The Social Impact of Mining on Children:

A Case Study in the Gobi Desert of Mongolia

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Mongolia is considered the most mining-dependent country in Asia. Sandwiched between China and Russia, mining plays a central role in Mongolia's economy and development strategies. While the country enforces environmental impact assessment law, the absence of a law for social impact assessment in large-scale projects leaves critical gaps in understanding the effects of mining on vulnerable populations, particularly children. The Gobi Desert in Mongolia is rich in minerals such as coal, gold, and copper, yet highly vulnerable to desertification and climate change, and hosts most of the country's major mining operations. This case study, situated in the Gobi Desert, examines the social impacts of mining on children in two distinct populations: mining employees working under fly-in, fly-out (FIFO) arrangements, and nomadic herders residing in mining host communities. Employing a mixed methods approach consisting of survey questionnaires and semi-structured interviews, this research aims to unpack the lived experiences of these communities and address regulatory and policy gaps. The study is guided by two objectives: (1) to understand the social context and identify the social impacts of mining on the target populations, and (2) to explain these impacts by analyzing the underlying factors that shape them. The findings indicate that the types of social impacts experienced by children of mining employees and those of nomadic herders are distinct, shaped by differing contextual factors. For children of mining employees, impacts are primarily influenced by income and parental absenteeism: the former enables higher wages and access to better education, while the latter leads to challenges such as disrupted parental involvement and communication breakdowns. In contrast, for children of nomadic herders, key shaping factors include: (1) Corporate Social Responsibility - through local consultations, infrastructure development, and support for social services; (2) environmental conditions - manifested in air pollution and groundwater depletion; (3) migration - characterized by population influx, economic stimulation, and increased child safety concerns; and (4) lifestyle - particularly the threats of displacement and restrictions on the traditional mobility of nomadic herders.

These findings contribute to the academic literature on mining and social sustainability while offering practical recommendations for policymakers, highlighting the often overlooked voices of vulnerable communities, such as affected children and families.

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1 INTRODUCTION

1.1 BACKGROUND

Minerals are an essential part of life and the modern world in particular economically, technologically, environmentally, and socially as they are used as raw materials in many industries such as manufacturing electronics, construction, production of consumer goods, preparation of drugs, and so on (Azapagic, 2004). It would be impossible to imagine our lives today without minerals as they are found in phones, houses, cutlery, food, and even medicine. Therefore, mining is an essential industry that some countries survive on, and one of them is Mongolia.

Mongolia is a mining country where the mining sector accounts for nearly 30% of the country's Gross Domestic Product (GDP) and approximately 90% of the export earnings (National Statistics Office of Mongolia, 2025), which makes mining the disproportionately biggest industry in the country in terms of contribution share to GDP. Mongolia's huge mining industry makes it the "most mining dependent country in Asia" (Sternberg & Ahearn, 2023; World Bank, 2021). The main minerals found in Mongolia are coal, gold, copper, iron ore, rare earths, silver and zinc (Gerel et al., 2021; MRPAM, 2025), many of which are critical minerals. Between 2008 and 2018, there was a staggering 60% increase in real GDP per capita in Mongolia due to the expansion of the mining sector (Baatarzorig et al., 2018). Mining provides significant economic benefit to the local economy in rural towns through taxes, fees and local development funds. Studies suggest that mining has stronger positive economic impact on households income in the mining host provinces than the non-mining concentrated provinces (Batdelger et al., 2022).

The economic impact of mining to the country is undeniable. The mining sector employs over 56,000 people, which is about 5% of the national workforce of Mongolia in 2022 (National Statistics Office of Mongolia, 2025d). Demographically, half of Mongolia's population lives in the capital city of Ulaanbaatar in the north, whereas most of the mining operations are concentrated in the Gobi desert region in Southern Mongolia (Sternberg & Ahearn, 2023), an arid region that is already ecologically vulnerable with severe desertification challenges and scarce rainfall (Han et al., 2021).

Mongolia has a small population of 3.5 million (National Statistics Office of Mongolia, 2025c). However, it is a large country of 1.5 million km^2 located between the two giant powers of China and Russia, and its landlocked location challenges its trade and other industries including mining. Mongolia, including the Gobi Desert is mostly spectacular open land, a home for the nomads grazing their livestock openly and freely in the nature since the beginnings of history. Today their shared pasture and land is owned by the state.

This nexus of natural resources, vulnerable eco-systems and traditional livelihoods brings complex challenges to the stakeholders, and the social impact of mining is arguably one of them, yet one that is often overlooked. Vulnerable communities like children are the least responsible for today's sustainability and development issues, yet most prone to the anthropogenic problems. Consequently, I wanted to focus on the social impact of mining on children through this research in the context of Gobi Desert in Mongolia.

1.2 RESEARCH PROBLEM

Mongolia's rich minerals resources and relaxed law of 1997 on mining license requirements quickly attracted both foreign and local investments in early 2000s (Byambajav, 2015). Following the proliferation of mining operations, the Mongolian government approved the Law on Environmental Impact Assessment in 2012 that requires mining companies to plan, implement and report on natural rehabilitation and restoration activities during mining operations and after closure (Law on Environmental Impact Assessment, 2012). While environmental impact mitigation is enforced and monitored through this law, there is no legal requirement for the assessment of the social impact of mining in Mongolia (Sternberg & Ahearn, 2023). In the Annex of the Mongolian Government resolution on Environemental Impact Assessment Rules, it briefly indicates the requirement for companies to have a plan to address social impacts on the affected stakeholders (Environmental Impact Assessment Rules, 2023); however, its implications for implementation, reporting and monitoring are not clear or comprehensive.

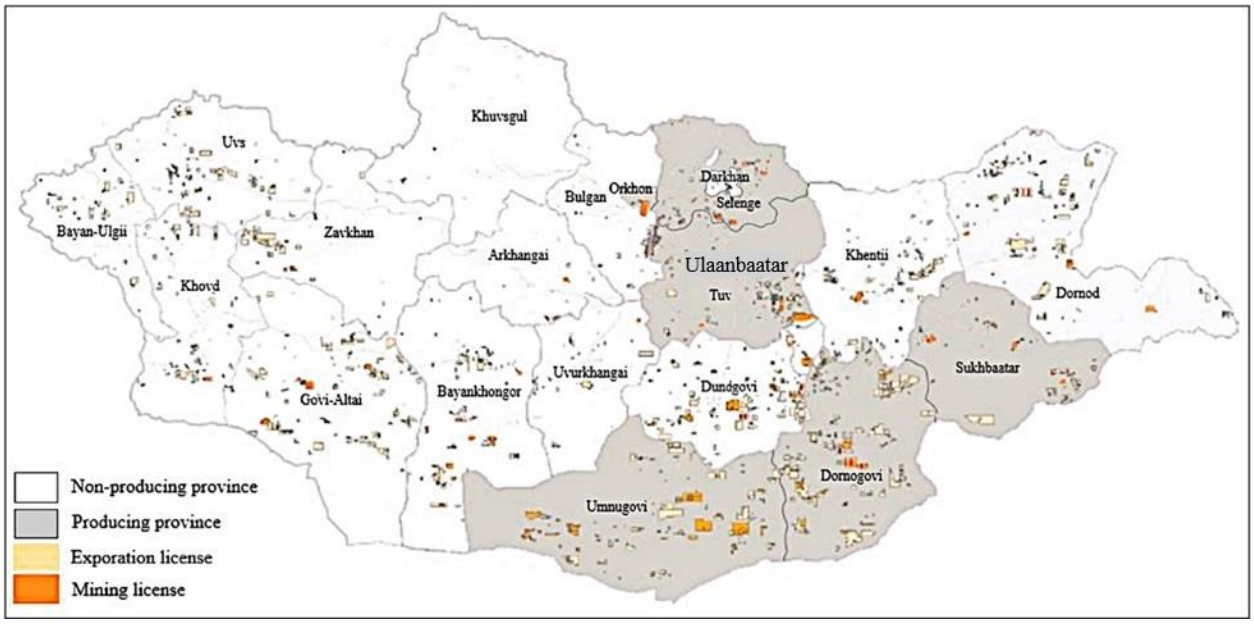

Figure 1: *Map of producing provinces of mining in Mongolia. Adapted from (Sternberg & Ahearn, 2023).*

Mining has social impacts particularly on the mining host communities as well as immediate family members of its employees. The unique cultural characteristics of the nomads in Mongolia are that they constantly move around, and they don't own the land they herd their livestock on as the land is the "state public property" according to the Constitution of Mongolia, so there is no strong legal grounding for displaced mining host communities to claim damage (Sternberg et al., 2022). United Nation's Human Right Council (HRC) was concerned over displacement and vulnerability of the mining host nomadic communities and urged Mongolia to take proper actions to consider human rights and impact assessments prior to issuing special mining license (HRC, 2020). Further social impacts on health and education, particularly on children were raised by UNICEF citing mining related in-migration. For example, the secondary schools in the mining area of South Gobi province experienced a 50 to 250 percent increase in student enrollment and similarly, the surge of new patients exceeded the capacity of local hospitals (UNICEF, 2017). While some research findings exist on the environmental impacts of mining, we know even less about the social impacts of mining in Mongolia, let alone on children.

The significance of social impact assessment has been emphasized in global commitments such as the UN Sustainable Development Goals and European Union policies, as mining related impacts pose constraints on achieving sustainable development (Mancini & Sala, 2018). For example, Canada has integrated environmental and social assessments into a unified concept of

"impact assessment" (Impact Assessment Act, 2019), ensuring that all potential impacts are carefully considered prior to the approval of mining projects.

1.3 Research Purpose, Objectives and Questions

The purpose of this research is to investigate the social effects of mining on children in Mongolia with a focus on children from mining host communities and mine employees. The intent of this research is to give voice to one of the most vulnerable groups in society - children - specifically those living in mining host communities and children of mining sector employees working under fly-in, fly-out (FIFO) arrangements in the Gobi Desert of Mongolia. This study aims to explore how mining activities affect children's lives and wellbeing within the context of the country's policy and legislative frameworks related to social and environmental governance.

To achieve this purpose, the study is guided by the following objectives:

Objective 1: To understand the social context and identify the social impacts of mining on the children of mining sector employees as well as on the children living in mining host communities in the Gobi Desert of Mongolia.

Objective 2: To explain the social impacts of mining on the children of mining sector employees and the children of mining host communities in the Gobi Desert of Mongolia.

Accordingly, this study is guided by the following research questions:

1. How are children of mining sector employees and mining host communities socially impacted by the mining industry in the Gobi Desert of Mongolia?
2. What are the key factors shaping these social impacts?

1.4 Thesis outline

This introductory chapter presents background of mining and mining in Mongolia. It then presents research problems followed by research objectives and questions.

Following the introduction, this thesis proceeds with a review of the literature on mining and the social impacts of mining, which establishes the theoretical background of the study. The subsequent Methods chapter outlines the methodological approach adopted, including a positionality statement, and describes the research context, focusing on the participants and the study location. The chapter concludes with details on data collection and analysis procedures.

The Results chapter presents the analyzed data gathered during the research, organized according to the study's objectives. The Discussion chapter interprets and explains these findings, again structured in alignment with the research objectives, drawing connections between the results and the broader literature.

The thesis concludes with a Conclusion and Recommendations chapter, which summarizes key findings, outlines implications, and suggests directions for future research. References and appendices are provided at the end of the thesis.

