ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

Важность анализа бизнес-сетей на примере компании «Hindalco Industries Limited»

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DOI: 10.22394/2070-8378-2023-25-6-46-52

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Аннотация: В статье рассматривается сеть дочерних предприятий компании «Hindalco Industries», а также подчеркивается важность такого анализа для российского бизнеса. Сеть «Hindalco» имеет предприятия в Индии, США и Канаде. Дочерние предприятия компании занимаются различными видами экономической деятельности, такими как разработка природных ресурсов и подготовка квалифицированной рабочей силы. Выбор отраслей и видов деятельности зависит от местоположения дочерних компаний. Дочерние компании сети «Hindalco», работающие на внутреннем рынке, сосредоточены на различных видах деятельности, а зарубежные – на производстве стали. Компания инвестирует в новые способы автоматизации производства и сфокусирована на внутреннем рынке, вкладывая значительные средства в энергетику и разработку компьютерного программного обеспечения. «Hindalco Industries Limited» сконцентрирована на продвижении своей сети компаний на лидирующие позиции в секторе сырьевой промышленности. Анализ бизнес-сетей может способствовать выявлению возможностей для повышения эффективности и экономии в условиях санкций, что является критически важным для современной России.

Ключевые слова: дочерние предприятия, сеть, отрасли, рынок, компания
Дата поступления статьи в редакцию: 5 декабря 2023 года.

The importance of business network analysis. Illustrative example of Hindalco Industries Limited

RESEARCH ARTICLE

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Abstract: The article examines the Hindalco Industries Limited subsidiary business network, emphasizing the importance of such analysis for Russian businesses. Hindalco’s network primarily focuses on India, the USA, and Canada. The company’s subsidiaries engage in various activities, such as accessing natural resources and promoting skilled labor. The choice of industries and activities depends on the subsidiaries’ locations. Hindalco’s domestic market subsidiaries focus on diverse businesses, while foreign companies focus on steel manufacturing. The company invests in the new ways to automate production and concentrates on the domestic market, with significant resources invested in the energy and computer software development sectors. Hindalco’s multinational network focuses on its innovative position as a leader in the primary industry sector. Applying business network analysis can help Russian businesses identify efficiency and cost-saving opportunities amidst sanctions.

Keywords: subsidiaries, network, industries, market, company
Received: December 5, 2023.

Introduction

The importance of network dynamics in the Russian business world has grown significantly. Giving the extraordinary economic pressure from USA and EU sanctions, Russian businesses have faced many challenges. One of the tools that can help a business with mitigating economic obstacles is to perform a network analysis of its own business, competitors and business partners.

Network alliances have been found to greatly enhance the flow of innovation knowledge within a network, as noted by Capaldo [Capaldo, 2007. P. 585–608]. In today's business landscape of Russia, the strategic management of subsidiary networks plays a critical role in determining their success in various regions. This article will primarily focus on analyzing the subsidiary network of Hindalco Industries Limited as an example for Russian businesses emphasizing the importance of such analysis and its clear visualization.

The methodology of this research includes examining the company's internalization strategy, supported by examples of its subsidiary network utilizing the NetDraw software. The article will present the main internalization activities by exploring different attributes of subsidiaries, centrality measures will be analyzed and presented. The research delves into the company's innovation strategy through subsidiary ownership.

Internalization strategy of Hindalco Limited

Through the visualization of the subsidiary network of Hindalco, which can be seen in **Figure 1**, the company mainly focuses on 3 countries: India, United States of America, and Canada. This can be proven by the number of subsidiaries in each country which can be observed from the **Table 1** below. According to the annual report of Hindalco Industries Limited [Hindalco Industries Ltd. report, 2015], the company is a multinational enterprise working in metal processing and metal production industry. Even though the company largely operates outside of its Indian domestic market, the majority of its subsidiaries are located in India. Following the number of subsidiaries outside of the domestic market, Hindalco Industries Limited is focusing on 4 other countries: United States, Canada, Germany, and the British Virgin Islands.

