

Sources of Competitive Advantages during the Industry 4.0 Revolution. Introduction to the Research on the Example of Selected Companies in the Healthcare Sector

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ABSTRACT: *The development of modern civilization increasingly depends on the progress of scientific research in the health care industry. Pandemic threats mean that the attention of the media, scientists, and generally all the people is currently (2020) focused on the effective and comprehensive use of scientific progress in medicine. In this article, the research was carried out on selected corporations of the healthcare sector in terms of their competitive advantages. The decisive advantage of these companies is their intellectual capital. It turns out that human skills, high knowledge and organizational skills of managerial staff acquire key importance in the face of the intensified industrial revolution, the growing common knowledge in the field of health protection, but also the rapid aging of societies. In addition, the role of the healthcare industry in creating future national revenues is becoming crucial. Investors are increasingly paying attention to promising prospects for the development of the entire healthcare industry.*

KEYWORDS: *healthcare sector, transnational corporations, technological revolution, human capital*

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I. INTRODUCTION

The industrial revolution Industry 4.0, unlike previous technological turning points, has a holistic and systemic character. It converges the real world with the digital one. Cyber-physical systems gained decision autonomy, thanks to which intelligent entities coordinate economic processes independently. All participants of the production cycle, i.e. people, robots, and automatic machines combine into a complicated network of mutual conditions and connections. The creation of networking takes place not only in "smart factories" but also between companies and industries - between different units in globalised economy. Therefore, the scope of the industrial revolution 4.0 is universal, it covers all stages of the production cycle and all its participants [bcg.com, 6.01.2020].

Industry 4.0 concerns various spheres of human social and economic life. It does not bypass any industry, any region, state or continent. The Fourth Industrial Revolution creates a new world in which virtual and physical production systems work together globally in a flexible, fluid and dynamic way. The digitization of economies not only changes most production processes, but also creates new business models and new perspectives for employees, especially those with high intellectual potential. Knowledge capital, and especially its effective transfer into new solutions, is becoming the main factor that increases the competitive advantage of entities that intensively participate in a global supply chain[mckinsey.com, 6.01.2020].

In Industry 4.0, production is combined with the latest information and communication technologies, and therefore, further progress in these areas creates the opportunity to obtain strong bargaining positions for those entities that connect interfaces with logistics and operational centers of global economy. The use of digital technologies in economic processes will result in a number of new solutions, and this will increase the chance of further development of our civilization[www.bmw.de, 8.01.2020]. Competitive advantages are currently found in regions with clusters of companies and supporting institutions (research centers, research and development centers) that use the latest scientific achievements and at the same time initiate a number of innovative solutions in broadly understood business activities[Schwab, 2018].

Digital technologies, robotics and automation, modern medicine and genetics are the most important areas of modern civilization progress. The main distinguishing feature of these fields is their high intellectual potential. The significant knowledge capital accumulated in those areas is the greatest asset and advantage in international competition. On the capital market, shares of companies from the sectors of new technologies, robotics, precision industry, and pharmaceuticals have enjoyed the greatest interest among investors for many years.

Knowledge intellectual teams are carriers of high intellectual potential. The analyzes of employee networks of corporations from leading industries clearly show that key employees of such entities are usually ex-

cellent professionals in specific fields, have significant professional experience in scientific, research, and development centers, and additionally have numerous contacts with public administration and non-profit sector entities.[Becker, 1964].

Knowledge, experience, and wide contacts facilitate quick and effective diffusion of knowledge, ideas, inventions in areas and fields that have high absorption capacity and are able to use new knowledge to strengthen their bargaining positions. The transfer of innovations and innovative solutions takes place in different dynamics and structure. Relevant channels and transmission paths are important elements of network economic systems. High relational capital and extensive experience in such practices mean that more and more people can benefit from scientific and technological progress[Jovanovic, Nyarko, 1994].

The progress of the world in the first two decades of the 21st century was accompanied by significant economic fluctuations, which led to distortions in international trade and a sharp increase in public debt in highly developed countries[tradingeconomics.com, 4.01.2020]. The technological progress took place in conditions of increasing civilization problems in many countries and regions. The improvement in the efficiency of companies and historical increases on many stock exchanges did not bring the expected social order, and on the other hand, social, cultural, demographic and environmental issues did not adversely affect the economic situation and investors' behavior on financial markets. Stock exchanges around the world responded primarily to areas using new technologies, innovations and inventions related to the expanding industrial revolution Industry 4.0. The second decade of the 21st century brought spectacular successes on many stock exchanges in the world.