2 SOCIAL IMPACTS OF MINING AND ASSESSMENT

This thesis is situated at the intersection of socio-economic and environmental disciplines, exploring the complexities of sustainability and development in the extractive industry. Specifically, it focuses on large-scale mining operations and their social impacts on host communities as well as mining employees including fly-in, fly-out (FIFO) workers. While political ecology literature has also examined the social impacts of mining and socio-political issues, this perspective was not included in this study. The focus of this research is on giving voices to host communities and analyzing their experiences through the lens of Social Impact Assessment (SIA). The SIA framework provides a more practical tool for identifying, categorizing, and addressing community-level impacts, which aligns closely with the objectives of this study.

The review begins with global perspectives on social impacts of mining, followed by the evaluation of SIA frameworks as it covers the impacts on all affected stakeholders, and continueing in Mongolia specific literature. The chapter concludes with a conceptual framework that integrates these strands.

2.1 SOCIAL IMPACTS OF MINING

The literature around mining and social impacts situates the industry at the heart of what (Martinez-Alier & Bowerbank, 2004) call "ecological distribution conflict", where marginalized communities or the "poor" resist environmental and livelihood disruptions on their traditional territories, while corporations pursue economic gain through resource extraction from the same lands. Mining impacts are multidimensional economic, environmental, and social and these dimensions often overlap. The immediate economic impacts of mining are typically reflected in its contribution to a country's GDP, employment rates, services, infrastructure, social and health support, and other benefits that are enabled by the economic activities. Environmentally, beyond the visible impacts such as land degradation and resource depletion, mining can also result in significant biodiversity loss and degradation of ecosystem services that support livelihoods and community wellbeing (Azapagic, 2004). Groundwater depletion is of particular concern in the Gobi Desert as Feng et al. (2022) have discovered that coal mining in Northern China, just across the border, has contributed severely to the region's groundwater storage fall coupled with other factors such as agricultural irrigation and lack of precipitation. While groundwater depletion can

be specific to an area such as Gobi Desert, another environmental impact that is a large regional challenge is dust pollution generated by the mining operations (Csavina et al., 2012). Scholars like (Azapagic, 2004) emphasize that mining operations face increasingly complex sustainability challenges that require systemic, rather than sectoral, responses. In terms of social impacts of mining, issues such as community engagement, pollution, poverty, and conflict have been reported in Central Asia, whereas in Southeast Asia, gender equality, quality education, and infrastructure are more commonly highlighted (Sternberg & Ahearn, 2023) illustrating how social impacts vary depending on context and location.

At the core of this sustainability discourse is the Brundtland Commission's definition of sustainable development: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The concept of "need" contains two key ideas, firstly, the needs of the world's poor where overriding priority should be given and secondly, the limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. (Brundtland, 1987). Mining, like any other sector, has increasingly been expected to address the sustainability challenges of today's world (Robert G. Boutilier & Thomson, 2018). However, companies have struggled to obtain and maintain a Social License to Operate (SLO), a concept that has gained prominence both academically and within industry. SLO refers to the informal but essential societal acceptance of mining projects (Moffat & Zhang, 2014; Prno & Scott Slocombe, 2012; Robert G. Boutilier & Thomson, 2018). And SLO has become both a central theme in literature and a strategic priority for the industry.

The emergence of international frameworks such as the United Nations Sustainable Development Goals, the UN SDGs (UN, 2015), the Mining, Minerals and Sustainable Development (MMSD) Project (Starke, 2016), and the Global Reporting Initiative (GRI, 2021) reflect efforts to integrate mining within a broader agenda of global sustainability. In parallel, countries like Canada, Australia, the United States, and those in the European Union have begun formalizing sustainability standards through legislation and environmental performance benchmarks (Azapagic, 2004; Mancini & Sala, 2018). However, persistent social challenges such as lower rate of education attendance, increased substance addiction, and inadequate housing continue to be reported as the most common issues in mining communities across North America (Goldenberg et al., 2010a).

Despite these frameworks, the mining industry still falls short of achieving true stakeholder trust or sustainable collaboration (Owen & Kemp, 2013) argue that the MMSD project report itself acknowledges that meaningful long-term engagement remains far from reality. This disconnect is particularly visible in the experience of vulnerable communities and industry employees, who face disproportionate impacts with limited voice in decision-making.

Corporate Social Responsibility (CSR) has also emerged as a parallel and sometimes complementary strategy, codified in standards such as ISO 26000. CSR is designed to align corporate activities with societal expectations and as support to the social services provided by the governments, though its voluntary nature often limits accountability (Reed, 2002). Because many companies fail to comply with certain standards or meet stakeholders' expectations, legal frameworks have been introduced in some contexts to strengthen Corporate Social Responsibility (CSR), often through enforcement mechanisms such as taxes and subsidies. The performance standards set by the International Finance Corporation (IFC, 2012) provide a more standardized and universal framework for mining projects financed through international institutions, and have been applied in projects such as Oyu Tolgoi, the biggest mining project in the Gobi Desert in Mongolia, where local herder communities have utilized them to voice "grievances mechanism" (Hatcher & Lander, 2023).

2.1.1 FIFO arrangements

Another angle in the literature of sociology and social work that is relevant to this research is the concept of fly-in, fly-out (FIFO), or drive-in, drive-out (DIDO), or long-distance commuting (LDC). For this thesis, I decided to stick to the term FIFO as most literature I reviewed had used the same term more frequently and also the majority of the mining employees I interviewed have FIFO arrangements as described and then discussed in detail in the Methods and Results chapters.

FIFO arrangements, common in countries like Australia and Canada, are designed to maximize operational efficiency but often result in social fragmentation. Studies show that FIFO arrangements are associated with increased parental absenteeism, emotional strain on children, and family disconnect, less "family times", however, there is a clear literature gap in the impacts of FIFO work arrangements on the employees as well as their families (Carrington & Pereira, 2011; Gardner et al., 2018; (Mayes, 2020); Dorow & Jean, 2022).

Although the social impact of FIFO work arrangements remains understudied in the scholarship, the limited existing research includes the Gardner et al. (2018) report that FIFO

parents struggle with behavior control in their children and frequently miss key developmental milestones. Sincovich et al. (2018) even link FIFO living to higher divorce rates in mining towns. Similar patterns are observed in Canada's oil sands sector, where Dorow & Jean (2022) highlight not only special characteristics of the mining camps in terms of logistical challenges but also the emotional toll of rotational work as workers try to catch up with their disconnected lives with family and friends upon returning from rotation. Labra et al. (2025) describe this ongoing struggle as a disconnect from family identity and social roles.

The concept of "multilocality" or multiple dwelling in rotational work arrangements such as FIFO contains diverse dimensions of wellbeing, as it affects not only the individual worker but also their relationships with partners, children, and even the dynamics among siblings. These interlinked relational impacts highlight the need for a space-time multidimensional approach to fully understand the effects of FIFO on family wellbeing (Gorman-Murray & Bissell, 2018).

2.2 SOCIAL IMPACT ASSESSMENT

Since the establishment of National Environmental Policy Act (NEPA) of 1969 in the United States, which originated the Environmental Assessment (EA) concept, different forms of assessment emerged including Social Impact Assessment (SIA) and Socio-economic Impact Assessment. The concept of SIA has developed both separately as well as within EA (Burdge & Robertson, 1990; Noble, 2021). Over the past five decades, impact assessment has evolved in diverse forms in different regimes, varying in their legal basis (established in law or policy), scope (focused specifically on environmental issues or including broader social and economic contexts), institutional positioning (at higher level in decision-making or more secondary), accountability (led by proponents or by government agencies), openness (participatory and transparent or largely internal), level of application (restricted to projects or extended to strategic undertakings), and stability (relatively enduring or subject to frequent revision) (Gibson & Fonseca, 2022).

In the beginning, SIA was included under the EIA umbrella, but over time, it was realized that social impacts are distinctly different from biophysical impacts. For example, the environmental impact is about when the project actually starts whereas social impact starts from when there is a rumor about a project (Vanclay, 2020) although environmental pre-project effects can also result from exploration or initial testing of prospective orebodies. (United Nations, 2011) Guiding Principles on Business and Human Rights or UNGP, in short, has obligated many

industries and companies to adopt and take social impacts and particularly human rights seriously in their business policies and operations, and detailed guidance even during operations such as the "grieving mechanism" are stressed to ensure meaningful engagement of the local communities in the context of social impact. Some of the adverse impacts are not a result of intention or deliberate act, but rather a lack of understanding and communication between stakeholders and decision-makers (Van Der Ploeg & Vanclay, 2018).

Since its inception, two primary approaches to SIA have emerged, particularly in policy-making contexts. The "technical" approach emphasizes the expertise and recommendations of professional assessors, adopting a positivist stance that prioritizes objective analysis. For instance, Mackenzie Valley pipeline proposal in Canada was initially assessed through technical approach as it was deemed appropriate for the formal adjudication, however, eventually it was assessed through other approaches as well (Craig, 1990). In contrast, the "political" or "participatory" approach underscores the importance of engaging community members, as policies are ultimately intended to serve those communities (Craig, 1990). Although most SIA have employed technical approach (Terrapon-Pfaff et al., 2017), it is also common to use both approaches in practice. A later Mackenzie Valley pipeline proposal was assessed through participatory approach with a particular emphasis on the Indigenous consultations and this also included significant technical review (Nuttall, 2008). An interesting conclusion was drawn from a case study in Morocco: despite minor differences in how local communities and experts determined the significance of positive and negative impacts of large-scale renewable energy facilities, their overall assessments did not differ greatly (Terrapon-Pfaff et al., 2017).

In addition to these, a "planning" approach has been proposed to further empower communities by allowing them to negotiate and bargain during early stages of decision-making (Lane et al., 1997). By adopting a planning approach, the Australian Government rejected the Coronation Hill mining proposal and instead incorporated the area into Kakadu National Park, recognizing Aboriginal land interests and enabling local communities to articulate their concerns and participate in the bargaining process from an early stage (Lane et al., 1997). While technical data may be collected from communities, it is often utilized later by decision-makers, highlighting the crucial need for meaningful relationships between communities and organizations. This calls for a sociological perspective that recognizes community engagement as a substantive process, not merely a procedural formality or "box-ticking" exercise (Rickson et al., 1990). Although different

stakeholders may adopt varying approaches based on their interests - often involving trade-offs - prioritizing public interest and participatory processes remains a meaningful imperative (Gibson & Fonseca, 2022).

SIA should be understood as a process, as well as a product, of analyzing, evaluating, and managing both intentional and unintentional, positive and negative social impacts of planned interventions such as policies, programs, projects, plans and any social change processes caused by the interventions (Vanclay et al., 2015). SIA should follow the principle of "plan-do-check-act" that emphasizes identification of the impacts, proper analysis of the situation (including the likely interactions among effects and their particular and cumulative consequences) and steps of activities to mitigate social and human rights risks (Esteves et al., 2017) and, preferably, ensure net positive effects. The Impact Assessment Act (IAA) 2019 of Canada has broadened the concept of EA to include social, health, and economic factors in addition to the environmental or biophysical impact, naming it "impact assessment" (IA) rather than "environmental assessment" (EA), and that is also the case in other countries (Noble, B.F. 2021).