This choice of countries can be justified by affirming that the company is following the Eclectic pragmatism internalization model. Dunning [Dunning, 2000] emphasizes, that there are four main types of activities that foreign subsidiaries execute and are designed for: targeting a particular foreign market, gaining access to natural resources, promoting and employing more skilled labor force, and promoting specific advantages of the invested assets. The National Geographic report [National Geographic report, 2017] outlines that North American continent, which includes Canada and United States of America, has a very large mining industry and is rich with natural resources. It is a justification for Hindalco to expand to those 2 countries in order to gain one of the Eclectic Pragmatism functions – gaining natural resources. Additionally, to employ higher skilled labor and to get access to new technologies the company has five subsidiaries in Germany. Balle, Wagner, and Eifler [Balle, Wagner, Eifler, 2009] acknowledge that German engineers are one of the leaders in metal industry and developed new technologies that provide the more efficient way of metal wielding. Finally, Shaxson [Shaxson, 2012] illustrates, the British Virgin Islands is one of the places which has simple taxation laws and low tax rates for businesses. Therefore, Hindalco is partially protecting some of its assets and revenue from higher taxation by having subsidiaries in that country.

Main activities of the company. Considering SIC codes

Table 2 and **Figure 2** show how many subsidiaries the company has in most popular industries within its network. The data in this section is limited by several SIC codes, subsidiaries provided and the software. As it can be observed, Hindalco Limited is mainly focusing on creating mining machinery and finding ways to improve it by using more autonomic electronic equipment. Surprisingly, it also has subsidiaries in the banking industry.

However, the choice of industries that company has subsidiaries in is closely related to the countries in which those subsidiaries are located. Grossman and Rogoff [Grossman, Rogoff, 2001] assert, there are certain associations with countries and industries those countries are most famous for, following comparative advantage.

Table 1. Number of Subsidiaries

Color	Country	ISO Code	Number of subsidiaries
	India	IN	195
	United States of America	US	46
	Canada	CA	17
	Germany	DE	10
	British Virgin Islands	VG	5

Figure 1. Country

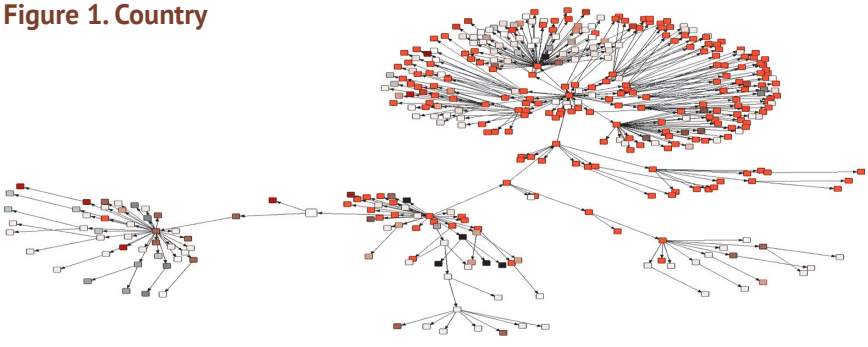


Table 2. Industry

Shape	SIC Code	Number of Sub-sidaries	Industry
○	491	20	Electric Services
+	615	17	Short-Term Business Credit Institutions
⊠	333	17	Primary Smelting and Refining of Copper
⊡	671	13	Officies of Bank Holding Companies
□	737	9	Computer Programming Services
◇	361	9	Power, Distribution, and Specialty Transformers
▢	508	7	Constraction and Mining Machinery and Equipment

Table 3. Revenue

Country	SIC Code	Industry	Revenue ($, mil.)
India	208	Beverages	708
	599	Retail Stores	685
	701	Hotels and Motels	673
	262	Paper Mills	587
Germany	333	Primary Smelting	556
UK	331	Steel Works	545
Canada	335	Aluminum Production	334

