along with the private sector contribute to development of innovation in a country. Respectively, the

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entrepreneurial university (as per Etzkowitz H. and Leydesdorff L., 2000) and the entrepreneurial state (as per Mazzucato M., 2013).

The empirical analysis of the report represents a case study on the green revolution innovation in Germany, from the 1970's till today. Germany was chosen for the case study as it represents a success story of green revolution not only in Europe, but in the world. The qualitative research method is used in the analysis, with secondary data from online databases like: Clean Energy Wire, European Scoreboard and others. The dependent variable in this research paper is innovation, while the independent variables are university and state influence. Therefore, the following hypotheses are chosen: h(1) state and universities have a similar role to the industry in fostering innovation, and h(2) state and universities do not have a similar role to the industry in fostering innovation.

2. Literature Review

There are many beliefs and shared views among the scholars when it comes to the role of the state and universities in innovation. While some consider the state and the university (which in many cases is sponsored by the state) small players in the innovation game and give the credit to the private sector, authors like Mazzucato M., Etzkowitz H. and Leydesdorff L. believe otherwise.

Starting with Mazzucato M. (2013), which advocates for the state as being the among the main players in creating innovation, one has to look back at the most innovative technologies of our times and analyze how they appeared and mainly, who sponsored them. According to Mariana Mazzucato (2013), the state is the one that assumes big risks and the one that sponsored many discoveries of today, despite the belief that they appeared in the private sector. Moreover, to her, the state's role is undermined, while the role of the private sector in creating innovation is hyped up. Therefore, Mazzucato's book takes back the "flashlight" to the public sector, as it does not watch from the shadows and intervene when the economy is in trouble, but is among the forces that contribute the most innovative projects in a country, from the US to China. Her arguments are based on examples of famous innovations and innovative companies that reached the peak of success (the Internet, GPS, Google, Apple, together with the "green revolution" movement) as a result of government support and initiative. (Mazzucato, 2013)

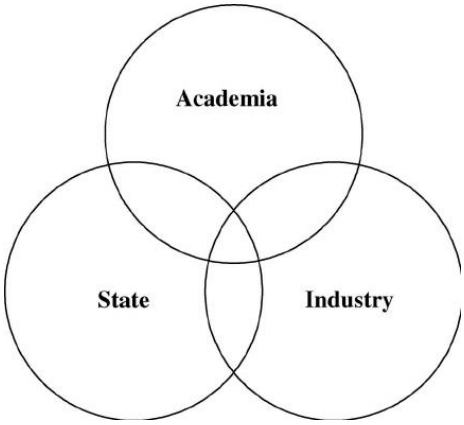
As per Mazzucato, the role of the state is still downsized and this should be changed in the near future if a states wants to reach economic growth, she explains this through the "creative destruction" theory by Joseph Schumpeter (1942). Her book acts as a defender of the public sector and the big role it holds in fostering innovation. Respectively, the author starts by pointing out that it is falsely believed that the state is choosing only safe projects to invest in, an example of this is the GPS, SIRI or touchscreen technologies used by Apple which were subsidized through state agencies (The Defense Advanced Research Projects Agency (DARPA), The Small Business Innovation Research (SBIR) Programme). (Mazzucato, 2013) Additionally, there are many myths that surround the public sector innovation and the author in cracking them one by one using the pharmaceutical sector innovation, as well as the green industry technologies as an example.

An important point from Mariana Mazzucato's book (2013) that proves the state implication in innovation is the green revolution. She gives case studies of countries like China, Germany and the United States and their achievements in green technologies, mentioning that this was only possible due to the state support and funding. From China's

"green" 5 year plan to investment banks and huge funds from national innovation and development agencies, the public sector proves to equal to private sector when it comes to innovation creation. Despite all the action the state does in supporting innovation and innovative companies, it does not always get the rewards for its deeds, or as Mazzucato says " does not eat its cake" and this one of the downsides of the public sector innovation. (Mazzucato, 2013: 158) The state is not an endless support fund and gets its money through taxation. And because many big companies (even the ones sponsored by the state like Apple) are adepts of tax evasion, the public sector does not get its money back and this is a discouragement for innovation. (Mazzucato, 2013) This issue will be further analyzed in the future perspectives part of the research paper.