Although there is no international treaty or agreement that mandates countries to conduct SIA, there are guidelines and other documents that countries can refer to, such as Guidance for Social Impact Assessment by the International Association for Impact Assessment (IAIA) that provides a concrete grounding and background for SIA (Vanclay et al., 2015) and Performance Standards on Environmental and Social Sustainability by the International Finance Corporation (IFC), an affiliate of the World Bank Group (Bristol-Alagbariya, 2020). The Guidance for Social Impact Assessment developed by the IAIA is a comprehensive document that provides well-reasoned, step-by-step guidance supplemented with case studies, and it serves as a reference for countries developing or strengthening their SIA procedures. Similarly, the IFC Performance Standards outline eight key standards categories that companies must meet in order to qualify for IFC financing: (1) Assessment and Management of Environmental and Social Risks and Impacts; (2) Labor and Working Conditions; (3) Resource Efficiency and Pollution Prevention; (4) Community Health, Safety, and Security; (5) Land Acquisition and Involuntary Resettlement; (6) Biodiversity Conservation and Sustainable Management of Living Natural Resources; (7) Indigenous Peoples; and (8) Cultural Heritage. Although designed primarily for IFC investments, these standards are widely adopted as reference points across other industries and sectors.

2.3 SOCIAL IMPACT ASSESSMENT IN MONGOLIA

Following the developed countries with heavy mining industry in their economies, developing countries are also adjusting to the needs of policy updates, new legislation and institutional reforms. However, there is still a gap at the policy level when it comes to mining in the context of sustainable development (Cao, 2007). Conflicts, dishonesty and miscommunication with the local communities are due to inadequate legislation and enforcement in the case of Central Asian countries of Kyrgyzstan and Mongolia (Shankleman, 2022). It is evident that there is insufficient literature on the social impact of mining particularly in Mongolia despite the prevelance of mining operations in the country.

The (World Bank, 2006) Review of Environmental and Social Impacts in Mining Sector of Mongolia (in Mongolian language) is one of the early reports that touched on social impact of mining in Mongolia, despite majority of the report focusing on environmental impacts. The brief section on the social impact mostly covers the issue of companies not providing job opportunities to the local communities; however, it also had a sentence on the commitment of artisanal miners still managing to send their children to school despite the everyday challenges they have and also reported on child labor in artisanal mining during school breaks (World Bank, 2006). The proliferation of artisanal mining was not regulated in the country until 2010, and while legalization proves to be efficient, there is still need for systemic support for artisanal (Hatcher, 2020) including challenges related to their social impacts.

However, I limited the context of this research to the large-scale mining in the country due to time and resources constraints as well as an apparent bigger gap in literature regarding social impact in the context of large-scale mining in Mongolia. It is evident that there is more literature and reports surrounding social impacts in the artisanal and small-scale mining in the country in both English and Mongolian language, than in the context of large-scale mining.

Few researchers have discussed the issue in a broader sense (Batdelger et al., 2022); did research on local livelihoods and social license to operate in Mongolia, focusing on how it is becoming increasingly difficult for the mining companies to obtain social license to operate from the public. In 2023, Sternberg conducted field work in Mongolia on Social Impact Assessment and Environment, Social and Governance in mining and highlighted the lack of Impact Assessment legislation in the country. A report published by UNICEF Mongolia in 2017 addresses in-migration impact on children due to mining. Number of case studies have been conducted in the

country that are relatable include (McIntyre et al., 2016) looking at impacts of mining on water quality. Farrington (2005) covers collisions between mining and protected areas and has stressed the lack of legal frameworks. A group of Mongolian and Korean researchers who conducted research on the health impacts of mining on the children living in South Gobi province identified the adverse impact of mining on children via "high" lead and mercury concentration (Surenbaatar et al., 2021). It is worth noting that some Mongolian and Canadian teams of researchers have advocated for the inclusion of health impact into the EIA law in the country (Byambaa et al., 2014).

According to Mongolia's Environmental Impact Assessment Rules (2023), the social impacts in Table 1 are considered as part of the EIA process.

Table 1: *List of social impacts considered in the current Mongolian EIA Rules (2023).*

Conflicts over land ownership and tenure;
Adverse social impacts on local residents;
The presence of towns or villages within the affected area;
Physical displacement of communities;
Impacts on cultural and heritage sites located in the project area;
Negative health impacts on local populations;
Risks to human health and life throughout the duration of the project.

Gankhuyag & Banzragch (2014) have concluded that the mining boom in Mongolia has resulted in more "equitable" child related expenditures of the state budget, but not necessarily "efficient", an indicative analysis regarding socio-economic impact of mining on children in the country.

A recent case study was conducted in the Gobi Desert, a site including Gurvantes soum in South Gobi Province, the same town examined in this study, has looked at the expansion of the mine area over the last two decades and the impact on nomadic herders. The authors have also evaluated the effectiveness of the SDGs through the knowledge of herders about it (Sternberg et al., 2025). They concluded that global initiatives, such as the UN SDGs, do not necessarily address localized issues faced by herder communities. This gap is evident in the widespread lack of awareness of the SDGs among herders in the Gobi Desert (Sternberg et al., 2025).

The term pastoralist has been used in several literature sources referring to nomadic herders in Mongolia (Hatcher & Lander, 2023; Sternberg et al., 2025). Hatcher & Lander (2023) discussed

whether nomadic herders should be considered as "indigenous" and although Mongolian government doesn't recognize its nomadic herders as "indigenous", there is an example of Oyu Tolgoi project considering them as indigenous and thus a grievance mechanism has been used and implementation measures are ongoing as the herders were found to qualify as "indigenous" according to (IFC, 2012) definition of Indigenous peoples. Moreover, United Nations Declaration on the Rights of the Indigenous Peoples (UNDRIP, 2007) articles on free, prior and informed consent could apply in the case of nomadic herders in Mongolia as the country has approved the declaration. However, this thesis does not engage in Indigenous studies.

2.4 CONCEPTUAL FRAMEWORK

2.4.1 Social and Ecological Systems Framework

This research fits well into Social and Ecological Systems (SES) Framework by (Ostrom, 2009). The SES Framework analyzes social, economic and political settings with related ecosystems through the interaction of subsystems within the framework (Ostrom, 2009).

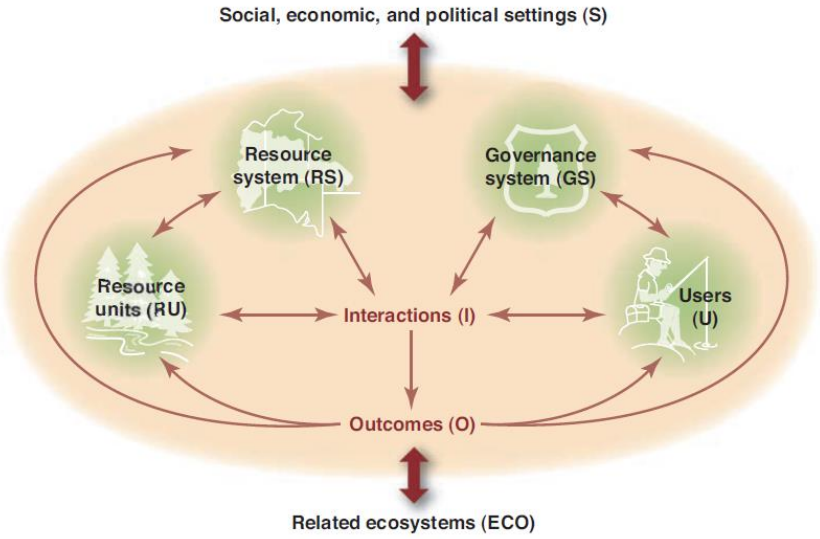

Figure 2: *The core subsystems in a framework for analyzing social-ecological systems adapted from (Ostrom, 2009).*

Figure 2 illustrates how the interactions between core subsystems of a particular social-ecological systems could generate important outcomes and it supports analyzes of this process within the case-specific context of social, economic, and political settings as well as the related ecosystems.

The subsystems in the context of this research are:

- *Resource System (RS):* Interrelated ecosystem and interaction between mining operations and livestock herding nomads.
- *Resource Units (RU):* Minerals (gold, copper, and coal), groundwater, and land as a mining site, pasture and living space.
- *Governance System (GS):* Government of Mongolia and local authorities, and how laws and regulations are implemented and followed. For instance, concerns arise over the concept of communal land and water rights in contrast to mining licenses. Governments should ensure the human rights are respected and SIA principles highlight the importance of human rights consideration (Vanclay et al., 2015) in which can be ensured through meaningful engagements with the local people, the Users.
- *Users (U):* Mining companies, employees and their immediate family members, nomadic herders including children, and community members.

The SES Framework helps me to identify and understand in depth the outcome of the interaction between the users (U) of the system, where the outcome is social impact of mining. This study highlights the process of interaction between users.

Table 2 further explains how SES Framwork applies to this research.

Table 2: Application of SES Framework in this research

SES Subsystem	General Definition (Ostrom, 2009)	Application to This Research
Resource System (RS)	The larger ecological and physical system in which resource units exist.	The interrelated socio-ecological system of the Gobi Desert of Mongolia, shaped by mining activities and traditional livestock herding, including land degradation, dust pollution, and groundwater extraction.
Resource Units (RU)	The specific stock or flow of resources within the system.	Minerals (coal, gold, copper), groundwater, and land as both mining sites and pastures/living spaces for nomads.
Governance System (GS)	Institutions, rules, and organizations that regulate use and interactions.	Government of Mongolia, local authorities, and regulatory frameworks such as the Law on EIA (2012). Gaps in SIA legislation highlight challenges in ensuring human rights and community wellbeing (Vanclay et al., 2015).
Users (U)	Actors who directly use or depend on the resources.	Mining companies and their employees (including FIFO workers and families), nomadic herders, children, and broader host communities in Gurvantes soum.

Interactions (I)	How users, governance, and resources interact within the system.	Mining operations competing with herders over land and water; CSR initiatives supporting local services; migration flows altering demographics; community grievances over displacement and child wellbeing.
Outcomes (O)	The social, economic, and ecological consequences that emerge from interactions.	Positive outcomes: income generation, economic stimulation. Negative outcomes: parental absenteeism, displacement of herders, pressure on groundwater/pasture, child violence and safety, lack of investment on infrastructure,
Social, Economic, and Political Settings (S)	Broader context shaping the SES.	Mongolia's mining dependent economy, governance challenges, global demand for minerals, and vulnerabilities of nomadic livelihoods under climate change.
Related Ecosystems (ECO)	Ecological systems influencing and influenced by the SES.	Gobi Desert ecosystem - fragile, arid, and climate sensitive, making it particularly vulnerable to intensive mining activities and groundwater extraction.

Conceptualizing social impacts can be understood in relation to one or more of the following dimensions:

- *People's way of life:* how they live, work, play, and communicate with one another on a daily basis.
- *Their community:* its sustainability, character, services, and shared facilities.
- *Their environment:* the quality of air and water, exposure to hazards such as dust and noise, physical safety, and access to and control over natural resources.
- *Their health and wellbeing:* encompassing physical, mental, spiritual, and social dimensions, not merely the absence of disease or illness.
- *Their personal and property rights:* whether they are economically affected or face specific disadvantages.
- *Their fears and aspirations:* perceptions of safety, concerns for their community, and hopes for the future of their children (Vanclay, 2003).

This framework guided the identification of themes and the categorization of social impacts in the Results chapter.

This chapter has examined the broader literature on the social impacts of mining, with particular attention to Social Impact Assessment (SIA) and the conceptual framework guiding this

study. It also reviewed literature on fly-in fly-out (FIFO) work arrangements, given the relevance of this group to the thesis research. The next chapter presents the methods employed in this study.

3 METHODS

This chapter outlines the methodological foundations upon which this thesis is built and details the specific methods employed in the research. It includes a positionality statement to reflect the researcher's standpoint and a description of the research context. The chapter concludes with an overview of the data collection and analysis procedures.