In countries that are significantly saturated with modern economic fields, and therefore have distinct competitive advantages over other countries, stock indexes in recent years (after the financial crisis of 2008) exceeded their current highest increases. Stock exchange records were recorded in countries where there were numerous clusters of companies representing the most modern economic fields. The United States, China and a few countries from Western Europe (Germany, Great Britain, Sweden, Denmark) are particularly noteworthy[stooq.pl, 4.01.2020].The main research purpose of the article is to conduct a survey of global companies in terms of their competitive advantages. The research hypothesis is the assumption that strong competitive positions of these entities are a derivative of their development potentials, including mainly their knowledge capital. An extension of the main hypothesis is the research aimed at examining the correlation between the Tobin Q index (the ratio of market values of the surveyed companies to the resources accumulated in them) and the return on assets (ROA). The study assumes that the demand for the assets of companies with leading market positions largely depends on the efficient use of accumulated assets, including mainly intellectual resources. Assuming that the intellectual resource accumulated in each company is the most valuable resource for it, one can formulate the hypothesis that in areas widely using new knowledge, profit increases will be the fastest and the most durable, which will significantly improve the investment attractiveness of the entities that operate in this way.

In the further part of the article, selected corporations from the healthcare sector are examined, as they largely based on new knowledge and use modern fields such as genetics, molecular biology, and robotics in their development. Corporations from the healthcare industry maintain high relations of their market values to their resources (Tobin's Q factor > 2), which qualifies these entities as leading in the knowledge-based economy.

The market positions of those companies are determined by their high development potentials accumulated and distributed in these entities. These potentials largely based on accumulated knowledge (retained structural capital), which significantly increases the value of intangible assets¹. The effective transfer of individual capital into structural capital increases the value of the intangible assets (goodwill) in the organization, which determines its strength and advantage on the market [Valler, Virovere, 2010].

It is worth noting that if a key employee leaves the organization, the enterprise loses all individual capital connected with him/her, retaining only the portion that was previously transferred to the structural capital[Al-Htaybat, Hutaibat, Alberti-Alhtaybat, 2019]. Enterprises that used accumulated knowledge (structural capital) to increase their intangible assets of their resources are playing an increasingly important role in international competition. This regularity applies to a large extent to the healthcare industry, which has significant intellectual capital potential.

The article examines the intangible assets (goodwill) and knowledge capital values in selected healthcare companies. The competitive advantages of these companies are associated with their leading roles in activi-

¹Structural capital is a part of human capital that also includes individual capital. Individual capital is assigned to individual employees of the enterprise, while structural capital, which is all accumulated knowledge, is the property of the organization - M. Geise.

ties related to the launch of new drugs, specifics, treatment methods and improved medical equipment, which provide our civilization with a great opportunity to improve the quality of life.

Position and structure of the leading companies in the world - research part

Among two thousand largest companies in the world classified according to the amount of annual turnover in 2018, there were three hundred and eight entities with a very high investment attractiveness, in which the ratio of market values to accumulated assets was two or more (Tobin Q index > 2).

In 2018, the largest concentration of such companies was in the United States, from which more than 50% of corporations (i.e. 156 enterprises) came from. There were next enterprises from China, together with Taiwan and Hong Kong (45) and companies from the European Union (42 corporations) (Table 1).

Table 1. Companies among the two thousand largest corporations in the world classified according to the amount of annual turnover and Q-Tobin > 2

Area/Country	number of companies	Area/Country	number of companies
UE	42	Switzerland	13
in it:		United States	156
Belgium	1	Asia	79
Denmark	5	in it:	
Finland	2	China	36
France	5	Hong Kong	5
Germany	7	India	9
Ireland	3	Indonesia	1
Italy	1	Japan	19
Luxembourg	1	South Korea	3
Netherlands	4	Taiwan	4
Spain	2	Thailand	2
Sweden	4	Others	18
United Kingdom	7	in All	308

Source: own study based on: <https://www.forbes.com/global2000>, access 10.01.2020.