Continuing with Etzkowitz and Leydesdorff (2000), in their article called the: "The dynamics of innovation: from National Systems and "Model 2" to a Triple Helix of university-industry-government relations" the authors explain the innovation process as an interaction and networking resulting from the university-industry-government relations. Moreover, according to them, there are three models of Triple Helix, the first one represents the state as the main actor which in itself is responsible for the industry and university, while the second model separates all three powers and makes them equal when it comes to innovation. Lastly, the third model is a mix of connections and relation between the university, industry and government, this also representing the model that mirrors the situation of the innovation generating powers in the present time. (Etzkowitz-Leydesdorff, 2000: 111-112)

Figure 1. The Triple Helix model of university–industry–government relations



Source: Etzkowitz and Leydesdorff (2000)

It has to be mentioned that the Triple Helix is undergoing various changes and establishes different relationships among its main components, therefore, there is a high probability that its structure will encounter changes in the future. Additionally, the model is non-linear, as there are not relations only among two factors but more, consequently establishing a multi-connection. As Etzkowitz H. and Leydesdorff L. (2000) mention, the university has always been there when it comes to innovation. In the beginning it was a university-government (military) relation which afterward transformed into a university-industry, and then in a university-industry-government relation. (Etzkowitz-Leydesdorff, 2000: 111-112) What is important to take out from the Triple Helix theory is that there is not just one actor in innovation but three, respectively, making it a complicated "spider net" of connections. Despite this, Etzkowitz-Leydesdorff (2000) are the promoters of the idea that university's role was always essential in creating innovation, from the war times to the present days. Thus developing the term of the entrepreneurial university, as it is the one where the skills are

learned and innovative ideas are nurtured. In this way, the authors suggest that the only thing that has changed and created misunderstanding when it comes to innovation creation is the relations between the university with industry and state.

Summing up the literature review, one has to mention that both university and state have a considerable role in innovation creation, but is usually undermined by the private sector who takes all the credit. This lead to the Triple Helix model which is most optimal for explaining the actual connections between the university, state and industry and will be further used in this report for proving the hypothesis that both university and state have a similar role to the industry in creating innovation.

2.1. Theories and Hypotheses

As already mentioned in the introduction and the literature review, the theories used in the report are the ones by Mazzucato and Etzkowitz-Leydesdorff. Respectively, the entrepreneurial state and the entrepreneurial university theories, together with the Triple Helix model, come to explain and give back the credit to the government and university when it comes to creating innovation. While the hypotheses derived from the above mentioned are: h(1) state and universities have an equal role to the industry in fostering innovation and h(2) state and universities do not have an equal role to the industry in fostering innovation.

3. Research design

The research question of this report refers to whether the state and university generate the same amount of innovation as the private sector or industry. This is due to the fact that in the present time the private sector gets all the credit for creating innovation as this is considered unfair by many scholars.

The research paper starts with a literature review, where innovation is considered from the perspective of public sector together with universities. Consequently, the work and theories of such authors like Mazzucato M., Etzkowitz H. and Leydesdorff L., in order to explain the innovation driven by the university-industry-state, is presented. In this context, the theory of innovative state and the Triple Helix are explained with the scope of proving that state and universities, along with the private sector, equally contribute to the development of innovation in a country. In addition to this, the literature review covers the evolution of companies like Apple and Google, as well as pharmaceutical and "green revolution" technologies, suggesting the role of state and university in the innovation process.

The dependent variable in this research paper is innovation and the independent variables are state, university and industry influence. Respectively, the hypotheses are: h(1) state and universities have an equal role to the industry in fostering innovation and h(2) state and universities do not have an equal role to the industry in fostering innovation. The empirical analysis follows the literature review and represents a case study of "green revolution" innovation in Germany, from the 1970's till today. The empirical data is taken from online databases like: Clean Energy Wire, European Scoreboard, and European Eco-innovation Aid. The qualitative research method is used in the analysis. The report ends with a future perspective for state and university innovation with suggestions from Mazzucato (2013) and this report's author point of view, followed by a conclusion which proves the hypothesis (1) set at the beginning of this report.

4. Case Study: Green Revolution in Germany

After the energy crisis in the 1970s, the biggest powers of the world started to look for solutions in replacing the traditional sources of energy with non-traditional ones, this meaning wind, solar, water and so on. Among those countries is and Germany which since then began an intense change in its energy supplies.

From a country functioning on atomic and nuclear reactors to a country that is number one in Europe in green energy production. This chapter will analyze Germany's "green revolution" and transformation, considering the entrepreneurial state/university and the Triple Helix model. Therefore, the influence of the state and university in contributing to "green revolution" innovation in Germany.