3.1 METHODOLOGY

The case study is more of an approach than a method since there are important philosophical assumptions regarding the nature of research that support the value of case research (Hay, 2000). Case study as an approach is an intensive study of a single unit aiming to understand a larger theme of similar units (Gerring, 2004). The case study approach provides two advantages to research, firstly it allows for knowledge utilization process and secondly, it provides deep insight on the subject (Yin, 2009). The Gobi region of Mongolia will be the case area. This case study will provide an in-depth analysis about the social impacts of mining on children in the Gobi region of Mongolia.

The mixed method approach integrating both qualitative and quantitative methods has increasingly become common among researchers in recent years as it provides rigor in research (Bryman, 2006). Ensuring rigor in research is important and it can be achieved through a process of triangulation using diverse sources and methods for data collection (Baxter & Eyles, 1997). Therefore, this research will employ a mixed methods approach using both qualitative and quantitative methods.

3.1.1 Quantitative method

This research incorporated a quantitative approach to strengthen the depth and breadth of the findings. A structured survey was employed to capture broader patterns and characteristics of specific group of participants, the mining employees with FIFO work arrangements. This allowed for triangulation with the interview data and provided a more comprehensive understanding of the issues under study.

3.1.1.1 Survey Questionnaire

The questionnaire survey is a useful quantitative method to understand peoples' opinions, behavior, experience and social interactions as well as awareness of events (Martin & Flowerdew, 2013). The questionnaire has limitations such as lack of subjectivity and in-depth inputs. However, the questionnaire survey provides following three advantages:

- It helps researcher to understand social trends, values, and attitudes.
- It is cost effective as it can reach wider population regardless of their size and geographical location.
- It is very flexible that it can be combined with other qualitative methods including interview and focus group discussions (Hay, 2000).

Purposive sampling is a common approach the invitation to participate is sent in accordance with the prior set characteristics and requirements for the participants, and the research results are not intended to be generalized for a broader population (Hay, 2000). I distributed the survey through several social media groups of mining employees in Mongolia, with explicit criteria requiring participants to have children under 18 and to be employed in FIFO arrangements in the Gobi Desert region. I also encouraged members of my community to share the survey link with others who might meet these criteria. This recruitment strategy, however, may have led to a sample skewed toward participants with similar backgrounds, particularly those with higher levels of education and income.

3.1.2 Qualitative method

It is common for researchers to use qualitative approaches when studying the social impact of mining. This can be seen from the results of a systematic review of the socio-economic impacts of mining in Africa where 84% of 170 peer-reviewed articles employed the interview method (Egunyu & Boakye-Danquah, 2024). This research employed interviews as a qualitative method.

3.1.2.1 Interview

Interview is defined as a face-to-face verbal conversation where the interviewer elicits information or expressions of opinion, belief or lived experience from interviewee. Semi-structured interview has some degree of predetermined structure and topical prompts, but it maintains flexibility in the way problems are addressed by the informant (Hay, 2000). This research employed the semi-structured style of interview.

Participant interview: I have purposefully targeted nomadic herder parents in Gurvantes town, South Gobi Province, Mongolia, with children under 18. I have used participant interviews to gain in-depth insights on the social impact of mining on children in the Gobi Desert of Mongolia as interviews are an excellent method to understand places, events, opinions, and experiences which will be diversely different depending the participants class, age, gender and ethnicity (Hay, 2000). Despite children under 18 being the subject of this study, children themselves were not included as participants in this research

3.2 POSITIONALITY

I was born and raised in Mongolia and speak Mongolian as my mother tongue. This allowed me to communicate with research participants without language or cultural barriers. Having spent most of my life in Mongolia, I am familiar with the country's economic, political, and cultural landscape and, like many researchers, naturally hold personal opinions shaped by this context.

Upon graduating from university, I briefly worked in the mining sector, where I began my professional career, though this did not involve FIFO arrangements. Over time, my career shifted toward the development sector. I have since gained professional experience with a non-governmental organization that focuses on addressing the socio-economic challenges faced by children in Mongolia. I am passionate about engaging with and learning from vulnerable and underrepresented communities such as children and nomadic herders.

While I acknowledge that my background and prior experiences have influenced the formulation of this research and may introduce some personal bias, I have made every effort to remain aware of these influences throughout the research stages. I strived to approach data collection, analysis, and interpretation with neutrality and to faithfully represent the perspectives and lived experiences of the research participants.

3.3 RESEARCH CONTEXT

In the context of this research, children are defined as individuals aged 18 years or younger, in accordance with the United Nations Convention on the Rights of the Child (United Nations, 1989). This definition also aligns with the Law of Mongolia on the Rights of Children (Law of Mongolia on The Rights of Children, 2016).

Mining projects operate across Mongolia, extracting a variety of mineral resources. The majority of these operations are concentrated in the Gobi Desert region, which includes the southern provinces of South Gobi, East Gobi, Gobi-Altai, and Bayankhongor. It is a vast desert landscape that is rich in minerals but scarce in water and pastureland (Han et al., 2021; Sternberg et al., 2022). In South Gobi province alone, there are 151 registered mining licenses, of which 110 are for active extraction and 41 for exploration (MRPAM, 2025).

3.3.1 FIFO Mining Employees

While most of the research participants reside in the capital, Ulaanbaatar, and commute to South Gobi Province for about 600 – 1,000 km one-way from Ulaanbaatar depending on the mine site, some participants live in the far eastern part of the country where commute is about 1,500 km for them. However, for some the commute is as short as 100 km.

One commonality is that they must work in the mining site non-stop for 2 weeks on average and then take 2 weeks off from work.

3.3.2 Nomadic Herders in the Mining Host Communities

Gurvantes town or "soum" is an administrative unit in Mongolia and equivalent to a township in Canada. Gurvantes soum lies within South Gobi province and is home to approximately 6,000 people (National Statistics Office of Mongolia, 2025c). It is located 330 kilometers from the provincial capital, Dalanzadgad city, and around 900 kilometers from the national capital, Ulaanbaatar. Although a paved road has been constructed for about 250 kilometers of the route from Dalanzadgad to Gurvantes recently, the remaining 80 kilometers remain in extremely poor condition, consisting of sand, dirt, and uneven terrain. This makes the transportation of people, food, and essential supplies especially challenging.

While most people live in the town center, nomadic herders live out in the land by themselves. Traditionally, Mongolian nomads move about 4 times a year changing their location looking for better grazing for their livestock. The practice varies depending heavily on their landscape. Gobi Desert in general is among the hardest in terms of pasture, forcing nomads to move sometimes even hundreds of kilometers in search of a pasture. These people wrestle with climate change and natural conditions already, with or without mining.

Unlike farmers, nomadic herders in Mongolia do not legally own land, as pastures remain state property. Nevertheless, many herding families have lived and grazed their livestock in the

same areas for generations, creating a strong sense of customary ownership. While this tenure is not formally recognized, herders regard these pastures as their own. In recent years, conflicts over grazing land have intensified, posing increasing challenges for the government in managing and regulating these informal land-use arrangements. Historically, Mongolia's communal land governance functioned effectively when the economy was primarily based on herding and pastoralism, with nomadic herders as the main land users and meat, wool, and cashmere as the dominant exports. In contemporary Mongolia, however, the economy relies heavily on mining, introducing new dimensions of land use and ownership. Addressing these complexities has become an ongoing legislative challenge (Barcus, 2018).

The concept of Community-Based Natural Resource Management (CBNRM) emphasizes the right of communities to access, use, and control locally valued natural resources. Evidence from six case studies—the Philippines, Nepal, Madagascar, Indigenous communities in North America (rights to forest land), Southern Africa (land use for grazing versus tourism), and Nicaragua (conflicts between local communities and mining/logging) - illustrates how the bottom-up principles of CBNRM are often undermined. In particular, government bureaucracies, donor-driven ideologies, and competing economic interests have challenged the implementation and sustainability of CBNRM initiatives (Dressler et al., 2010). Therefore, the recognition and legal protection of herders' rights to communal land and water resources in Mongolia should be given serious consideration (Sternberg et al., 2025). The social impacts of mining vary depending on factors including family background, geographic location, and socio-economic status (Vanclay et al., 2015). For the purposes of this study, two key groups of children are the focus:

- *Children of mining sector employees* in the Gobi region, particularly those whose parents work on FIFO rosters, resulting in prolonged periods of parental absence from home.
- *Children living in mining host communities,* including both settled residents of the soum center and nomadic herder families in the surrounding areas.

3.3.3 Selection Criteria

To ensure the relevance and depth of insights for this research, specific selection criteria were established for participants from two key groups: mining sector employees and nomadic herders.

Mining Employees:

- Individuals (or their spouses) who are employed in the mining industry in the Gobi region under a FIFO roster system.

- Individuals who have one or more children under the age of 18.

Nomadic Herders:

- Nomadic herders or local residents residing within the territory of Gurvantes soum, South Gobi province, Mongolia.
- Individuals who have one or more children under the age of 18 in their household.

In rural areas of Mongolia, it is both culturally common and practically essential for grandparents to serve as primary caregivers for their grandchildren, often to support the children's parents in maintaining employment as can be seen from my Results section. Reflecting this social reality, grandparents residing with and actively caring for their grandchildren in Gurvantes soum were also included in the study as research participants.

3.4 DATA COLLECTION

3.4.1 Survey Questionnaire

The survey questionnaire was made available in both English and Mongolian via the Qualtrics platform, allowing participants to choose their preferred language. Of the total respondents, 22% completed the survey in English, while the remaining 78% chose Mongolian. Before accessing the questionnaire, participants were presented with a detailed information sheet on the first page and were asked to complete a consent form. The estimated time for completing the survey was approximately 10 - 15 minutes.

Participant recruitment was conducted primarily through social media platform of Facebook. I joined several Facebook groups related to mining sector employees and shared a recruitment poster. Additionally, the poster was distributed through my personal and professional networks, with a request to forward it to individuals who met the selection criteria.

Written informed consent was obtained from each participant prior to completing the survey. The consent covered voluntary participation, the use of anonymous quotations, and permission for the study data to be published in this thesis and in future academic publications.

A total of 88 entries were recorded. Among these, 39 were partial or blank submissions that did not include responses to any survey questions, possibly due to repeated access attempts by the same individuals. Three entries were incomplete, with only 65–85% of the questionnaire completed. One respondent indicated disagreement with the consent terms, hence completed the

survey without answering any questions. As a result, a total of 45 valid and complete responses (N=45) were obtained and further considered for analysis.

The questionnaire began with demographic questions, including age, gender, marital status, education level, and the number and ages of children. It then proceeded to questions regarding participants' employment characteristics, such as years of experience, roster schedule, and the number and types of important life events they had missed due to work commitments, as well as their willingness to relocate as a family to the mining site.

3.4.2 Individual Interviews

3.4.2.1 Semi-Structured Individual Interviews with Mining Employees

At the end of the survey questionnaire, participants were asked whether they would be willing to take part in a follow-up individual interview lasting approximately 20–30 minutes to further discuss the research topic. Those agreed or interested were asked to provide their email address. Those not interested completed their participation in this research at the end of the questionnaire. A total of 16 participants expressed interest by submitting their email address. Despite multiple follow-up emails, only three participants responded to my emails and proceeded with the interview.

