

Strategic Critical Relationship between the University and the Real Sector

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ABSTRACT

This study has investigated the relationship between the real sector in the field of health and the academic world. In this relationship, we have analyzed the effects of companies, universities, other institutions, and organizations in the real sector on the development of the health sector. As a result of the research, more than 50% of the doctoral degrees received in the USA in 2018 were directly related to the health sector. On the other hand, it has been determined that USA 'companies in the field of health are proportionally more than 50% in the world stock market value ranking. The existence of the institutions that rank among the top 10, 20 and 50 in the world ranking of the human resources working in these companies in the USA has been determined as measurable and concrete. This situation is the joint success of companies and academic institutions in real terms. All countries in the world have faced with the strategically and critically important fact that the health sector is not only a money-making sector, but also in the epidemics we have experienced in recent years and the COVID-19 pandemic. Databases in different fields have been used to obtain measurable data. We think that the size, power and future of countries depend on the strategic critical scale population size, well-trained critical scale population ratio, critical scale economy, critical technology production in scale size. This represents the human resources and capital strategic size of companies in the healthcare field, universities, R&D organizations.

Keywords: *University, Health, strategic size, medicine, economy*

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I. INTRODUCTION

In the world real economy, the number of employees in the 2019 Fortune 1000 large companies is 33 million, their total income is more than \$ 15 trillion, and these situations are clear in Forbes 2020 global 2000 [1-3]. Similarly, these situations are seen in many open sources. While the total population of the world exceeds 7.8 billion, only 4.23% of the world population can be effective or produce monopoly in certain industrial areas. Here, for our real world, the effective or critical population size or qualified human resources is only 4,230% of the total. Perhaps 90% of the other population are just trying to survive and earn income.

In the research, more important than the commercial properties of healthcare and pharmaceutical companies is that they are the manufacturers of many drugs, medical chemicals, medical hospital supplies and other electronic systems used for examination in hospitals [4-5]. For this reason, countries all over the world have understood how important health institutions and human resources are for the protection of human health when we encounter COVID-19. Human resources working in these organizations should be considered as critical human resources for these countries and then for the humanity of the world. These strategic organizations and resources are more valuable than money. In previous studies, technical terms such as critical scale population size, well-trained critical scale population ratio, critical scale economy and critical technology production at scale size were introduced to economics [6]. In another study, the proportional sizes in the real economy between companies, universities, public or foundation R&D organizations and sectors were also determined [7].

The aim of the research is to analyze the relationship between human resources and related sectors, who have received doctorate and master degrees from universities and other health-related departments. In the state, foundation, company, and all kinds of institutions and companies that produce health services have been taken into consideration. Measurability was used as the basic criterion in the study. For this reason, Natureindex, ARWU-Shangaiuniversity ranking, CWUR, Value-today and Statista databases were used [8-11]. Information

was collected by making use of the fact that some of these databases were open periodically. This information was obtained between 15-May-15 June-2020. This study has taken Ranking in Statista and Value-today databases within companies into account.

II. HEALTH SECTOR

We evaluated the institutions with the highest stock market value in the world as the research area. The reason for the acquisition of these companies is that they both have market dominance in free market conditions and are companies that produce technology in their fields. Therefore, the relationship of human resources with the industry has been investigated.

Systematic, regular and formal training of human resources begins primarily in universities, institutes and R&D centers, which are institutional structures. The first stage of the development of the most effective human resources starts with the undergraduate and the second stage of the universities, where the master and doctorate are held. For this reason, we think that these institutions and organizations are very important for raising human resources, shaping young generations, instilling and popularizing the philosophy of science and research in young people and gaining researcher skills. For this, it was ensured that the relationship between the training of human resources in the countries and the success of the companies was established by cross-examining the CWUR-2017 science fields and the organizations that were included in the Natureindex-2020, CWUR-2020, ARWU-2020 evaluation rankings and giving the results in these. Within this, it has been determined that critical population sizes are the basis of the real reasons for the success of the leading countries. All of the technological and innovative countries in the world have been found to be leaders in certain areas of science and technology. This is also evident in the global 2020 innovation research [12-13].