As per Kirschbaum E. and Wacket M. (Independent, 3 July 2017), in the first half of 2017 Germany reached 35% of renewable energy of its total power production and is expected to grow even more because of the Renewable Energy Act (EEG). Moreover, Germany plans to close all its nuclear power plants by 2022 and to decarbonize the economy by the middle of the century. This is only possible to reach because of the innovative technologies sponsored by the state and the meticulous work on "green" innovation of labs belonging to universities which will be analyzed below.

4.1. The Role of the State

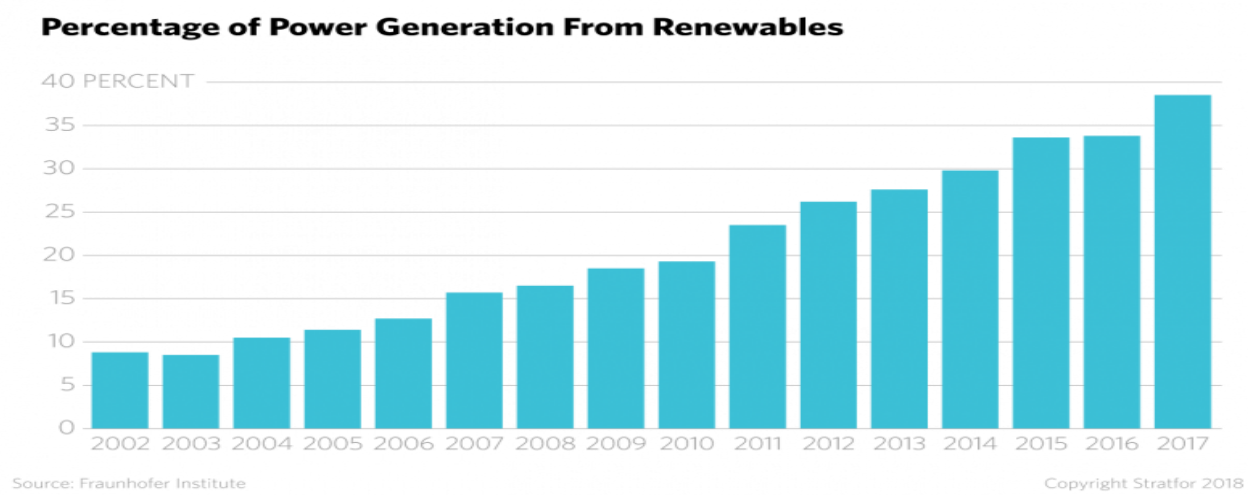
The role of the state was and is crucial in Germany's "green revolution" transformation. With the policies and funding the state was able to increase its renewable energy production/consumption ahead of the set timetable, actively contributing to the "green" revolution movement and innovation. (Kirschbaum-Wacket, Independent, 3 July 2017) Among the policies developed by the state is the "Energiewende" which in translation means energy revolution or transformation.[8] With this policy, Germany plans to reduce climate-damaging CO2 emissions by cutting nuclear energy. (Russell-Wettengel, Clean Energy Wire, 2017) Moreover, the "Energiewende", was initially an anti-nuclear and environmental movement which transformed into a national agenda with deep connections and roots in all sectors of the economy. Russell-Wettengel (Clean Energy Wire, 2017) write that the main transformations have happened in the electricity sector with a boom of wind and solar energy production which was generously financed by the state. As per the authors, Germany is considering to change its scope of energy transition, thus to replace fossil fuel with renewable sources. (Russell- Wettengel, Clean Energy Wire, 2017)

Figure 2. Shows the growth of the power generation of renewables in Germany, from 2002 till 2017. Moreover, the percentage of Power Generation From Renewables presented below is continuously increasing with every year and serves as proof that renewable energy shifted considerably in the recent years as a result of the state policies and investments. According to Stratfor (2018), through Energiewende Germany was able to produce 38.5 percent of its power renewable sources during 2017. Regarding the innovation in the eco or "green revolution" field, the results of Germany can be seen on the European Eco-innovation Scoreboard (2018). Thus, Germany performs well in eco-innovation patents and exports of products from eco-industries and developed a good waste infrastructures and recycling rates.

[8] "Energiewende" - legally approved since 2010 and has as target the reduction of greenhouse gas by 80–95% and increasing renewable energy to 60% by 2050. Federal Ministry for Economic Affairs and Energy (BMWi) (November 2015): The Energy of the Future: Fourth "Energy Transition" Monitoring Report — Summary (PDF). Berlin, Germany, retrieved from: https://www.bmwi.de/Redaktion/EN/Publikationen/vierter-monitoring-bericht-energie-der-zukunft-kurzfassung.pdf [09.04.2018].