Figure 2. SIC Code and Country of subsidiaries

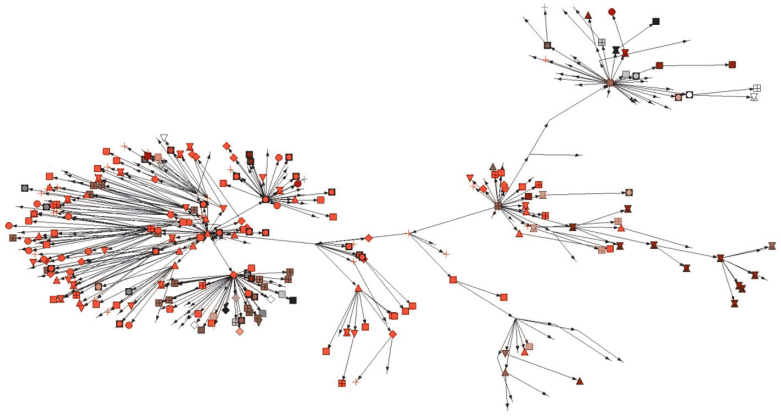
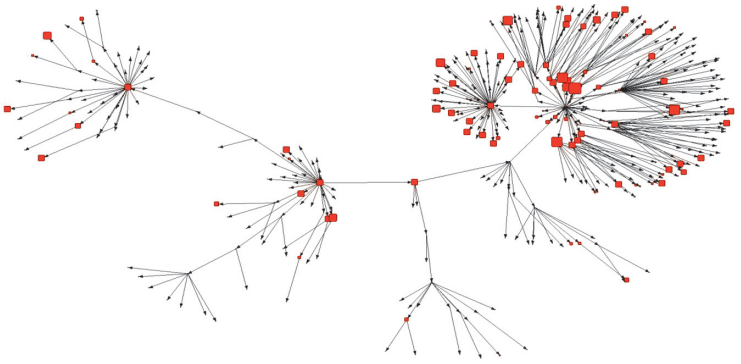


Figure 3. Revenue



For example, the United States and Canada have a substantial amount of natural resources compared to other countries, therefore companies that specialize on the extraction of those resources will have a greater competitive advantage. It also might be the reason why some banking industry subsidiaries are located in financially beneficial economic areas, such as British Virgin Islands (**Figure 1** and **2**).

Furthermore, Porter [Porter, 1998] explained, four classes of attributes that can be applied to subsidiaries of the parent company and why they are making it more successful than others, also known as National Diamond Theory. These four classes are:

- Factor conditions,
- Demand conditions,
- Related and support industries,
- Company strategy, structure, and rivalry.

Factor conditions are human, psychical, knowledge, capital and infrastructural resources of a country. Demand conditions are not only demand in a subsidiary's country but also in a country of a parent company. Related and Support industries are defined as parent company specialization that can help in achieving competitive advantages. Finally, company strategy, structure, and rivalry are the highly deepened factor of the environment of its operations. For instance, again, Hindalco Industries Limited has subsidiaries in India that mainly focus on electronics and computer development. Nachane [Nachane, 2009] emphasizes, that India is becoming more and more technologically advanced, especially in the field of computer and software engineering. In addition, the number of start-ups in this field is continuously increasing. This creates the healthier environment for the industry, since more human capital are involved in research and development of relevant technologies.

Applying National Diamond Theory, India is a place that suits all of the necessary conditions:

- Factor conditions: educated human capital,
- Demand conditions: satisfies demand of several countries,
- Related industries: the parent company operates in highly connected industries,
- Company's internal environment: implementing innovations that are supported by future technological development.

Considering revenue and number of employees

Figure 3 shows revenue-based network of Hindalco Industries Limited. The bigger the nodes are, the more revenue a company generates and vice versa. In its domestic market, Hindalco Limited is focusing on non-primary business activities. The main focus is on

Table 4. Number of Employees

Country	SIC Code	Industry	Number of Employees
India	494	Water Supply	921
	361	Power Distribution	771
	591	Drug Stores	600
USA	336	Aluminum Die-Casting	504
	738	Security System Services	750
Italy	333	Primary Smelting	386
UK	331	Steel Works	210

Figure 4. Number of Employees

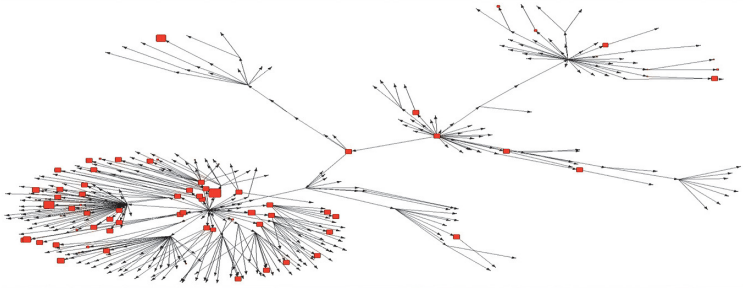
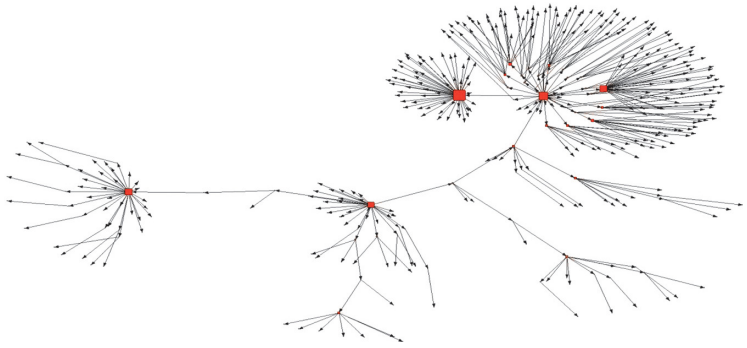


