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Research Article

Analysis of Energy Raw Material Coal, Industrialization and Industrial Revolution Phenomena with N-gram

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Geopolitics
Coal mining
Mercantilism
Industrialization
Industrial Revolution.

Abstract: In this study, coal, which is one of the energy raw materials, and coal-related keywords and the relationship between industrialization and political/social events from past to present were investigated by n-gram analysis. Within the scope of the study, using the English works registered in the Google books directory, coal as energy raw material and related keywords "coal", "coal mine", "coal mining", "fossil fuels", "industrial revolution", "industrialization" "mercantilism", "geopolitics", and "geology" were used, and these words were subjected to n-gram analysis as subgroups that would form a unity within themselves.

With this study, coal-energy raw material, which is the most important engine power of industrialization in the industrial revolution and the following period, and the relationship of its related concepts with "Geo(logy)politics and its parallelism with political, military, social and economic events from past to present have been examined with n-gram analysis.

As a result, there has been an increase in the frequency of use of keywords after the 1820s in relation to the beginning of the Industrial Revolution and the increase in its effectiveness in world history, and it has been determined that the related words have significant co-changes with each other. Therefore, with the n-gram analysis, the Industrial Revolution/industrialization relationship between coal and related keywords was easily observed. When the digital environment, which is a large data source, is analyzed with the n-gram method using the appropriate keywords to be selected, it is understood that it will be possible to reach many sources and that such a large corpus will allow multi-purpose and multidimensional evaluations. The fact that this study reveals the origins of coal-related concepts and industrialization in the literature with the n-gram analysis method, which is one of the energy sources, also presented an extraordinary perspective with an analysis technique out of the ordinary.

1. Introduction

In today's world, where information technologies are an important part of our lives, and their use is spreading to all areas of our lives (Hussein, 2021; Raudeliuniene et al., 2020), digital media data analysis is gaining importance day by day and finds its place in many areas. While globalization and technological advances color our world, which has turned into an information universe, on the other hand, it also contains difficulties in every field at the point of management of such a large amount of information. Technological innovations also increase

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very creative demands (Raudeliuniene et al., 2020). Today, information technologies and technology-based social networks are used by more than 50% of the world's population. This has brought some innovations that seem impossible to return in our age, in many areas of our lives: communication tools, information exchange, products and services, etc.
Especially with the widespread use of the internet, accessing information has become faster and easier than ever before. The irrepressible increase in information has presented a new problem for researchers: How to use such a large source of information efficiently and easily. In this context, "big data" and "data mining", which are now widely used in the literature, have become popular concepts in almost every scientific field (Wang et al., 2020). The concept was first expressed in the journal Nature and defined as data on a very large scale that cannot be presented, processed and analyzed with existing technology, methods and theories (Goldston, 2008). Today, new research/evaluation methods have been started to be developed for such a large data collection that has been transferred to digital media and can be accessed from almost the most remote point of the world via the internet (Lin et al., 2019). What is important today is how effectively researchers can use these methods in the information universe rather than their access to information. Researchers gain a linear advantage over other researchers with the methods they use/develop.

In this study, one of the important energy sources and the most important engine power of industrialization, coal, and the relationship between coal-related concepts and economic and political events, using the data in the digital environment, were examined with n-gram analysis, which is a kind of natural language processing method. The study is also related to the fields of geopolitics and geology. Although geology is briefly defined as earth sciences, it covers many fields with its sub-branches and sheds light on underground resources and many issues that are especially important for countries (Bobbette & Donovan, 2019). Geopolitics, on the other hand, is the science that examines the relations between the geographical features of states and their politics. The name of the concept originates from Swedish Rudolf Kjellen (1864-1922). He introduced the concept for the first time in 1916 in his book The State as an Organism. C. Haushofer, one of the geopolitical theorists, also defines geopolitics as the relationship of the state with the place in which it lives. Although the concept of geopolitics, which became widespread between the two World Wars and was widely used during the Second World War, seems to have lost its importance today with the development of transportation and communication technologies and the decrease in the dependence of countries on geographical features, it still has an important place (Dodds, 2007). The concept of geopolitics also emphasizes the importance of natural resources and therefore, geographical location in the development. Along with the concept of geopolitics, the concepts of geography-geostrategy have also found use. Coal, one of the fossil fuels, which was the main energy source for the energy demand, which was a kind of engine of the Industrial Revolution, had a dominant place in the history of World Industrialization(Andrews, 2008; Beresford, 2018). Considering all the infrastructure explanations mentioned above, the ability to examine the relationship between industrialization and energy resources with each other and with political/social/economic events from past to present is the research question of the study, and the aim of this study is "*A conceptual retrospective analysis of coal in particular, an important motivational force of the Industrial Revolution, natural energy resources/fossil fuels in general, and the industrialization/industrialization process, from the past to the present, with political/social events, by making use of the English works registered in the Google books directory in the digital environment, by the n-gram method*".
N-gram analyzes have been used in the literature mostly in the informatics sector. There are very limited studies in the literature on the use of analysis with natural resources, which are important raw materials for geology/geopolitics and political, social and technological developments of countries (Çiftçi et al., 2019; Çiftçi, Ural, et al., 2020; Çiftçi, Vural, et al., 2020a, 2020b; Ural et al., 2020c, 2020b, 2020d; Vural et al., 2021b; Vural, Çiftçi, et al., 2020; Vural, Ural, et al., 2020a, 2020b; Vural et al., 2021a; Vural & Çiftçi, 2021b, 2021a). In the studies conducted by Vural et al. (2019; 2020c), the relationship between colonialism and precious metals (gold, silver) was analyzed with the n-gram method and a significant relationship was revealed. In the study by Vural et al.(2021a; 2020), it was emphasized how the colonial activities toward gemstones such as diamonds affected the fate of weak countries. In a similar study, a retrospective analysis of Pb-Zn-Cu elements (base metals for short), which has an important place in Industrialization, was carried out by Çiftçi et al. (2019; 2020). Ural et al. (2020a, 2019) tested the hypothesis that rare earth elements (REE), which is an important raw material of high-tech products, will relate to the supply, market and geopolitics with n-gram analysis and reached satisfactory results. In the aforementioned studies, researchers have shown that significant relationships can be determined by n-gram analysis in the evaluation of geopolitical processes, colonization and related events that accelerated after the Industrial Revolution.
Although fossil fuels, especially coal, have been partially recognized and have long been known by humanity, they have gained importance in the history of humanity both politically, socially, economically and technologically with the Industrial Revolution and have always maintained this importance until today. It is known that coal was used for heating and simple metallurgy activities (smelting copper) in China about 3000 years ago. In the 4th century AD, the Romans also used coal. In the 13th century, it is known that surface coal mining was carried out, especially in France (Ünalan, 2013). Until the 18th century, the use of coal was on a small