Following these initial interviews, I recruited an additional five participants through a combination of snowball and purposive sampling methods. One other individual, who participated in the survey and met most criteria (i.e., working in the mining sector and having children), was excluded from the interview sample because they did not work under a FIFO roster. I expressed appreciation for their willingness to contribute but discontinued the interview, and the data from this interaction was not included in the further analysis.

Due to the participants' demanding work schedules and personal commitments, scheduling Zoom interviews proved difficult. As a result, all eight interviews were conducted via phone calls.

Oral consent was obtained from each participant prior to the interview. This included consent for voluntary participation, permission to record the phone call, and agreement for the potential use of direct quotes in this thesis and future academic publications. Two out of the eight participants requested that I seek their approval before using any direct quotes. One such direct quote was used in the Results and Discussion sections, and explicit approval was obtained through

a follow-up phone call. The remaining six participants confirmed that prior approval was not necessary for the use of anonymized direct quotes.

The interviews were conducted in a semi-structured format, using a prepared script with the flexibility to add, modify, or skip questions based on participants' responses and the flow of the conversation.

3.4.2.2 Semi-structured Individual Interviews with Nomadic Herders

As part of the fieldwork for this research, I traveled to Gurvantes soum in South Gobi province, Mongolia, where I conducted 16 interviews with nomadic herders. Among the participants, 15 identified themselves as nomadic herders, raising livestock such as sheep, goats, cows, horses, and camels in and around the soum territory. Only one participant identified as a local resident based in the soum center, having transitioned from a previous nomadic herding lifestyle due to mining. Therefore, this individual was considered a nomadic herder and was considered for further analysis.

Prior to the interviews, participants were provided with a brief explanation of the research objectives. They were then asked to complete and sign a written consent form, confirming their voluntary participation, agreement to the audio recording of the interview, and consent for the potential use of anonymized direct quotes in this thesis and future academic publications. No participant has requested explicit approval prior to the use of their direct quotes. It is worth noting that I had to explain the consent form, including its purpose, meaning and implications, to the interview participants orally as many have seemingly struggled understanding parts of the form despite it being in Mongolian.

3.5 DATA ANALYSIS

3.5.1 Survey Questionnaire

Survey data were extracted from Qualtrics and analyzed using Microsoft Excel. The initial step involved cleaning the raw dataset by removing entries that contained no responses. I also reviewed the three partially completed responses (65%–85% complete) and chose to exclude them from further analysis, as they were missing critical information - particularly questions related to job characteristics and parental absenteeism - that were central to the research objectives.

A total of 45 fully completed responses were retained and analyzed. The analysis was divided into two main categories: participants demographics and descriptive statistics. The participants' demographics captured participants' personal and household characteristics, including age, gender, marital status, education level, and information about their children. The descriptive statistics focused on participants' employment-related attributes, especially those relevant to the study's focus on absenteeism, such as work schedules, roster types, and missed public holidays/family events.

3.5.2 Individual Interviews

All interviews were conducted in the Mongolian language, transcribed into Mongolian text, and subsequently translated into English for analysis. No digital tools were used in the transcription or translation process, as concerns regarding the reliability and accuracy of automated tools led me to prioritize manual processing to ensure data quality and contextual accuracy particularly considering limited use and exposure of Mongolian language in modern digital tools.

The translated transcripts were analyzed using thematic coding, with responses categorized into broad themes of positive and negative impacts, as well as impacts related to children's health services, education services, and protection services. In many cases, the thematic codes aligned with the interview questions. However, there were instances where participant responses diverged from the question prompts. For example, when asked about the positive impacts of mining, several nomadic herders instead focused exclusively on negative impacts, such as dust pollution, which were accordingly coded under negative impacts. This flexible approach to coding allowed for the emergence of themes that more accurately reflected the participants' perspectives and lived experiences.

3.6 LIMITATIONS

One limitation encountered during data collection was the lack of response from the participants via email communication for the interview. Although 13 out of 45 survey respondents provided their email addresses expressing willingness to participate in the interview, only two responded to my follow-up emails, despite multiple attempts. This suggests that individuals working in certain sectors such as mining with FIFO work arrangements where internet connectivity is inconsistent may rely more heavily on phone or in-person communication than on emails. While email communication offers advantages of low cost and rapid delivery, it is often

associated with lower response rates compared to traditional methods such as mail or telephone, partly due to connectivity issues and the increasing prevalence of spam filters (Fan & Yan, 2010). As a result, additional interview participants were recruited through snowball sampling. This led to six out of the eight mining employee interviewees being affiliated with the Oyu Tolgoi project, a world-class mining operation owned by Rio Tinto. While Oyu Tolgoi project employees provide valuable insights, the mining sector in Mongolia is diverse and extends beyond this single project. Including more participants from other mining sites may have offered additional perspectives and nuances to the findings. Similarly, most survey participants were highly educated, which was partly a result of snowball sampling. Including a more diverse group with varied educational backgrounds could have provided additional perspectives.

Moreover, Mongolia's vast geographical expanse and ecological diversity mean that mining host communities across the country may experience different social and environmental impacts. Expanding the scope of fieldwork to include other regions could have strengthened the research through broader representation. However, given the time and resource constraints typical of a Master's-level study, such extended fieldwork was not feasible.

Another limitation of this research concerns ethical clearance for studies involving children. While "Western" ethical principles are often difficult to apply in Global South contexts, the literature documents a range of methodologies—including participatory approaches—that emphasize conducting research *with* children rather than *on* them (Abebe, 2009). Nevertheless, several scholars highlight the complexities and obstacles of working directly with children, including challenges during the research process and heightened scrutiny of methods and practices in multiple disciplines (James & Christensen, 2008). In this study, the added challenges were not only about ethical concerns but also about any potential risk of negative outcomes for participating children. As an early-career student researcher, I therefore chose to do this research on children rather than with children. However, I acknowledge that incorporating children's voices could have offered valuable additional insights and a richer perspective on the findings.

This chapter has outlined the methodology grounding this research, along with the research context, data collection, and analysis procedures. A positionality statement and discussion of limitations were also included here, as they were deemed most appropriate in this section. The following chapter presents the results derived from the data collection and analysis.

4 RESULTS

This chapter presents the findings analyzed from the survey questionnaires and interviews conducted as part of this research. The results are organized according to the research objectives outlined in this thesis. The chapter begins by addressing Objective 1, which seeks to understand the social context and identify the social impacts of mining on children of mining employees and children of nomadic herders. It then moves on to Objective 2, which aims to explain the underlying factors that shape these identified social impacts. Drawing on data collected through both surveys and interviews, this chapter highlights the various ways in which large-scale mining operations influence the everyday lives, wellbeing, and opportunities of children living in mining employee families and nomadic herder households.

4.1 SURVEY PARTICIPANTS DEMOGRAPHICS

There were 45 survey participants. I will start by presenting the demographics of the survey participants by describing their age distribution. Figure 3 provides an overview of the age distribution of the survey participants.

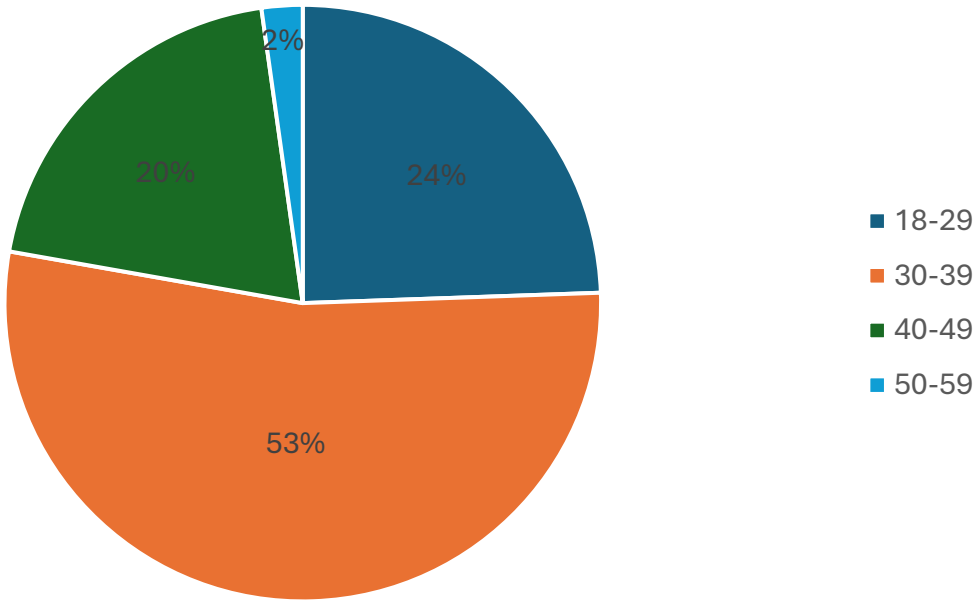

Figure 3: *Age group of the survey participants. N=45*

Figure 3 outlines the demographic characteristics of the survey respondents. The ages of the survey participants ranged from 18 to 59 years. Slightly more than half of the participants were in their thirties, while the remainder consisted of relatively equal proportions from younger and older age groups. Only one participant fell within the 50–59 age group.

In terms of gender, the distribution of survey participants was uneven: approximately one-third were female, while the remaining two-thirds were male. See Figure 4.

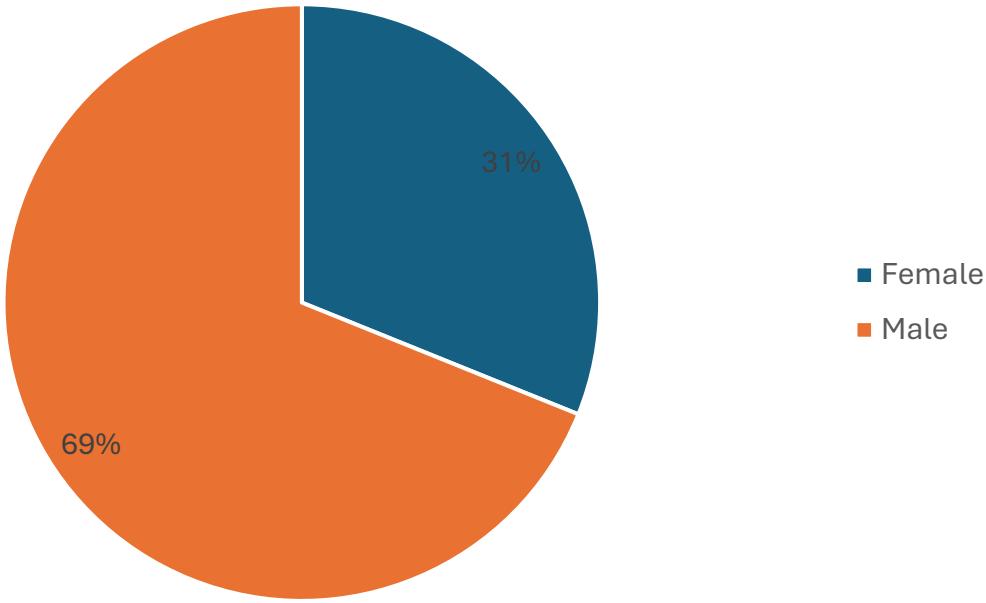

Figure 4: *Gender of the survey participants. N=45*

Figure 4 shows that the majority of the survey participants were male. When asked how many children they had, the majority of survey participants reported having between one and three children, with these categories showing a relatively even distribution (see Figure 5). A smaller proportion, comprising six participants (13%), reported having four children. No participants indicated having more than four children.