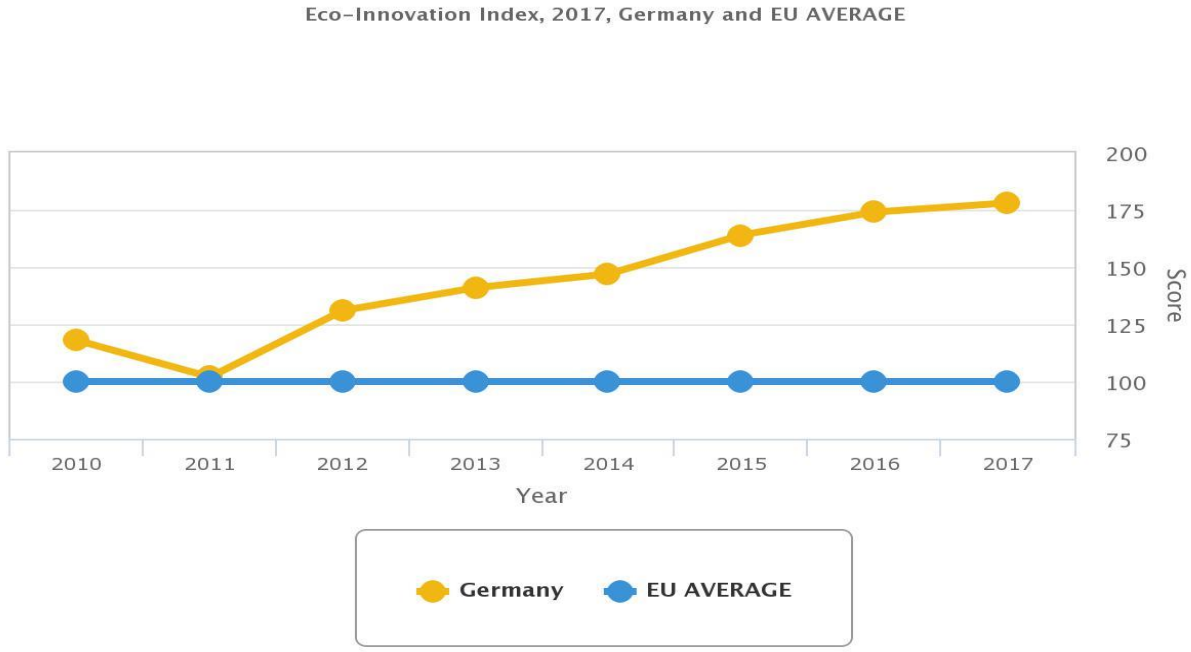
This was possible to reach due to the Waste Prevention Programme in 2013 and gave Germany a leader position in exporting innovative waste management solutions. While the implementation of the Renewables Energies Act (in 1991) and the introduction of the German Resource Efficiency Programme (ProgRess) in 2012, assured Germany's smooth energy transition. (European Commission, Eco-innovation Action Plan, 2018)

Figure 2. Percentage of Power Generation From Renewables



Source: Stratfor (2018), retrieved from: https://worldview.stratfor.com/article/germany-and-green-power-revolution [07.04.2018].

Figure 3. Eco-innovation Index (2017), Germany and EU Average



Source: European Eco-innovation Scoreboard (2018), retrieved from: https://ec.europa.eu/environment/ecoap/indicators/index_en [13.04.2018].

The European Eco-Innovation Scoreboard shows that Germany's Eco-innovation Index is 139, occupying the third place in Europe after Sweden and Finland, the results of all European Eco-innovation indexes can be seen in the Annexes, Figure 1. In this context it is essential to look at the Eco-innovation inputs (Eco-IS), which the European Eco-innovation Scoreboard (2018) defined as "the sum of Governments environmental and energy R&D appropriations

and outlays (% of GDP); total R&D personnel and researchers (% of total employment); plus the total value of green early stage investments (USD/capita).” The result of Germany’s Eco-IS is 178 and can be seen in the Annexes, Figure 2.