scale. In the 18th century, the most important energy source effective in the birth of the first Industrial Revolution in Europe was coal. It has maintained its importance from the Industrial Revolution until today without losing its importance. Today, it is the most important and most abundant fossil energy source in the world, and when it is considered as a reserve, its volume is quite high compared to oil and natural gas. It is thought that coal will still be available after the depletion of these raw materials. Considering that the regions where a large part of the world's coal reserves are located and the regions where the industry was born and developed are different (United Kingdom, Europe, industrialized-America, Asia, Africa raw material source), the supply-demand imbalance has increased the imperial appetite for the supply of this mine. Therefore, this imbalance has been the driving force of important exploitation movements in history and has led to social/political consequences. In this study, coal and other related keywords, which have an important place in the political-economic life of the mentioned societies, were analyzed using the n-gram method, and it was examined whether the frequency of use of these words overlapped with the social/political/economic events covering approximately 250 years. It has been investigated whether the n-gram analysis of the political/social/economic events in the mentioned period with the selected keywords works.

2. Material-Method

In this study, the n-gram analysis method, which has been used very limitedly in the social/political field, has been used. N-grams are all combinations of adjacent words or letters of length n that can be found in the source text. (Çiftçi, Vural, et al., 2020b). If each word is considered as a class in the N-gram analysis method, language modelling can also be viewed as a classification problem (Aleahmad et al., 2007; Huang et al., 2012). This is used to create an index of how often words follow each other. The assumption that the probability of a word depends only on the previous word is also known as the Markov conjecture (Gagniuc, 2017). Markov models are a class of probabilistic models that assume that the probability of a future unit can be predicted without looking too far into the past.

In this study, n-gram analysis method was used. For N-gram analysis, the works registered in the Google books database were scanned with the interface prepared by Google. In the scanning, 3 was used as the smoothing factor and the English language was used as the corpus. Since the field of energy is a large phenomenon in itself, only "coal" from energy raw materials and related concepts and the phenomenon of industrialization were investigated in this study. By revealing the historical usage frequencies of these concepts in the literature with the n-gram analysis method, an extraordinary perspective has been tried to be presented with an analysis technique (n-gram) out of the ordinary.

As keywords in N-gram analysis industrialization, fossil fuels, the industrial revolution, coal mining, coal mine, geopolitics and mercantilism concepts are preferred. The graphs of n-gram analysis, in which all the concepts are used together, were not preferred because they present a complex appearance and in some cases, some concepts suppress other concepts, instead, it was preferred to create analysis graphs by considering the concepts that exhibit meaningful integrity with each other.

3. Findings and Discussion

Within the scope of the study, n-gram analyzes were carried out by using the keywords that characterize the energy raw materials coal and coal and other political/social events of interest (Figure 1-10). As stated in the method section, n-gram analysis was carried out separately for the related concept groups, since the graphics of the analyzed concepts were not very clear due to the dominance of some concepts compared to other concepts. In this context, first, n-gram analysis was created by using the concepts of coal and coal mine and coal mining (Figure 1). It is clearly seen in the graph that the word “coal” suppresses the other two words. When n-gram analysis is made with other keywords, it is observed that the word coal is always dominant, since the graphics in question are not meaningful, they are not included in the article, only the coal keyword and the graphics of the coal mining and coal mine keywords are given in the article. For this reason, it is preferred to interpret the graphic formed by the word coal. When the concept of coal is examined (Figure 1), it is seen very comfortably that it has had an upward trend since the 1750s. This upward trend showed itself more strikingly after the 1860s and reached its peak in the early 1900s (just before the First World War and the war years). The 1920s (1929 economic depression years) were the years of transition to a decreasing trend. On the eve of and after World War II, the downward trend was reversed again, and the aforementioned years became the years of an upward trend with the effect of the war. From the 1940s to the 1960s, a decreasing trend was observed in the frequency of use of the concept. The cold war years of 1970 and after being observed as the years in which the keyword tends to increase. It is thought that the economic struggle of the bipolar world is effective in this. The rise seen in the graph in the 1970s can also be associated with the 1973 Oil Crisis. The increase in the price of oil, which is an important energy source, and the decrease in its production and supply, brought about the discussion of alternative energy sources such as natural gas, nuclear energy, and wind energy. In this period, it can be easily thought that coal among alternative energy sources came to the fore and discussed. For example, at the

beginning of the 20th century, England made its coal-fired warships run on oil in order to maintain its dominance on the seas (Yılmaz & Kalkan, 2017). Probably the 1973 Oil Crisis has created a reversal trend here.

The 1980s and later and the 1990s were the years in which the frequency of use of the concept tended to decrease with the transformation of the cold war into a unipolar world order and with the effect of environmental concerns and awareness of carbon emissions (Figure 1).

When the graph of the n-gram analysis, in which the keywords fossil fuels and industrial revolution are evaluated together, is examined (Figure 2), it is understood that the concept of fossil fuels, which was rarely used in the past, began to be seen prominently in the literature after the 1920s. It is understood that the frequency of use of the concept increased after the 1940s, therefore, in the past, concepts such as coal and oil were used separately instead of fossil fuels (Figures 1 and 2). Similar to Figure 1, the 1980s and later and the 1990s were the years when environmental concerns and awareness increased, and a more increasing trend is observed in the concept of fossil fuels in this period (Figures 1 and 2). The concept of the industrial revolution, on the other hand, shows an increasing trend after the 1860s, as expected. After the 1920s, there was a remarkable upward trend between the years 1940-1970, following the downward trend. This time period is the period when the growth in the economies of the World's capitalist countries is the highest and the Industrialization accelerates. It was also found significant that it overlapped with the years corresponding to the revolutionary youth movements (1968 generation etc.). When the concepts of industrialization and industrial revolution are analyzed together (Figure 3), it is seen that the concept of industrial revolution dates back to the 1750s, while the concept of industrialization has a remarkable increase after the 1920s.