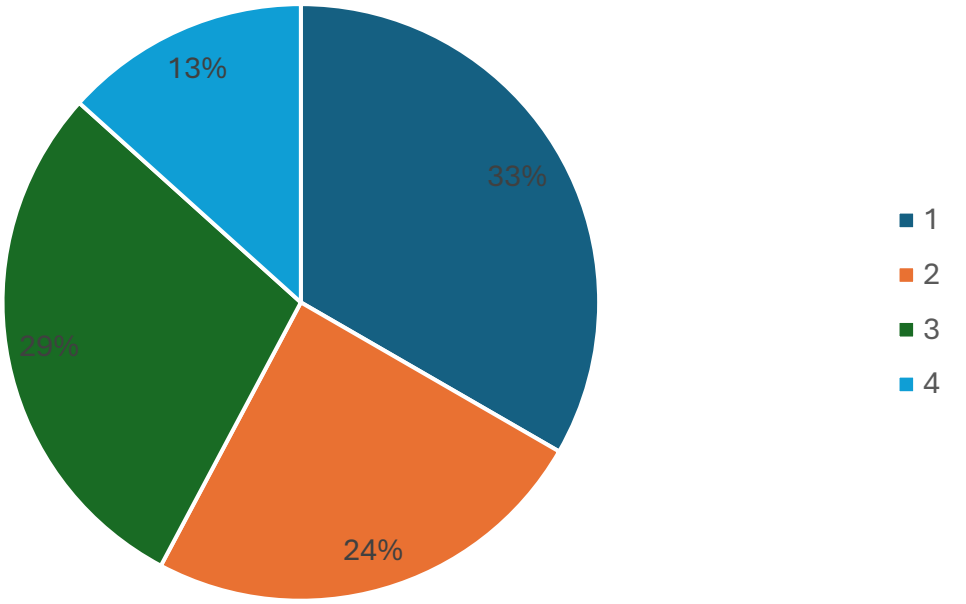

Figure 5: *Number of children of the survey participants. N=45*

As illustrated in Figure 5, families with one to three children make up the majority of the research participants, reflecting a trend toward smaller family sizes within the study population, whereas larger families (four or more children) were less frequent.

The survey participants collectively reported a total of 101 children, that is an average of 2 children per family. Figure 6 shows the age groups of the children. More than half of the participants' children were of school age, approximately one quarter were of kindergarten age, and around one tenth were infants. All children of school and kindergarten age reported in the survey were enrolled in education services; no cases of educational exclusion were identified among these groups. However, one case of a child not attending school was noted among the mining employee interview participants, attributed to the parent's FIFO work arrangements.

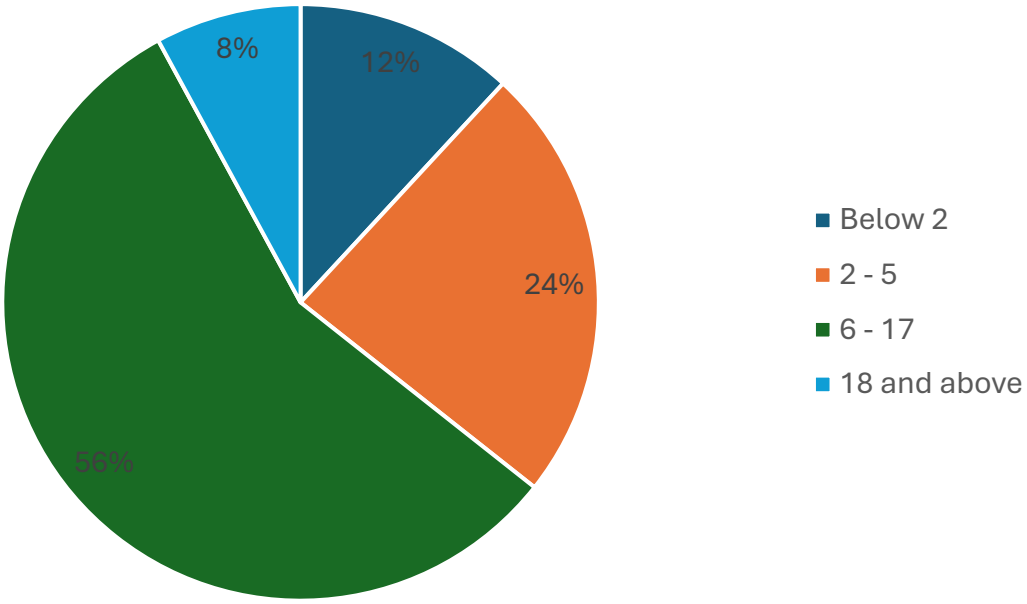

Figure 6: *Children's age group of the survey participants. N=101*

Some survey participants also reported having children aged 18 and above; however, all participants in this situation also had at least one child under the age of 18 and therefore met the selection criteria for this study. In addition to the survey data, mining employee interview participants reported a total of 22 children, while nomadic herder interview participants reported 41 children. Considering the overlap where some interview participants also completed the survey, the research covers a total of 164 children.

In terms of education level of the survey participants, more than two-thirds of them reported having attained at least a bachelor's degree or higher. Approximately 24% had completed high school, while 7% had completed middle school. In accordance with the General Law on Education (2023), completion of high school is mandatory and provided free of charge in Mongolia. None of the participants selected the "no formal education" option that was available in the questionnaire. See Figure 7.

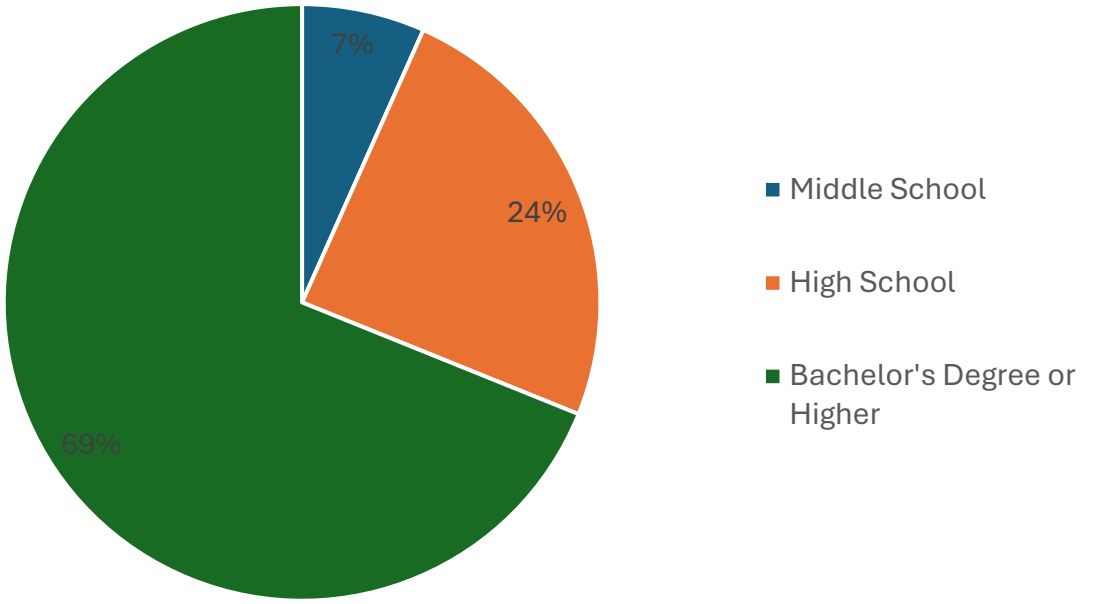

Figure 7: *Education level of the survey participants. N=45*

These findings indicate that the study sample represents a relatively well-educated group, which provides important context for interpreting the subsequent results on social impacts.

The majority of survey participants reported being married, with only a small proportion indicating other marital statuses. In particular, 11% of participants identified themselves as single parents. See Figure 8.

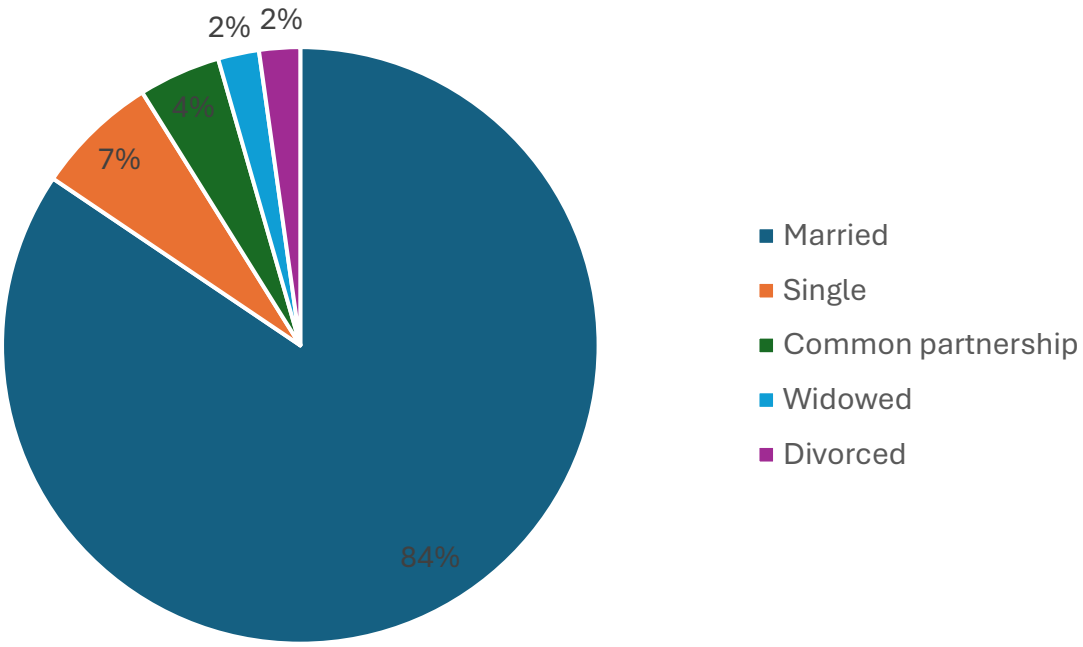

Figure 8: *Marital status of the survey participants. N=45*

This distribution of marital status provides additional context for understanding family structures and potential variations in the social impacts discussed in subsequent sections.

4.2 Descriptive Statistics of FIFO Work Arrangements

This section presents the descriptive statistics related to FIFO work arrangements among the survey participants. It provides an overview of key job characteristics and outlines patterns of work-related absenteeism, which are important for understanding the broader social impacts examined in subsequent sections.

Approximately one-third of the survey participants had been working in their current job for two to five years. One-quarter reported a relatively short tenure of less than two years, while a similar proportion indicated five to ten years of experience. Fewer than 20% of participants had held their current position for more than ten years. See Figure 9 for a schematic presentation of work tenure.

