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The Lithium Paradox: Mining for Low-Carbon Future; A Case Study of Lithium in Serbia

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Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:

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The Green Economy is widely seen as a new promising concept, which should combine economy, sustainability, and environment. However, the transition to clean energy will require mining four times more minerals worldwide than we mine today. In the case of the transport industry, one of the main minerals needed for transition is lithium, known as the 'white gold' of this century. Serbia lies on one percent of the world reserves of this gold, discovered by Rio Tinto, which is rushing to bear its fruits. However, the mineral so needed for decarbonization, paradoxically, has to be mined, potentially leaving devastating consequences on the local environment. And Serbian lithium lies below one of the country's most fertile lands, requiring relocation of local population and elimination of their primary source of income, agriculture production. The proposed project has sparked the largest environmental conflict in the country's history, following which the government, which previously supported the project, abolished all the permits for Rio Tinto, at least for now. This thesis researches the potential environmental, social, and economic effects of the proposed lithium project in the Jadar Valley and the motivation behind the ecological uprising in the country, comparing it to similar conflicts worldwide. Based on the case study of lithium in Serbia, the main conclusion is that a green economy cannot be 'low carbon, resource-efficient, and socially inclusive', as defined by the United Nations, and that it would create certain sacrifice zones, including the potential one in the Jadar Valley, Serbia.

Keywords: Green Economy, Lithium, Mining, Environmental Justice, Sacrifice Zones, Rio Tinto, Serbia, Jadar Valley

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1 Introduction

According to the Paris Agreement, the electrification of the transport sector, which currently contributes to almost a quarter of greenhouse gas emissions, is crucial to achieving the agreed targets. (United Nations Climate Change 2015) The transition to clean energy has created the concept of a 'Green Economy', which combines economy, sustainability and environment, and is defined as low carbon, resource efficient and socially inclusive. (United Nations 2022) The inclusion part of it could, however, be challenged, considering the mineral demand needed to achieve the transition to the clean energy. One of the crucial minerals required for the electric vehicle production is lithium, which is not widely available and needs to be obtained by mining or brine extraction, that can potentially lead to various negative environmental and social consequences. The lithium-rich areas, in same cases, have faced (or could face) a paradox of clean energy transition by turning into a sacrifice zones for green economy.

The aim of this research is to understand the potential environmental, economic and social effects of lithium mining on a case study of lithium mining in Jadar Valley, Serbia. As this proposed mine has led to massive opposition by the academic community, local residents and activist groups, this study also aims to understand their motivation behind the protest.

By researching lithium demand and supply, and potential effects of lithium mines, I argue that the green economy cannot be socially and environmentally inclusive, as envisioned by the United Nations. The extraction of lithium, a crucial element of electrification, can leave devastating environmental and social consequences in certain areas. Therefore, even though the transition from fossil fuels would lead the reduction of greenhouse gas emissions and achieving the climate targets, it would also create specific sacrifice zones. One such zone could be the lithium-rich Jadar Valley in Serbia.

1.1 Aims and Objectives

This study aims to understand the framework on lithium mining in Serbia, including its environmental, socio-economic and political dimensions, as well as the causes of environmental conflicts around Rio Tinto's project, taking into the account the standpoints of environmental activists, local residents, academic community, Rio Tinto and Serbian government. The thesis aims to contribute to the academic debate on lithium mining in Serbia, environmental justice and sacrifice zones of green economy, with the main focus on benefits and disadvantages of the proposed lithium project and motivation behind rising environmental activism in the country. Both lithium mining and environmental activism are new topics in Serbia, that have led to the massive protests during last year, causing the abolishment of the proposed lithium project. There has been limited research done on the topic of importance of Serbian lithium for the green economy and potential benefits and losses for Serbia, in terms of economy, environment and social welfare.

The research would investigate two questions:

a) How should Serbia tackle its lithium resources, taking into account the economic, social and environmental effects of lithium mining?
b) How has lithium mining sparked largest environmental activism efforts in the history in a country that already faces one of the highest air pollution levels in Europe?

The main questions will be answered based on the conceptual research of existing data around lithium mining in Serbia, including the official communication of Serbian government, investor company and scientific and gray literature, such as newspaper articles and recorded interviews, as well as several informal interviews with activists. The main objective of the study is to present a holistic picture of lithium mining in Serbia and the standpoints of different stakeholders in the process.

1.2 Thesis Outline

In the following chapter, I will elaborate on the literature review and theoretical framework. This chapter will review the available literature on the paradox of green economy, due to rising mineral demand for its achievement and the concept of sacrifice zones. The focus of the literature review would be lithium, as one of the crucial minerals for achieving green economy, its rising demand and available resources, the ways to extract lithium and its environmental effects as well as existing conflicts related to the lithium mining in the world. The third chapter would provide the context and background of lithium mining in Serbia, and more detailed information on proposed lithium mine in the Jadar Valley. Chapter four will discuss the methodology used in this research. Chapters five and six will present the results of this study. Chapter five will elaborate on the the economic, social and environmental effects of the proposed mine, while chapter six will cover the motivation behind the rising activism caused by the lithium project. Finally, chapter seven will include the conclusion and recommendations of the thesis.

2 Literature review and Theoretical Framework

2.1 Global North, Decarbonization Efforts and Green Economy

The Global North has been focused on a Green New Deal, a set of measures developed by multiple countries and areas of the Global North to achieve the targets of the Paris Agreement and achieve a transition to clean energy. (Zografos and Robbins 2020) The transition to clean energy has created a new concept called green economy, defined by United Nations as 'low carbon, resource-efficient, and socially inclusive economy. (UNEP - UN Environment Programme n.d.) The transition to clean energy would or will lead to the establishment of new industry sectors and products necessary for the transition. As the main aspects of a green economy, United Nations see ecology, economy and equity. In their view, green economies pave the way to more jobs and new investments in renewable energy sources, including wind power, solar power, hydrogen and electric vehicles. (United Nations 2022) They argue the four dimensions of green economy, including (1) good health and well-being, (2) peace, justice and strong institutions, (3) climate action and (4) responsible consumption and production.

However, the transition to clean energy technology is highly interlinked with the growth in mineral demand required for their production. As paradoxical as it may sound, the International Institute for Sustainable Development (ISSD) foresees that the mining sector will play a crucial role in this transition. (Church and Crawford 2018) In fact, the International Energy Agency (IEA) predicts that we would need four times more minerals than today to manage the transition, including minerals needed for Solar Photovoltaics (PV), wind, Electric Vehicles (EVs) and battery storage, hydrogen and electricity network. (IEA 2021) IISD argues that, although extraction of mineral resources could be a significant chance for revenue for developing countries, if managed properly, it can also contribute to conflict due to its potential effects on communities and the environment. Some authors (Jerez, Garcés and Torres 2021) and (Zografos and Robbins 2020), argue that a clean energy transition would have numerous negative aspects

that have not been taken into account, including environmental justice issues and the environmental footprint of projects needed to enable the transition, such as the mining industry and building of wind and solar mega projects.

2.2 Sacrifice Zones

According to the authors presented in the last chapter, such a need for mineral resources could lead to the creation of so-called green 'sacrifice zones'. (Jerez, Garcés and Torres 2021) The term 'sacrifice zone' was initially used for contaminated areas by uranium mining to develop nuclear weapons during the Cold War. (Zografos and Robbins 2020) Today it is much wider. Lerner defines the 'sacrifice zone' as “low-income and minority population who are required to make disproportionate health and economic sacrifices that more affluent people can avoid”. (Lerner 2010, 3) It is argued that the inhabitants of such 'sacrifice zones' would be the ones to bear the burdens of the clean energy transition, including effects on their immediate environment and health, as well as social and economic costs (Zografos and Robbins 2020) and even that 'zero-carbon lifestyles' of the Global North could be ‘paid’ by the certain communities in the Global South, in terms of environmental and economic damage they would overtake. (Jerez, Garcés and Torres 2021)

The authors define two main aspects of 'sacrifice zones': cost shifts and green colonialism. (Jerez, Garcés and Torres 2021) Cost shift is a practice when private companies, such as mining enterprises, 'pass the costs' of damages made by their activities to a third party, such as the state or local communities. The second aspect is green colonialism, explained as the foreign exploitation of resources of poor countries. Atiles-Osoria (2013) further defines green colonialism as the exploitation of natural resources leading to the extraction of wealth and environmental destruction. Such colonialism could especially be expected in the case of lithium, as lithium-ion batteries are commonly used technology in EVs. Lithium is already

experiencing the highest growing demand related to decarbonization, and its demand is expected to grow significantly until 2040. (International Energy Agency 2021)

2.3 Rising Mineral Demand for Green Economy

To better understand the connection between mineral demand and transition to the clean energy, International Energy Association (IEA) has researched the differences in mineral demand electric and conventional cars production. (International Energy Agency 2021) According to IEA, over six times more minerals are required to produce an average electric car (206,6 kilograms per vehicle of minerals per vehicle), compared to the production of a conventional car (33,5 kilograms of minerals per vehicle). The main minerals required for EV production is copper (53,2kg), lithium (8,9 kg), nickel (39,9 kg), manganese (24,5kg), cobalt (13,3 kg), graphite (66,4 kg) and other minerals (0,3kg), while only copper (22,3 kg) and manganese (11,2 kg) are required for production of conventional vehicles.

Electronic vehicles (EVs) have less impact on the climate than conventional vehicles, and thanks to government subsidies, demand for them is growing and is expected to grow in the years to come. The share of electric vehicles in the total light-duty vehicles is predicted to be 8-14% by 2030. (Xu, Dai and Gaines 2020) According to data from the US Energy Information Administration, the share of light-duty electric vehicles in the world in 2020 was 0,7% and it is predicted to grow to 31% by 2050 when 672 million such vehicles are expected to be on the market worldwide. (US Energy Information Administration 2021) The US Energy Information Administration also predicts that the share of EVs in OECD countries in 2050 will be 34%, while in non-OECD countries it will be 28%. (US Energy Information Administration 2021)

Predicting the growth of electric vehicles is connected to the policies and targets introduced related to the electrification and bans of internal combustion engine vehicles. To this date, more than 20 countries introduced these targets. Most of these countries are a member of the

European Union from Western and Northern Europe, including Norway, Denmark, Iceland, Ireland, Netherlands, Scotland, Slovenia, Sweden, UK, France, Canada, Portugal, Spain and Germany, together with China, Japan, Israel, Sri Lanka, as the countries outside of European Union. Looking at the countries, we can understand that most of them belong to the Global North, with a few exceptions such as China, Sri Lanka and Chile. (International Energy Agency 2021) Serbia, which is not yet a member of the European Union has introduced no electrification targets to this date.

