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Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)
<https://www.zbw.eu/econis-archiv/>

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Influence of Energy Sector Corporations on the Corporate Control Functions of Cities

Piotr Raźniak*, Sławomir Dorocki, Tomasz Rachwał, Anna Winiarczyk-Raźniak

Institute of Geography, Pedagogical University of Krakow, Poland. *Email: piotr.razniak@up.krakow.pl

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ABSTRACT

The energy sector is one of the most important industrial sectors, especially in the era of depleting sources of mineral fuels, climate-related threats resulting from negative effects of energy production from fossil fuels on the natural environment, and the associated need to develop energy sources based on renewable sources. Hence, the financial performance of firms in the energy sector, especially the largest firms, is an important research issue. The purpose of this paper is to determine the financial position of the largest firms in the energy sector listed by Forbes Global, 2000 and their impact on the command and control (C&C) functions of cities. In this paper, we present a index of potential for selected cities based on revenue from sales, net profits, assets, and market value for selected sectors of the economy (CCI). Research has shown that the energy sector is one of the leading sectors in the world economy, both in terms of corporate financial performance and as a whole. However, the energy sector is a dominant sector in relatively few cities around the world (Beijing, Moscow, Houston, the Hague). At the same time, the energy sector is considered not very stable relative to other sectors of the economy. Given the increasing importance of the largest firms in this sector in shaping the command and control function of cities, it would be reasonable to combine the forecasting of their financial performance with a focus on its impact on the command and control function of cities in order to evaluate patterns associated with this function for leading cities in the world.

Keywords: Energy Sector, Command and Control Function of Cities, Financials, Resources

JEL Classifications: F3, G3, R1

1. INTRODUCTION

It is difficult to imagine the modern world without the use of energy. Constant growth in the world's population and size of its industrial sector demands an ever increasing amount of electrical energy (Türkan and Ozel, 2019). Despite significant technological progress and the introduction of power-saving machines and devices, demand for electricity keeps growing across the world. Increasing levels of economic development require more electricity to sustain economic growth (Sun et al., 2011) despite the pursuit of energy efficiency policies at the country level or European Union level (Primc and Slabe-Erker, 2020). While the increase in demand for electricity in developed economies is small, the increase in demand in developing economies remains high. According to the Global Energy Statistical Yearbook, 2018,

demand for electricity almost doubled in the world as a whole in the period 1990-2017. Electricity production almost doubled as well. In order to meet demand, new investment is needed in plants that generate and distribute electricity. Such investment is very capital-intensive, which is why the energy sector is dominated by very large firms whose potential increases with mergers and hostile takeovers. This is why firms in the energy sector constitute a sizable portion of the list of the largest firms examined by Forbes Global, 2000 (www.forbes.com).

There do exist detailed analyses of the command and control (C&C) function of cities relative to the R&D sector, for example (Tóth and Csomós, 2016), however, there are no detailed analyses for other sectors generating this function. Given that the energy sector plays a substantial role in the generation of the command and

control function of cities (Csomós, 2017) and demand for energy is growing at different rates across the world (Tóth and Szép, 2019), it is reasonable to examine this issue in greater detail. Hence, the purpose of the study was to determine the financial position of the largest firms in the energy sector versus that for other sectors as well as to assess their significance in the generation of cities' command and control function in the period 2006-2018.

The study is focused on energy sector companies classified on the basis of the Global Industry Classification Standard (GICS), which is commonly used in research studies on the command and control function of cities (Taylor and Csomós, 2012; Csomós and Derudder, 2014; Taylor and Csomós, 2017). The energy sector includes businesses associated with the oil and gas industry. The authors also consider the fact that, in a broad sense, the energy sector also includes utility companies that use not only oil and gas, but also other sources of energy such as water, solar power, and nuclear power. These types of companies are part of utility industries, which means that according to the GICS classification they are part of other sectors. The research studies whose results are discussed in this paper purposefully note the part of the energy sector that is based on the use of nonrenewable sources of energy. Hence, it is important to note that the term "energy sector" used in this paper implies mainly businesses associated with the use of nonrenewable energy sources – solid fuels, liquid fuels, and gas form fuels. It is also noteworthy that changes in the development of this sector are associated largely with the development of the automobile industry and the degree of use of cars and trucks.