The uneven distribution of the most attractive companies among the largest corporations in the world also occurred within the given countries. In the United States, a significant concentration of such enterprises was in five states, i.e. California, New York, Massachusetts, Florida and Texas, in China the largest concentrations of such corporations occurred on the east coast, in the provinces of Guangdong, Fujian, Jiangsu and Zhejiang, while in the European Union all companies came from Western Europe, mainly from Germany and Great Britain [forbes.com, 10.01.2020].

The next stage of the research concerned the 500 largest corporations in the world classified by annual turnover in 2018. The group contained forty-seven corporations with the highest level of investment attractiveness, in which Tobin's Q-index was higher than two. Also in this case, American companies definitely prevailed, of which there were thirty in the whole group [forbes.com, 10.01.2020].

To verify the hypothesis on the significance of the correlation between the Tobin Q index and the return on assets (ROA), the student's t-test was used. Due to incomplete data, the survey was conducted on a group of 1994 companies (from the list of 2000 largest corporations in the world classified according to annual turnover in 2018). The results of the study showed that the selected variables are statistically significantly corre-

lated. The Pearson correlation coefficient was (+) 0.48 (positive correlation and average strong)². The result means that the efficient use of resources (including intangible assets) increases the investment attractiveness of companies.

Studies of the correlation of selected variables repeated for the 500 largest companies in the world (according to annual turnover in 2018) led to the same conclusions. The Tobin's Q-ratios and return on total assets were statistically significantly correlated. The Pearson's correlation between these variables was (+) 0.72 - it turned out to be positive and very strong³.

In the era of the fourth industrial revolution, the intellectual potential (intangible assets) is becoming the company's most valuable resource. The further rapid increase in profit and return rate (ROA) in enterprises will be increasingly determined by the effective use of knowledge capital. The increase of market value of assets issued by the company will depend on the rapid diffusion of knowledge capital into its structural capital. The strongest and most numerous groups of knowledge workers are located in the world's largest companies. The competitive advantages of companies are conditioned by the composition of such employee groups. In the healthcare industry, the intellectual potential accumulated in individual companies determines the strength and position of them.

Healthcare industry on the global market

Aging societies and growing awareness of many risks related to civilization diseases cause an increase in demand for goods and services related to health protection and preventive care. A significant demand for those goods increases development opportunities for many medical equipment manufacturers, pharmaceutical companies as well as treatment and rehabilitation centers. In the next decades, even faster development of the entire healthcare industry should be expected.

In 2018, in the surveyed group of companies (308 entities) with the highest Q-Tobin ratio, there were thirty-eight entities representing the healthcare industry (Annex Tab. 6). The increase in production capacity (asset value) occurs as a result of expanding the capital base of already operating companies or the creation of new units, which leads to an increase in the demand for financial capital. Subsequent issues of shares of companies in healthcare industry are of great interest to investors. The growing demand for securities of these corporations successively increases their market values and the investment attractiveness of the entire industry. A series of such events could lead to a significant reevaluation of such companies' shares. Prospects for the emergence of further innovations and breakthrough solutions in healthcare mean that the risk of financial bubbles in this case is definitely smaller, although always possible.

In 2018, in the surveyed group of leading and most attractive corporations in the world that operate in the healthcare industry, there was a significant concentration of economic activity, financial results and production capacity in US companies. Twenty American corporations concentrated 65% of turnover, 62.5% of profits and 70% of assets of the entire surveyed group of companies. The perfect communication between scientific and research and development staff with business people as well as an effective support for institutional environment increased the competitive advantages of American companies. In Europe, strong centers of the healthcare industry were located in Denmark and Switzerland, while in Asia, Chinese enterprises gained stronger positions [forbes.com, 10.01.2020].

A visible advantage of the surveyed group of companies from the healthcare industry was their very high efficiency measured by the net turnover profitability index. In 2018, the entire group of corporations obtained the result of this indicator at the level of 19.5%. For comparison, in 2 000 largest corporations in the world classified by annual turnover in 2018, turnover profitability reached around 8%. The above comparison shows that the surveyed group of corporations from the healthcare industry maintained more than twice the level of efficiency than the entire two thousand largest companies in the world [forbes.com, 10.01.2020].