At the beginning of the Second World War, the concept of the industrial revolution was horizontal, while the concept of industrialization decreased slightly in the period coinciding with the war years. It is also possible to see this as a reflection of the decline in industrial production during the war years and the necessity of industrialization. Economic historians and social scientists state that the fastest growth and development in industrialized countries occurred between the 1950s and 1970s. For example, the average growth rate in industrial production between 1953 and 1975 was 6% (Kennedy, 1996). The increase in the frequency of use of the concept of industrialization observed in Figure 3 has parallels with this period. The growth between 1950-1970 is traced to the peak point in the 1970s on the graph (Figure 3). The concept of “industrialization” has a decreasing trend in terms of usage frequency after the 1970s, and it has started an upward trend since the 2000s, especially with the concept of industry 4.0 (Jones, 2021; Mavropoulos & Nilsen, 2020).

Considering the n-gram analysis of the concepts of industrialization and fossil fuels, it is seen that the 1980s had a generally parallel trend, confirming Figures 2 and 3 (Figure 4).

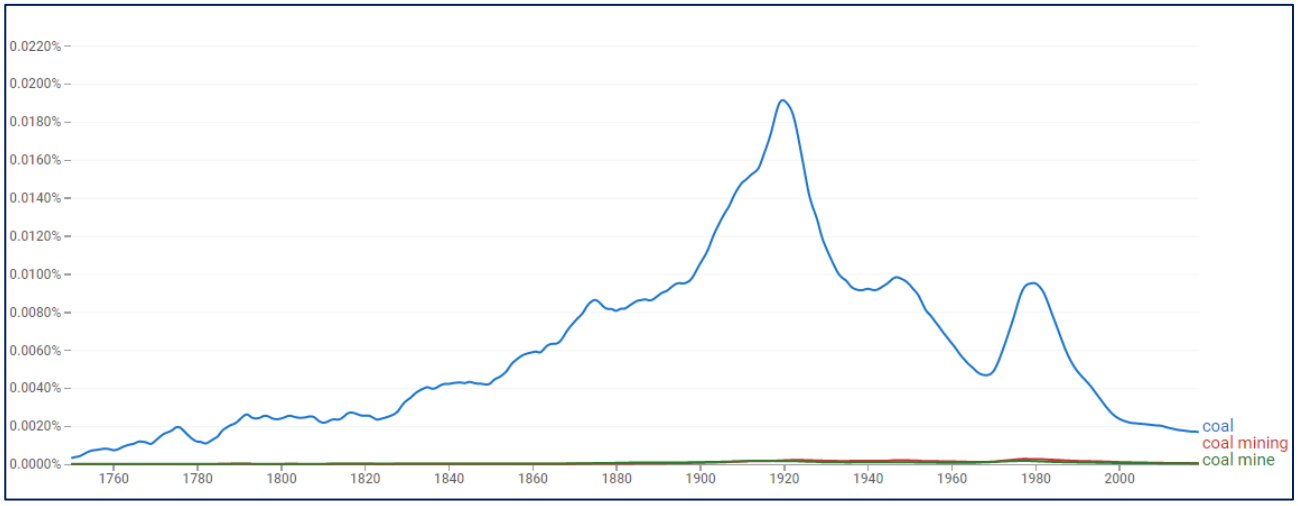

Figure 1. n-gram analysis graph of coal keyword

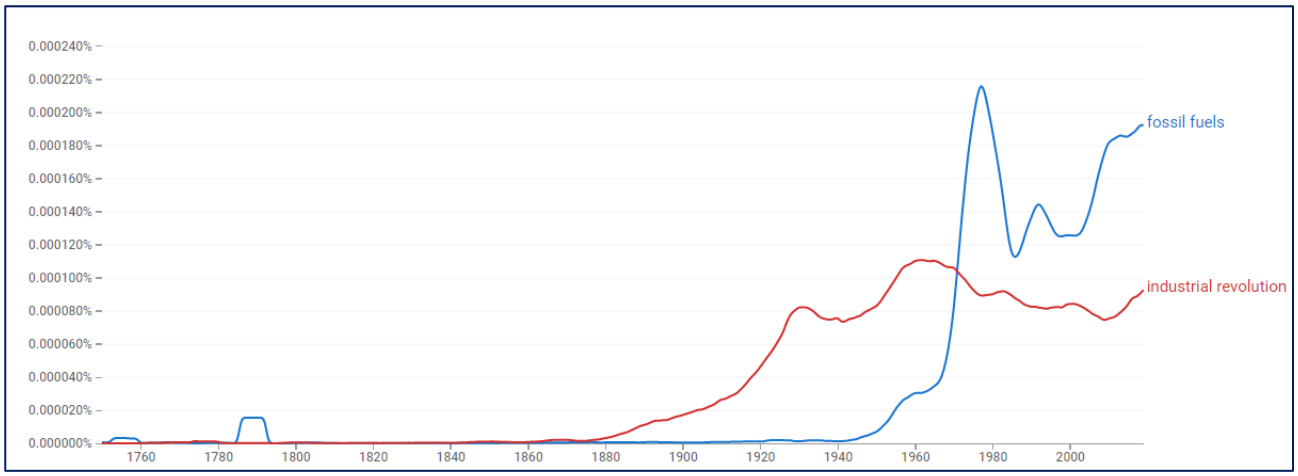

Figure 2. Analysis of Industrial Revolution and Fossil Fuels concepts together

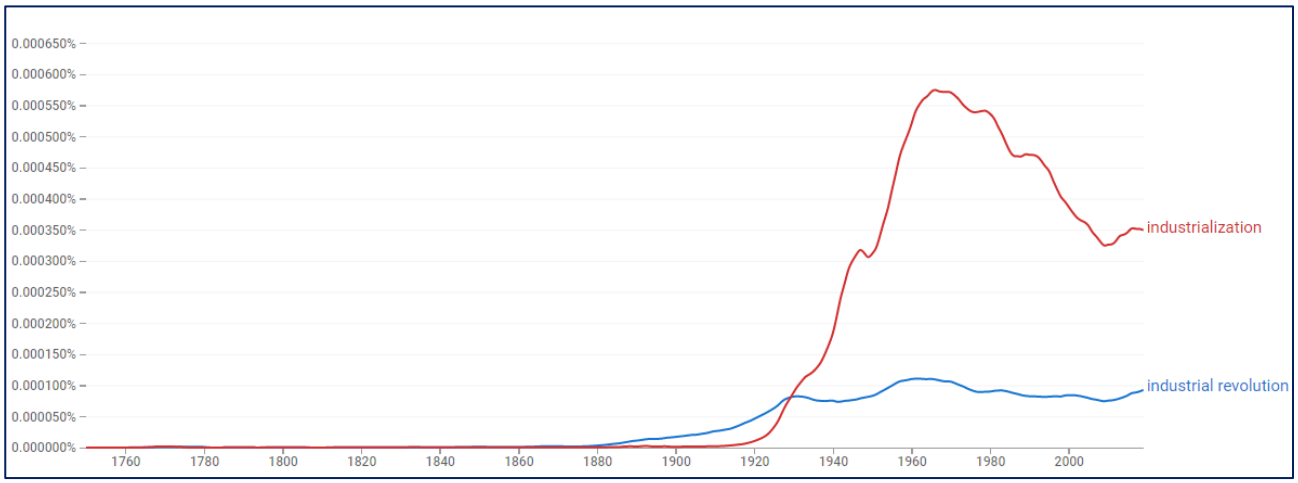

Figure 3. n-gram analysis of industrialization and industrial revolution keywords