In light of changes in the energy policy of many countries and the attempt to transition towards renewable sources of energy, this type of research approach makes it possible to ascertain whether traditional energy companies based on nonrenewable sources of energy are still making an impact on the command and control function of cities in the world economy. It is reasonable to suspect that their role in the future will diminish in favor of companies producing energy based on renewable sources as well as due to the decline of the use of gasoline-fueled cars. This makes it possible to run an assessment of the current role of the traditional energy sector based on fossil fuels in generating the command and control function of cities in the world – prior to the stage of quite possibly very dynamic changes in the world energy sector, which may include a transition away from gasoline as the primary fuel source for vehicular transportation. This is the rationale for narrowing analysis in the present paper to the energy sector as defined by the GICS classification.

2. THEORETICAL BACKGROUND

Sectors such as energy, mining, and processing represent key areas of industrial growth. The energy sector produces a tangible product – energy – that is needed in the functioning of other sectors of the economy and that of modern households. While it plays a role in economic prosperity, it also produces a negative environmental impact (Leisen et al., 2019). This is why many different types of researchers are interested in this sector. Researchers note that this sector is undergoing significant change due to market integration (Batalla-Bejerano et al., 2019) and the liberalization

of electricity markets in many countries in the late 1990s. They also note that there do exist efforts to mitigate climate change by means of a clean energy transition manifested globally in the Kyoto Protocol of 1997 (Leisen et al., 2019). These changes have helped many new firms enter the energy market, which requires a change in the models used to manage large, established firms in this sector. In some cases, significant restructuring is needed. This is true not only of firms in Central and Eastern Europe, where a fundamental economic transformation has been underway since 1989 (Rachwał, 2011; Rachwał, 2015; Malec and Benalcazar, 2020). These structural changes are also likely to affect highly developed market economies.

This is due to rapid changes in policy in areas such as industrialization, energy security, and environmental protection as well as technological changes and the increasing need to adapt to new regulations associated with clean production, all of which forces energy firms to change how they function. Defeuille (2019) notes that trajectories of energy sector change are not only technology-driven but may also be examined in terms of social change. It is important to consider growing social awareness in the area of the energy sector's environmental impact. In the view of researchers, it is necessary to consider an array of factors that affect the operations of firms in the energy sector. This is especially true of firms operating in the European Union and in other countries attempting to implement climate agreements in line with sustainability goals set by the UN and OECD. In the view of Louresa and Ferreira, 2019, considering that economic growth is an obvious national goal, the European Union must design measures encouraging investment in more efficient and less pollutant technologies. Significant here is also the issue of regulations associated with the production of electricity, as studied by many different authors (Allen et al., 2019). In many countries including those in the European Union, changes in the production of electricity are governed by national energy policy (Wood et al., 2019).

Other countries are also aware of the fact that environmental protection considerations make the pursuit of renewable energy investments important with concern that future fossil fuel energy resources could be exhausted (Opan et al., 2019). Investment in renewable energy sources represents a challenge for energy firms; however, it is also an opportunity to accelerate business development thanks to substantial support from national governments that support the development of renewable energy sources. Hence, it is important to examine the state of firms in this sector and the role they play in the command and control function in the world economy there exists a strong relationship between the availability of sources of energy and human development. However, economic processes such as specialized production, offshoring, and plant relocation between countries have caused a skyrocketing increase in international trade (Artoñigo et al., 2016).