Figure 1 shows healthcare, and figure 2 shows the pharmaceutical companies and figure 3 shows the countries of pharmaceutical companies. The first 20 companies were ranked according to the number of employees, taking into account the value of the stock market of the companies in the health sector for 2020. The total number of employees of these companies is around 860,000 according to open source information. These 20 companies are companies of 8 countries, respectively USA, UK, CHE, GER, JPN, FRA, DNK, and AUS. These companies are also leading companies in Healthcare, pharmaceutical and other sectors of healthcare. The total number of human resources employed by them is Healthcare 860,000 and pharmaceutical 1292434 employees. The total of both consists of 2152434 employees. With so many employees, it is seen as the top 20 companies of the world stock market value in its own sectors. Therefore, we think their sales and profits are also big. We think that the number of qualified employees, especially in technological companies engaged in manufacturing and research, is at least 10% like other technology companies. Accordingly, we calculate that the number of scientists will be 2153 and the number of researchers will be 215243 for 10% and 107622 for 5%. Because these companies consist of companies that are innovative and continuously make product variety [4-5].

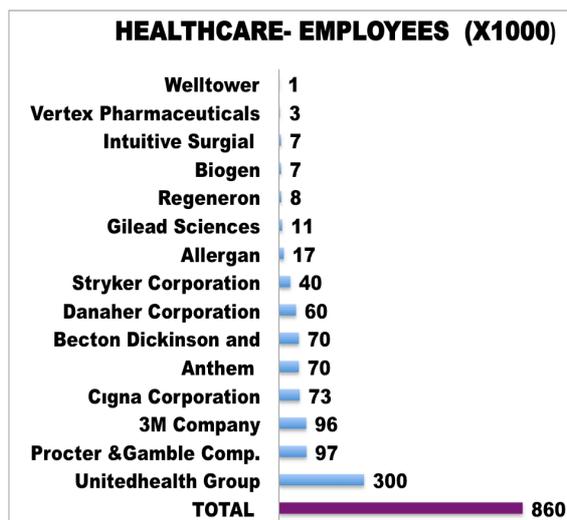


Figure 1. Companies in the healthcare field and the total number of personnel working in this field [4-5].

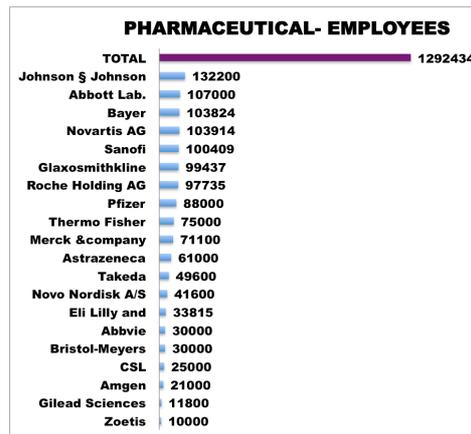


Figure 2. Pharmaceutical companies and the number of employees in these companies. Source: satista-2020, June [4-5].

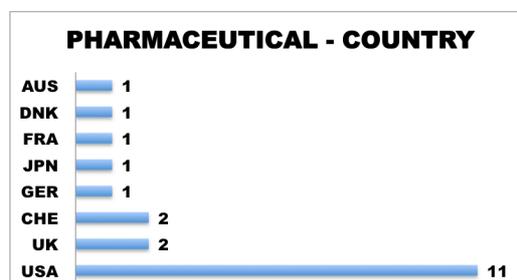


Figure 3. Distribution of pharmaceutical companies by country [4-5].

In the ARWU-2020 resource, the distribution of the universities in the world according to their geographical regions is made. In this geographical distribution, considering the world's first 800 universities of 2019-2020, there are 16 universities in the USA and 4 in Europe among the top 20 universities, 52 in the USA, 33 in Europe and 13 in Asia and Oceania among the top 100 universities. In other words, Africa does not have a university in the top 100 university rankings, and in this case, it is not surprising.

The countries ranking in the life sciences are seen in Figure 4. The life sciences ranking is produced from ARWU-2020. According to this ranking, USA has a ratio of 8/10 in biological sciences and 7/10 in human biology. In the total of both sciences, the USA has a 15/20 or 75% ratio. When looking at the general total, there is a ranking as USA (19), UK (6) and CHN (4) and it is seen that USA is clearly ahead. The other area where USA is the leader is "Biological Sciences and Human Biological Sciences". These two areas reinforce the USA's dominance around the world. The reflection of this in the industry is the size of USA companies in the production of pharmaceuticals, medical and hospital supplies. In other words, if you employ well-trained human resources in the same field, you will become a leader in the world and produce technology. The USA has achieved this success by foreseeing this strategy for the future.