2.4 Lithium Demand

The increased production of electric vehicles is significantly driving the demand for lithium, a mineral that has only recently gained momentum, although discovered in 1817. (Sterba, et al. 2019) According to the predictions from International Energy Agency (IEA 2021), lithium demand for the green economy is expected to grow the fastest among the major minerals by 2040, increasing over 40 times. To understand the future demand growth, IEA has developed two scenarios: Stated Policy Scenario (STEPS), based on the assessment of current or announced policies in place by 2040, and Sustainable Development Scenario (SDS), based on demand that meets the Paris Agreement goals. Based on the first scenario, STEPS, total lithium demand would triple by 2030, from 74 to 242 kilotons, and it would grow five times by 2040, from 74 to 373 kilotons. The share of lithium that would be used in the EV industry would grow from 29% in 2020 to 68% in 2030 and 74% in 2040. Sustainable Development Scenario predicts a much higher demand growth for this critical mineral. To meet the Paris Agreement targets, lithium demand would need to grow over six times by 2030, 82% of which would be used for Clean Energy, and it would grow by fifteen times in 2040. In that year, EIA predicts that 92% of total lithium would be used for Clean Energy.

EIA also predicts that two major production sites in Australia and Chile, that are currently expanding their production by more than 2.5 times, could support the demand projected by STEPS scenario by late 2020, but not the demand projected by SDS.

2.5 Lithium Supply and Availability

The increasing demand for lithium is making it one of the most critical resources for clean energy transition, leading to a so-called 'lithium rush'. The main targets of this rush are the countries with the highest identified lithium resources, primarily Latin American countries. This chapter will give more details about current lithium production and identified lithium resources in the world.

In the existing literature covering lithium availability, it is important to distinguish two concepts: reserves and resources. (Vikström, Davidsson and Höök 2013) Lithium resources refer to the quantities available for exploitation in the world that are either currently or potentially feasible for extraction. Reserves, on the other hand, are part of the identified resources currently available for exploitation, taking into account technical, economic and social aspects. One of the most used literature sources related to the data on lithium availability is the United States Geological Survey, which publishes annual reports on lithium production, reserves and resources. (U.S. Geological Survey 2021) According to their 2021 report, global lithium production grew by 21% in 2021 compared to 2020, to around 100 kilotons, while the global demand increased by 33% year on year.[1] In the same report, US Geological Survey elaborated on the significant increase in lithium prices during 2021. Four countries dominated lithium production in 2021, namely Australia (40%), Chile (18%), China (14%) and Argentina (6.2%).

[1] Worldwide data, excluding United States

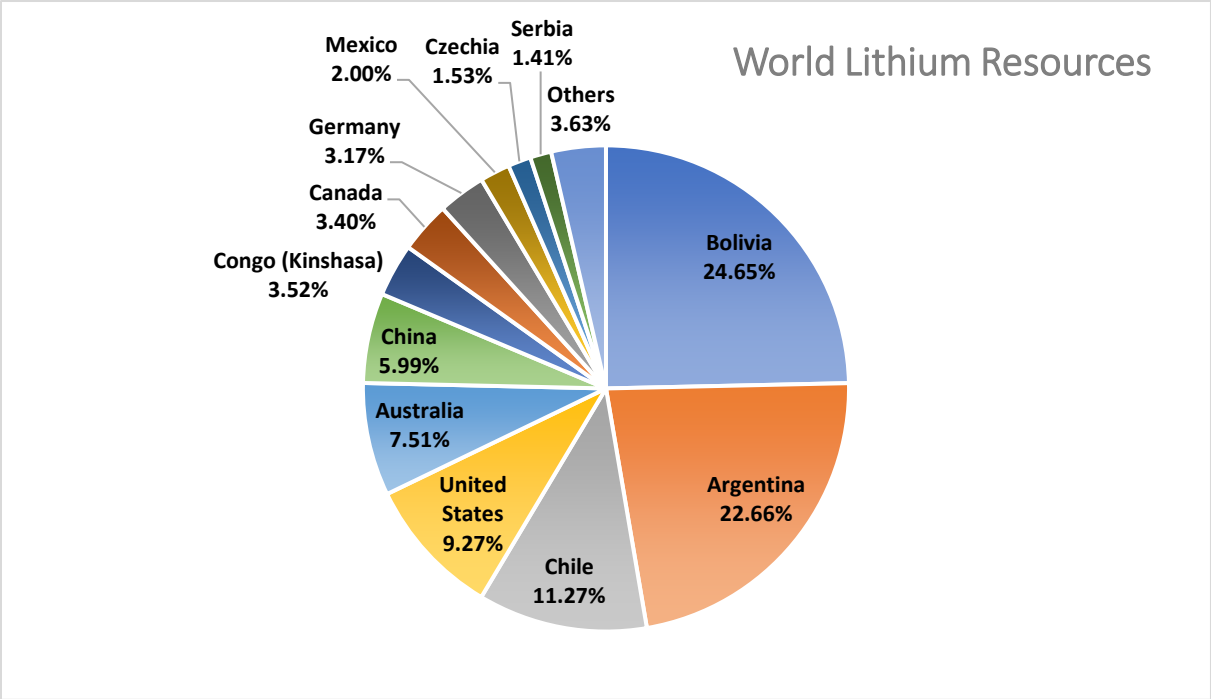

Figure 1: World Lithium Resources per country in percentage; Source: US Geological Survey 2021

This report also distinguishes lithium resources and lithium reserves. Figure 1 shows currently available lithium resources in the world. The largest discovered lithium resources in the world are discovered in the so-called Lithium Triangle in South America along the border of three countries: Bolivia, Argentina and Chile. (Samar Ahmad 2020) This area accounts for 59% of currently discovered lithium resources, 25% of which are found in Bolivia (21 million tons), 23% in Argentina (19,3 million tons) and 11% in Chile (9,6 million tons). United States (9%), Australia (7%) and China (6%) follow. When it comes to Europe, the largest lithium resources have been found in Germany, with 2,7million tons of lithium, representing 3,17% of world resources. The Czech Republic follows with 1,3 million tons or 1,53% of discovered lithium worldwide. Serbia's lithium resources, which will be discussed in more depth, equal 1,2 million tons, or 1,41% of discovered lithium. However, not all of these resources could be utilized for lithium production at this moment, due to the different technical, economic and social factors, as defined in the definition of 'resources'.

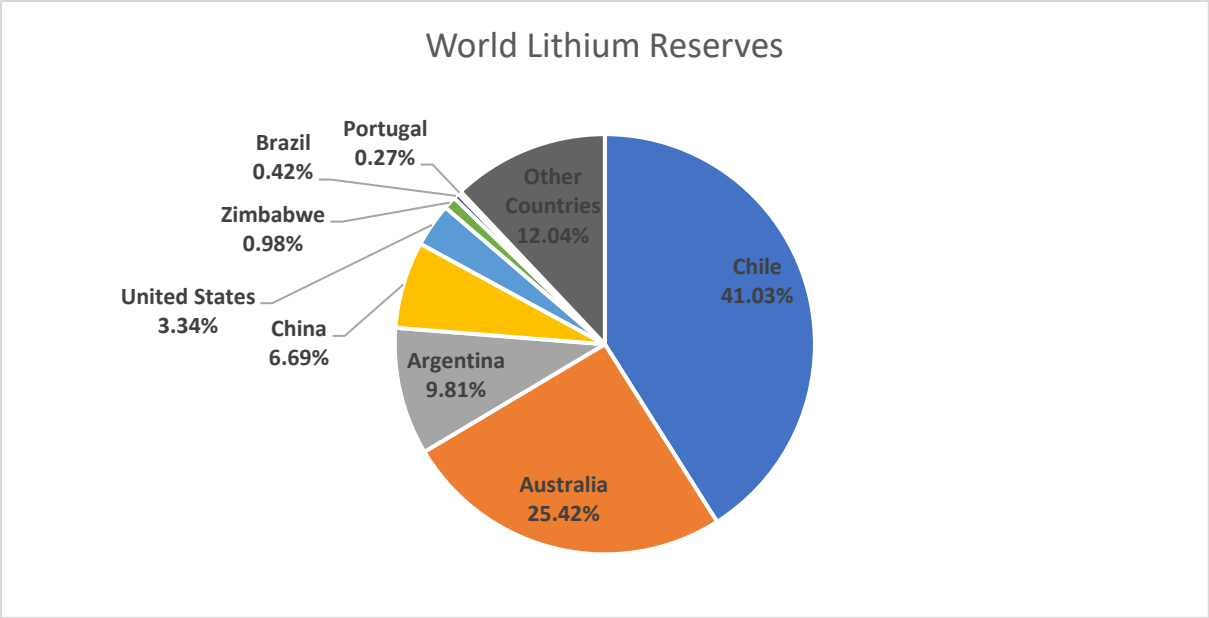

Figure 2: World Lithium Reserves per country in percentage; Source: US Geological Survey 2021

While current lithium resources are estimated to around 85 million tons, lithium reserves, or part of resources that are feasible to be extracted are almost four times lower, estimated to 22 million tons. The geographical distribution of current lithium reserves is presented in Figure 2. Almost a quarter of current lithium reserves were found in Chile (9,2 million tons), 14% in Australia (5,7 million tons) and 5% in Argentina (2,2 million tons). China and United States follow, with 1,4 million and 750 thousand tons respectively. It is, however, not clear from the report how much reserves are available in European countries, including Serbia. Portugal has been featured amongst the countries with highest lithium reserves, with 60 thousand tons of lithium available in the country. Austria, Czechia, Finland, Germany and Serbia are included in the 'Other countries', together with Canada, Congo (Kinshasa), Mali and Mexico, having 2,1 million of tons of litihum reserves altogether, or 12% of total reserves.