State investment that contributed to obtaining the result presented above are: publicly co-funded venture (Business Angels Network Deutschland); public guarantee funds (Mikrokreditfonds Deutschland); R&D funding (National High-Tech Strategy, 6th Energy Research Programme, BioEconomy 2030, SME - innovative: Resource and energy efficiency); collaborative grants (National Climate Initiative's programmes); R&D infrastructure (“IT goes green”, “Support of wastewater facilities”) and many others. (Eco-innovation Observatory, 2015: 18-19)

4.2. The Role of Universities

Moving to the role and influence of university in generating “green” innovation in Germany, one must look at the educational trainings/programs, as well as the university think tanks and labs that support innovation. Respectively, the Eco-innovation Observatory (2015) in the country report of Germany, presents a list of such programmes which include: tailored training courses for companies, entrepreneurs (“Umweltbildung, -erziehung und -information”); advice/consulting for startups, companies, entrepreneurs (“Informations- und Schulungsveranstaltungen sowie Workshops”, Efficiency Agency NRW (EFA), VDI Zentrum Ressourceneffizienz GmbH); support for R&D workers recruitments (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)). Another important factor and role provided by the universities are the competence centers, clusters, science-technology parks, among them are: the “Umweltcluster Bayern”, the “Cluster Umwelttechnologie NRW”, “Network Resource Efficiency”. Same role is fulfilled by the Technology platforms and innovationnetworks like Netzwerk Ressourceneffizienz (NeRess), Netzwerk Innovative Kreislauftechnologien (NIK), together with Foresight and common vision building as Bürgerdialog - Ressourcenschonend leben. (Eco-innovation Observatory, 2015: 20-21)

According to Reuters (2018) Germany scores high at the numbers of innovative universities in Europe, respectively, there are 23 universities (more than any other European country) in the top 100 innovative universities in Europe. Among the most innovative universities that could be found on the list is the Technical University of Munich where a big number of German startups in the field of renewable energy, semiconductors and nanotechnology started. Other innovative universities found on the list are the University of Erlangen Nuremberg, University of Munich, Free University of Berlin and University of Freiburg. (David Ewalt, 2017) In the same time, in the ranking of the 25 most innovative institutes in the world from 2017, Germany has an amount of 6 institutes that make the list. Those institutes and research units cover sectors as energy, transportation, communication, healthcare, and environment. (David Ewalt, 2017). Moreover, there are around 180 universities and polytechnic colleges in Germany which take part in the energy transition plan according to Hocken P. (The New York Times, 2014). Thus, $2.65 billion in competitive grants were provided by the German Federal Research Ministry from 2011 to 2013 in order to support the “green revolution” transition and innovation, thus proving that both state and university implications in innovation.

So far, Germany’s “green revolution” movement shows that the state and the university had and have a huge role in generating innovation. From state policies and funding, to educational platforms and innovate institutes, Germany managed to occupy a leading role in

"green revolution" innovation in the world and is an example of best practice among the countries that involve the state, university, together with industry in creating innovation.

5. Future Perspectives

From what is shown in the media today, the credit for innovation is always given to the industry or the private sector. This is not necessarily true and the literature review, together with the case study on Germany's "green revolution" innovation from this report come to prove it. Still, a lot must be done in order to change the common opinion about innovation actors. Therefore, below are presented some possible solution to this situation.

In chapter 10 of her book "The Entrepreneurial State" (2013), Mazzucato writes about changing the framework of innovation, so the state can actually take its credit for the risky innovation it has done, from pharmaceutical sector to green technology. She suggests the state to commercialize its successes, the way the private sector is doing it. Respectively, the state must speak loud and clear about its funding and involvement in innovation, mentioning directly its achievements. Another possible solution that the author suggests is the creation of an innovation fund from which startups can benefit but will have to return the borrowed money when they start gaining profit, in this way state contribution is more transparent. Moreover, Mazzucato sees the development banks, following the example of China and Brazil, as a good practice for pushing more innovation from the state's side, in the same time increasing the transparency and visibility of funding. (Mazzucato, 2013)

As per the university, similarly to the private sector, it has to increase its visibility by promoting its innovative research and projects. This could be a feasible solution that could show and prove its role in generating innovation to the non-supporters. In doing so, the universities could win more funds both from the private and the public sector. Because the university is mainly the place where basic research is happening and where specialists are acquiring knowledge, university is an important factor in creating innovation and this should be understood by the state and by the industry.

Following the Triple Helix model, the connections between the three actors university-industry-state is inevitably and happening at the moment, but this is not commercialized enough and not known to the public. For this reason, this misunderstanding has to change in the future if more economic growth and wellbeing is desired. Respectively, promoting common projects, from basic research to funding, is necessary not only to change the perspective to innovation actors but also to create more profit to all sides involved.

6. Conclusion

The role of the state and the universities continues to be undermined when it comes to generating innovation and the scope of this report was to prove that this statement is not true. For this reason the qualitative analysis concentrated on showing how the state and the university have a similar role to the industry in creating innovation.