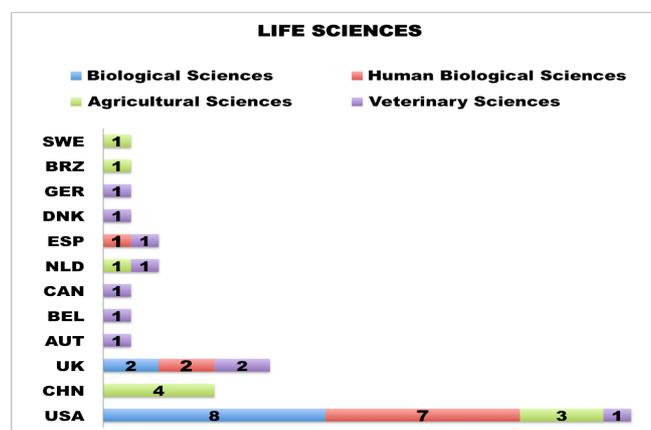


Figure 4. Life-sciences-2019-2020 country rankings [10].

In Figure 5, according to the source [10], distribution of 59 companies serving worldwide in 6 branches of science under the heading of medical sciences, is given in 7 countries. The distribution of these companies by countries is USA (54.23%), UK (22.03%), AUS (8.47%), CAN (6.77%), SWE (5.08%), GER (1.69%) and BRA (1.69%). When the distribution is viewed from a different perspective, the companies show distribution as 62.71% in North America, 1.69% in Continental Europe and 28.81% in Europe. There is no country here from Asia, Africa and Oceania. The countries that exist are the continent of America, Europe and the union of Great Britain. For this reason, the countries of Asia, Africa and Oceania are in a desperate situation in case of any attack from the health field. In a possible health problem, they have no other solution than using traditional treatments and medicines.

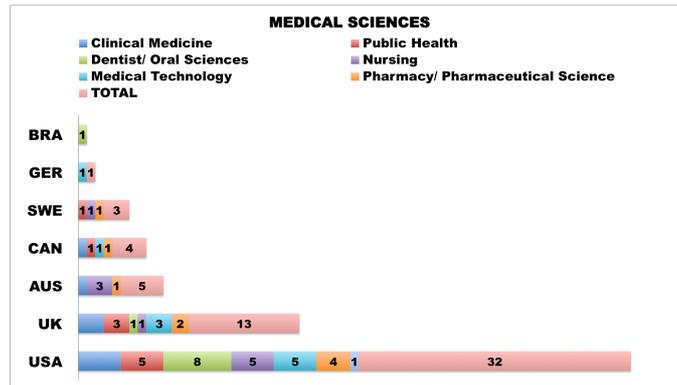


Figure 5. Medical sciences fields and distribution by country [10].

III. ALL INSTITUTIONS ACCORDING TO NATURE INDEX-2020

The data in the tables below have been generated from the data source "Nature Index 2020 Annual Tables, Vol: 580 N0: 7805-2020" [11]. The data in the source has been sorted in general and different sorting techniques have been used. These are classified and ranked in global, government, all, corporate and NPO / NGO fields. In this study, data including 500 establishments taken from reference [11] were processed. In Table 1, only the ranking of them in the first 20 is given. All academic and non-academic institutions in the top 20 were included in all countries in the ranking. These institutions include all universities, research centers, R&D and similar organizations established by the private sector and foundations, all R&D and human resources established by non-profit foundations or similar organizations in the country. In this data source, the rankings of 100 only "CORPORATE" organizations are given. In Table 1, only the top 20 of them are included.

Most of the organizations in Table 1 are companies operating in the field of health. Among these, there are also technology companies that have made huge indirect contributions. In this distribution, USA companies have a ratio of 45%. All of these institutions or organizations are companies that produce technology in their fields. Some technology companies indirectly give their ranking and market share in the world in their fields. These organizations seem to be at least as effective as universities. It may be due to the fact that other countries other than USA do not have large companies, they see their R&D studies as wasted money or because of the insufficiency of human resources. As a result, we consider that their contribution to the development of their countries, technology and science production is insufficient in whatever way they may be. Another meaning of this is that the attitudes of the political governments that govern the country are also very important. If the governments that manage the countries do not encourage or enforce R&D studies or eliminate the competition conditions in favor of the capital owners, then why should private companies do R&D? They don't do R&D anyway. Here, the situation of companies that spend money and value R&D is shown in the tables below.

Table 1. Companies in all areas and their distribution by country.