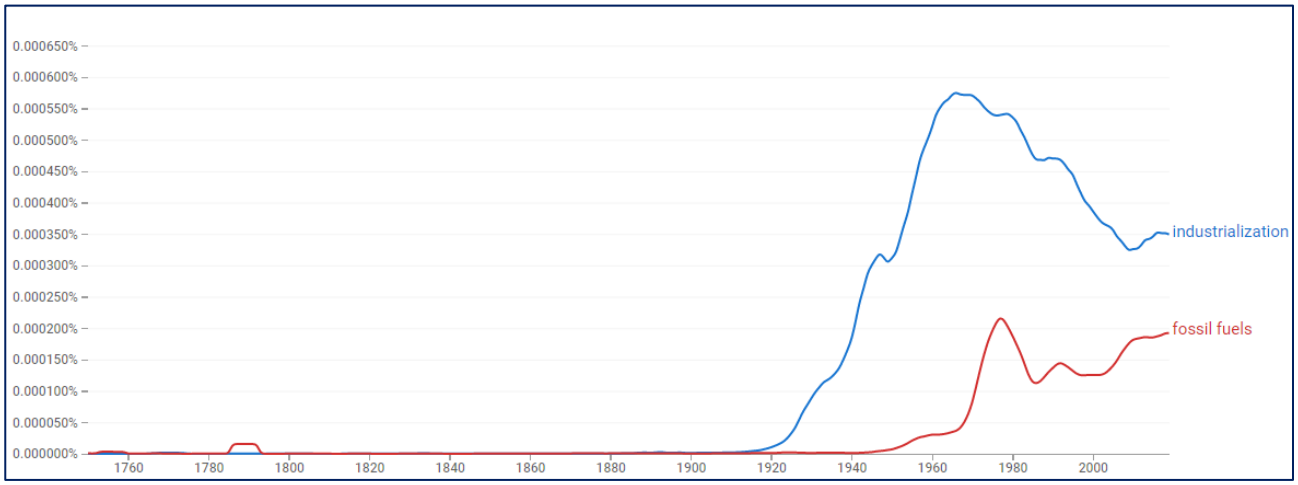

Figure 4. n-gram graph of fossil fuels and industrial revolution keywords

When the concepts of “industrial revolution”, “coal mining” and “coal mine” are subjected to n-gram analysis as a group (Figure 5), it is seen that the frequency of use of coal mine and coal mining keywords in the literature dates back to before the 1800s, although there are small fluctuations. After the 1800s, coal-fired engines came to the fore (Bruere, 1922), and coal gained importance, and in parallel, a relative increase was observed in coal and related keywords. When these two concepts are evaluated together with the concept of the industrial revolution, the increase in their use in the literature in the 1820s is remarkable. Especially after the 1870s, the increase shows itself more with small fluctuations (Simmons, 1976). It is known that since the beginning of the 1900s, mass production began in the industry, and as a result, the amount of product produced has increased many

times over the previous decades. Therefore, the use of coal in the industry and the frequency of use as a concept in the literature tend to increase in this period, which was confirmed in Figure 5. The rise seen in the graph from the 1900s to the 1940s can also be explained by the mass production in the industry. Among the reasons for the increase seen after the 1920s, the development of India, especially based on the coal industry, should be mentioned. There is a parallelism with this situation (Simmons 1976). Likewise, their monopolization by acquiring European coal mines is in parallel with this process. Considering the aforementioned data, the increase in the frequency of use of the concept seems more significant.

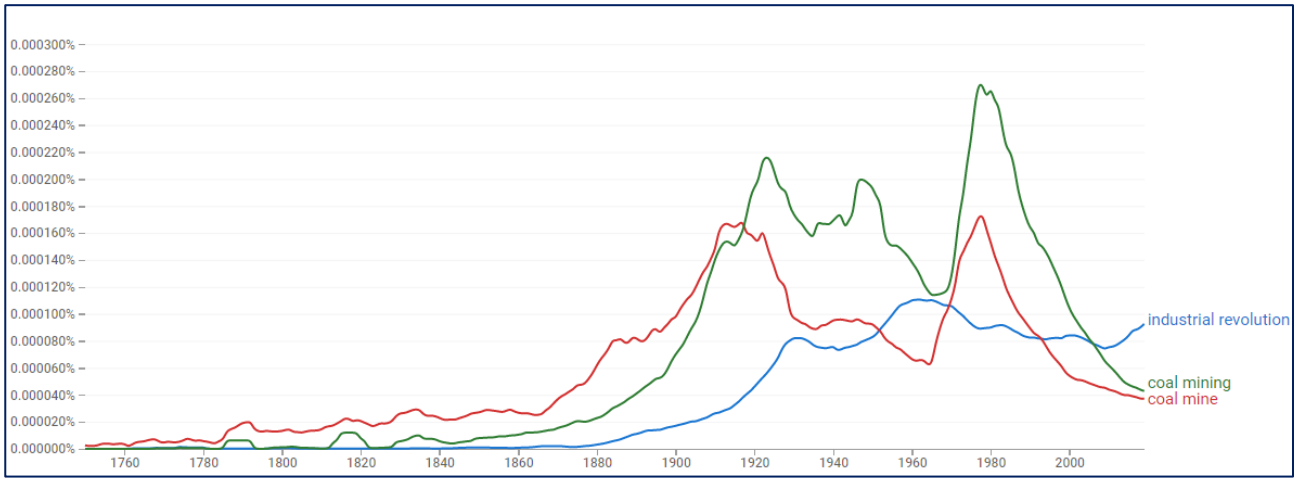

Figure 5. n-gram graph for keywords industrial revolution, coal mine and coal mining