In the modern economy it is very important to examine the ownership structure of firms and how they are interrelated (Śleszyński, 2018). The largest firms have been studied in terms of their geographic location and financial performance for many

years, which has yielded some basic concepts such as the *world city* (Friedmann and Wolff, 1982) and *global city* (Hymer, 1972). It is asserted that corporate headquarters located in a given city generate what is known as the command and control function of the city, which then becomes a center of decision-making in the world economy (Csomós, 2013). Only a handful of cities and firms were studied in terms of their effect on the world economy starting in the 1960s and ending in the early 1990s (Hall, 1966; Friedmann, 1986; Sassen, 1991). However, this pattern of research prompts the following question: Is it reasonable in a globalizing world to examine only a handful of cities in the role of global control centers? Current research shows that several hundred cities around the world feature a large degree of intercity connectivity (Taylor and Derudder, 2016; Derudder, 2018; Neal et al., 2019) and hundreds of cities wield a command and control function (Csomós, 2017).

These findings show that while a very narrow approach to the number of global nodes may have been appropriate in the middle of the 20th century, it is no longer representative of a globalizing world in the 21st century (Parnreiter, 2019). Firms listed by Forbes Global, 2000 had a total revenue of about 31 trillion USD in 2006 and 45 trillion USD in 2016 [32]. Hence, research on the command and control functions of cities needs to consider the impact of the 2000 largest firms listed by the Forbes company (Taylor and Csomós, 2012). Command and control functions of cities are examined mostly in terms of the geographic location of their headquarters and other facilities as well as sector differences on a world scale (Rażniak et al., 2020b) continental scale (Dorocki et al., 2019; Rażniak et al., 2018; Rażniak et al., 2020a), and subcontinental scale (Zdanowska, 2017; Rażniak et al., 2020b), but not in the context of energy sector companies that generate a city's command and control function.

3. METHODS

Reports published by Forbes Global, 2000 were used to examine the financial results of the largest firms in the world in the years 2006-2018. The economic potential of these firms may be analyzed both on an international scale and domestic scale. At the same time, firms on the Forbes Global, 2000 list yield the C&C function of cities (Csomós, 2013).

The position of selected cities was compared using standardized values based on their share in a total of four values: revenues from sales (x_1), net profits (x_2), asset value (x_3), and market value (x_4)—for selected sectors of the economy (CCI) (Csomós, 2013) (1).

$$CCI_s = \frac{\sum_{i=1}^4 \frac{x_i}{\sum x}}{4} \cdot 100 \quad (1)$$

where x is: revenues from sales (x_1), net profits (x_2), asset value (x_3), and market value (x_4)

s – sectors of the economy

Finally, a command control index (CCI) was constructed by adding the CCI values of each given sector.

$$CCI = \sum CCI_s$$

4. RESULTS

According to the GICS, the global economy is divided into 10 sectors. Assuming a fairly balanced C&C structure of cities, every sector should have 10% of the total function value. Even though the energy sector is one of the most important sectors of the world economy, as it stimulates the world economy and world politics (e.g. OPEC), the significance of energy firms in the C&C function of cities is declining.

An analysis of the energy sector share in total CCI by quartiles shows that in cities 1, 2, and 3, the energy sector was overrepresented in 2006 (14.62-16.87%). Values significantly exceeding 10% indicate its overrepresentation. In 2018 its share decreased substantially. Only in the second quartile of cities does it still have a relatively high share, although among leading cities in terms of the C&C function, the energy sector is not a crucial sector (6.73%) (Table 1).