2020 TABLE / INSTITUTIONS : TABLE CRITERIA: GLOBAL / CORPORATE / ALL							
INSTITUTIONS / COUNTRIES	CHE	USA	UK	JPN	NZL	CHN	S.K
1 F. Hoffmann-La Roche AG	1						
2 Novartis International AG	1						
3 IBM Corporation		1					
4 Merck & Co., Inc.		1					
5 AstraZeneca plc			1				
6 Alphabet Inc.		1					
7 Nippon Telegraph and Telephone Corporation (NTT)				1			
8 Pfizer Inc.		1					
9 Toyota Group				1			
10 Johnson & Johnson		1					
11 Bristol-Myers Squibb (BMS)		1					
12 GNS Science					1		
13 China Shipbuilding Industry Corporation (CSIC)						1	
14 Amgen Inc.		1					
15 GlaxoSmithKline plc. (GSK)			1				
16 FiberHome Technologies Group						1	
17 Samsung Group							1
18 BGI						1	
19 Microsoft Corporation		1					
20 Thermo Fisher Scientific Inc.		1					
TOTAL	2	9	2	2	1	3	1

Table 2. Healthcare organizations and countries in all areas. In this data source, the ranking of 100 only "NPO / NGO" organizations is given.

2020 TABLE / INSTITUTIONS : TABLE CRITERIA : GLOBAL / HEALTHCARE / ALL		
INSTITUTIONS / COUNTRIES	USA	ITA
1 The University of Texas Southwestern Medical Center	1	
2 Columbia University Irving Medical Center (CUIMC), CU	1	
3 UC San Diego Health Sciences	1	
4 Duke University Health System	1	
5 Memorial Sloan Kettering Cancer Center (MSKCC)	1	
6 Massachusetts General Hospital (MGH)	1	
7 UW Medicine	1	
8 UCLA Health	1	
9 Michigan Medicine, U-M	1	
10 NYU Langone Medical Center (NYULMC)	1	
11 The University of Texas MD Anderson Cancer Center	1	
12 Vanderbilt University Medical Center (VUMC)	1	
13 Brigham and Women's Hospital (BWH)	1	
14 Mount Sinai Health System (MSHS)	1	
15 Boston Children's Hospital (BCH)	1	
16 Scientific Institute for Research, Hospitalization and Healthcare (IRCCS)		1
17 Dana-Farber Cancer Institute (DFCI)	1	
18 UCSF Health	1	
19 Health Sciences Center (HSC)	1	
20 Mayo Clinic, "United States of America (USA)	1	
TOTAL	19	1

In Table 2, USA is by 19/20 in terms of health services sector in the state, private and all other institutions and organizations. In the field of healthcare, the USA has a clear leadership or market dominance. We think that other developed countries are under market pressure from the USA. In this case, it means that other countries are not in a position to compete in this market dominated by the USA. For this reason, the development of countries is only possible when the state, private sector, other institutions and organizations develop collectively.

Figure 6 is produced according to the countries that ranked in the top 100 in the 2019-2020 Natureindex Global-Healthcare-All ranking. 12 countries are included in this ranking. In the field of health, USA has a large ratio of 68% of the total. USA has a ratio of 19/20 in the category of institutions in the field of health. This cannot be accidental. As a result of the strategic decisions of all other public and private institutions and organizations, the university has been directed to the training of human resources for health. This situation may be the strategic decision taken by the state or it should be evaluated as the sector that brings more profit than other sectors in the future. In other words, we do not think it will be chosen by chance or developed.

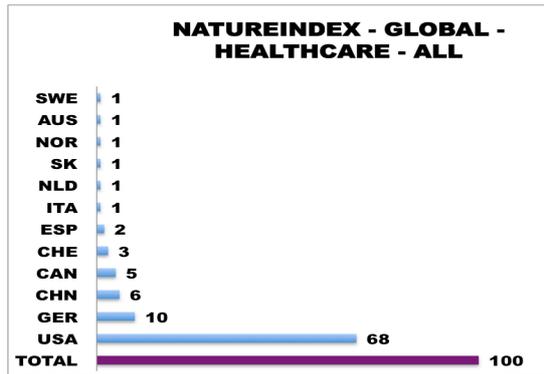


Figure 6. Distribution of all areas in Healthcare top 100 by country according to Nature Index