The concept of mercantilism, which argues that the economic power of states is related to the mines they own (Magnusson, 2015; Stern & Wennerlind, 2014), is also directly related to concepts such as industrialization and industrial revolution. (Çiftçi et al., 2019; Çiftçi, Ural, et al., 2020; Vural et al., 2019). Considering that the energy, and therefore the possession of energy raw materials (especially coal) in the industrialization of countries, is related to mercantilism, the concepts of mercantilism and coal mining and coal mining were also analyzed with n-grams (Figure 6). When Figure 6 is examined, it is seen that the concepts of coal mining and coal mining show parallelism with each other, while the concept of mercantilism in general terms has been on an upward trend since the 1880s. When the concepts of geopolitics and mercantilism are evaluated together, it is seen that the concepts of mercantilism and geopolitics have entered an upward trend together since the late 1930s. The concept of geopolitics was used a lot in the literature during the Second World War, and it peaked after the war. While the two concepts showed a downward trend, although not parallel, in the 1960s, the concept of geopolitics had a remarkable upward trend after the 1990s (Figure 7). Since the end of the Cold War and the bipolar world order at the beginning of the 1990s, and the establishment of a new order or disorder, the concept of geopolitics has come to the fore in the literature, as can be seen in the graphic, a sharp rise has been observed since the 1990s. Figure 7 clearly demonstrates this. Today, the concept of geopolitics has a high frequency of use in line with its importance.

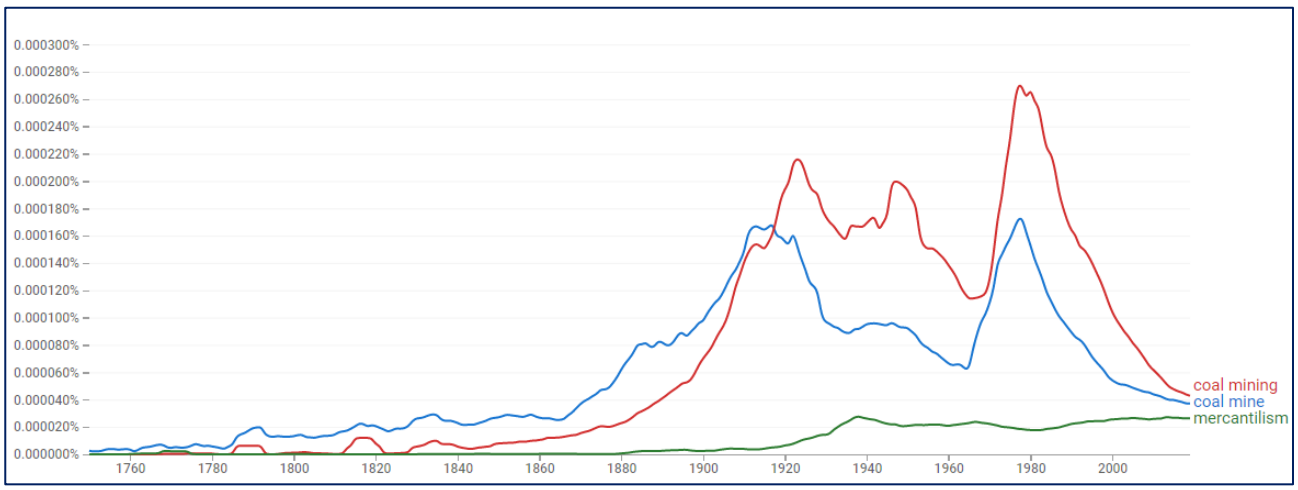

Figure 6. Graph of n-gram analysis of coal mining, coal mine, mercantilism concepts

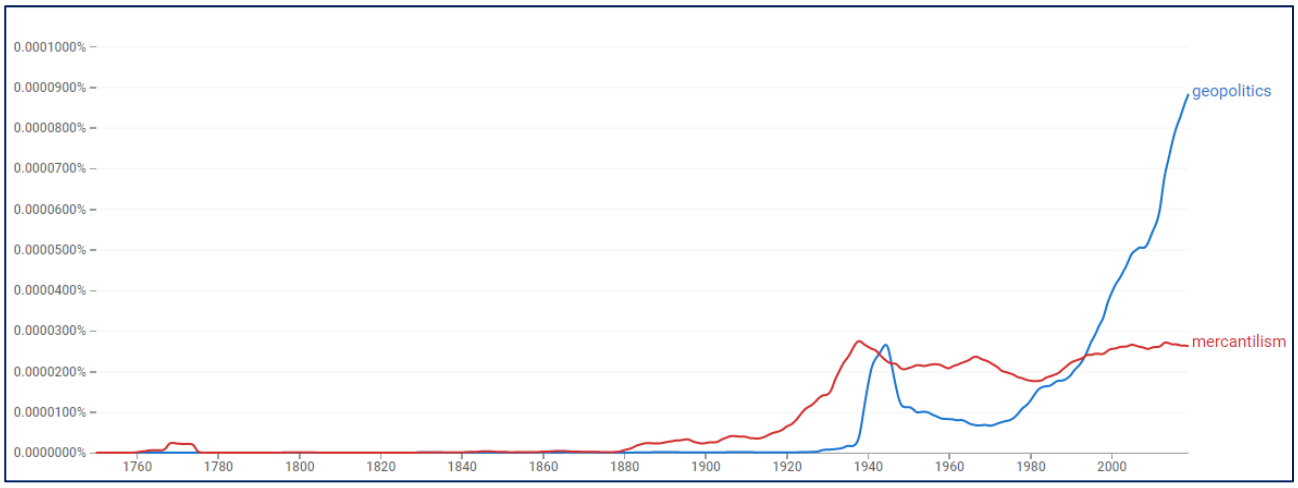

Figure 7. n-gram analysis of geopolitics and mercantilism

The science of geology (especially economic geology), which also deals with the exploration and discovery of natural resources, has gained importance, especially with industrialization and, subsequently, colonialism. Coal, which has an important place in industrialization and the industrial revolution, can be chosen as a suitable keyword group with the science of geology in this sense. Therefore, in the study, the concepts of industrialization, the industrial revolution, coal mine and coal mining were subjected to n-gram analysis in subgroups, taking into account the multiplier effects of the concepts (Figure 8-10).