In the literature review, the entrepreneurial state theory and the Triple Helix model come to explain why industry is not the only one generating innovation. Moreover, it is a mix of connections between the three actors. Consequently, some provide funds and policies, others provide know-how, while the last ones contribute with basic research. Famous examples of companies like Apple come to prove this, from being subsidized through state funding and to

becoming the main innovator in the mobile industry. The same goes to the pharmaceutical, green innovation industry and many other innovative sectors.

Answering the research question of whether the state and university have a similar role in fostering innovation as the private sector is done also in the Germany's "green revolution" case study of the research paper. Following this, the hypothesis (1) holds, as the state and universities have a similar role to industry in generating innovation. Furthermore, the same can be deducted from the Eco-innovation Index and the Eco-innovation Inputs, as well as the number of top innovative German universities and their startups. Government policies and funding has always been at the core of innovation in Germany, and the Energiewende is a real example of it. In the same manner, universities contributed to innovative basic research, whether by its own means or by collaborating with non-university partners.

As Mariana Mazzucato mentions in her book (2013), state's contribution was always there, but not enough commercialized, the same goes for the universities, and this must be change in the future. Increasing the visibility and transparency of government/university fostered innovative initiatives should be the agenda of every state that wishes to gain development in any sector of the economy. Therefore, pushing for further cross collaboration between the three actors is essential, being it with the means of investment funds or development banks. Only by acknowledging the influence of the university-state-industry, it will be possible to achieve the best outcome and economic growth.

References

David Ewalt (1 March 2017): *Most Innovative Research Institutes - 2017*, Reuters, retrieved from: https://www.reuters.com/article/innovative-institutions-ranking/the-worlds-most-innovative-research-institutions-2017-idUSL2N1GC1NG [15.04.2018].

David Ewalt (3 May 2017): *Europe's Most Innovative Universities - 2017*, Reuters, retrieved from: https://www.reuters.com/article/us-reutersrankings-europeanuniversities/europes-most-innovative-universities-2017-idUSKBN17Z09T [15.04.2018].

Eco-innovation Observatory (2015): *Germany - Country Profile*, European Commission, retrieved from: https://ec.europa.eu/environment/ecoap/sites/ecoap_stayconnected/files/field/field-country-files/germany_eco-innovation_2015.pdf [14.04.2018].

Etzkowitz, H., & Leydesdorff, L. (2000): *The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations"*, Research Policy 29, p. 109-123.

European Commission (2018): *European Eco-innovation Scoreboard*, retrieved from: https://ec.europa.eu/environment/ecoap/indicators/index_en [13.04.2018].

European Commission (2018): *Eco-Innovation Action Plan*, retrieved from: https://ec.europa.eu/environment/ecoap/germany_en [11.04.2018].

Federal Ministry for Economic Affairs and Energy (BMWi) (November 2015): The Energy of the Future: Fourth "Energy Transition" Monitoring Report — Summary (PDF). Berlin, Germany, retrieved from: https://www.bmwi.de/Redaktion/EN/Publikationen/viertermonitoring-bericht-energie-der-zukunft-kurzfassung.pdf [09.04.2018].

Hocken P. (11 May 2014): *Germany Taps Universities in Its Push for Green Energy*, The New York Times, retrieved from: https://www.nytimes.com/2014/05/12/world/europe/germany-taps-universities-in-its-push-for-green-energy.html [16.04.2018].

Kirschbaum E., Wacket M. (3 July 2017): *Germany breaks green energy record by generating 35% of power from renewables in first half of 2017*, Independent, retrieved from: https://www.independent.co.uk/news/world/europe/germany-green-technology-

record-power-generation-35-per-cent-renewables-solar-wind-turbines-a7820156.html [08.04.2018]

Mazzucato, M., (2013): *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*, Anthem Press, retrieved from: http://www.looooker.com/wp-content/uploads/2015/05/The-Entrepreneurial-State-Debunking-Public-vs.-Private-Sector-Myths.pdf [01.04.2018].

Russell R., Wettengel J. (4 Aug 2017): *Find your way around energy transition*, Clean Energy Wire, retrieved from: https://www.cleanenergywire.org/dossiers/germanys-energiewende-easy-guide#Description [10.04.2018].

Stratfor (18 January 2018): *Germany and the Green Power Revolution*, retrieved from https://worldview.stratfor.com/article/germany-and-green-power-revolution [07.04.2018].