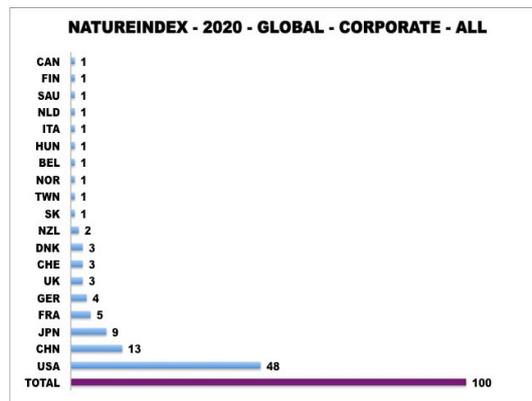


Figure 7. Natureindex-2019-2020 Global-Corporate-All rankings

For the years 2019-2020, there are only 19 countries in Nature index Global – Corporate - All rankings. There are over 200 countries registered with the UN. Among these, only USA, CHN and JPN correspond to 70% of the total, while only 1.5% of the member states of the UN. Rankings of 100 only "HEALTHCARE" organizations are given in this data source.

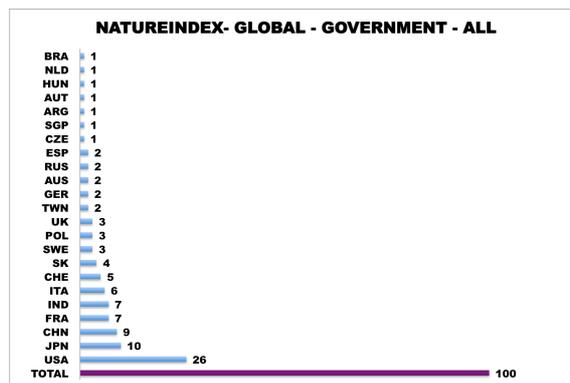


Fig.8. Natureindex-2019-2020 Global-Government-All rankings.

In the state institutions listed in Figure 8, a total of 23 countries are included in the ranking. In this area, USA 26%, JPN 10% and CHN 9% correspond to 45% of the total. This shows the importance of state institutions in training human resources. All of these organizations achieve success depending on human resources. While these organizations achieve success, they lead the development of new human resources that will ensure the continuity of success.

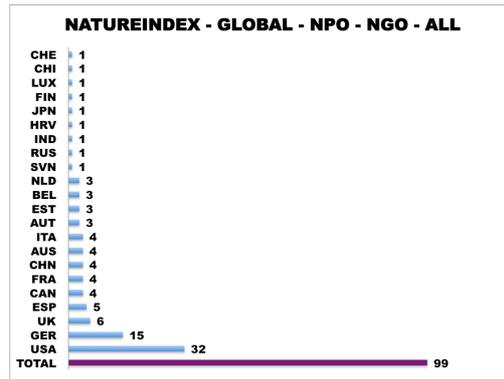


Figure 9. Natureindex- 2019-2020 Global-NPO-NGO-All rankings.

While there are a total of 22 countries in the ranking in Figure 9, the top three countries are 32% USA, 15% GER and 6% UK, respectively. The total of three countries corresponds to 53% of all countries. NPO institutions and organizations of countries contribute to science, technology and the training of human resources. The most striking country here is GER. Since Germany does not have a university in the top 20, Germany meets this deficiency with NPO-NGO institutions.

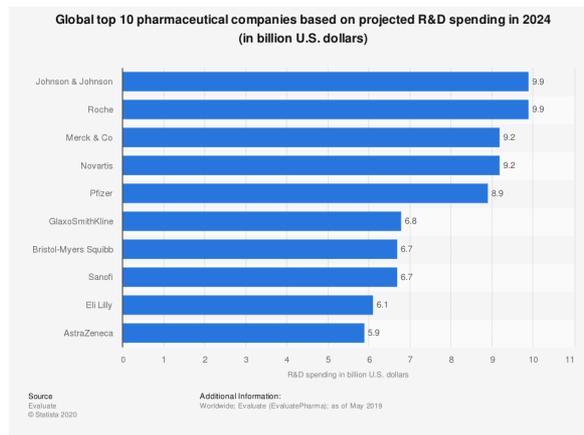


Figure 10. Planned R&D expenditure of the global top 20 companies for 2024 [14].

Figure 10 shows the projected expenditures of the top company in the pharmaceutical field in the R&D area. Most of these companies are USA companies. Figure 11 shows the market situation of the top 10 companies in the field of healthcare worldwide in 2019. These companies are 9/10 or 90% USA companies.