2.6 Lithium Extraction Methods and Environmental Effects

It is also important to differentiate the ways lithium is available in these countries, as different extraction methods have different economic and environmental impacts. As lithium does not occur in nature as an element, it has to be extracted from two main sources: minerals and continental brines. (British Geological Survey 2016) Both methods are connected to different environmental concerns, mostly related to water depletion, and the potential pollution of water, air and soil. (Kaunda 2020) The less common technology is lithium extraction from geothermal brines, which has been discovered in the US and Germany. (Stringfellow, William and Dobson 2021) Furthermore, lithium is almost unlimited in the oceans. (Vikström, Davidsson and Höök 2013) However, its extraction from seawater is not considered technically or economically feasible. (Greim, Solomon and Breyer 2020)

2.7 Conflicts around lithium extraction

The 'lithium rush' has caused numerous conflicts and protests worldwide. Only Environmental Justice Atlas, a website that documents different conflicts around environmental issues, has reported on 18 different conflicts around lithium mining across the world, in the US, China, Canada, Spain, Serbia, Zimbabwe, and the Lithium Triangle countries, including Argentina, Chile (Sherwood 2019) and Bolivia. (Environmental Justice Atlas n.d.) Further protests took place in Portugal (Faget 2021), Czechia (Lazarová 2017) and Australia (Loney 2019). Part of these conflicts is related to the existing lithium mines and their negative effects on the environment, while part of the conflicts has a preventive character and is related to the proposed lithium projects. (Environmental Justice Atlas n.d.) The main themes of the conflicts are environmental and socio-economic issues related to lithium mining, including water access rights, air pollution, biodiversity loss, soil contamination, groundwater pollution, mine tailing spills, people displacement, impact on cultural heritage and loss of landscape. (Environmental Justice Atlas n.d.) In many areas, the proposed or existing mines are located in areas populated

by indigenous communities. In the US, for example, the Nevada project is within 35 miles of Native American reservations, which are concerned about the environmental impact, as well as the impact on their cultural heritage. (Holzman and Waldman 2022) The protests are turned against the government bodies and foreign companies investing in the local project, most of which come from the countries of the Global North, including Australia, Canada, China, Germany, the US and the UK. (Environmental Justice Atlas n.d.) The way how governments respond to their lithium potential is not the same in all countries. While most lithium-rich countries see lithium as a potential and development chance and are open to foreign investments such as Argentina (Ecclestone 2021) some governments, such as Bolivia, have nationalized lithium resources to avoid the extraction of the country's mineral wealth by foreign companies. (Hilaly 2020)

In the next subchapters, I would cover the conflicts and standpoints towards lithium in Argentina, as a country open to lithium extraction and Bolivia, as a country that is against foreign extraction and compare them to the situation in Serbia in the research.

2.7.1 Lithium in Argentina

Globally, Argentina ranks second in available lithium resources, currently estimated at 19,3 million tons or 23% of total world resources, as shown in figure xx, (U.S. Geological Survey 2021) while in 2021 it accounted for 6.2% of total lithium production. However, due to the government's openness to attract lithium investors, it is predicted that Argentina would overpass Chile and become the largest lithium producer in the world by 2030. (Ecclestone 2021) In Argentina, the government obtains a 3% royalty fee on lithium mining, (Perotti and Coviello 2015) while the provinces have ownership of mineral rights. (Belda, Ghilotti and Yang 2022)

Currently, there are two lithium projects in operation in Catamarca and Olaroz provinces (Greenhalgh 2022) and 60 more projects are in the planning phase. (Dor 2021) The existing

mine in the Catamarca region has sparked conflicts between the indigenous communities, investor company and authorities.

'Fenix' lithium mining project, located in the Salar del Hombre Muerto salt flat area started in 1997 by US lithium technology company Livent. Initially, the capacity of the project was 12,000 tons of lithium carbonate and about 6,000 tons of lithium chloride, and the expected lifecycle was estimated to be 70 years. All of the mined lithium is currently being exported. (Environmental Justice Atlas 2021) In 2019, the company produced 17,000 tons of lithium carbonate and 4,000t of lithium chloride in 2019, and it has received government permission for mine extension which is currently in the planning stage, aiming to increase production up to 40,000 tons of lithium carbonate per year. (NS Energy n.d.) In addition to Livent, eight more foreign companies are currently planning other lithium mining projects in Salar del Hombre Muerto.

The conflicts around the Livant's current and proposed mine peaked in 2018 after the local Trapishe river dried up as a result of the mining operations. In the region with naturally low rainfall, currently seven times more water evaporates than it enters the system, mainly due to the water extraction by the lithium mining operation. (Environmental Justice Atlas 2021) Some scholars, such as Gallardo, call this method of lithium production 'water mining'. (Gallardo 2011) In the expanded mine, the company would use over 15 million liters of water per day from another river, Los Patos. It is estimated that the company would use the same amount of water that 2000 local inhabitants together use in a year in only 14 days. It is stated that the company does not pay for the water it consumes. Local communities organized several protests and roadblocks to demand government response, which led to the violence and several arrests. The communities protested around the water scarcity, contamination of fresh water and negative effect on biodiversity, but received no response from the government. The protests stayed on the local level. (Environmental Justice Atlas 2021)

2.7.2 Lithium in Bolivia

Although Bolivia has the quarter of currently discovered lithium reserves in the world, with Salar de Uyuni representing the largest lithium deposit in the world (Gonzalez 2021), this mineral is a controversial topic in Bolivia, which has not yet started its extraction.

After seizing the power in 2005, Bolivia's former president Evo Morales put fighting against extractivism as one of the main priorities, terminating some of the existing mining contracts that exploited indigenous populations. (Hilaly 2020) In 2006, he decided to nationalize Bolivia's lithium resources and give full control and ownership of the lithium extraction to the state. He planned to develop a '100% national' lithium industry, covering the entire production chain related to lithium, instead of simply exporting raw materials. (Samar Ahmad 2020) However, some of the main challenges related to this plan were the technological investments required for the development of a mine, which Bolivia, as one of the poorest countries in South America, (Borgen Project n.d.) lacks. (Samar Ahmad 2020) Therefore, the country formed a joint venture with a German company, ACI Systems in 2019. The company, which has Tesla, BMW and IBM as some of its main customers (Harasim 2020) planned to invest USD 1.3 billion in the industrial use of lithium. (Samar Ahmad 2020)

This has sparked large-scale environmental protests by the indigenous population in the region of Potosi, who were dissatisfied with the benefits for their communities from the projects and concerned about the potential environmental effects. (Environmental Justice Atlas 2021) The protest organizers, Potosí Civic Committee demanded the increase of the royalty fees for local communities from 3% to 11%, with the leaders organizing a hunger strike related to these requirements. (Harasim 2020) Besides the royalty fee, local populations saw no benefits related to employment, as the mine provided only jobs for the unskilled workforce. (Samar Ahmad 2020) Besides economic effects, the protests raised environmental concerns related to this project, focusing on water scarcity and pollution, biodiversity loss and soil erosion and pollution

as some of the main concerns. (Environmental Justice Atlas 2021) Having in mind how water-consuming lithium extraction process is, water scarcity was the main concern raised by local communities, considering that, in one of the communities less than a quarter of households have access to basic sanitation, and only half of the households have access to the drinking water. When it comes to the biodiversity loss, local residents fear that the mine would affect the displacement of the flamingos in the region. (Environmental Justice Atlas 2021) As a result of the protests, the Bolivian government has scraped the joint lithium project with German company. (DW 2019)

Only a week later, the Bolivian president was overthrown in military coup after being accused of dishonest elections and had to exile the country. The president claimed that the coup has been financed by US, who aim to get access to Bolivia's lithium resources. (Harasim 2020)

Although the local activists claimed the victory in 2019, it does not end a story of Bolivian lithium. The new president of Bolivia, Luis Arce Catacora, sees lithium as one of the main national priorities, aiming to go for a rapid lithium development agenda until 2025. (Molen 2022) He has openly invited investors with direct brine extraction technology to participate in the public bidding on extracting lithium deposits in Bolivia and is willing to continue partnership with German company ACISA. (Harasim 2020)

3 Context: Lithium in Serbia

3.1 Project Background: Jadarite, Lithium and Rio Tinto in Serbia

Jadarite is a lithium sodium borosilicate mineral, with the chemical formula LiNaSiB3O7(OH) discovered in 2004 in Jadar Valley, Serbia. It has been discovered by Rio Tinto, an Anglo-Australian multinational company, on their quest to find borate mineral in the region. However, instead of borate, they discovered something more valuable: a new mineral, containing both borate and lithium, which was named jadarite, after the river Jadar in which area it has been found. (Rio Tinto n.d.) Jadarit was officially approved by the Commission on New Minerals, Nomenclature and Classification (CNMNC), International Mineralogical Association in 2006. (C. Stanley 2007) The new mineral got into the public eye after BBC reported that a mineral with the same formula as Superman's Kryptonite was found in Serbia. (BBC News 2007) Typically, lithium minerals contain lithium content between 0.5% and 2%. Based on several research studies, the content of lithium in jadarite minerals is 3.16%, making the quality of lithium derived from jadarite one of the highest in the world. (Siljkovic , Denic and Rakic 2017) As described in the literature review, most of the world's lithium is found in the brines or pegmatite minerals, primarily spodumene. Lithium in a clay-minerals is rare and can be found only in jadarite and hectorite minerals. As jadarite can only be found in Serbia, there has been no experience from other countries on its mining technology and its effects.