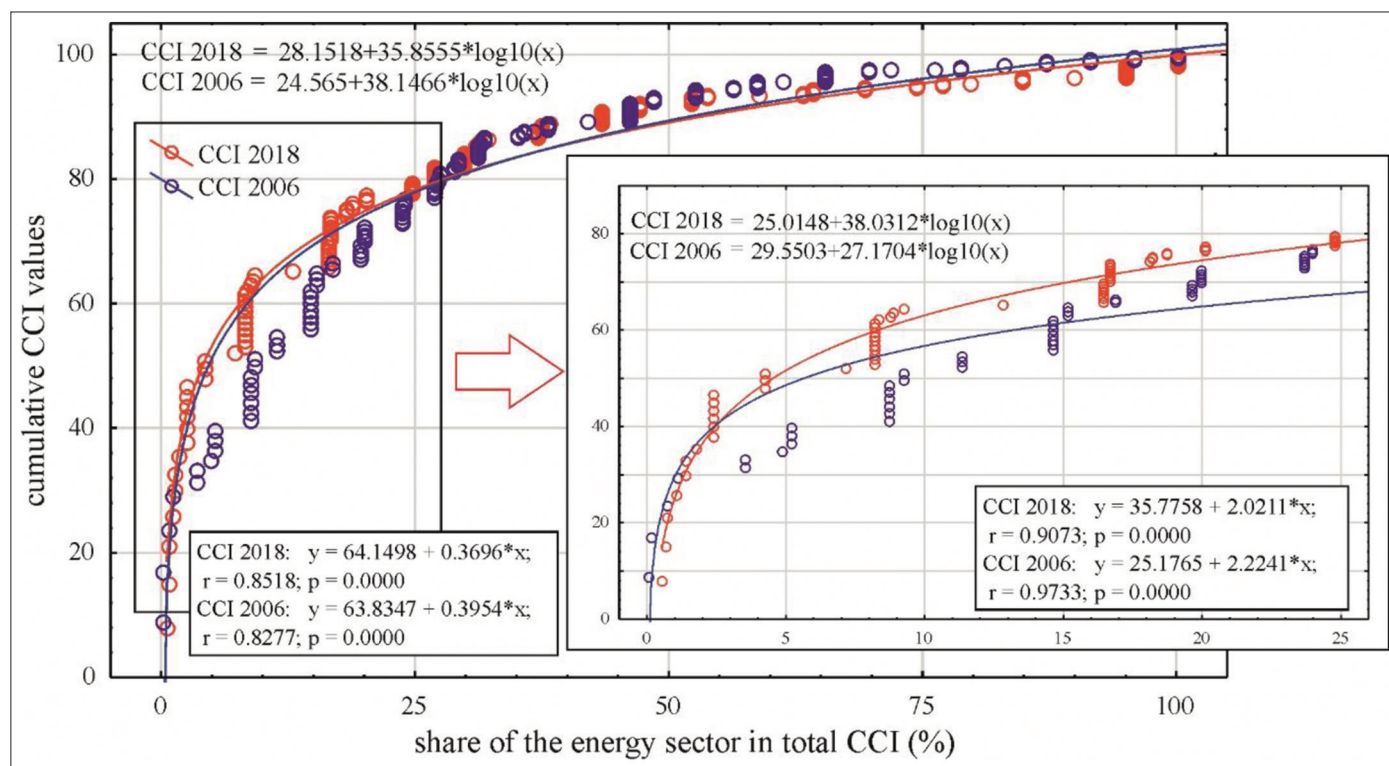
For the purpose of analyzing changes in the significance of the energy sector in yielding the command and control function of a city, CCI values were contrasted with the share of the energy sector in the generation of a city's CCI. These values were used to generate cumulative series for the years 2006 and 2018. As shown in Figure 1, the largest differences in the decline in the significance of the energy sector for the two studied years occurred among cities with the largest CCI potential (first quartile). The opposite may be observed for cities with the weakest C&C function. The difference in the share of the energy sector between the two studied years was not as vivid as in the case of cities from the first quartile. The distribution of cumulative CCI values for both years was very similar for the middle 50% of observations (from Q1 to Q3) or a typical area of variance, as calculated via the share of the energy sector in total CCI.