Although the mining activities of human beings started with the existence of humanity on earth (Vural, 1998, 2006; Vural et al., 2009; Vural & Aydal, 2016; Vural & Ünlü, 2020, 2016), the concept of "geology", which has become synonymous with earth sciences and benefiting from natural resources, began to take place in the literature at the end of the 1700s, and the frequency of use always had an increasing trend with temporal fluctuations in the period until the end of the 1900s (Figure 8-10). The concept showed an upward trend until the end of the 1980s in parallel with the concept of industrialization after the 1920s. After the 1980s, with the concept of economic geology replacing the concept of geology, the frequency of use of the concept decreased. The concept of industrialization, on the other hand, entered an upward trend again, albeit slightly, after the 2000s, as stated earlier (Figure 8).

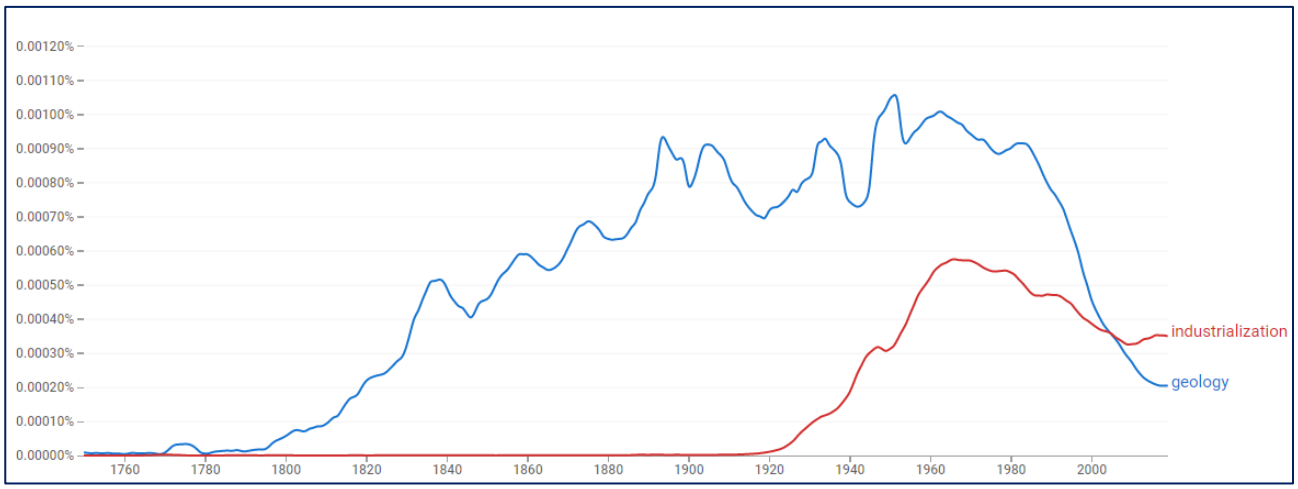

Figure 8. n-gram analysis of industrialization and geology concepts

Although the concepts of "geology" and "industrial revolution" do not show clear parallelism (Figure 9), both concepts are in an increasing trend from the early 1900s to the 1980s (2000s). Since the frequency of use multipliers are different, clear relationships are not seen, but the fluctuation trends of both concepts show relative parallelism, especially from the 1920s to the 2000s (Figure 9). The same is true for the concepts of geology, coal mining and coal mine. (Figure 10). Therefore, there are significant usage frequency relationships

between the concepts of geology, the industrial revolution, coal mine, coal mining and even industrialization.