Rio Tinto has a long history in Serbia. They established a company 'Rio Sava Exlorations' in 2001, three years before the exploration of jadarite. After the official approval of the new mineral in 2006, Rio Tinto conducted its first experiment drillings in 2008. In 2013, they have commissioned a pilot Jadarite processing plant at Bundora Research Center in Australia. The first official Memorandum of Understanding between Rio Tinto and the Serbian Government related to the 'Jadar' project has been signed in 2017, more than 10 years after the mineral exploration. (Rio Tinto n.d.) The aim of this Memorandum, according to the official press

release, was to establish joint working groups between the Serbian Government and Rio Tinto to enable the development of the 'Jadar' Project, a development of lithium and borate deposits 100% owned by Rio Tinto, through the study phase and enable obtaining official permits. Based on that document, Rio Tinto aimed to start producing lithium and borate in early 2023, given that the feasibility study and all the necessary permits are in place. (Rio Tinto 2017)

3.2 Jadar Project Location and Spatial Plan

The proposed project is located in the Jadar region in west Serbia, near the border with Bosnia and Herzegovina. The region got its name from the Jadar river, a 75 km-long tributary of the Drina river. Three rivers flow into the Jadar river, namely Pecka, Likodra, and Rakovica rivers. It belongs to the Black Sea drainage basin, as the Drina flows into the Sava, which further flows into the Danube in Belgrade. (Wikipedia n.d.) The good soil, climate, and geographic orientation of the region make it suitable for agriculture production. The region includes the cities of Loznica and Krupanj, and it is estimated that around a hundred thousand people live in the area. According to the latest estimations, around 20,000 citizens are engaged in agriculture, producing fruit, vegetables, grapes, honey, cattle, and other agricultural products. (Zvezdan Kalmar, CEKOR 2021) Figure 3 shows the fertile land surrounding Rio Tinto drilling areas.

Figure 3: The area of Rio Tinto proposed mine; *Source: Rio Tinto*

First official information about the project got into the public in November 2019, when the draft of a new Spatial Plan of the special purpose area for exploration and processing of jadarite got published. The plan contained a detailed elaboration related to the special purpose complex for "Jadar" project and accompanying infrastructure. The Spatial Plan covers an area of 293.91 km2 and a total of 22 municipalities in the city of Loznica (settlements Runjani, Lipnica, Bradić, Brnjac, Veliko Selo, Jarebice, Draginac, Simino Brdo, Cikote, Šurice, Stupnica, Slatina, Korenita, Gornje Nedeljice, Donje Nedeljice, Grnčara and Šor) and the municipalities of Krupanj (settlements Kostajnik, Dvorska, Brezovice, Krasava and Cerova). The aim of this plan was to enable planning basis for issuing location permissions and preparing future parceling projects related to the special area. As shown in the Figure 4, the area would be split into several zones, including mining zone, production zone, landfill and traffic infrastructure zone. The graph also predicts primary zones that would experience environmental impact form mining and industrial production.

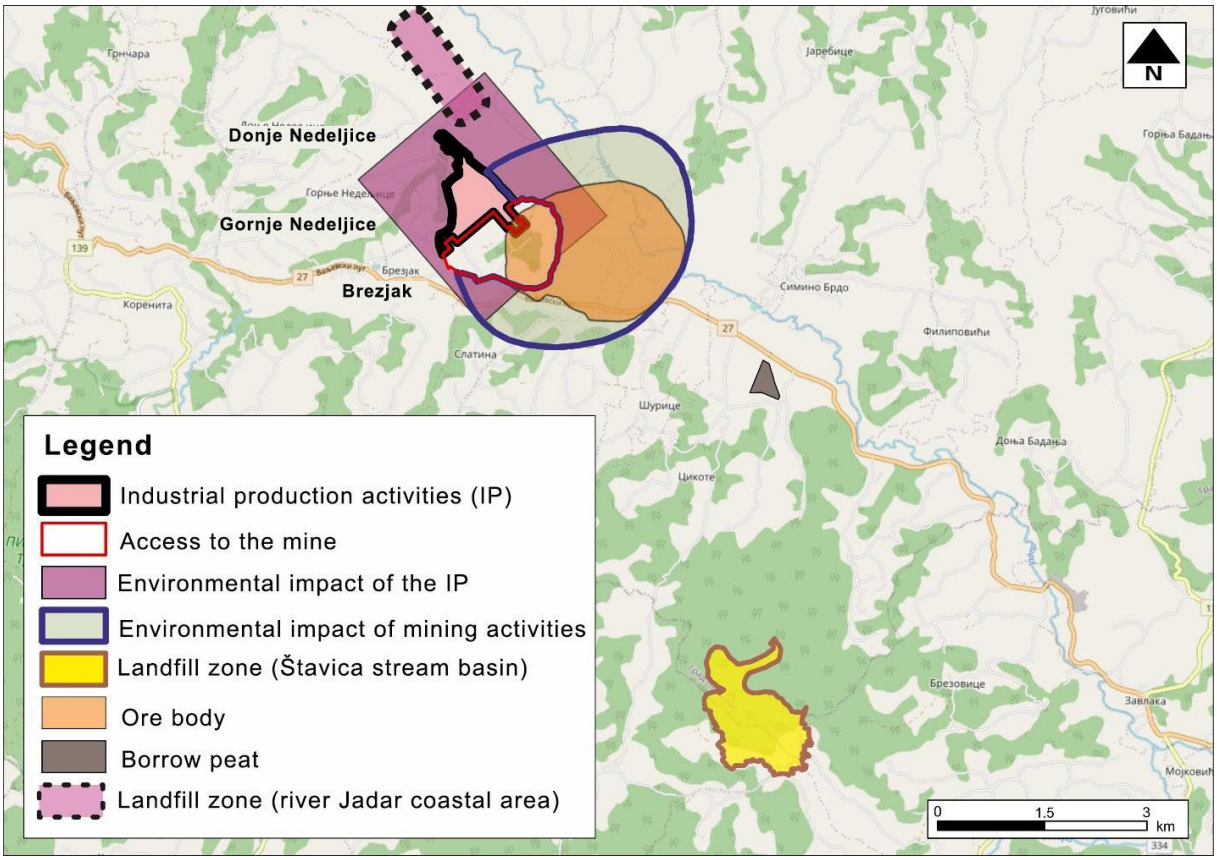

Figure 4: The Planned Facilities and Impact Zones in Jadar Project, Serbia; *Source: Spatial Degradation Within The „Jadar" Project*

The plan also includes information about the acquisition of private land and housing in the area and the relocation of families living in the special area. (Institute Of Architecture And Urban & Spatial Planning Of Serbia 2019) The Spatial Plan was officially approved by the Serbian Government in March 2020 and was added to the new plan of the city of Loznica in July 2020. (N1 Beograd 2021) Two days before the approval of the Spatial Plan, Rio Tinto issued an official statement, committing to invest $2.4 billion in the Jadar project, in case all relevant approvals and permits are received. They announced the start of the mine building in 2022, following the approval of the Environmental Impact Assessment (EIA). According to the same press release, the start of lithium production is expected in 2026, and full production capacities will be in place in 2029, producing ~58,000 tonnes of lithium carbonate, and 160,000 tonnes of boric acid (B2O3 units) and 255,000 tonnes of sodium sulfate per year. (Rio Tinto 2021)

3.3 Concerns about the Jadar Project

Jadar project has provoked the largest environmental protests in Serbian history. The first opposition to the project started after the first officially released information about the Spatial Plan, the approval of which has sparked big concerns amongst citizens, local NGOs, and the academic community. The first protests were started locally, by residents of the Jadar region and activists against the proposed Rio Tinto mine. The local community members claimed that they were not properly informed about the project and that no socio-economic or environmental studies have been conducted before the project approval. According to some of the local activists, they have not been concerned about the mine before the Spatial Plan was revealed. They had a good relationship with Rio Tinto employees over the last 17 years and completely immersed them in the local life. Locals believed that the mine would be modest, covering only 20 hectares of Jadar territory, and it would not have any negative effects on the environment. The situation changed when Spatial Plan showed that the mine would be on 30 times larger area, covering 600 hectares, including the areas of their homes. (Meaker 2022)

After discovering that Rio Tinto did not reveal the information about the technology that should be used to extract lithium in the proposed mine, the citizens called the Spatial Plan illegal and requested its annulment. Two local activist organizations, KORS and Protect Jadar and Rađevina published an official proclamation about the unacceptability of the project. They requested the government to conduct a socio-economic and environmental study related to the proposed project. Multiple other non-profit organizations have joined the protests and demanded from the government to suspend the project and all activities related to the potential mine and revoke the controversial spatial plan. (Zvezdan Kalmar, CEKOR 2021)

Concerns were related to the social, economic, and environmental impact of the proposed mine, including its impact on land, water, air, and biodiversity, which will be further discussed.

3.4 Serbian Lithium – Decarbonization effort, development chance or sacrifice zone?

Similar to other governments from the lithium-rich countries in the Global South, such as Argentina and Chile, the Serbian government sees lithium as a development chance. Serbian Prime Minister, Ana Brnabic, called lithium 'enormous development potential for Serbia'. (Brnabic 2021) The President Aleksandar Vucic claimed that 'Serbia has no seaside and tourism potential, but it has Jadarite'. (Vucic 2021) Zorana Mihajlovic, Minister of Mining and Energy and Vice President of the Serbian Government also emphasized the importance of lithium for Serbian development, adding that Serbia has 156 million tons of reserves of this mineral crucial for the green agenda. (The Government of the Republic of Serbia 2022) The numbers however do not always add up. As shown in the literature review, the EIA estimated Serbian lithium reserves to be 1.2 million tons. Rio Tinto announced that their proposed mine would produce 2.3 million tons of lithium carbonate during the mine lifecycle of 40 years. (Rio Tinto n.d.) The number of 156 million tons that the minister announced could be related to the estimations of jadarite reserves, which Rio Tinto estimated to be 143.5 million tons. (Rio Tinto 2022)

Similar to the estimations of reserves, there has been different communication and estimation around the percentage of Serbian lithium reserves in the world. The Prime Minister announced, and several media channels reported that Serbia has between 10 and 12 percent of total lithium reserves in the world. (Brnabic 2021) According to the US Geological Survey report, however, Serbia owns around 1 percent of total lithium reserves. (U.S. Geological Survey 2021)

Due to such an attitude towards the proposed mine, some activist organizations accused the Serbian government of lobbying for Rio Tinto. (Environment Energy Mining Watch SEE 2020) The evidence of lobbying behavior could also be seen in the Serbian pro-government media, including the national broadcasting channel RTS, (Šljukić Bandović 2021) who have broadcasted the official commercial of the Jadar Project, that emphasized the importance of

lithium for green technologies and clean air, both of which depends on one of the 'most important lithium deposits in the world' in Jadar Valley. The main message of the advertisement was 'Together we have a chance to save the planet. (Eko Straza 2022)

The emphasis on clean air and saving the planet with green technologies got negative reactions in Serbia, considering the country's current environmental challenges. According to the IQAir estimates, Serbia is amongst the countries with the poorest air quality in Europe, with five times higher average concentration of PM2.5 particles than the WHO recommended value. The air pollution in Serbia can be attributed to its dependence on coal power for energy generation, the burning of fossil fuels for domestic heating, and pollution from the aging transport fleet. (IQAir 2022)

Looking at the transport industry, the country is heavily relying on the import of used cars. Only in 2019, 120000 used cars have been imported to Serbia, which is being called 'scrap yard' of European cars. (Bjelotomic 2019) On the other hand, only 4,000 electric and hybrid vehicles have been registered in Serbia by mid 2021, with 100 electric charging stations in the entire country. Despite the country's recent subsidies on purchase of electric vehicles, the purchase of such cars is still seen as unprofitable, and the lack of infrastructure is influencing the small demand. (Serbia Business 2021)

Further signs of government lobbying for Rio Tinto were exposed in their proposed change of two laws related to the acceleration of expropriation in cases of the projects of strategic importance for the country, such as Project Jadar. This will further be explained in the next chapters.