The corporations from healthcare industry became the absolute leader among the largest companies in the world. This situation is extremely comfortable for this industry, as a high level of efficiency attracts investors from the stock market. The rapid development of medicine, pharmaceuticals, the medical apparatus indus-

² The calculated t-student statistics at $r_{xy} = 0.484$ and the number of observations $n = 1994$ was 44.632. From the tables of critical values t - student for $\alpha = 0.05$ and an infinite number of observations, the value $t_{\alpha / 2} = 1.965$ can be read. Because $t = 44.632 > t_{\alpha / 2} = 1.965$, it can be stated that the Q-Tobin ratios and return on assets (ROA) in 2018 for the group of 1994 largest companies in the world were statistically significantly correlated.

³ Calculated based on data from: <https://www.forbes.com/global2000>, access 10.01.2020.

try, biotechnology and genetics will certainly be even more encouraging to buy the assets of companies representing these areas.

Case study for selected American corporations from healthcare industry

Among twenty American champions from healthcare industry, six came from the state of California. These were: *Clorox, Intuitive Surgical, Edwards Lifesciences, Illumina, ResMed and Veeva Systems*. A distinctive feature of these corporations is their significant investment attractiveness, which is manifested in a very high ratio of market values to the assets accumulated in them (Tobin's Q index). This indicator is 7.5 and is more than twice as high as the ratio calculated for the whole group of thirty-eight corporations. Such a disproportion results both from the generally high valuation of indices on the US stock exchanges as well as from investors' expectations as to the further rapid development of these corporations [forbes.com, 10.01.2020].

From the California group of companies, three of them deserve special attention: Intuitive Surgical, Edwards Lifesciences and Illumina. These are corporations with the highest investment attractiveness and business activity in areas that determine the future comfort of human life. Significant development opportunities of these corporations result from the constant search for new products and services, innovations, but above all from the high intellectual potential of their managers. These companies maintain a comparable level of annual turnover and similar growth dynamics. In addition, they have a very high level of efficiency and exemplary financial liquidity. These entities have all attributes to consider them as the best deposits in long-term investment prospects [Fisher, 2007].

The Intuitive Surgical Company was founded in 1995 and has its headquarters in Sunnyvale, California. The subject of its activity is the production and sale of the da Vinci's surgical system (surgical robots). The work on this system began at the end of the 1980s. The prototype surgical system of that time gained a great interest of the Agency for Advanced Research Projects in the Field of Defense as it could be used to perform remote surgical operations directly on the front line under the control of surgeons in safe locations. Dr Frederic Moll, the founder of Intuitive Surgical, took the opportunity to raise sufficient capital and start intensive work on improving the prototype [annualreports.com, NASDAQ_ISRQ, 10.01.2020].

The close cooperation of the newly formed company with the Stanford Research Institute, and especially the purchase of new technologies from the company, enabled its rapid development. An important factor in the development of the corporation was also the employment of experienced specialists in the field of medical robots, among others from the Massachusetts Technical Institute and IBM. When a strong group of staff was employed, three prototypes of these robots were developed. The first tests of robots' operations were carried out on animals and then on humans. In 2000, the FDA approved the use of the da Vinci in laparoscopic practices. Since then, the dynamic development of the company has been registered. It should be remembered that Dr Frederic Moll is also the inventor of surgical trocar used in laparoscopic procedures around the world [people-pill.com/people, frederic-moll, access 10.01.2020].

The biggest breakthrough for the company took place at the beginning of 2014, when a new, more perfect model of a surgical robot was introduced to the market. From 2015, it was selling with great success in the United States and some Western European countries. It is estimated that in 2017, about 900,000 operations were carried out using these devices worldwide in many fields of medicine, including general surgery, laryngology, gynecology, cardiology, and urology. The biggest advantage of these devices is their high precision and reduction of undesirable side effects [annualreports.com, NASDAQ_ISRQ, 10.01.2020].

The corporate success of the corporation caused a sharp increase in share prices on the stock market. From the end of 2016 to the end of 2019, the rate of return on the company's assets reached 183% (for comparison, at the same time the DJI index on the New York stock exchange increased by 44%) [stooq.pl/q/?s=isrg.us]. The estimated sales revenue for 2019 is expected to be USD 4.25 billion, which is 78.6% more than in 2015. The efficiency of this company is also amazingly high (Table 1).

Tab. 2. Economic indicators for the Company Intuitive Surgical

specification	2015 year	2016 year	2017 year	2018 year	2019 year
return on Sales	66,4%	70,0%	70,0%	69,9%	70,1%
total Revenue (in Billion USD)	2,38	2,7	3,13	3,72	4,25
gross Profit (in Billion USD)	1,58	1,89	2,19	2,6	2,98

Source: <https://www.morningstar.com/stocks/xnas/isrg/financials>, access 10.01.2020.