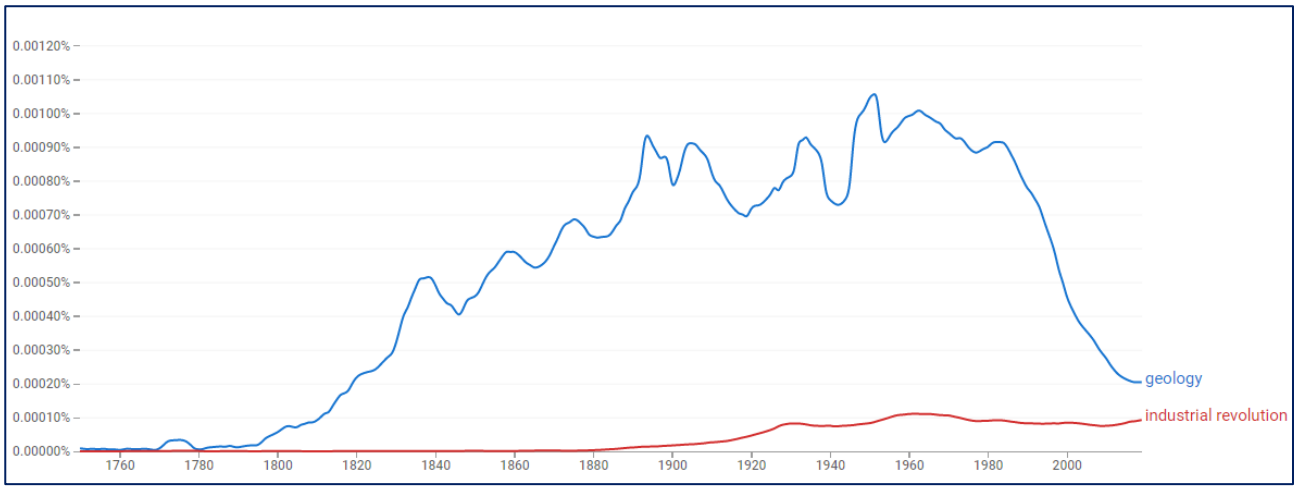

Figure 9. n-gram analysis of the concepts of geology and industrial revolution

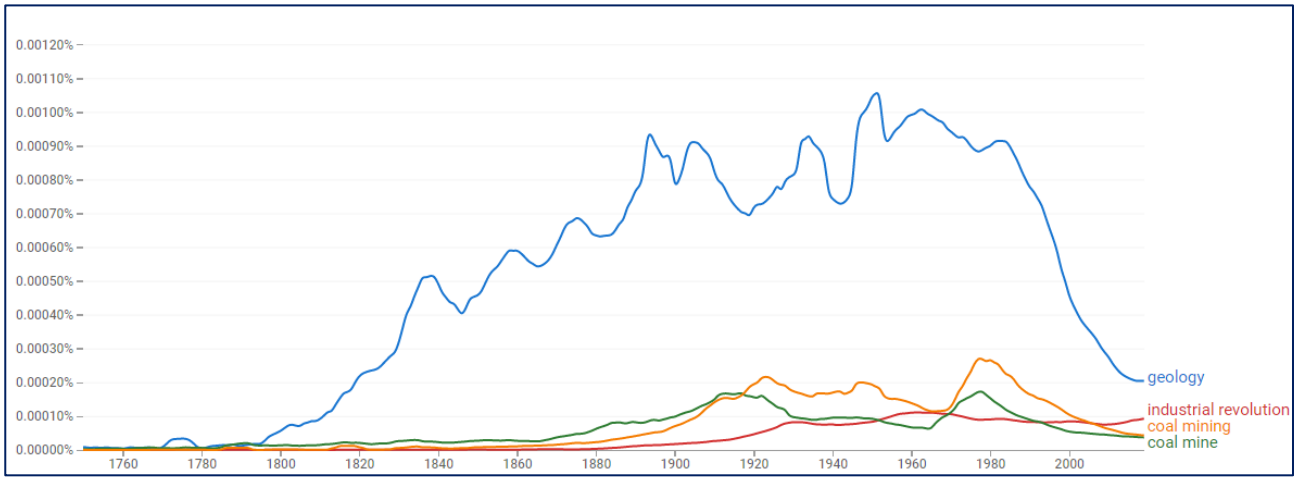

Figure 10. n-gram analysis of the concepts of geology, industrial revolution, coal mine and coal mining

3. Results

In this study, the concept of coal, which is an important energy raw material, has been analyzed with the n-gram method by associating it with industrialization and the industrial revolution and using related keywords that are expected to contribute to the analysis of the subject. For this purpose, the keyword “coal” was chosen as “coal mine” and “coal mining” keywords to be the distinction, and the related keywords were “fossil fuels”, “industrial revolution”, “industrialization”, mercantilism”, “geopolitics” and “geology” has been determined. Since it would be difficult to do an n-gram analysis of all keywords together, these words were subjected to n-gram analysis under subgroups. When the n-gram analysis graphs obtained are evaluated together, it is understood that the n-gram analysis of coal, which has an important place in the industrial revolution and early industrialization period, with related keywords, shows a usage frequency trend associated with political, social, military and economic events in history. Therefore, the possibility of deep analysis on the targeted subject with n-gram analysis with appropriate keywords has been confirmed/shown in this study.

Author Contribution

In this study, the selection of keywords, the determination of appropriate keywords and the analysis of appropriate keywords by reducing them to subgroups were carried out by Alaaddin Vural. The n-gram analyzes of the keywords were made by M. Nuri Ural. The evaluation of the data obtained and its interpretation in relation to political, social, military and economic events was mainly carried out by Ali Çiftçi and partially by Alaaddin Vural and M. Nuri Ural. The translation of the text into English was carried out by M. Nuri Ural.

Conflict of Interest

The author(s) confirm that there is no known conflict of interest or common interest with any institution/organization or person.

References

Aleahmad, A., Hakimian, P., Mahdikhani, F., & Oroumchian, F. (2007). N-gram and local context analysis for Persian text retrieval. *2007 9th International Symposium on Signal Processing and Its Applications, ISSPA 2007, Proceedings*, 1–4. https://doi.org/10.1109/ISSPA.2007.4555345

Andrews, T. G. (2008). *Kiling for Coal*. Harvard University Press.

Beresford, Q. (2018). *Adani and the War over Coal*. Newsouth.

Bobbette, A., & Donovan, A. (2019). Political Geology. In *Political Geology: Active Stratigraphies and the Making of Life*. Palgrave mcmilan publishment. https://doi.org/10.1007/978-3-319-98189-5_3

Bruere, R. (1922). *The Coming of Coal*. Association Press.

Çiftçi, A., Ural, M. N., & Vural, A. (2020). Baz metallerİn dünya sİyasİ tarİhİndekİ önemlİ olaylarla bağlantısının retrospektİf lİteratür taramasi yöntemİ İle araştırılması. *International Social Sciences Studies Journal*, *6*(60), 1453–1461.

Çiftçi, A., Ural, M. N., & Vural, A. (2019). Investigation of the Relationship between Base Metal (Pb-Zn-Cu) and Social/Political/Economical Events by N-gram Analysis. *4. Uluslararası GAP Sosyal Bilimler Kongresi*, 116–124.

Çiftçi, A., Vural, A., & Ural, M. N. (2020a). Analysis of Environmental and Healt Related Concepts with N-Gram Method. *5.Uluslararası Sağlık Bilimleri ve Yönetimi Kongresi*.

Çiftçi, A., Vural, A., & Ural, M. N. (2020b). N-Gram Analysis of Industrial/Industrial Revolution Relation with Coal and Related Keywords. *Euroasia Summit Congress on Scientific Rearches and Recent Trend-6*, *May*, 587–591.

Dodds, K. (2007). Geopolitics: A Very Short Introduction. In *Journal of Contemporary European Studies*. Oxford University Press. https://doi.org/10.1080/14782804.2015.1067453

Gagniuc, P. A. (2017). *Markov Chains: From Theory to Implementation and Experimentation*. John Wiley & Sons.

Goldston, D. (2008). Big Data Wrangling. *Nature*, *455*(7209), 15.

Huang, Y. C., Lin, H., Hsu, Y. L., & Lin, J. L. (2012). Using n-gram analysis to cluster heartbeat signals. *BMC Medical Informatics and Decision Making*, *12*(1). https://doi.org/10.1186/1472-6947-12-64

Hussein, K. M. (2021). Review in Digital Data in Supporting of Information Technologies. *Journal of Digital Integratet Circuits in Electrical Devices*, *6*(1), 23–29.

Jones, S. M. (2021). *Advancing a Circular Economy. A future without waste?*

Kennedy, P. (1996). *Büyük Güçlerin Yükseliş ve Çöküşleri: 1500'den 2000'e Ekonomik Değişme ve Askeri Çatışmalar* (6. Baskı). Birtane Karanakçı (Çev.) Türkiye İş Bankası Yayınları.

Lin, Y., Wang, H., Li, J., & Gao, H. (2019). Data Source Selection for Information Integration in Big Data Era. *Information Sciences*, *479*, 197–213.

Magnusson, L. (2015). The political economy of mercantilism. *The Political Economy of Mercantilism*, 1–230. https://doi.org/10.4324/9781315694511

Mavropoulos, A., & Nilsen, A. W. (2020). *Industry 4.0 and Circular Economy*. Jhon Wiley&Sons Ltd.