When referring to Rio Tinto project in Serbia, several media outlets and activist organizations used the term 'sacrifice zone' of EU for the needed clean energy transition. (European Western Balkans 2021) This term came into the focus especially after the former German Chancellor Angela Merkel visited Serbia (European Western Balkans 2021) and after the documents that

have allegedly leaked from the conversation between the representatives of Rio Tinto and the officials of DG GROWTH, European Commission's Directorate General for Internal Market, Industry, Entrepreneurship and SMEs made public. (N1 Belgrade 2021) During the press conference following her visit, Angela Merkel stated that 'EU is interested in Serbian lithium, as the rest of the world is'. (Todorovic 2021) Although it cannot be considered scientific evidence, the second event that increased public distrust and increased suspicion about Serbia as sacrifice zone was the leak of the mentioned documents, which contain information about the political support of Serbian president Aleksandar Vucic to the proposed mine and promises of Rio Tinto that Jadar would be an 'European project', further explaining how they would prefer to partner with European actors for the development of the EU battery value chain. (N1 Belgrade 2021)

However, although Jadar project is being announced as the largest lithium mine in Europe, Serbia does not have the largest reserves on this continent. As shown in literature review, the largest lithium reserves in Europe are found in Germany, and Czech Republic follows. However, Serbia is the only country with large lithium reserves outside of European Union, meaning it does not need to follow the stricter environmental standards of European Union. Although there are chances that lithium gets further explored and exploited in the countries of European Union, this process could take more time as all the environmental aspects would need to be considered. Serbia, on the other side, could be a 'quick win' for Europe to get the needed lithium reserves in this decade. The lithium can also be seen as a 'quick win' for Serbian government to increase the economic performance of the country measured by GDP, neglecting the other effects on economy, such as loss of agriculture and costs of the recovery of the area after the end of the mine's lifecycle.

4 Methodology

4.1 Conception of Research

Within the research, I would include both conceptual and empirical research. Conceptual research will focus on background research on lithium mining in Serbia, using the available information from local and international data sources, including both scientific literature and gray sources, such as newspapers and recorded video interviews, to better understand the importance of Serbian lithium for the decarbonization effort and green economy in both Serbia and the world. Within this part of the research, I tried to understand the environmental, social and economic effects of the proposed mine on Serbia and its citizens, and the standpoints of different stakeholders, including the government of Serbia, investor company, local communities, activists and the general population that is opposed to the proposed mine. Based on these findings, I tried to understand the importance of Serbian lithium for green economy and discuss if the Jadar Region of Serbia could be seen as a sacrifice zone of the clean energy transition, bearing the costs of low-carbon transition of the countries with electrification targets, as described in the literature review. Furthermore, as the proposed lithium project sparked the largest environmental conflict in Serbia to this date, I tried to understand the motivation of those that supported protests, by researching the communications around the protest, including the pamphlets, speeches and interviews. In addition, to get more clarity on why this particular project brought so many people on the streets, I would conduct additional informal interviews with five activists who have joined the protests for the first time. Their motivation and results of the conflict would then be compared to similar conflicts that happened in the world, which have been explained in the literature review.

4.2 Limitations of Research

I have faced several limitations while researching this topic. The main limitations were related to the availability and quality of data related to the Jadar project and biases from all the parties. I tried to understand the standpoints of different actors in the process, including the Serbian Government and investor company, Rio Tinto, who have so far published only limited data, which can in most cases be considered as biased, as both parties are pro project and shared only communication that could enable project to be started as soon as possible. Other actors, including local residents, the academic community and environmental activist have opposed to the project, also showing the biased behavior. Further limitation is the lack of published academic sources related to the lithium mining in Serbia. Therefore, I had to turn to the media sources and gray literature, including the recorded interviews of different stakeholders, and newspaper articles. The media has also showed biased behavior. Most of the Serbian media channels have been marked as pro-government and have not covered the environmental protests in Serbia, or if they have been covered, it was with negative connotation and often lies. On the other hand, the only media channel that has reported around the protest, N1, has been marked as against government, and has also shown some biased behavior. Therefore, my research included more international and independent media sources covering the conflict. Despite these limitations, I believe I managed to understand the main messages and standpoints form different stakeholders, by looking into the different gray and scientific literature.

5 Potential Impacts of the Proposed Mine

In this chapter, I would explain the results of conceptual research, covering potential environmental, social and economic impacts of the proposed Rio Tinto mine, based on the communication of different stakeholders, including the Serbian government, Rio Tinto, the academic community and activist groups.

5.1 Potential Environmental Impacts

Rio Tinto states that they are committed to the highest environmental standards in the Jadar project. According to their website, that 12 environmental studies and over 23,000 analyses of soil, water, air and noise have been done for the Jadar project, as a basis for developing Environmental Impact Assessment Studies (EIA). Information about the topics of the studies and their developers, shown in Table 1, are available on the official website of Rio Tinto. (Rio Tinto n.d.) However, none of the documents are available to the public. Additionally, in 2021, after announcing their investment, Rio Tinto stated that the project is subject to receiving all relevant approvals, permits and licenses, including the approval of environmental impact assessment studies. (Rio Tinto n.d.) However, they have not stated when and by whom this study would be conducted.

Study	Developer
Environmental and Community Impact of Subsidence at the mine area study	Faculty of Mining and Geology, University of Belgrade
SEVESO Safety analysis of the Jadar Project from the aspect of chemical accident	Petram/SGS
SEVESO Study (II)	Petram/SGS
JADAR EIA Gap Analysis Report (two separate studies)	Faculty of Mining and Geology and Mechanical Faculty, University of Belgrade
Generation of noise model for the Jadar lithium-borate project components	SGS
Air Quality modeling of the Jadar Project	Mechanical Faculty, University of Belgrade
Hydrologic study on the jadar river within the zone of a future water supply intake	Jaroslav Cerni Institute for the Development of Water Resources

Jadar Project Water Supply Study (JPWSS)	Jaroslav Cerni Institute for the Development of Water Resources
Water monitoring	Jaroslav Cerni Institute for the Development of Water Resources
Waste water discharge study	Jaroslav Cerni Institute for the Development of Water Resources
Hydrotechnical Study - flood protection and flood zones in the Jadar river valley	Jaroslav Cerni Institute for the Development of Water Resources
Hydrotechnical Study on the relocation of the Korenita River	Jaroslav Cerni Institute for the Development of Water Resources
Preliminary hydrogeological Study of protection of the spring by the church in Gornje Nedeljice village	Faculty of Mining and Geology, University of Belgrade
Soil monitoring report	Agriculture faculty, UoB
Soil monitoring report (ii)	Public Health Institite Belgarde
Air Quality monitoring	Public Health Institite Belgarde
Noise Model for the Jadar Lithium Borate Project Components - Forest Option	SGS
Jadar Project Biodiversity Baseline Report	Faculty of Biology, UoB and Environmental Resources Management
Static Geochemical Characterisation of Tailings Samples	SRK consulting
Noise monitoring	SGS and Zastita Beograd

Table 1: Environmental Studies conducted for Jadar Project; Source: Rio Tinto

The Spatial Plan, concluded by the Ministry of Infrastructure, states that there could be some negative effects on the environment based on changes in land use, ore mining using explosives, ore processing, and disposal. All of these activities could impact the quality of air, water, land, and biodiversity, as well as the health of residents. Further in the plan, we can read that using 'technological' and other measures the effects on the environment could be controlled and within legally permitted limits. The mine would have primary and secondary zones of environmental footprint. The primary zone includes the area of mines, landfill, factories, and related infrastructure. The secondary zone includes the area around the mine. According to the plan, the size and the effects in the secondary area could differ depending on people and wildlife migrations, and water and wind flow. (Institute Of Architecture And Urban & Spatial Planning Of Serbia 2019) Aside from claiming that the further from the mine we go, the fewer environmental effects there are, the plan does not state which geographical area is considered

secondary, and which potential negative effects it could get. The plan, also, does not state any concrete threats and measures that would be taken to prevent them.