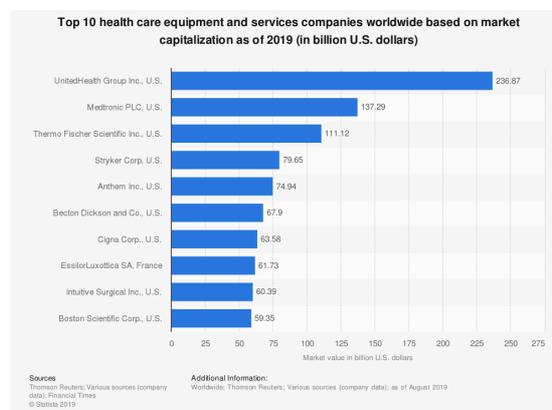


Figure 11. Healthcare market of top 10 companies [15].

Figure 12 shows the 2024 financial expenditure plans of the top 20 companies in the medical technology R&D field. The number of USA companies is equal to the 13/20 rate, or 65% of the total. USA maintains its strategic size in the field of health, with a ratio of more than 50% in any case.

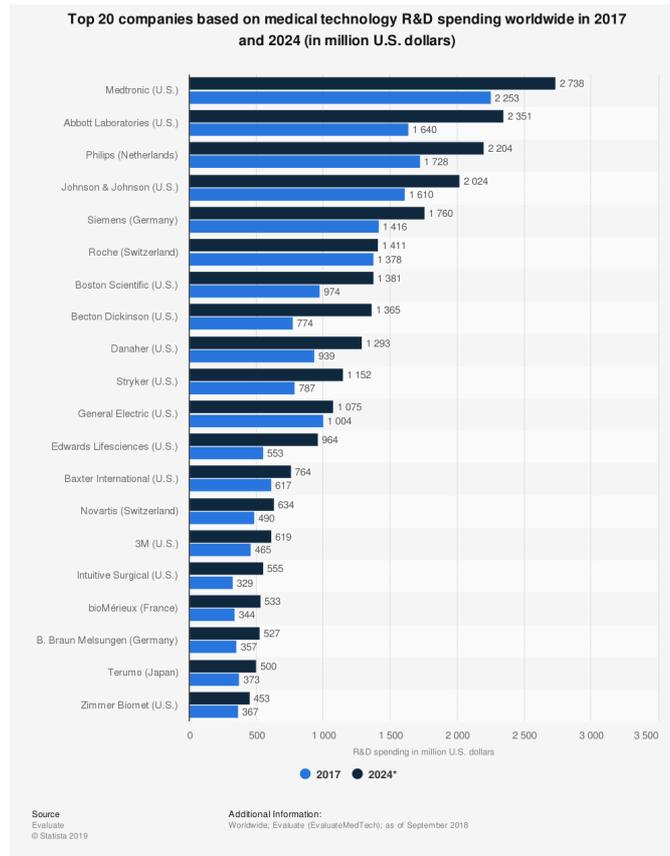


Figure 12. Medical technology R&D expenses of top 20 companies [16].

In Figure 13, the comparison of USA and Europe in the field of medical technology is made. USA's expenditures alone have been nearly three times that of Europe. If the proportion is made according to the population, Europe spends 576% of the USA on R&D. The real reason for this is the USA's doctorate and similar investments in human resources. As a result, it is a qualified human resource.

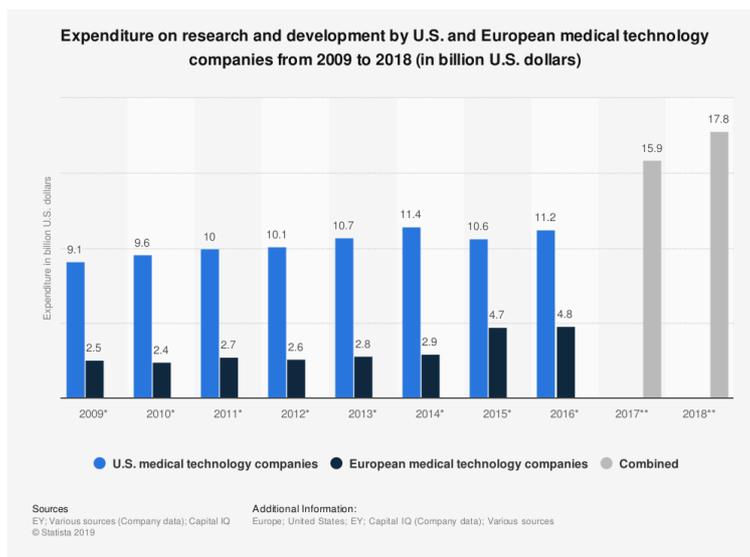


Figure 13. Comparison of medical technology R&D expenditures between Europe and the USA between 2009-2018 [17].