In order to better understand changes among the top 25% of cities, only data for cities with the highest C&C potential were contrasted. In 2018 the increase in CCI values was not as connected with the increase in the share of the energy sector as in 2006. The log function shows that the significance of the energy sector among top companies decreased almost 40%. This is also shown in Figure 2, where world centers of the energy sector, such as Dallas and Beijing, recorded very large declines in the years 2006-2018 in the share of the energy sector in the generation of the C&C function of a city. Other cities such as Houston, the Hague and Moscow also recorded declines in the share and value of CCI for the energy sector. Smaller cities that only have an energy sector also exhibited a decline in the significance of the energy sector in the generation of a city's C&C function. In a few cases, an increase in the significance of the energy sector occurred – including for Calgary and San Antonio. However, the CCI for these cities was low in 2006 and became even lower in 2018.

Table 1: Share of the energy sector in the generation of the command and control function of cities by quartiles

| | Energy sector CCI 2006 | Total CCI 2006 | Share of the energy sector in quartile % w 2006 | Energy sector CCI 2018 | Total CCI 2018 | Share of the energy sector in quartile % w 2018 |
|----|---------------------------|-------------------|--|---------------------------|----------------|--|
| 1Q | 15.0 | 88.9 | 16.87 | 5.93 | 88.16 | 6.73 |
| 2Q | 1.14 | 7.8 | 14.62 | 0.71 | 7.9 | 8.99 |
| 3Q | 0.23 | 1.48 | 15.54 | 0.096 | 2.67 | 3.60 |
| 4Q | 0.14 | 2.31 | 6.06 | 0.0 | 1.26 | 0.00 |

Source: Author's own compilation based on Forbes Global, 2000 reports

Figure 1: Distribution of cumulative CCI values for the energy sector in cities as well as share of the energy sector in total CCI in the years 2006-2018

Source: Author's own compilation based on Forbes Global 2000 reports

Data obtained from the Forbes Global, 2000 list were used to construct figures showing the number and share of energy sector companies in the generation of the command and control function of cities where this sector is found (Figure 3). In 2018 only 49 of 395 cities (11.4%) were home to the energy sector.