Table 5. Degree Centrality Measures

Country	SIC Code	Industry	Degree Centrality
Canada	335	Rolling, Drawing, and Extruding of Copper	32
India	361	Power, Distribution, and Specialty Transformers	57
	641	Insurance Agents, Brokers, and Service	41
	208	Malt Beverages	33

Figure 5. Degree Centrality Measures



industries of everyday consumption, which are essentially B2C, such as retail stores and beverages sales. **Table 3** demonstrates that most profit in India gained by subsidiaries operating in different industries. At the same time, those subsidiaries which are not located in India are focusing on steel manufacturing, which is the primary activity of the business.

Schmid and Schurig [Schmid, Schurig, 2003] conclude differences in local demand determining the business strategy and targeting of business activities. From the network analysis (Figure 3) it seems that Hindalco Industries Limited has very different focus groups for the subsidiaries, as local domestic market subsidiaries are focusing on maintaining different businesses, which might be more profitable than steel manufacturing in that region or a country.

This can also be proven by analyzing the number of employees in different subsidiaries. **Table 4** explains the number of employees in biggest subsidiaries of the network. Again, the company focuses on non-primary industries for its domestic market. Simultaneously, most of the business activities connected to steel industry are located in other countries.

After conducting the analysis above, the network demonstrates that the company is following Porter's National Diamond and Dunning Internalization strategy. To an extent, where the choice of ownership of subsidiaries and distribution of resources is based on the environment within a selected country. The core decisions were made according to a country's resources and demand on the local market.

Centrality Measures Analysis

This section of the report is going to focus on centrality measures analysis of the Hindalco Industries Limited subsidiary network. Four centrality measure will be discussed: Degree, Betweenness, Closeness and Eigenvector centrality.

Degree

According to Scott [Scott, 2000], degree centrality measures the number of direct contacts of a person or a business. It can also be called local centrality, where the high number of degrees means the high number of direct connections for a node. It demonstrates how well connected a node is with its local environment. It considers the local environment while indirect connections, in this case, are ignored when degree centrality is calculated.

In the case of Hindalco, there are four companies with the largest number of direct connections. **Table 5** lists the most powerful subsidiaries in terms of direct connections that are related to metal industry outside of the domestic market and are focusing on other businesses in the domestic market.

Betweenness

Capaldo [Capaldo, 2007. P. 585–608] connects betweenness centrality references to the distance within a network between nodes. In other words, it observes the closeness of the points to each other – the higher the number, the farther away the node is in terms of its connections. Meanwhile, a point with a low degree of betweenness can play an important role in the network.

Table 6. Betweenness Centrality

Country	SIC Code	Industry	Between-ness
India	283	Medicinal Chemicals and Botanical Products	771
	287	Nitrogenous Fertilizers	771
	615	Short-Term Business Credit Institutions, Except Agricultural	771
	7011	Copper Ores	1155
	1021	Hotels and Motels	1155

Figure 6. Betweenness Centrality

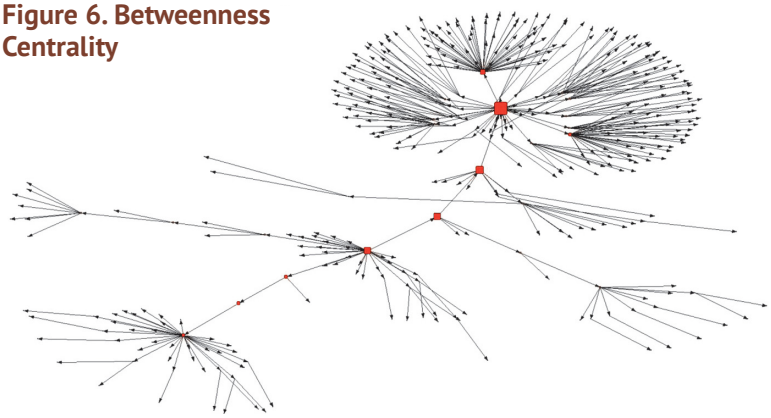


Table 7. Closeness Centrality

Country	SIC Code	Industry	Closeness
India	641	Insurance Agents, Brokers and Service	1178
	6311	Life Insurance	1286
	615	Short-Term Business Credit Institutions, Except Agricultural	1440
	361	Power, Distribution, and Specialty Transformers	1452
	208	Malt Beverages	1500
	371	Motor Vehicles and Passenger Car Bodies	1540