The profitability of gross sales reaching 70% is a significant "lure" for investors who are counting on high dividends when buying shares. Additional advantages of the company are: a high level of reserves in work-

ing capital, a very low level of overall debt and maintaining the golden balance sheet principle (developed on the basis of the data provided in the annex in Table 9).

Headquartered in Irvine (Los Angeles metropolitan area), California, the Company Edwards Lifesciences is a world leader in production of heart valves. Aging societies will increasingly need medical assistance in the field of cardiac surgery. The extending of life span will largely depend on the smooth functioning of implanted heart valves. New generations of these components create greater comfort for millions of patients around the globe. One of the innovative solutions in this area is the InspirisResilia valve of the Edwards Lifesciences Company. It is a new generation of biological valve made of beef pericardium. This valve is characterized by high resistance to limestone processes, thanks to which patients who receive it can enjoy long-term comfort of life without the need for further surgical procedures[annualreports.com, NYSE_EW, 10.01.2020].

The company's founders are Miles Lowell Edwards and Albert Starr. Edwards came from the family of inventors. His father was the founder of the first electricity company in his hometown of Newberg. M. L. Edwards after graduating from Oregon State University won the competition for the position of engineer in General Electric. Three years of experience in this reputable company allowed Edwards to acquire solid inventive skills. After returning to Oregon, he began working on industrial pump designs as an engineer at the Bingham Pump Company, then at the Weyerhaeuser Timber Company, where he designed a large water pump. His ingenuity, commitment and diligence resulted in independent searches for new types of centrifugal pumps. Many years of work in the home workshop was a great success. The centrifugal pump made by M. L. Edwards was used by Boeing in the production of military combat aircraft during World War II. Once retired, Edwards worked on using his inventions and projects to develop a prototype of artificial heart[ohsu.edu, 10.01.2020].

In 1958, he tried to attract the attention of Albert Starr, a cardiac surgeon, who - while serving in Korea - performed cardiovascular operations during the war in the so-called mobile operating points. A. Starr found Edwards' idea too difficult to implement, but started working with him on a heart valve project. Together, the researchers managed to develop the world's first heart valve (Starr-Edwards artificial mitral valve), which, after successful implantations in dogs, was used in human cardiac surgery.

In the 60s of the XX century, A. Starr and M. L. Edwards significantly improved their valve model. Working together brought new ideas, including the development of many types of artificial pacemakers. Starr was awarded the Albert Lasker prize for his outstanding scientific achievements in the field of clinical medical research. This outstanding cardiac surgeon together with M. Edwards made a huge contribution to the development of cardiac surgery around the world [books.google.de, Albert+Starr+herzklappe&source, 10.01.2020].

The confirmation of great medical successes is the excellent financial situation of Edwards Lifesciences. It is seen on the stock exchange in a very high rate of return on its shares. The closing price at the end of 2019 was USD 234.6, which is 107.7% more than at the end of 2016[stooq.pl/q/?s=ew.us, 10.01.2020].

According to the financial report, the turnover at the end of 2019 will amount to USD 4.15 billion, which is 67% more compared to 2015. The dynamic increase in economic activity was accompanied by a very high level of efficiency. The profitability of gross turnover in 2015-2019 fluctuated around 75% (Table 3).

Table 3. Economic indicator for the Company Edwards Lifesciences

specification	2015 year	2016 year	2017 year	2018 year	2019 year
return on Sales	75,5%	73,3%	74,4%	74,7%	74,5%
total Revenue (in Billion USD)	2,49	2,96	3,44	3,72	4,15
gross Profit (in Billion USD)	1,88	2,17	2,56	2,78	3,09

Source: <https://www.morningstar.com/stocks/xnys/ew/financials>, access 10.01.2020.

Also, in the case of this company, the demand for further share issues will certainly translate into even greater business success, especially since the corporation has had additional financial attributes. The company maintains financial liquidity, low financial leverage and a golden balance sheet principle. The provisions in working capital and the correct structure of assets additionally strengthen the foundations of this company's operations (based on the data provided in the annex in Table 8).