Raudeliuniene, J., Albats, E., & Kordab, M. (2020). Impact of information technologies and social networks on knowledge management processes in Middle Eastern audit and consulting companies. *Journal of Knowledge Management*, *25*(4), 871–898. https://doi.org/10.1108/JKM-03-2020-0168

Simmons, C. P. (1976). Indigenous Enterprise in the Indian Coal Mining Industry. *Indian Economic and Social History Review*, *13*(2), 189–217.

Stern, P. J., & Wennerlind, C. (2014). Mercantilism Reimagined Political Economy in Early Modern Britain and Its Empire. In *Mercantilism Reimagined Political Economy in Early Modern Britain and Its Empire*. Oxford University Press, Inc. https://doi.org/10.1093/acprof:oso/9780199988532.001.0001

Ünalan, G. (2013). *Kömür Jeolojisi*. Maden Tetkik ve Arama Genel Müdürlüğü.

Ural, M. N., Vural, A., & Çiftçi, A. (2020a). Analysis of Rare Earth Elements (REE) in the Literature by Using N-gram Method and Comparison with Social/ Political/ Economic Even. *Journal of Social, Humanities and Administrative Sciences*, *6*(24), 369–379.

Ural, M. N., Vural, A., & Çiftçi, A. (2020b). Conceptual Analysis of the Change in the Historical Process in Thermal Tourism. *Journal of International Health Sciences and Management*, *6*(12), 67–73.

Ural, M. N., Vural, A., & Çiftçi, A. (2020c). Conceptual Development Analysis of Health Tourism Based on "N-Gram." *5.Uluslararası Sağlık Bilimleri ve Yönetimi Kongresi, 9-11 Temmuz 2020, Kırşehir/Türkiye*.

Ural, M. N., Vural, A., & Çiftçi, A. (2019). Analysis of Rare Earth Elements (REE) in the Literature by Using N-gram Method and Comparison with Social/Political/Economic Events. *4. Uluslararası GAP Sosyal Bilimler Kongresi*, 135–144.

Ural, M. N., Vural, A., & Çiftçi, A. (2020d). N-Gram Analysis of Nuclear and Alternative Energy Sources and Historical and Political Course. *Euroasia Summit Congress on Scientific Rearches and Recent Trend-6*, *May*, 582–586.

Vural, A. (1998). *Güneyköy ve Çevresi (Eşme-Uşak) Arsenopirit Cevherleşmelerinin Maden Jeolojisi*. Ankara Üniversitesi.

Vural, A. (2006). *Bayramiç (Çanakkale) ve Çevresindeki Altın Zenginleşmelerinin Araştırılması*. Ankara Üniversitesi.

Vural, A., & Aydal, D. (2016). Bayramiç ve Yakın Çevresindeki Altın Zenginleşmelerinin Araştırılması. *69. Türkiye Jeoloji Kurultayı*, 376–377.

Vural, A., & Çiftçi, A. (2021a). An analysis of some concepts related to environmental issues and development by N-gram. *Euroasia Journal of Social Sciences & Humanities*, *8*(2), 18–28. https://doi.org/http://dx.doi.org/10.38064/eurssh.158

Vural, A., & Çiftçi, A. (2021b). Analysis of Raw Material Supply-Demand Relationship Using N-Gram: Chrome Mine Example. *Euroasia Journal of Social Sciences and Humanities*, *8*(1), 1–9.

Vural, A., Çiftçi, A., & Ural, M. N. (2020). Kıymetli Taşlar ve Sömürgecilik: Dijital Veri Materyallerinin Analizi Örneğiyle (Precious Stones and Colonialism: Example of Analysis of Digital Data Materials). *Euroasia Journal of Mathematics, Engineering, Natural & Medical Sciences*, *7*(13), 122–134. https://doi.org/10.38065/euroasiaorg.404

Vural, A., Çiftçi, A., & Ural, M. N. (2021a). Kıymetli Taşlar ve Sömürgecilik. *73. Türkiye Jeoloji Kurultayı*, 237–241.

Vural, A., Çiftçi, A., & Ural, M. N. (2021b). Precious Stones and Colonialism. *73rd Geological Congress of Turkey*, 237–241.

Vural, A., Kaya, S., Başaran, N., & Songören, O. T. (2009). *Anadolu Madenciliğinde İlk Adımlar*. Maden Tetkik ve Arama Genel Müdürlüğü, MTA Kültür Serisi-3.

Vural, A., & Ünlü, T. (2020). The geology and mineralogical / petrographic features of Umurbabadağ and its surroundings (Eşme , Uşak - Turkey). *Journal of Engineering Research and Applied Science*, *9*(2), 1561–1587.

Vural, A., & Ünlü, T. (2016). Güneyköy ve Çevresindeki Kalıntı Altınlı Arsenopirit Cevherleşmelerinin Maden Jeolojisi Açısından İncelenmesi. *69. Türkiye Jeoloji Kurultayı*, 374–375.

Vural, A., Ural, M., & Çiftçi, A. (2020a). Evaluation of Historical Development of Some Concepts Related To Development And Environmental Issues with N-Gram Analysis. *International Black Sea Coastline Countries Scientific Research Symposium- V. November 28-29, 2020 / Zonguldak, Turkey*.

Vural, A., Ural, M. N., & Çiftçi, A. (2020b). N-Gram Analysis of Raw Material Supply-Demand Relationship: In Case of Chromium. *International Black Sea Coastline Countries Symposium-5*, 60–61.

Vural, A., Ural, M. N., & Çiftçi, A. (2019). N-gram Yöntemi İle Değerli Metallerin Sosyal/Siyasal/Ekonomik Olaylarla İlişkisinin Değerlendirilmesi. *4. Uluslararası GAP Sosyal Bilimler Kongresi*, 125–134.

Vural, A., Ural, N., & Çiftçi, A. (2020c). Değerli Metallerin Sosyal / Siyasal / Ekonomik Olaylarla İlişkisinin N- gram Yöntemi İle Değerlendirilmesi. *Social Mentality and Researcher Thinkers Journal*, *6*(29), 247–257.

Wang, J., Yang, Y., Wang, T., Simon Sherratt, R., & Zhang, J. (2020). Big data service architecture: A survey. *Journal of Internet Technology*, *21*(2), 393–405. https://doi.org/10.3966/160792642020032102008

Yılmaz, S., & Kalkan, D. K. (2017). Enerji Güvenliği Kavrami: 1973 Petrol Krizi Işığında Bir Tartışma. *Uluslararası Kriz ve Siyaset Araştırmaları Dergisi*, *1*(3), 169–199. http://dergipark.gov.tr/uksad/issue/33359/371272