According to Figure 14, the number of doctoral graduates in the USA in 2017/18 was 109705/184070 in the field of health. Thus, this success is a current example of raising or owning a strategic critical population size. We think that this ratio will be preserved for the future.

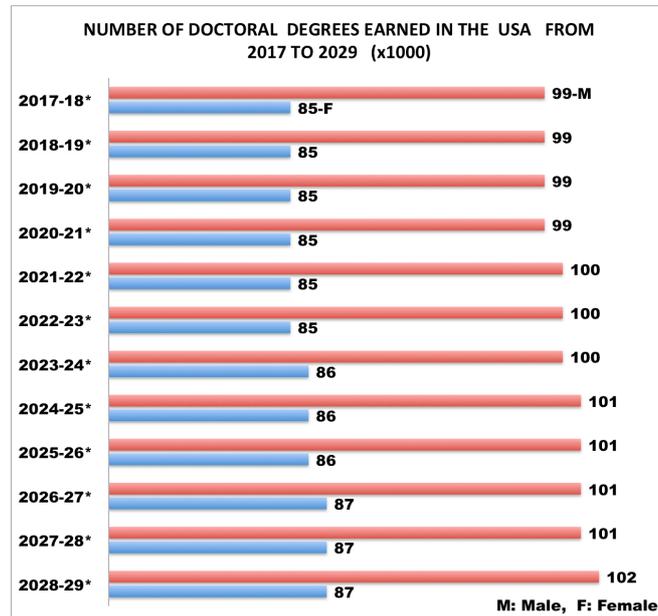


Figure 14. Estimation of those who have and will have a PhD title in the USA in 2017 and beyond [18].

The USA plans to have an average of 187000 PhD graduates each year between 2018 and 2028. If the same ratio is maintained in relation to the health sector, it will have at least 1 million qualified human resources in 2030. In this case, USA may have unrivalled companies, the pharmaceutical sector and the service sector in the world in the health field. Epidemics in the last 20 years in our world also emphasize the importance of the health field. In addition, the health sector emphasizes not only the sectors that make money for countries, but also the status of strategic critical sizes. Maybe wars can be fought with such epidemics in the coming years. Current technology is sufficient for this. The number of 2019 master graduates of USA are around 850000. In the same year, it is predicted that it will give around 184000 PhD graduates. USA's doctorate / master ratio corresponds to $184000 / 850.000 = 21.647\%$. If other doctoral programs are taken into account, we think the real rate will be more than 25%.

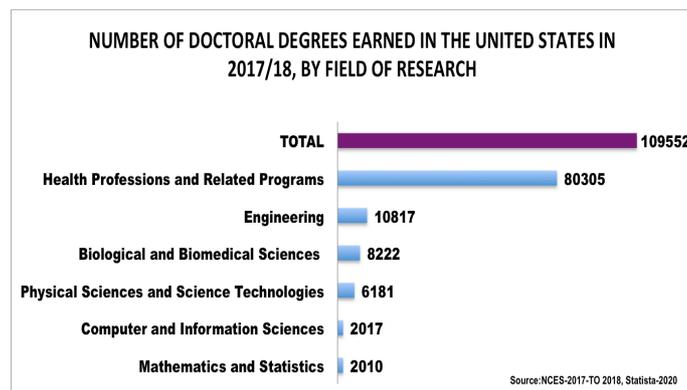


Figure 15. Distribution of those who received their doctorate degree in health field in the USA during 2017/2018 [18].

Total graduates: 184070, health field: 109522 corresponds to the number of human resources that can work directly or indirectly in the health sector.

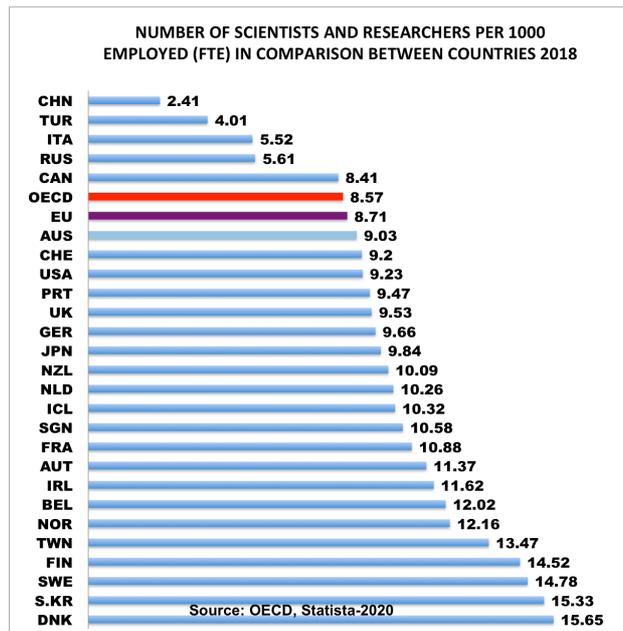


Figure 16. Relationship between scientist / researcher and employees in 2018 countries [19].