The last of the surveyed companies is the Illumina from San Diego. As in the case of the previously described corporations, this entity achieved spectacular business success in recent years. The efficiency in the analyzed period was very high, and gross turnover profitability fluctuates within 70%, and the rate of return on the company's shares in the last three years (2016-2019) was almost 160%, which also maintains the growing demand for subsequent company's shares[stooq.pl/q/?s=ilmn, 12.01.2020].

Tab.4. Economic indicators for the Company Illumina

Specification	2015 year	2016 year	2017 year	2018 year	2019 year
return on Sales	69,8%	69,6%	66,5%	69,1%	69,4%
total Revenue (in Billion USD)	2,22	2,4	2,75	3,33	3,46
gross Profit (in Billion USD)	1,55	1,67	1,83	2,3	2,4

Source: <https://www.morningstar.com/stocks/xnas/ilmn/financials>, access 12.01.2020.

The company maintains financial liquidity and the golden balance sheet principle. The increase in the overall level of debt and the high financial leverage maintained since 2016 are not obstacles to achieve very good financial results. In 2015-2019, the corporation was a stable entity with promising prospects for further development (based on the data provided in the annex in Table 7).

The Illumina's business is the production and distribution of devices for genetic analyzes and bioinformatics tools for genomic research. The company supplies its equipment to research centers, government laboratories, hospitals, and pharmaceutical companies in many countries around the world. The biggest challenge for the company and, at the same time, hope for humanity is to improve methods of recognizing genetic material, genome mapping, and thoroughly examine interactions occurring within the genome. The development of this field creates opportunities to eliminate many serious human diseases in the coming years [annualreports.com, NASDAQ_ILMN, 12.01.2020].

The Corporation's Board of Directors consists of fourteen outstanding specialists from various fields and sciences who have significant knowledge and professional experience. Since 2016, the president and CEO of the company is Francis deSouza, an experienced manager, with many business successes, a graduate of the Massachusetts Institute of Technology. In his career, he was general director of companies such as Symantec Corporation and Flash Communications. Then he worked as a managerial in Microsoft and was a member of the board of The Walt Disney Company.

The company's medical director is Dr. Phil Febbo, who is responsible for introducing genomic tests into medical practice. Previously, he worked in many hospitals as a professor and dealt with, inter alia, the use of genomics for clinical research in prostate cancer. Charles Dadswell is the senior vice president of the company who is primarily responsible for intellectual property issues. He also worked in many companies mainly dealing with the protection of patents and inventions. He contributed to the economic success of companies such as GlaxoSmithKline and bioMerieux. Paula Dowdy is the commercial director for Europe, the Middle East and Africa. She gained almost 20 years of professional experience working in managerial positions at Cisco. Her considerable involvement in her professional work resulted in a dynamic increase in economic activity in this region of the world. The commercial director for China is Li Qing, an experienced businessman responsible for developing the company's priority market. The company's strategic goal is to expand economic activity in the country, including medical, regulatory, legal and marketing aspects. Li Qing accumulated considerable professional experience in working in managerial positions of such companies as GE, Healthcare, Baxter, Novartis and Solvay. There are nine specialists on the board of directors whose contribution to the company's development is also significant. The strength of the corporation is measured by a very strong composition of the company's board of directors [annualreports.comNASDAQ_ILMN, 12.01.2020].

In these companies, very good economic results are the result of many factors and long-term processes. Their products meet a high and fast growing demand, which ensures the development and strengthening of their position. Final products were created during many years of work and experience as well as various experiments and technical improvements. Strenuous, persistent and perfectly organized work ultimately brought spectacular successes. Scientific centers, research centers and universities provided entrepreneurs not only with the supply of highly qualified staff, but also guaranteed access to research equipment, technology, database needed to run efficient processes. Many years of practice of partner and cooperative relations between business and science developed in California significantly facilitates the transfer of various innovations in this area to specific applications. The contribution of knowledge capital of key employees to build their strong competitive positions is huge. Outstanding inventors, specialists from many industries, and experienced managers created a strong staff composition in these enterprises, without which the described change process would not be possible.

Knowledge capital in these companies is significantly increased by intangible assets (hidden assets) that determine their strong market positions. This part of the article will estimate the value of knowledge capital

in them using the CIV method. The study adopted a ROA return for the pharmaceutical sector of 19.5% and a discount rate on the US financial market at 3%⁴.