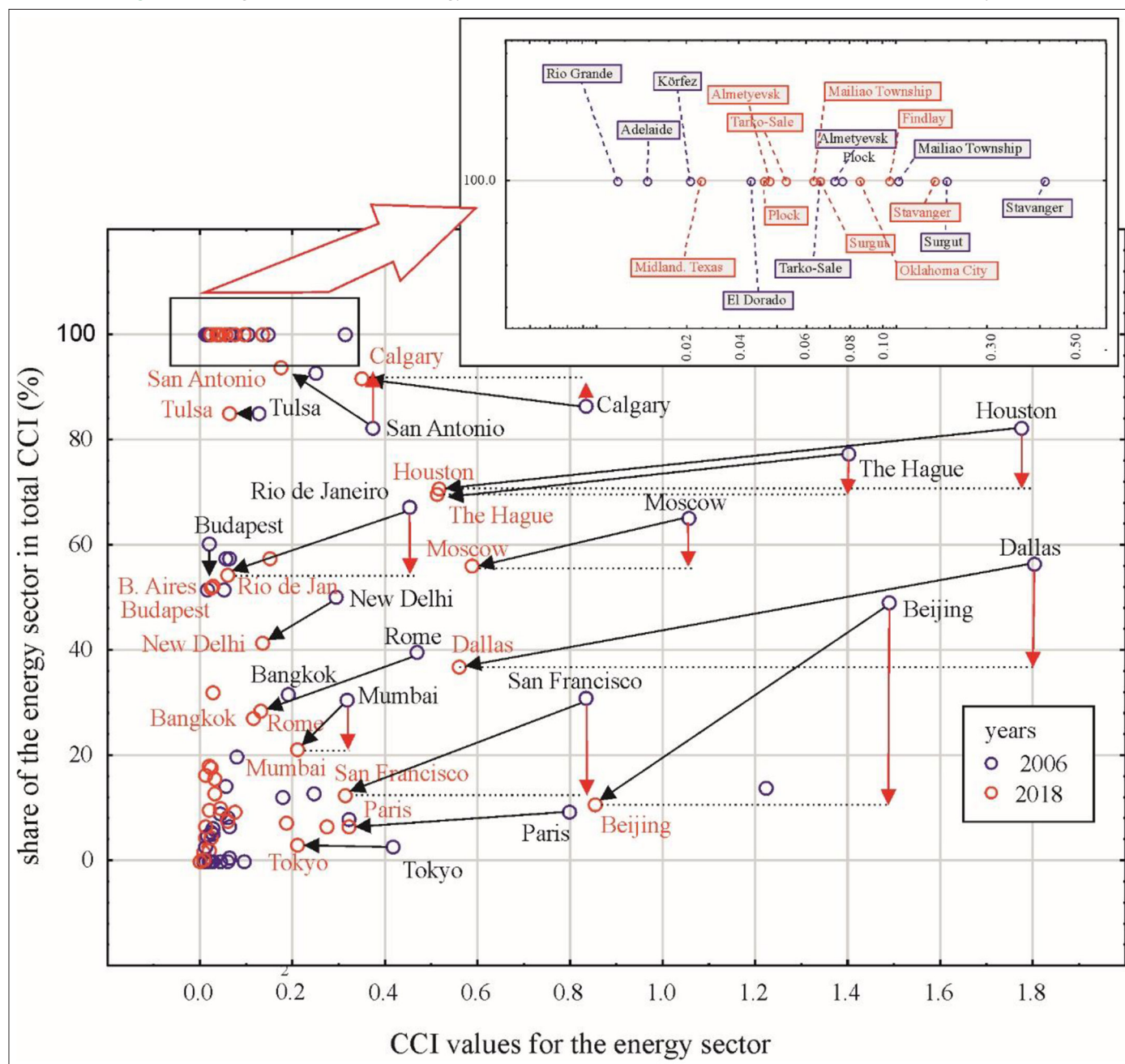
The largest number of firms were noted in Houston (14), Calgary (8). The third-ranked city in 2018 was Beijing and Tokyo with 5 firms in the energy sector. Moscow was the European leader in the sector with 4 firms. The following cities are home to only one firm on the Forbes list: Almet'yevsk, Findlay, Mailiao (Taiwan), Midland (Texas), Oklahoma City, Płock, Stavanger, Surgut, Tarko Sale. This yields a situation where the share of the given sector in CCI generation is 100%. However, on the world scale, these cities are not very critical in terms of the command and control function. Considering cities with more than one sector, the energy sector is quite dominant in selected North American cities such as San Antonio (94%), Calgary (92%), Tulsa (85%), and Houston (71%). On the other hand, Asian cities tend to be more diversified in terms of sectors. With the exception of Mailiao, the share of

the energy sector in the generation of the C&C function does not exceed 30%. Two key clusters of energy sector cities are observed – one in North America and another in Europe; and two smaller clusters are also observed: Eastern and Southern Asia. European cities are usually home to only one energy sector company, while there are 4 Asian cities with at least 3 energy sector firms: Beijing (5), Tokyo (5), Seoul (4), Mumbai (3). Other regions of the world are not really relevant in terms of the C&C function generated by energy sector companies.

5. DISCUSSION

The energy sector is one of the leading industrial sectors in the world economy seen as a whole as well as in terms of the financial performance of the largest firms contributing to the command and control function of cities. The financial performance of the energy sector according to the GICS classification) over the studied period of time ranks it second only to the financials sector. The average value of the energy sector increased from 83.4 billion USD in 2006 to 147.5 billion in 2018. The energy sector appears to be

Figure 2: Changes in the CCI for the energy sector and its share in the creation of CCI cities in 2006 and 2018 years