Academics from the Serbian Academy of Art and Sciences claim that this project would irreversibly change and degrade the existing landscape and endanger biodiversity. (Ristic, et al. 2021) Based on their estimation, the initial formation of the mine would lead to permanently degrading 533 ha of land, including 204 ha of forest, 317 ha of agricultural land, 8.3 ha of residential buildings, and 4.2 ha of orchards. The planned landfills would bring an additional 146 ha of land degradation by deforestation. They also saw it as a permanent risk to the health of citizens of the town of Loznica and nearby villages. They call for appropriate, independent expert analyses at the national level. (Ristic, et al. 2021) Based on performed research, they have indicated that the project could permanently destroy the potential for agriculture in the area, devastating and polluting the environment and endangering water, air, and soil. (Ristic, et al. 2021)

5.1.1 Effects on air

Regarding effects on the air, Rio Tinto states they would use the latest technology and 'anticipates' that green power would be used in the mine to reduce the carbon footprint. The spatial plan also does not estimate the effects on the air. Within the document, it is mentioned that the air quality could be impaired due to the mining. The highest effects on the air are expected during the first year of construction works, but the concentration of NO2 and CO would not exceed the maximal value allowed by law. It was, however, not mentioned what the expected value would be. Regarding the PM10 particles, the document states that those particles would get above-allowed limits in the area of landfill and would be significantly high in the underground mine area, while in the area of jadarite processing, it could not have negative effects on health. (Institute Of Architecture And Urban & Spatial Planning Of Serbia 2019) The air contamination could come as a result of dust from mining, machinery operations and usage

of explosives. In their article about impact of lithium mines on the environment, (Trpeski, Šmelcerović and Jarevski 2021) claim that the riskiest part of lithium extraction comes from a temperature, as the ore should be treated with concentrated sulfuric acid at a temperature of 250°. If, however, they try to reduce the temperature using hydrofluoric acid (HF), the effects would still be devastating, as large amounts of toxic silicon fluoride gas (SiF_4) would go into the atmosphere.

5.1.2 Effects on Water

According to Rio Tinto, water management will be state-of-the-art, with a US$35 million dedicated wastewater treatment plant resulting in approximately 70% of raw water coming from recycled sources or treated mine water. The company's estimations related to water consumption is that 6-18 liters of water would be used per second, or 1.3 liters per one kilogram of product. (Rio Tinto n.d.) Taking into account their production estimations, this would mean that the annual water consumption of the mine would be around 615000 cubic meters. The excess water, according to the company, would be treated and as a result, even exceed the water standards required by the regulations of Serbia. The filtered water would be released into the Jadar river. When asked about the water sources, the company mentioned three different sources: treated water from the mine, rainfall and extracting groundwater deposited by the Drina river, near Lipnicki Sor. As a comment, a company added that that water source was already contaminated by gravel extraction and has no potential as a high-quality water source. They added that water would not be sourced directly from the Drina river. The company did not share any information related to the quantity of underground water that should be used, as they are still conducting the study. (Rio Tinto n.d.) Although it is one of the major concerns of residents and activists, the spatial plan does not cover water quality extensively. It mentions that the quality of water and its biodiversity *could be disturbed* by mining activities, thorough pumping of water from the alluvium of the Drina River and lowering groundwater levels, discharge of

treated wastewater into the Jadar river and lowering water quality by landfilling of the mining waste. In addition, the plan indicates the potential threats of toxic substances from ore processing, including sulfuric acid 96-98%, sodium hydroxide and hydrochloric acid, that could all affect human health, water quality and flora and fauna. (Institute Of Architecture And Urban & Spatial Planning Of Serbia 2019) The academic community, activist groups and residents expressed much higher concerns related to the water. There are significant reserves of groundwater in the underground of the Jadar Valley, and it belongs to the Black Sea drainage, serving as a source of drinking water to the cities and villages located in the coastal area, including the city of Belgrade. According to the paper published in Knowledge journal (Trpeski, Šmelcerović and Jarevski 2021), to extract lithium from the Jadarite mine, it is necessary to use sulfuric acid. The water, containing this toxic material, would be returned to the Jadar river. According to them, the quantity of wastewater would be 50% higher than the quantity of groundwater taken from the Drina. This represents 1500tons of wastewater, out of which more than 500 tons will come from the impurities from the ore, residual acids and their salts, but also toxic elements that the ore contains. Additionally, the experts from the Serbian Academy of Arts and Sciences (Ristic, et al. 2021) express concern about the effect of landfills on water and soil. As they state, the planned landfills on the streams of Korenita and Jadar river, with a volume of several million m3, with huge amounts of arsenic, nickel, cadmium and lead compounds, represent a real danger to the quality of groundwater and surface water. A similar case of water pollution from a pegmatite lithium mine happened in Tibet, causing massive death of fish in Lichu River in Minyak Lhagang, as a result of leakage from the water leaching site. (Central Tibetan Administration 2016) Furthermore, the academic community is concerned about the flooding potential. They predict that due to climate change, we could expect a higher frequency of river overflows, which typically occur during high waters and floods. Jadar river also has a frequent occurrence of floods, so another concern is related to the

risk of flooding which could lead to the spillage of millions of tons of hypertoxic waste, polluting both water and soil in this area, contaminating it permanently.

5.1.3 Effects on Biodiversity

When talking about biodiversity, Rio Tinto claims they try to avoid and minimize biodiversity loss. They claim that they have done the study on flora and fauna in the area, but do not give details about which and how many species would be affected. They added a comment about mitigation measures, such as protecting the animals by relocating them before the construction. (Rio Tinto n.d.) The landfill on the Stavica stream basin would be built on the area of 166ha, removing 26,000 m3 of forest area, which would lead to habitat distraction and negatively affect biodiversity. According to them, several hundred plants and animal species are currently living in that area, and 145 of them are registered as protected species. (Ristic, et al. 2021)

5.2 Economic effects

The economic benefits of this project for Serbia remain unknown, with many different versions of the story. Rio Tinto has committed to invest US$2.4 billion in the Jadar project, subject to all the approvals from the government. On top of that, they announced that they have 'committed' US$450 million in pre-feasibility, feasibility and other studies. (Rio Tinto n.d.) When talking about employment, Rio Tinto stated, and the Prime Minister of Serbia confirmed (Radio Televizija Srbije (RTS) 2020) that 2100 jobs would be created in the construction phase of the mine, while 1000 people would be employed in the mine operational phase. In the Spatial Plan, however, it is stated that a maximum of 700 employees would work in the mine area, 400 of which in the underground mine, 100 on the surface, and 200 people would be employed in maintenance. (Institute Of Architecture And Urban & Spatial Planning Of Serbia 2019) Serbian Chamber of Commerce (SCC) financed a study of economic feasibility, where even higher employment numbers are shown. According to that study, 5120 new jobs could be enabled by

project Jadar, 1170 directly employed by Rio Tinto, with an average net salary of 1222 dollars, and 3950 additional jobs in related sectors. (Privredna Komora Srbije 2021)

There are also several views on the contributions of this project to the Serbian economy. According to Rio Tinto, their investment would contribute 1 percent directly and four percent indirectly to GDP. (Rio Tinto n.d.) In the economic feasibility study, SCC stated that the annual contribution of this project to the Serbian economy is estimated to be 2,9 percent of GDP, out of which the direct contribution of this would be 627 million dollars, indirectly 589 million dollars and induced 296 million dollars. (Privredna Komora Srbije 2021) Financial Times reported even higher numbers, based on the prediction of the Serbian President, estimating that the Jadar project could increase Serbian GDP by 10 billion dollars per year, which is an increase of 22% of the current GDP, assuming the new investments of factories using lithium in their production. In the same article, Financial Times claims they have seen the document where the Serbian government 'envisages' that China's CATL, the largest battery maker in the world, would invest 2.5 billion euros in the factory in Jadar Valley, Volkswagen could invest 3 billion, and other companies from Germany and Slovakia could contribute with another 1.5 billion. (Dunai 2021) Some, however, call these effects on GDP pure statistical manipulation, as the entire export revenue of lithium would increase Serbian GDP, but would not belong to Serbia, but Rio Tinto. The only benefits for Serbia, on the other hand, would be the ore rent, which is in Serbia 5% on lithium, taxes that the company would pay, and salaries to the employees. (Katic 2022)

When it comes to revenues from Rio Tinto mine, Serbian Chamber of Commerce predicts that the annual revenues for Serbia would be 133 million dollars, including 70 millions of profit tax, 32 millions of ore rent, 2.7 million of real estate tax, 20.9 millions of tax dividends and 7.4 millions of employment tax. (Privredna Komora Srbije 2021) Some of the activist groups, reported by Guardian, predicted much lower numbers, namely 30 million in revenues per year,

including 7.6 million euros for ore rent and 23.4 million of euros for taxes. According to them, Rio Tinto could achieve profit of 4 billion euros for ten years, while Serbia would profit over ten times less, having revenue of 300 million euros. (The Guardian 2022)

Some members of academic community state that the economic analysis from this mine is not complete, as it was only calculated what the company and the state could earn by selling lithium, while it was never estimated what the state and local municipalities could lose by opening the mine. (Djordjevic 2022) It was added that, while doing economic analysis, the government should calculate the total worth of what exists in this area today, including fertile land, forests, rivers and the agriculture activities of local residents, and then compare it with the potential earnings from lithium mining. (Stevanovic 2022)

The part of academic community tried to calculate such numbers. Based on research of experts from Serbian Academy of Arts and Sciences, it was estimated that possible income from agriculture in ten villages of Jadar valley are at around 81.96 million euros per year, which is higher than potential income from ore rent to Rio Tinto. The scientists further evaluated the value of ecosystem services of the soil complex in the area of proposed mine, including hydrological functions to prevent soil erosion and floods and water protection from pollution to 9.642 million of dollars per year. (Ristic, et al. 2021) They also add that the Government aims to support the project by investing into the infrastructure, without providing any information about the investments or conducting the feasibility study.

5.3 Social effects

Rio Tinto sees the support of government and local community as ‘fundamental to start a project’. (Rio Tinto n.d.) To start building the mine, Rio Tinto would need to purchase 650 hectares of land that currently belong to 335 landowners. (Banktrack 2021) Much of that land

is being used for agriculture for generations. In addition, 52 households would need to be displaced, in addition to 40 so-called weekend houses. (EJ Atlas 2021)

There are different data on how much land has already been purchased by the company. In September 2021, Rio Tinto stated that they have purchased 40% of the required land area. (Centar Za Istrazivacko Novinarstvo Srbije 2021) In November 2021, the media reported even higher purchases, namely 80% of needed land. (The Guardian 2021) However, further research states that the company had purchased 50% of total parcels by number, 130 hectares out of 600 hectares required, which represents 21% of the land needed to start the mine development. (Banktrack 2021) On their website, Rio Tinto states that they are engaged in a voluntary land acquisition program, aiming to provide the same or better quality of life and work for people who agree to sell their properties and provide economic and sociologic support to them. Although the company does not state what will happen to those households who do not agree to the voluntary acquisition program, they do mention that they offer 'additional payments to those who agree to move in a shorter period'. (Rio Tinto n.d.)