Table 5. Intangible assets by the CIV method in selected companies of the healthcare sector

specification	Companies		
	Intuitive Surgical	Edwards Lifesciences	Illumina
discount rate _{US/2018}	3%		
ROA(for the sector)	19,5%		
average profit* (2016-2018)	2,23	2,50	1,93
average asset value* (2016-2018)	6,70	5,18	5,50
ROA (2016-2018)	33,28%	48,26%	35,09%
excess value for the company*	$19,5\% * 6,70 = 1,3065$	$19,5\% * 5,18 = 1,0101$	$19,5\% * 5,50 = 1,0725$
profit from investments in intangible assets*	$2,23 - 1,3065 = 0,9235$	$2,50 - 1,0101 = 1,4899$	$1,93 - 1,0725 = 0,8575$
income tax* (21%)	0,194	0,313	0,180
net profit on investments in intangible assets*	0,730	1,177	0,677
value of intangible assets*	$0,730 : 3\% = 24,3$	$1,177 : 3\% = 39,2$	$0,677 : 3\% = 22,6$

*mld USD

Source: Based on data from <https://www.morningstar.com>, access: 13.01.2020.

The results of the analysis show that in each company, the values of intangible assets (knowledge capital) clearly exceeded the book values of their assets. Such companies are the best long-term deposits for investors because they guarantee a sufficiently high level of profitability in the long run [Fisher, 2007]. Prospects for further price increases for these securities are likely.

II. CONCLUSIONS

- Competitive advantages of companies largely depend on their intellectual potential and methods of their use. The effective knowledge transfer for specific applications is the key to success for any enterprise and, as a result, a source of income for its owners and shareholders.
- Health protection in the era of rapid civilization changes, including mainly the development of genetics, biotechnology, and medical automation, is becoming a key industry in the economy of the 21st century. Aging societies and the growing awareness of many health threats make this industry gain priority in the processes shaping the direction of our civilization.
- In the healthcare industry, American corporations, including those from California, take the opportunity for rapid development in the best way. Clusters of many significant companies, the best universities with research and development centers, as well as efficient supporting institutions launched synergistic development mechanisms in this state, leading to the creation of one of the most developed regions of the world.
- The competitive advantages of California healthcare companies are significantly shaped not only by long-term capital and technology concentration processes in this area, but also by efficient management in business entities and cooperating institutions. The concentration of highly qualified labor resources and economic ties formed in this area further strengthened the region in international competition. Relational capital, which is

⁴ This ROA was for 38 companies in the healthcare sector with the highest level of attractiveness in the world in 2018.

a component of California's competitive advantage, is the result of diffusion of knowledge and experience in intangible assets of key state's companies. Patterns, good practices and innovative solutions recorded in the memory of this territory strengthened the region.

- Intuitive Surgical, Edwards Lifesciences and Illumina are among the most effective and attractive healthcare companies from California to invest in. The advantage of these corporations is the result of both effective ways of managing tangible assets, such as tangible assets and technologies, but also the exemplary use of intangible assets. Structural capitals recorded in intangible assets (goodwill) determine the strength and advantage of these entities on the American and global market of goods and services from the healthcare sector.

Annex

Tab. 6. Economic data and indicators for selected companies in the healthcare sector