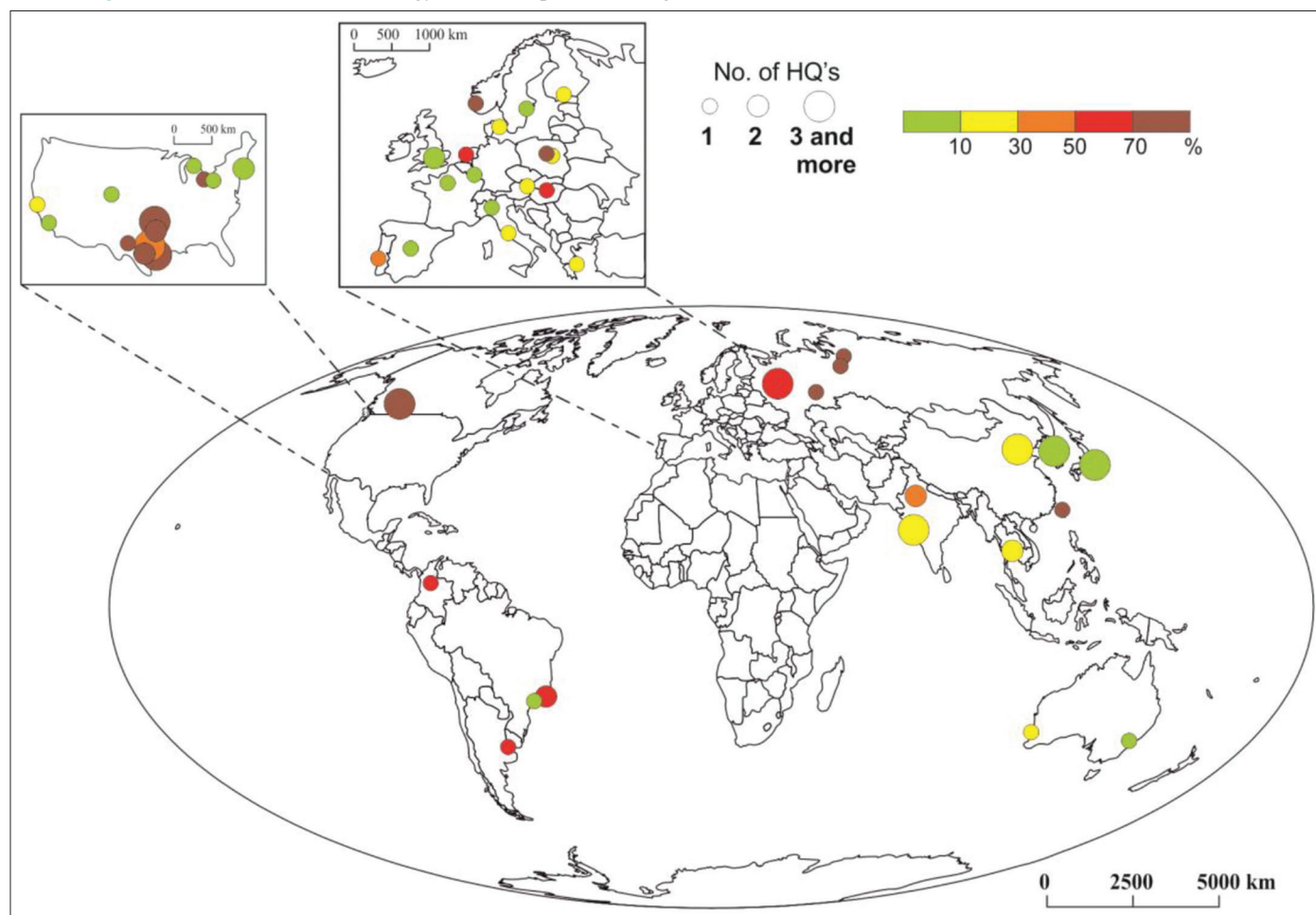
Source: Author's own compilation based on Forbes Global 2000 reports

one of the more financially stable sectors of the economy, which generates high potential for cities with an energy sector. Despite the global economic slowdown in the years 2007-2009, the financial stability of the energy sector increased. This stability decreased to some extent over the last few years, but remains close to the average for other sectors.