The purchased homes, now belonging to Rio Tinto, have been demolished by previous owners, who tool roofs, doors and windows. According to local residents, those homes are continuously being visited by armed security patrols paid by Rio Tinto. (Banktrack 2021) The land acquisition has already caused numerous conflicts between the residents, some of them state. According to them, the properties that have been sold to Rio Tinto mostly belonged to younger generation who do not live in the area, but used those properties as 'weekend houses'. The rest of the local population, however, does not want to sell their homes and move. They have been born and raised in those homes, that have been in the family ownership for more than a century. However, they state that Rio Tinto is using a psychological pressure to convince them to sell their homes now, stating that if they do not sell the land at offered price, the land would get expropriated for significantly lower amounts. (Kljajić and Đukić Pejić 2022)

The pressure continued by the state, according to the residents and NGOs. In the autumn of 2020, the Republic Geodetic Authority of Serbia informed part of the land owners that their agriculture parcels have been repurposed into building parcels. Activists and residents believe that this has been done by the state to prevent them to apply for agricultural loans and increase their land taxation, adding pressure for those owners to sell their land to Rio Tinto. (Banktrack 2021) In the attempts to purchase all the houses on a 'voluntarily basis', Rio Tinto representatives are trying to convince the local owners to sell them properties for a higher price, proposed by Rio Tinto, and not to wait for the 'inevitable' expropriation, where they would receive smaller amounts of money defined by the government. One of the residents has been arrested after he claimed in one of the conversations that he would never get out of his home, and if someone tries to make him do that, he would reach out for a gun. After that, the police came to his house to research it and got him arrested. (Kokanović 2021)

In November 2020, the government proposed changes to the expropriation law in Serbia, raising the distrust of residents and adding to the belief that it is lobbying for Rio Tinto. According to the new law, all expropriation cases should be marked as 'urgent'. Based on this law, the owner of expropriation land would have 5 days to officially accept the expropriation offer proposed by authorities and 3 days to request changes to the offer. After the expiration of that deadline, the competent authority should immediately, and within 15 days at latest, issue a decision on the expropriation. (Republika Srbija, Ministarstvo Finansija 2021)

The Serbian Parliament has adopted the law in November 2020, followed by massive protests by activist groups and political opposition. The critics claimed that this law was passed on behalf of Rio Tinto, to enable them quick expropriation of the land around the proposed mine. The Serbian Prime Minister opposed these critics, stating that Rio Tinto has already bought all the land they need, and that none of the parcels would need to be expropriated. (Anđelković 2021)

5.4 Conclusion

While the Serbian government and Rio Tinto state that this project would be a great economic opportunity for Serbia and that impacts on the environment will be minimized, the academic community, local population, and activist groups disagree. Many Serbian academics raised their concerns about the project, following the approval of the spatial plan. In the book they published about the proposed project, the Serbian Academy of Arts and Sciences called the economic, environmental, and social aspects of this project 'unacceptable', fearing that the project would lead to 'massive spatial devastation, permanent change of the landscape character, degradation of biodiversity, soil, forests, water and groundwater, displacement of the local population, termination of sustainable and profitable agricultural activities. (Ristic, et al. 2021) When it comes to the economic benefits for Serbia, this project would bring improvements to Serbian GDP, not only from the mine itself but also from the potential industry that could be developed around the mine. However, the potential losses that the mine could cause have not been calculated, including the loss of agriculture from the area and the costs of recovery of environmental damage that could be left after the mine is closed. Social aspects should also not be ignored, as the local population would lose not only their homes but also their agricultural land which is their primary source of income. Typically, lithium mining from minerals is conducted in the desert area, not in the area of fertile land that requires people's relocation. (Djordjevic 2022)

6 Environmental Activism

In this chapter, I would include the background around environmental activism in Serbia against the proposed lithium mine and understand the main motives of the protest, by researching the communications, speeches and recorded interviews during the protests, and interviewing several activists that have taken part in such protests for the first time.

6.1 About Environmental Protests

The passing of the expropriation law has sparked the largest environmental protests seen in Serbia. Several environmental organizations and movements have organized the protests, and thousands of citizens joined them in the highway and bridge blockades in several cities in Serbia. Their main aim was to request the abolishment of the Law of Expropriation and stop Rio Tinto from relocating people around the proposed mine. The protests caused incidents in several cities, causing clashes between protestors and police, and protestors and supporters of the ruling party of Serbia. Dozens of people have been arrested. (Slobodan Maričić 2021) After two weeks of protests, the Serbian Government has withdrawn the Expropriation Law. In their official statement, they announced that the government will analyze whether proposed amendments are necessary, and if so, they would engage in a public debate, involving professionals, business and civil society. (Vlada Republike Srbije 2021)

Most environmental organizations continued with the protest even after the government revoked the Expropriation Law. The protest was organized in over 40 cities in Serbia and over 10 cities abroad. The main requirement was withdrawal of all official documentation related to Rio Tinto, including the revoke of the Spatial Plan of the city of Loznica. (Radio Slobodna Evropa 2021) They wanted to see Rio Tinto out of Serbia. Although dozens of environmental organizations supported the protests against Rio Tinto, a few organizations stood up as protest organizers, including Kreni-Promeni, Ekoloski Ustanak and Mars sa Drine. Their Petition, 'Stop

Lithium Mine' has been signed by around 294,000[2] people to date, with the main request to stop lithium mining and processing project in the Jadar Valley. The call for the petition has been signed off by several representatives of the academic community and leaders of ecological organizations. The petition has been addressed to Serbian Prime Minister, Ana Brnabic. (Kreni-Promeni 2021) Political parties, such as the Party of Freedom and Justice, Democratic Party, People's Party, Party of Freedom and Justice and the Do not let Belgrade drown movement, have supported the protests. Numerous public figures from the world of acting, sports and politics expressed their support for the activists, either by taking part in the protests or supporting it through social media. One of the most vocal organizations in the protest was 'Mars sa Drine', whose name has a very symbolic meaning, linked to the song 'Mars na Drinu', a Serbian patriotic march that symbolizes the resistance of Serbia to the Central Powers in the World War I. This is how many activists see this conflict: as an act of resistance of Serbian people and local communities to the colonialist countries, who 'aim to take our land for their profit'.

The activists proclaimed several victories as a result of protests. After months of protest and public discontent around the project, the Serbian Government has announced that it would revoke the lithium mining licenses to Rio Tinto and abolish the Spatial Plan of Loznica. (The Guardian 2022) In his first interview announcing the plan abolishment, the Serbian president said that the government has no right to destroy the lives of more people than it has initially been planned, referring to Rio Tinto's project changes related to the landfill that would be based in the village. (Vucic 2021) This statement has been used by the activist organizations, who claimed that he has admitted that certain lives would be ruined by opening the mine.

[2] Data as of 30-07-2022

Rio Tinto expressed their disappointment in this decision in their Annual report, stating that they are 'exploring all options and reviewing the legal basis of the decision'. This decision came weeks before the elections, raising concerns that it could be changed after the elections. As a result, some of the environmental groups continued their protests, requesting a law that would ban all lithium and borate mining in Serbia, as they fear that other mining companies could get interested even if Rio Tinto abandons the proposed 'Jadar' Project. (Todorović 2022) In their first announcement after the election, on May 5, Rio Tinto's CEO announced at the company's annual meeting that they are keen to reopen talks with the Serbian Government, as 'elections are out of the way'. (Sonali 2022) Local citizens and NGOs also show distrust in the latest decision, claiming that Rio Tinto continued its field works and land acquisition, registering three new land parcels in the Jadar area after the decision was made. (Dragojlo 2022) After his party won the elections, the Serbian president commented that the project withdrawal was a mistake for Serbia, and that Jadar could have been the most developed part of Serbia. (BETA 2022)

6.2 Main themes of the protests

When researching the main themes behind pamphlets, speeches and interviews during and after the protests published online, as well as interviews conducted in this research, the main topics that emerged have been extractivism, environment, politics, corruption and the former unsustainable practices of the company Rio Tinto.

Extractivism: One of the main themes of the conflicts was extractivism. The main slogan during several cities in the protests was 'Serbia is not for sales', 'We are not giving Serbia away', 'Stop (Foreign) Investors, Save the Nature' and 'Betrayal'[3]. Such statements do not refer only to Rio

[3] The term 'Betrayal' in the protest refers to the betrayal of the Serbian government which works in favor of the foreign corporations, instead of its people

Tinto, but to all similar projects from the past and the future. 'Today it is Jadar, tomorrow it is everything else' is one of the slogans that confirmed their fear of the future extractivism in rush for mineral resources, adding that they do not want foreign corporations to claim ownership of their country. During the interviews made during protests, some activists stated that they want to fight against foreign corporations who are taking their land and ruining their environment (D. Jovanovic 2021) and turning people into 'environmental refugees' in favor of foreign corporations. (A. Jovanovic 2021) *"Our country is not for sales. I live in Western Europe, and there is no way such a mine, without conducting a proper Environmental Impact Study could be conducted anywhere in Western Europe. In the same way, I would like that all the studies and regulations were respected before talking about lithium mine in Serbia",* added one of the activists who joined protests in Munich. [4]

Environment was, naturally, one of the main themes of the conflict. However, the environment-focused slogans and statements did not refer only to lithium mining, but to a general environmental situation in the country. 'Clean Air and Water for our children' was written on multiple flyers and stated my several interviewees, referring to the general pollution problems in the country, adding that they have 'rights on clean environment'. Several slogans were referring to a need for protecting the fertile land, emphasizing that 'one cannot eat money'. Novak Djokovic, a Serbian tennis player supported the protests writing that 'clean air, water and food are key to the health', and that we should pay more attention to the environment. (N1 Belgrade 2021) According to some interviewees, they have joined the protest to stop ecological catastrophe near their homes (Al Jazeera Balkans 2021) and that 'nature is the only thing left to protect', referring to the negative socio-political situation in the country. (BBC 2021) Some members of the academic community joined the protests, adding that activism in Serbia is now