In the calculations made indirectly from Figure 16, the number of researchers corresponding to a population of 325 million [20] in the USA is 1450000 [21] or 4461 / 1000 in proportion, while the number of researchers corresponding to a population of 515 million in the EU is 1950000 [22] or 3786 / 1000 proportionally. The numerical values in Figure 16 are obtained by summing up the doctorate and equivalence, master and all researchers. In order for EU to be at the same rate as USA, the number of researchers must be 2297415 or 347415 qualified researchers are missing. According to Figure 17, when the graduates in 2019 and 2020 are taken into account, the number of doctorate students corresponds to 4868000 [24]. For this reason, the ratio of doctorate and master in the total employment of USA corresponds to 19.28% of the total employment. This may be the secret reason for USA's success.

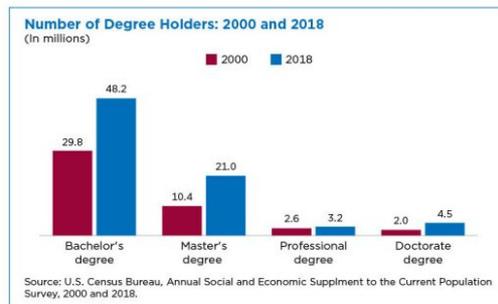


Figure 17. Number of USA's doctorate, master and undergraduate graduates [23].

IV. CONCLUSION AND EVALUATION

In this study, the real relationship between university and real sector in the field of health was investigated. This research is based on stock market value rankings for real sectors. Worldwide rankings for universities and other institutions and organizations are taken into account. According to this ranking, we think that especially the PhD candidate pays special attention to the human resources to work in the health sector of USA. Most of the companies listed in this list are from USA, and more than 50% of the doctorate holders constitute human resources to work by the health and pharmaceutical sector. When these human resources are combined with the real sector, it is seen that companies in the USA health sector have achieved great success. We think that the successes are not coincidental and the real sector and human resources are carried out in parallel with joint planning. Countries' real achievements for their universities are such real sectors. We consider every other situation just to distribute diplomas. We are faced with the fact that universities and research institutes have a significant contribution to the development of countries, the training of human resources and the competition of countries.

Although the ranking of evaluation bodies can be very controversial, they also provide a lot of information. Of these organizations, only 19 countries ranked for Natureindex-2019-2020, out of 100 basic science fields selected according to their ranking. Among these are the USA with 48%, China with 13% and Japan with 9%. The total of these three countries corresponds to 70% of the total and 1.5% of the 200 UN member countries. In other words, it can be evaluated that these three countries have a 70% market share in the world technology product trade in selected sectors. It is observed that companies in the real economy support academic institutions in all aspects and that academic institutions are structured according to the human resources needs of companies in the real economy. In other words, we think it is a real success resulting from the collaboration of companies and academic institutions. The reason why these countries become leaders is because they have these critical human resources and they make critical technological production.

Countries must first have strategic critical human resources for sustainable development, sustainable welfare society and development. If these human resources are not available, nothing is sustainable. Only poverty and misery can be sustained.

We think that economic wars and micro-organisms that can cause epidemic diseases specially produced according to the DNA structure of nations can be used instead of military hot conflicts and weapons used today in the wars of the future. Therefore, human resources in every field are at the basis of strategic and critical dimensions. This strategic resource includes scientists, holders of a doctorate, special skills, and anyone with qualifications. It has shown how much and how it can harm the micro-living countries that are causing the COVID-19 pandemic. The USA and other countries appear to be ready for COVID-19 and future pandemics. The reasons for this are that USA's qualified human resources in health, medicine and medical technologies are better than other countries. The leading countries that will find vaccines and drugs for epidemics will be the USA and other countries.

The size, power and future of the countries are limited by well-trained human resources. We think that these are dependent on proportional sizes such as critical scale population size, well-trained critical scale population ratio, critical scale economy, scale size critical technology production. It represents the strategic critical companies of USA in the field of health, human resources, capital, economy and technology production. Therefore, it is a powerful country in the world.

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