The energy sector is the financially dominant sector in cities such as Beijing, Moscow, Houston, and the Hague. The sector's position in Moscow and Beijing is extremely strong in light of its rapid growth there in recent years. The significance of the sector decreased in some cities during the studied period. Declines in the sector's role in the potential of a city is not so much caused by a financial decline in the sector itself, as by growth in other

economic sectors that are growing more rapidly. However, the energy sector still remains the more stable sector. Changes in the spatial distribution of energy sector firms was observed using financial data and the number of corporate headquarters in the period 2006-2018. The number of energy sector cities in Asia decreased, while that in Europe increased. An increase was also noted in South America and Australia. In addition, a very large increase in the financial performance of firms in Beijing and Bangkok as well as the United States was noted.

The largest share of the energy sector in the generation of a city's command and control function is noted in cities with only one company on the Forbes list. This is a disadvantageous situation, as a crisis in that one sector can substantially reduce a city's C&C

Figure 3: Number and share of energy sector companies in the generation of the command and control function of cities in 2018

Source: Author's own compilation based on Forbes Global 2000 reports

function, which will affect the local economy and the region in general.

One general conclusion is that the role of the energy sector in the generation of the C&C function is declining around the world, although the sector remains one of the more important sectors of the economy (Csomós, 2017). This is particularly easy to observe in leading global cities due to the emergence of other innovative sectors in the economy. Although the energy sector remains a fundamental sector of the world economy by driving economic growth and stability, its value in the creation of the C&C function continues to decline.

On the other hand, growth in this sector stimulates growth in other sectors of the economy. Its search for renewable sources of energy and research on these new sources place this sector squarely in the realm of innovative sectors of the economy. Growing globalization now (Derudder, 2018) also provides new opportunities for development in the energy sector in Asia as well as Central and Eastern Europe. The increase in the significance of energy companies in the creation of the C&C function of cities in Asia may be related to the increase in Asian countries' GDP (Artoinigo et al., 2016).

Finally, the current COVID-19 crisis around the world is reducing demand for energy. In this context, energy use forecasts driven by

population and manufacturing growth are likely no longer accurate (eg. Benalcazar et al., 2017; Tóth and Szép, 2019). Forecasts will need to be revised, which in itself is a research issue. More research is needed on the broadly defined energy sector based on GICS information. This may be especially important for cities where the energy sector dominates the C&C function. Cities with this sector had declined already prior to the global pandemic in the years 2006-2018. A host of new economic woes may push these smaller cities out of the realm of the command and control function of the world economy.

6. CONCLUSIONS

In the modern world, the largest corporations including firms in the energy sector play an increasingly large role in the global economy; however, their role in the generation of the command and control function of cities continues to decline over time. The role of the energy sector is substantial, as it is a prerequisite for the functioning of other economic sectors. The sector utilizes perishable resources, although it is now investing more funds in more ecological technologies that would use more renewable resources. The purpose of this effort is to at least partly reach sustainability goals set forth in the UN Sustainable Development Goals strategy. Hence, it is vital to examine the changing role

of this sector in the overall economy. In addition, the spatial distribution of major energy sector firms listed by Forbes Global, 2000 is changing across the world. Given the significance of the largest firms in this sector in shaping the command and control function of cities, it would be sensible to study the present and future financial performance of these firms in conjunction with their impact on the command and control function of the city. In order to accomplish this goal, efforts are needed to formulate research methods that would match the specific nature of the energy sector and also consider the possible impacts of future recessions in the world economy on this particular sector.

It is important to note that the energy sector as defined by GICS represents firms in the oil and gas industry as well as firms that use water, sunlight, and nuclear energy to produce power. The latter group of companies consists of utility companies that belong to various other sectors according to the GICS classification system. This yields a number of difficulties in analyses with respect to other sectors, as the broadly defined energy sector includes some firms from the utilities sector, which precludes accurate comparisons.

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