[4] Interview Jelena Vasiljevic, protestor in Munich, 22-07-2022

concentrated around Rio Tinto, however, it is much larger than that. The activism is against turning Serbia, which is a full fertile land focused on agriculture into a mining country, that could be devasted and not appropriate for life after the exploitation of the available ores. (Djordjevic 2022) It was added that while other countries are preserving their fertile land and nature, the economic development in Serbia is not sustainable, as the country is rushing for short-term profit, sometimes leaving nature devastated after it, where it could take centuries for the nature to recover. (Stevanovic 2022) Spomenka Rogic, who volunteered to organize a protest in Munich, Germany, even though she has no previous experience with environmental activism added: *'Even though I had to leave Serbia for the better future my family has been given abroad, my wider family and friends stayed in our home country, and I want to show them that we are with them. They deserve to breathe clean air, to drink clean water and to continue doing their agriculture on a fertile land Serbia is rich with.'* [5] Another interviewee from Belgrade added*: "The air quality in Serbia, particularly in Belgrade is unacceptable. The government needs to do something to increase the air quality and stop the projects that would lead to its further destruction".* [6]

Politics and corruption were another theme of the protest, more specifically dissatisfaction with the current political situation in Serbia. Looking at the speeches, pamphlets and interviews some of the main political themes of this conflict were betrayal, corruption, theft, dishonesty of the government, the selloff of natural resources for individual benefits. Several interviews were related to the dissatisfaction with the ruling party and the president Aleksandar Vucic, who has been in power on the political scene for around 30 years. 'This has to end somewhere' was the statement of one of the interviewees, referring to the behavior of the Serbian government in the past decades. When asked about why they joined protests, multiple respondents answered that

[5] Interview Spomenka Rogic, organizer of protests against Rio Tinto in Munich 20-07-2022
[6] Interview, protestor in Belgrade, Serbia 23-07-2022

they want a better future for their children and that they do not want their children to leave Serbia. (BBC 2021) (Al Jazeera Balkans 2021) (N1 Belgrade 2021) This is a response to the massive emigration of the young and educated population from Serbia in the last two decades. (Judah 2019) Corruption in politics was also mentioned during the protests. The Union of Environmental organizations has asked the government to see every 'secret deal' that the government made with Rio Tinto (Al Jazeera Balkans 2021) and the activists shouted corruption accusation messages at the Minister of Internal Affairs, who briefly appeared in the protests. (BBC 2021) One of the first-time activists who joined the protest in North Serbia added: *"The timing of expropriation law leads us to believe that it has been written to support Rio Tinto and relocate the families from the Jadar valley in the shortest possible term to enable opening of the mine. Today it is Jadar Valley, tomorrow it can be us. We need to stop that".* [7]

Rio Tinto's company practices were another theme of the protest. Many slogans of the protests were 'Rio Tinto, get out of Serbia'. However, although Rio Tinto's proposed mine was the reason for the conflict, it was not the main theme. Some of the respondents emphasized the company's poor sustainability agenda and its infamous history that left devastating consequences on nature in other countries. One of the protestors added that he has decided to join the protest after seeing the devastated nature left after Rio Tinto's operations in other countries, such as Spain, India and Papua New Guinea. (Dzelatovic 2021) "I have read about Rio Tinto's past, in particular the civil war in Papua New Guinea, and I feel that I have to support in preventing the similar scenario in my country" [8], adds one of the protestors in Novi Sad, Serbia.

[7] Interview Stevo Grkovic, protestor in Sombor, Serbia, 21-07-2022
[8] Interview Milica Antonic, protestor in Novi Sad, Serbia, 25-07-2022

6.3 Conclusion

Although environmental protests in Serbia have been organized to stop the law of expropriation and Rio Tinto's potential lithium mine, the motivation behind the protest is much wider than Rio Tinto and Jadar Valley. It can be seen as a protest against poor environmental practices in Serbia, which is facing high air pollution in the past years, and against the government and foreign corporations who are potentially sacrificing Serbian nature to achieve short-term profit. According to one of the most vocal members of the academic community opposed to the mine, although activism in Serbia is now concentrated around Rio Tinto, it is much larger than that. It is rather against turning Serbia and its fertile land into a mining country, that could be devasted and not appropriate for life after the exploitation of the available ores. (Djordjevic 2022) Therefore, although Rio Tinto's mine brought people to the streets, their rebellion can also be seen as long-term dissatisfaction with governmental affairs, a lack of environmental agenda, and a tipping point of foreign extractivism in the country. Unlike the activism in Argentina, that began after residents witnessed the first environmental damages and then started protesting, Serbian protest had a prevention character, trying to stop the project before it can create the damage. Serbian protests were also wider than those in Argentina, having reached nation-wide population and country government. So far, they have been successful, as they managed to prevent the mine opening, like in Bolivia. However, it cannot be expected that the situation is final, similarly like in Bolivia, where negotiations about lithium mines continued after the change of the government. The main difference between the mining projects in South American countries and Serbia is the mine location. Although in South America some indigenous communities live in the area around the mine, none of them was expected to relocate in order for mining operations to start. Relocation efforts, and buyout of fertile land that is being a main source of income for the population in Jadar Valley was one of the main forces behind the protests.

7 Discussion and Recommendations

7.1 Jadar Valley as a Potential Sacrifice Zone

In the literature review, four dimensions of green economy, defined by UN have been shown: (1) good health and well-being, (2) peace, justice and strong institutions, (3) climate action and (4) responsible consumption and production. If we compare these four dimensions with the research results, we can conclude that none of these dimensions apply to the lithium mining in Serbia. Point one, good health and well-being is not guaranteed, taking into account the potential water, air and soil contamination of the proposed mine and their potential effects on the health of the local community and wider population in Serbia. If we look at the conflict caused by the proposed mine and lack of research and Environmental Impact Study conducted by Serbian government and their lobbying behavior towards the foreign corporation, we can discard the second point proposed by UN, which is peace, justice and strong institutions. Regarding climate action, lithium mining in the Jadar Valley could benefit the climate in terms of transport electrification in the countries with targets and means for electrification but could bring environmental burden on the Jadar Valley in Serbia. Lastly, it is questionable if lithium production in Serbia would be responsible, considering the lack of available data, and the existing data on water consumption and waste that would be generated by the mine and production facility.

The two main aspects of sacrifice zones, explained in the literature review, could support the statement that Jadar Valley could become a sacrifice zone of green economy. The first aspect, cost shift, has not been discussed or aligned between Serbian Government and foreign corporation. The expected life of the mine is 40 years, during which the part of the fertile land in the region would be turned into the mining area. Currently, there is no evidence on the discussion or commitment from the company on what would happen with the mine area at the end of the mine lifecycle, and who would bear the costs of the land recovery. With no agreement

in place, it is natural to conclude that the company would pass the costs of their damages to the state and local communities. The second aspect of sacrifice zone is green colonialism, defined as foreign exploitation of resources of poor countries and communities. Based on Serbian lack of green agenda and electrification targets, we can conclude that Serbian lithium would not be used for decarbonization of transport sector in Serbia, but rather for the countries with clear and more ambitions green transport goals, such as the countries of Western Europe. Serbian lithium would be either exported, or used by foreign companies that would potentially open battery production facilities near the mine, in which case the batteries or vehicles produced in the country would be exported.

As a result of this study, I confirm my initial argument that the green economy cannot be socially and environmentally inclusive, and that it leads to the creation of sacrifice zones, whose inhabitants would bear the burden of the clean energy transition. Jadar Valley in Serbia could potentially become such a sacrifice zone, based on the current, but limited, research on the proposed project. The areas in Argentina, described in the literature review, can already be seen as sacrifice zones of the green economy.

7.2 Recommendations

As discussed in the result chapter, some of the main themes of the environmental activism in Serbia have been current environmental and political situation in the country, which faces above average air pollution in the recent years. So far, Serbia has not set a real climate commitment and actions to tackle the air pollution. On top of the current issues, the government sees its development chance in the mining industry, currently having 327 exploitation fields, extracting coal, construction raw materials, copper, lead, zink, gold, silver and other resources. (Insajder 2022) The lack of green agenda, focus on extractivism and commoditization, rise of air pollution and other environmental problems have led to the dissatisfaction by general population and activist groups and distrust towards the government. Therefore, the government

of Serbia would need to create clear strategy and targets related to the climate change and the environmental protection.

In light of the green economy and current lithium rush, it is hard to imagine that Serbia can completely ban lithium mining, as requested by the activist groups, taking into account the pressure from foreign corporations and international community. However, the government could change its approach to the mining of lithium and other resources. Serbia is not yet a member of the European Union, and as such, does not need to comply with the ecologic standards of European Union, but relies on its own standards, based on Law of Mining, which often lack implementation. This makes it attractive for the foreign mining companies, who can obtain minerals on the gate of the European Union, but without respecting its strict laws. This can bring the short-term economic benefits to Serbia, but could at the same time, increase the ecological damage in the country and make it one step further from joining the European Union. Therefore, Serbia needs urgent changes in the environmental policies and their implementations.

Regarding the lithium project, the government would need to conduct deeper analysis on all the aspects of the potential lithium mine, including environmental, social and economic effects. To understand the economic effects beyond immediate impact on GDP, Serbian government should conduct more detailed and transparent economic studies and consider the potential of agriculture in that area in the next 40 years and beyond and the potential costs for the country to recover its resources after the end of the mine lifecycle. Furthermore, the prerequisite for every mining project is the Environmental Impact Study that has not been conducted in the case of Rio Tinto. Before obtaining such study, the government should not consider any approval of the project or vocalize its benefits. More information about the project is missing, such as technology that would be used for mining and the detailed water management process of the proposed mine, which should be requested by the government and specified by the investor

company. Based on that documentation, the government could understand the real potential effects of the proposed projects and decide on all the future actions. Furthermore, it should provide a detailed plan related to the affected communities, if the project proves to be beneficial for Serbia, and provide the members of these communities with the same, if not better, quality of life in the future. However, if the environmental and economic effects of the mine prove to be negative for the country, the government should reconsider the opening of the mine and focus on the wellbeing and justice of its citizens. It should also consider providing lithium from the different identified resources in the country, ten of which are currently in exploration phase if they prove to be more environment friendly.

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