Corporation	Country	Revenues*	Profit*	Assets*	Market Value*	Tobin	ROA	ROS
CSL	Australia	8200	1800	11500	61700	5,37	15,65	21,95%
Jiangsu Hengrui Medicine	China	2700	642	3500	42000	12,00	18,34	23,78%
Shenzhen Mindray	China	1600	383	2400	23000	9,58	15,96	23,94%
Yunnan Baiyao Group	China	4000	500	4400	14000	3,18	11,36	12,50%
Coloplast	Denmark	2700	617	1900	21900	11,53	32,47	22,85%
Novo Nordisk	Denmark	17700	6100	17000	116300	6,84	35,88	34,46%
Novozymes	Denmark	2300	511	3000	13200	4,40	17,03	22,22%
H Lundbeck	Denmark	2900	618	3500	8300	2,37	17,66	21,31%
Ipsen	France	2600	460	3900	11000	2,82	11,79	17,69%
CSPC Pharmaceutical	Hong Kong	2700	466	3400	12200	3,59	13,71	17,26%
Hoya	Japan	5100	1000	6600	25200	3,82	15,15	19,61%
Shionogi	Japan	3100	1100	6600	17400	2,64	16,67	35,48%
Terumo	Japan	5300	824	10300	21100	2,05	8,00%	15,55%
Celltrion	South Korea	892	243	3300	22700	6,88	7,36%	27,24%
LG Household & Health	South Korea	6100	620	4700	20700	4,40	13,19	10,16%
Sonova Holding	Switzerland	2800	427	4300	12900	3,00	9,93%	15,25%
Roche Holding	Switzerland	58100	10700	79600	222000	2,79	13,44	18,42%
Smith & Nephew	United King-	4900	666	8100	16400	2,02	8,22%	13,59%
IDEXX Laboratories	United States	2200	377	1500	18800	12,53	25,13	17,14%
Veeva Systems	United States	862	230	1700	18700	11,00	13,53	26,68%
Intuitive Surgical	United States	3700	1100	7800	60900	7,81	14,10	29,73%
Edwards Lifesciences	United States	3700	722	5300	36900	6,96	13,62	19,51%
Vertex Pharmaceuticals	United States	3000	2100	6200	43000	6,94	33,87	70,00%
Illumina	United States	3300	826	7000	46900	6,70	11,80	25,03%
Incyte	United States	1900	109	2600	15800	6,08	4,19%	5,74%
Zoetis	United States	5800	1400	10800	47500	4,40	12,96	24,14%
Clorox	United States	6200	790	5100	19700	3,86	15,49	12,74%
ResMed	United States	2500	450	3900	14200	3,64	11,54	18,00%
3M	United States	32800	5300	36500	126100	3,45	14,52	16,16%
Regeneron	United States	6700	2400	11700	36400	3,11	20,51	35,82%
Cerner	United States	5400	630	6700	20300	3,03	9,40%	11,67%
Eli Lilly	United States	24600	3200	43900	119300	2,72	7,29%	13,01%

Sources of competitive advantages during the Industry ..

Stryker	United States	13600	3600	27200	67300	2,47	13,24	26,47%
Baxter International	United States	11100	1600	15600	38000	2,44	10,26	14,41%
Johnson & Johnson	United States	81600	14700	153000	366200	2,39	9,61%	18,01%
Boston Scientific	United States	9800	1700	21000	48800	2,32	8,10%	17,35%
Bristol-Myers Squibb	United States	22600	5000	35000	74400	2,13	14,29	22,12%
Alexion Pharmaceuticals	United States	4100	78	13900	28300	2,04	0,56%	1,90%

*mln USD

Source: <https://www.forbes.com/global2000>, access 10.01.2020

Tab.7. Selected information from the balance sheet for the Company Illuminia

specification	2014 year	2015 year	2016 year	2017 year	2018 year
non- current assets	1,45	1,59	1,96	2,28	2,47
current assets	1,89	2,1	2,32	2,98	4,49
total assets	3,34	3,69	4,28	5,26	6,96
equity	1,88	1,84	2,01	2,51	3,11
non current liabilities	1,15	1,23	1,31	1,76	1,31
current liabilities	0,31	0,62	0,96	0,99	2,54
total liabilities	3,34	3,69	4,28	5,26	6,96

Source: <https://www.morningstar.com>, access 13.01.2020.

Tab.8. Selected information from the balance sheet for the Company Edwards Lifesciences

specification	2014 year	2015 year	2016 year	2017 year	2018 year
non- current assets	1,23	2,01	2,27	3,16	3,04
current assets	2,29	2,05	2,24	2,54	2,28
total assets	3,52	4,06	4,51	5,7	5,32
equity	2,19	2,5	2,62	2,96	3,14
non current liabilities	0,9	1,08	1,36	1,34	1,31
current liabilities	0,43	0,48	0,53	1,4	0,87
total liabilities	3,52	4,06	4,51	5,7	5,32

Source: <https://www.morningstar.com>, access 13.01.2020.

Tab.9. Selected information from the balance sheet for the Company Intuitive Surgical

specification	2014 year	2015 year	2016 year	2017 year	2018 year
non- current assets	2,11	2,71	3,24	2,95	3,52
current assets	1,85	2,2	3,25	2,81	4,33
total assets	3,96	4,91	6,49	5,76	7,85

equity	3,38	4,32	5,78	4,73	6,69
non current liabilities	0,08	0,1	0,11	0,33	0,34
current liabilities	0,5	0,49	0,6	0,7	0,82
total liabilities	3,96	4,91	6,49	5,76	7,85

Source: <https://www.morningstar.com>, access 13.01.2020.

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