Figure 7. Closeness Centrality

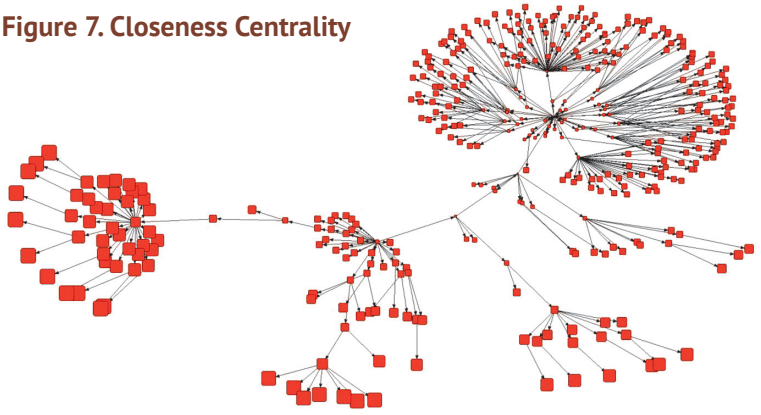
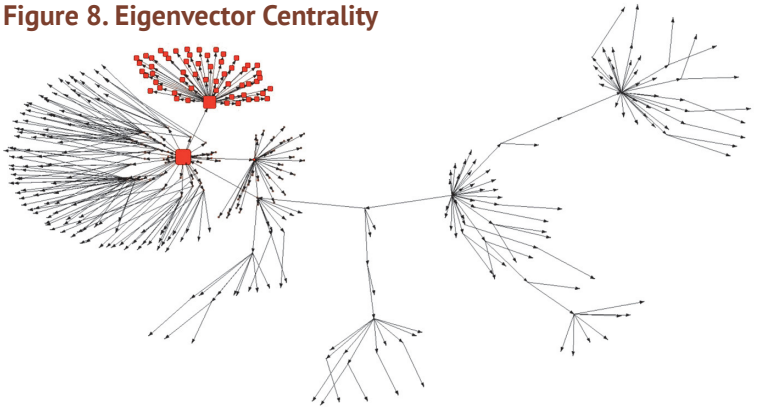


Table 8. Eigenvector Centrality

Country	Eigenvector	SIC Codes	Industry
India	0.409	641	Insurance Agents, Brokers, and Service
	0.336	361	Power, Distribution, and Specialty Transformers
	0.11	871	Engineering Services

Figure 8. Eigenvector Centrality



In Hindalco's network, there are five companies (**Table 6**) that have the lowest degree of betweenness centrality, which means these companies have potential control over subsidiaries they are connecting to the main network, because otherwise those subsidiaries will not be able to communicate with the network.

Closeness

Freeman [Freeman, 1978. P. 215–239] defines closeness as the distance between the nodes. This distance characterizes how fast the information will go through the network from one node to another. The larger the distance, the more time it will take for one node to receive information from other nodes. For example, **Figure 7** illustrates the closeness of subsidiaries in Hindalco Industries Limited network. The smaller the nodes are the faster they will get knowledge in the flow of information.

There are six companies that are shown in **Table 7**, which have the smallest degree of closeness centrality. In this case, those six companies will be amongst the first companies within the network of subsidiaries to receive information.

Eigenvector

Ahuja [Ahuja, 2000. P. 425] describes Eigenvector centrality as a measure that examines the importance of nodes in relation to other nodes within the network. The importance of a node is defined by the importance

of other nodes it is connected to. The higher the measure, the more important a node is within the network.

After analyzing eigenvector centrality in Hindalco Limited, we can identify that there are three companies that can be called the most important in the network. As demonstrated in **Figure 8**, it seems like the company's strategy is to focus on the domestic market as companies with highest eigenvector score are all located in India.

Innovation strategy

As it was mentioned before, Hindalco Industries Limited is operating in the metal industry and most of its operations are connected to it. From the network analysis, it seems like the company is investing a significant amount of resources in finding new ways to automize production (Tables 1, 2 and 3).