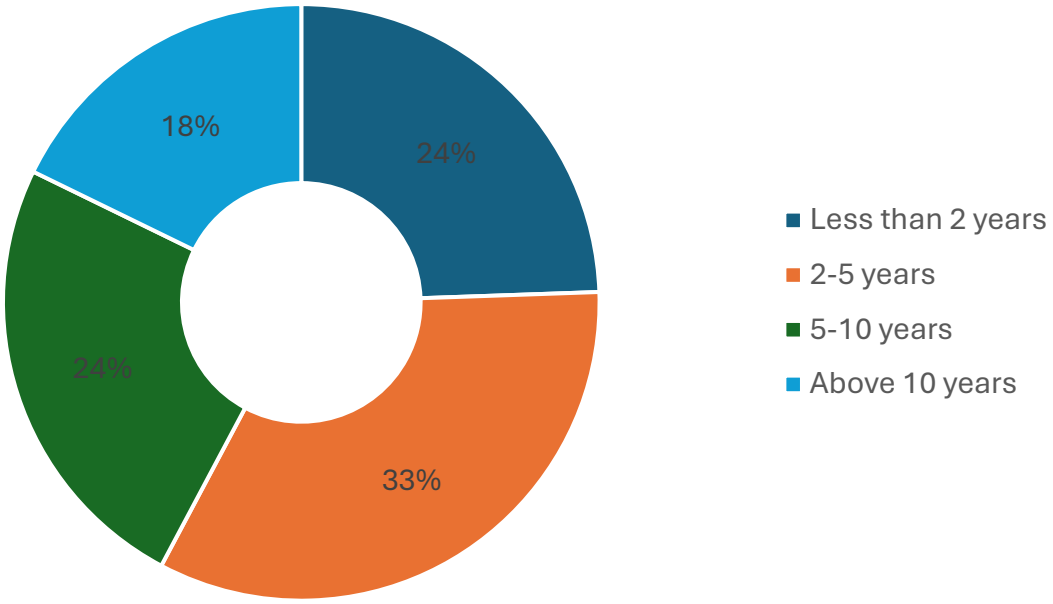

Figure 9: *Work experience of the survey participants in mining industry. N=45*

These patterns of job tenure provide important context for understanding how the duration of employment may influence the experiences and social impacts associated with FIFO work arrangements.

The great majority of survey participants (80%) reported working under a fly-in fly-out (FIFO) rotation in which they spend two weeks at the mining site followed by two weeks off. In some companies, alternative rosters were reported, such as a cycle where employees spend one week at the mining site, one week working in an office located in Ulaanbaatar, and then take one week off. Figure 10 provides an overview of the work arrangements of study participants.

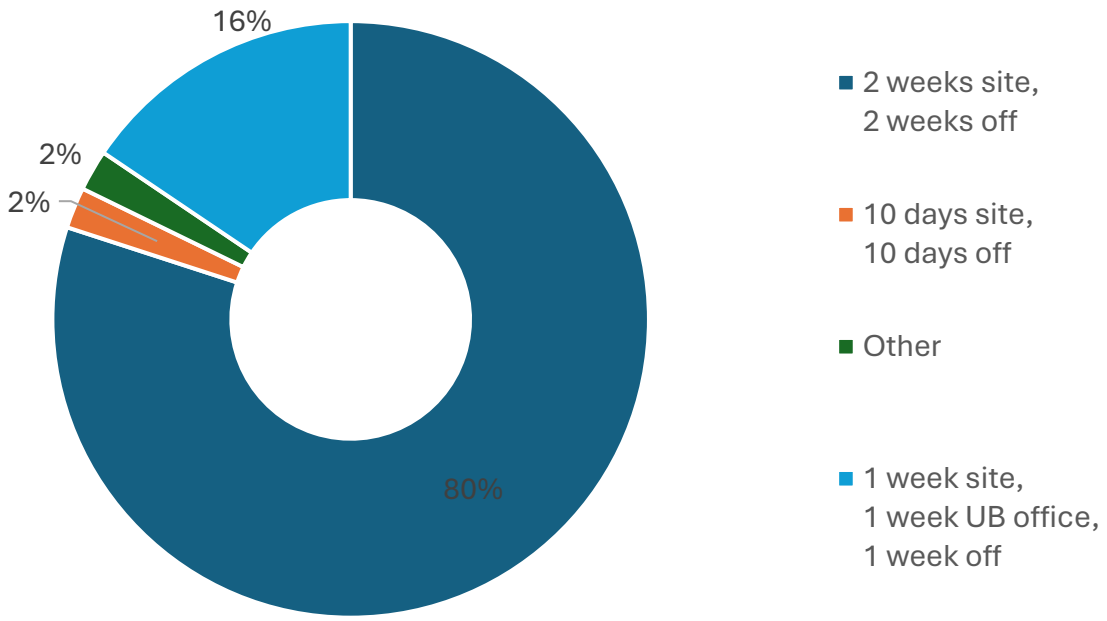

Figure 10: *Roster schedule of the survey participants. N=45*

Despite this result in the survey, interview data presented at the end of this section, further revealed that some contractors employed under self-arranged FIFO agreements may work on site continuously for up to two months before taking leave.

More than half of the survey participants reported being away from home for work with a total duration between three and six months on average each year. Approximately one-third indicated that they are absent from home with a total duration for more than half of the year (See Figure 11).

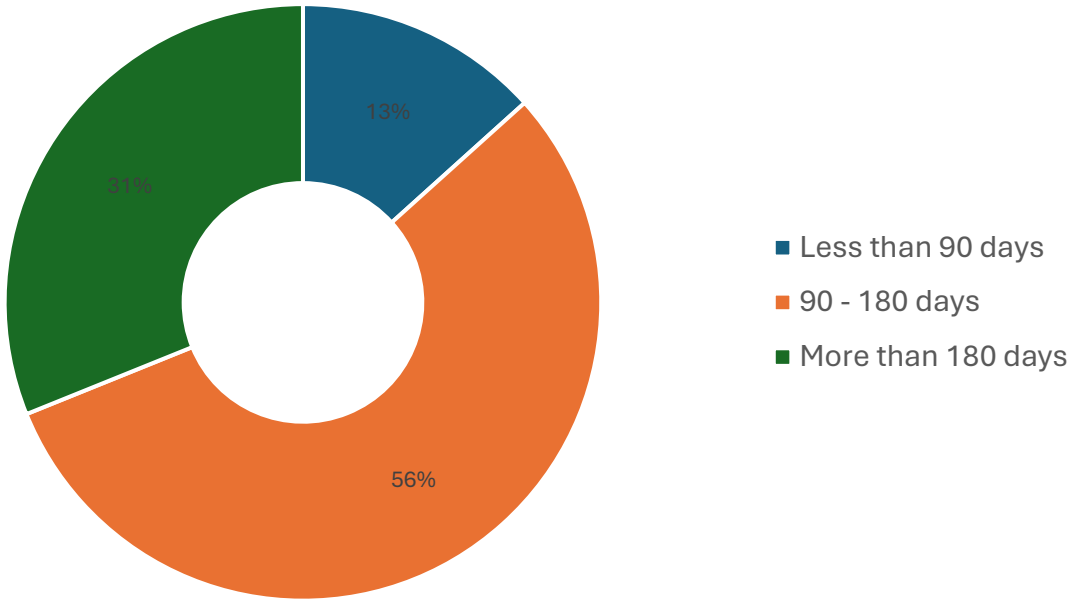

Figure 11: *Average absence from home duration in a year. N=45*

These findings on the duration of time spent away from home highlight the extent of prolonged absences associated with FIFO work, which provides important context for examining its potential effects on family dynamics and children's wellbeing in later sections.

Over the past year, a higher proportion of survey participants reported missing public holidays due to work than missing organized events at their children's school or kindergarten, with absences for hospital emergencies at home reported less frequently. Approximately half of the participants had to miss family hospital emergencies and school events at least 1-2 times whereas missing public holidays and family events was more frequent, at least 3-4 times in the last year. It should be noted that public holidays and family events occur throughout the calendar year, whereas schools and kindergartens operate only during the academic year from September to June. See Figure 12.

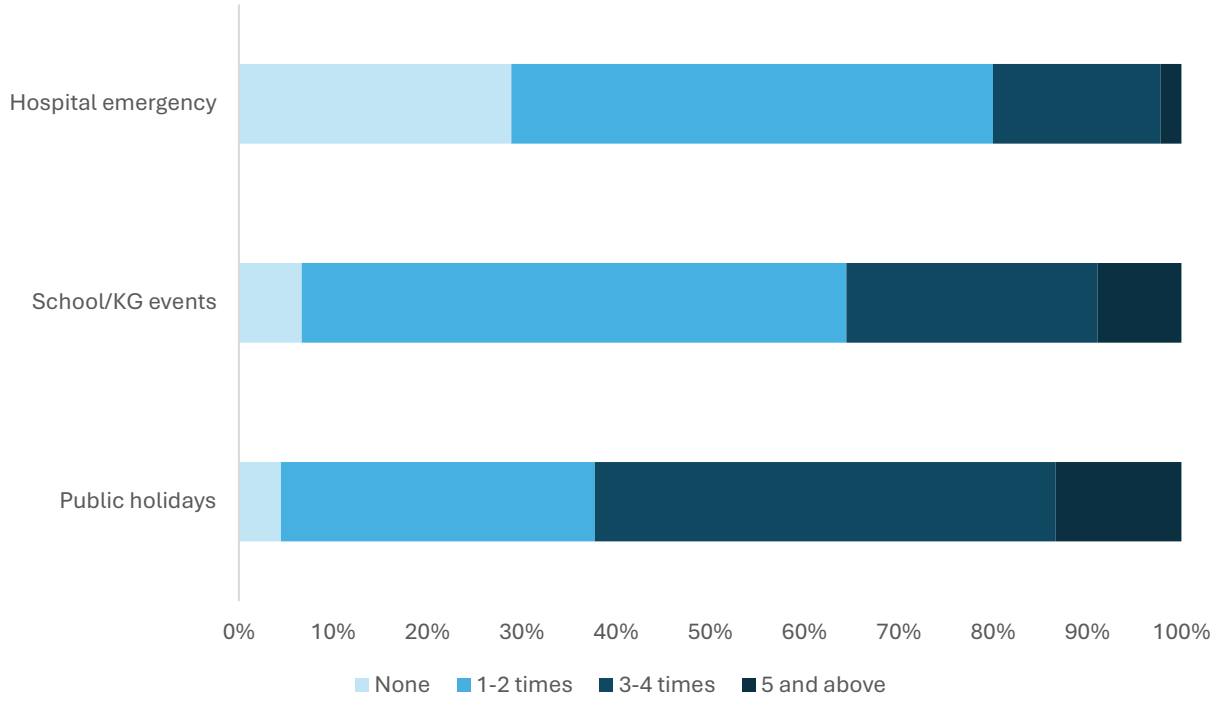

Figure 12: *Number of notable events missed during the past year due to work, based on Likert scale responses. N=45*

Interview data further indicated that hospital emergencies involving children were more commonly experienced during the winter months, when seasonal influenza and other respiratory illnesses place additional pressure on the health system.

When asked about their willingness to relocate with their families to the mining site location, 8% of survey participants indicated that they would be willing to do so if circumstances allowed. The remaining participants responded "No" and were invited to provide reasons for their decision, with the option of selecting more than one response. Although the reasons for declining relocation were distributed relatively evenly across several factors, the absence of adequate schools and kindergartens for their children was reported slightly more frequently than other considerations. See Figure 13.