A lot of subsidiaries are operating in energy and computer software devolvement sectors, this can potentially help to speed up the production process by implementing new computer technologies. However, in its domestic market, the company is focusing on the production of goods and services in other sectors, such as retail, banking and brewing of beverages. This can be explained by different demands on the market and opportunities for certain businesses. This approach is called Multi-Domestic Strategy and focuses on meeting local demand by having subsidiaries in the sectors which satisfy the demand on the market. Ghoshal and Bartlett [Ghoshal, Bartlett, 1990. P. 603] emphasize that this can significantly help Russian businesses in overcoming geopolitical obstacles.

By having a lot of subsidiaries in different sectors the company has a lot of potential opportunities for business innovations. Hakansson and Ford [Hakansson, Ford, 2002. P. 133–139] acknowledge that sharing the same information flow can bring new ideas to the table. With the broader network and the larger amount of subsidiaries in different sectors there are more potential innovative ideas to occur. Implementing those ideas can be not a straightforward process because of different macro- or microenvironments of countries or regions. Those opportunities benefit all the companies and are related to the number of resources that companies share and can combine to achieve their goals.

Nevertheless, there are some issues that can slow down innovation process in such a network that Hindalco has. Uzzi [Uzzi, 1997. P. 35] claims that there is a significant level of interdependence between subsidiaries and the parent company. For instance, if one subsidiary would want to change its course of actions or introduce a new service, it needs an approval since the parent company invested resources in its subsidiaries and owns it. It is called the first network paradox. The resources that subsidiary has determined its strength and position within the network, but those resources cannot be fully used when the subsidiaries want to use them, as it is a part of the network and needs further authorization.

Conclusion

Hindalco Industries Limited is a leading multinational company in the primary industry sector. With its extensive network of subsidiaries and operations in various countries, the company is able to tap into diverse markets and leverage local expertise. This not only enhances its ability to innovate but also allows it to cater to the specific needs and preferences of different customer segments. One of the key strengths of Hindalco is its focus on technological advancements in manufacturing processes. The company invests heavily in research and development, constantly seeking new ways to improve efficiency, reduce costs, and minimize environmental impact. By adopting cutting-edge technologies, Hindalco is able to stay ahead of its competitors and maintain competitive edge in the industry. Another notable aspect of Hindalco's strategy is its adoption of a Multi-Domestic Strategy approach.

This means that the company tailors its products and marketing strategies to suit the unique requirements of each country it operates in. By understanding the local culture, regulations, and market dynamics, Hindalco can better serve its customers and gain a stronger foothold in these markets.

However, the presence of numerous subsidiaries across different sectors poses challenges in terms of effective management. Ensuring coordination and alignment among these subsidiaries can be a complex task. It requires striking a balance between providing them with the freedom to innovate and make independent decisions, while also maintaining control and ensuring consistency across the organization.

Hindalco Industries Limited's multinational network and focus on innovation position it as a leader in the primary industry sector. Its ability to adapt to different markets through a Multi- Domestic Strategy approach and its commitment to technological advancements contribute to its success. However, effective management of its diverse subsidiaries remains a challenge that Hindalco needs to address to sustain its growth and maintain its competitive advantage.

Network analysis uncovers opportunities for efficiency and cost savings that can help offset the financial impact of sanctions on Russian businesses. This could include identifying redundancies in the supply chain, opportunities for consolidation, or areas where new technologies can be implemented to enhance productivity. Furthermore, it facilitates planning the scenarios, enabling Russian businesses and governmental institutions to model the potential impact of various sanction scenarios and devise appropriate response strategies. This could involve assessing the feasibility of different strategies, such as diversifying its product portfolio, forging strategic partnerships, or lobbying for regulatory changes.

In conclusion, network analysis can provide valuable insights for Russia to navigate the challenges posed by EU and USA sanctions. By revealing interdependencies within its global network, it can help the company develop robust contingency plans, uncover efficiency opportunities, and facilitate scenario planning. This proactive approach can enable Russian businesses to maintain its profitability and competitive edge even under the pressure of sanctions.

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Для цитирования: *Филатов Н.С.* Важность анализа бизнес-сетей на примере компании «Hindalco Industries Limited». *Государственная служба*. 2023. № 6. С. 46–52.

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For citation: *Filatov N.S.* The importance of business network analysis. Illustrative example of Hindalco Industries Limited. *Gosudarstvennaya sluzhba*. 2023. No. 6. P. 46–52.