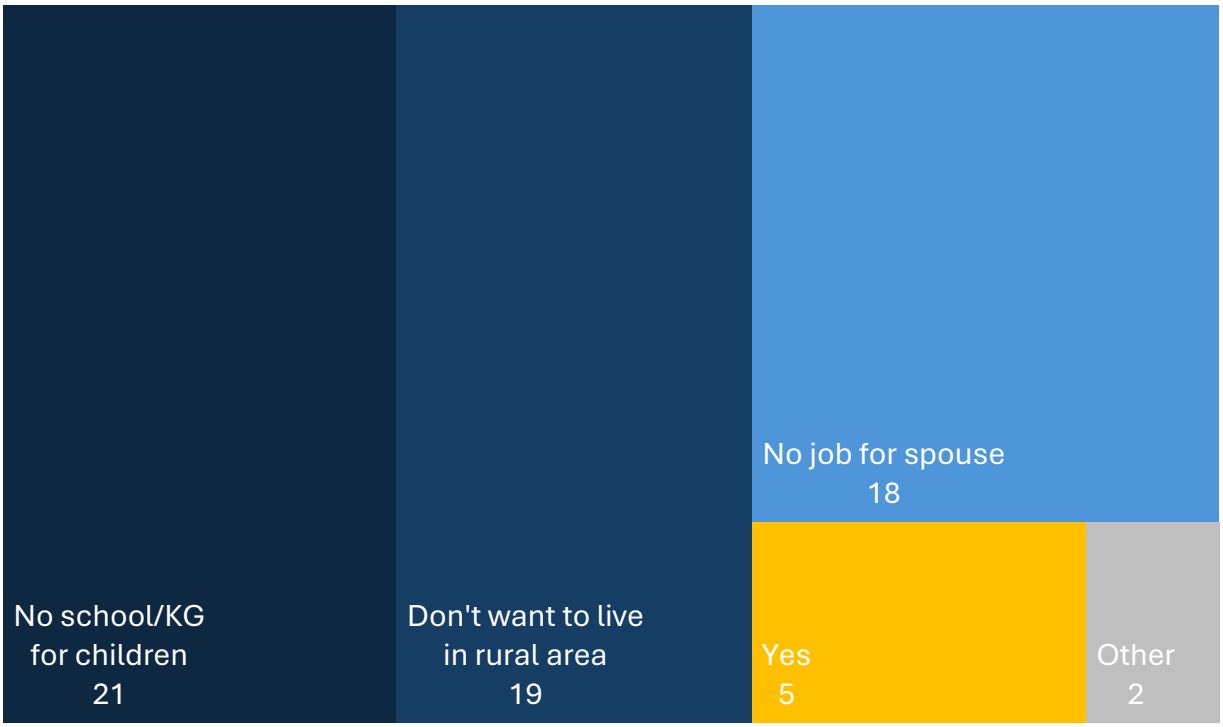

Figure 13: *Treemap showing survey participants' willingness to relocate to the mining site and the reasons provided. N=65*

These findings highlight the role of access to educational and childcare facilities in shaping families' decisions about relocation, an issue that has broader implications for community development and social impacts discussed in later sections. In addition, concerns regarding employment opportunities for spouses and reluctance to live in rural towns also emerged as important factors influencing these decisions.

4.3 Overview of Interview Participants

Table 1 provides an overview of the key characteristics of the interview participants, including gender, number of children, employment attributes, lifestyle, and family connections to the mining sector for both mining employees and nomadic herders.

Table 3: *Demographic information of the interview participants*

Mining Employees	**Number**	**Comment**
Gender		
Female	5	
Male	3	
Number of Children of the Participants		
Total # of children	22	
Employment Attribute		
Mining employee	6	One participant's spouse also works in the mining sector
Spouse	2	One participant also used to work in the mining sector but shifted career recently while their spouse still works in the mining sector
Employer Type		
International company	6	Renowned international company
Local company	2	
Transportation Mode		
Fly-in, fly-out	6	
Car	2	It takes 2 days of car travel one-way between mining site and home for one of the participants
Nomadic Herders	**Number**	**Comment**
Gender		
Female	9	
Male	7	
Number of Children of the Participants		
Total # of children	41	
Caregiver Attribute		
Parent	10	Two participants care give both to their children and grandchildren under 18
Grandparent	6	
Participant Lifestyle		
Nomadic herder	15	
Local resident	1	Gave up nomadic lifestyle due to mining
Residence Origin		
From Gurvantes	14	
Moved in	2	
Family Member Employment in Mining		
Yes	15	Two participants have previously worked in the mine
No	1	

As shown in Table 3, the interview participants were evenly distributed by gender and reflected a diverse range of backgrounds within both the mining employee and nomadic herder groups.

4.4 Identifying Social Impacts on Children

The social impacts identified through the interviews and surveys are organized into two broad categories: positive impacts and negative impacts. The following sections present these impacts separately for the two participant groups: children of mining employees and children from nomadic herder households. Numbers on the chart represent the frequency with which each impact was mentioned by survey participants.

4.4.1 Impacts on Children of Mining Employees

The most frequently reported positive impact of mining employment relates to income. Interview participants emphasized that higher salaries enable them to provide better education for their children. They also explained that they benefited from regular and timely pay. See Figure 14.

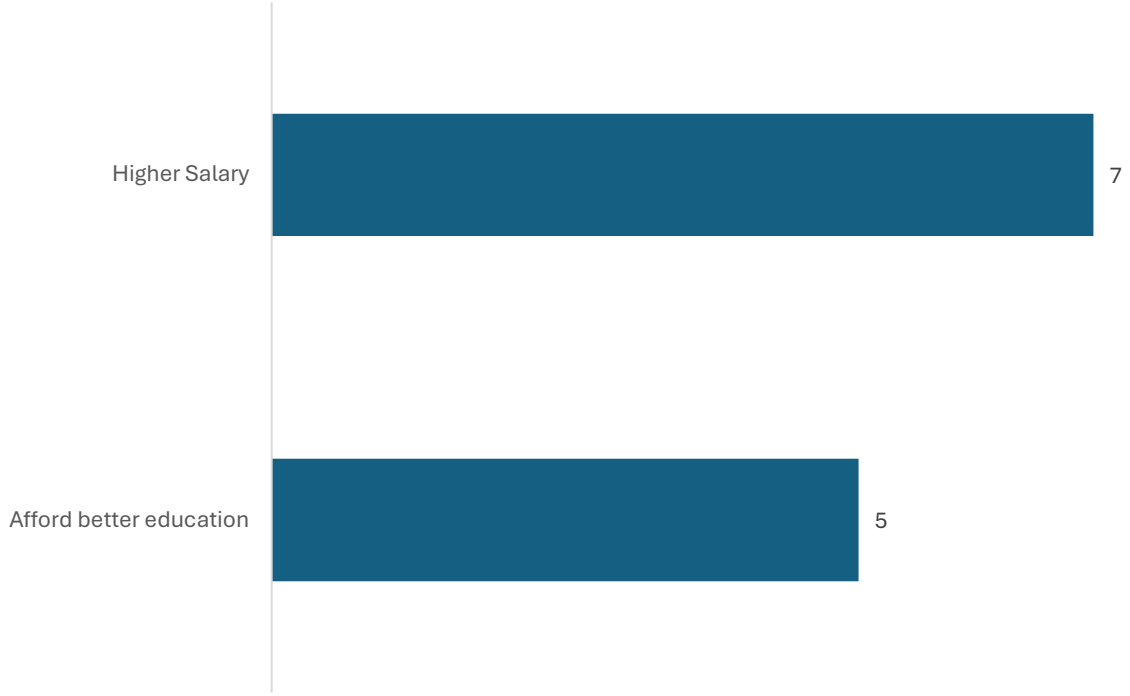

Figure 14: *Positive impacts on children of mining employees mentioned by interview participants.*

Specifically, seven out of eight participants mentioned higher income as a key benefit, and five of these highlighted that this income allows them to afford improved educational opportunities for their children such as private school. For instance, a survey participant has expressed *"I expect*

and believe my children are doing good at school because I send them to private tutoring as I don't have enough time to take care of it myself" (ME02). Two participants also valued the predictability of timely salary payments. Beyond financial benefits, some participants identified other positive aspects of their work: three mentioned opportunities for professional development and learning, while one participant each highlighted a sense of professional pride and the flexibility provided by the FIFO roster.

In terms of negative impacts, most of them were related to parental absenteeism due to work as a major challenge affecting their children, emphasizing the strain of prolonged periods away from family. See Figure 15.

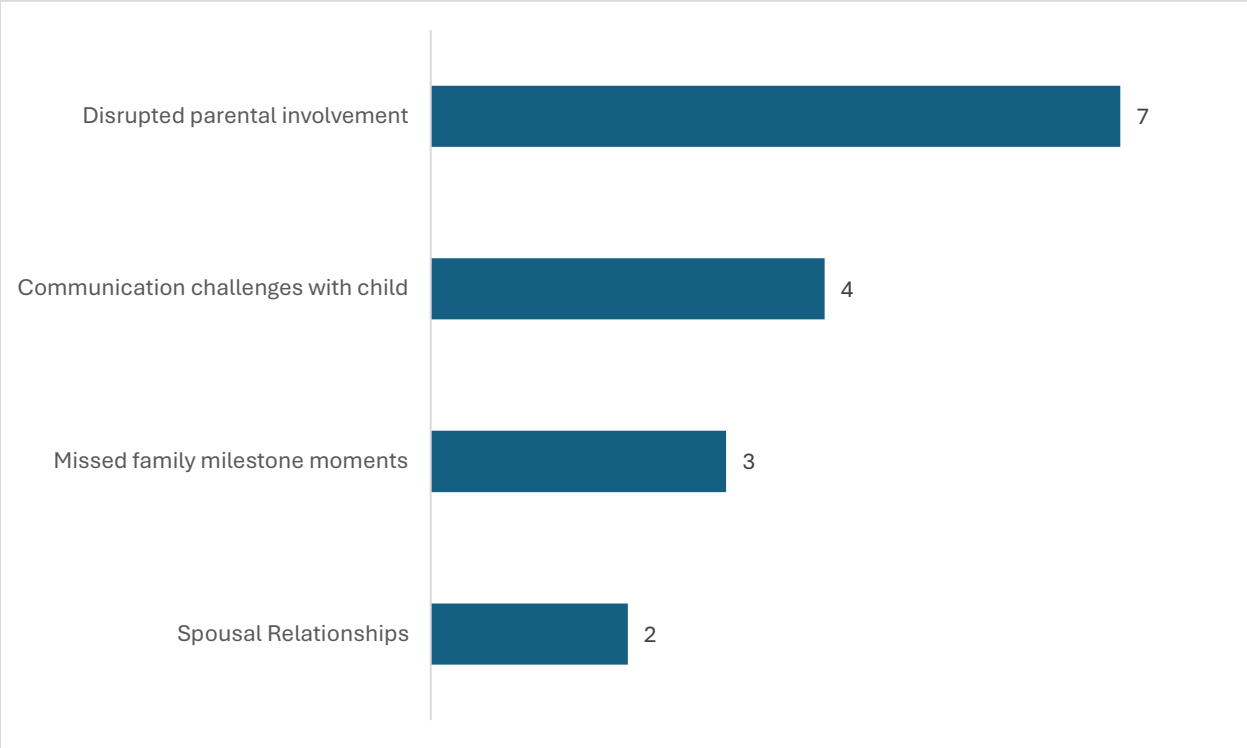

Figure 15: *Negative impacts on children of mining employees mentioned by interview participants.*

Seven participants elaborated on this absenteeism as it disrupted parental involvement in their children's upbringing. Despite behavioral control or usual parenting, other disrupted involvement included a situation during medical emergency. One participant shared the common frustration and helplessness experienced in these situations: *"I don't know why, but it's always that my baby gets sick when the father is away for work"* (ME01). Another participant described a more serious scenario: *"As we speak, my wife is in the hospital with our child waiting to be medically operated, but I'm not a doctor, so I better be working and earning here to support them*

financially" (ME08). Half of the participants also noted difficulties in communicating with their children, particularly with teenagers as one participant has highlighted *"My children are quite extroverted. However, nowadays I'm failing to communicate well with my 13-year-old son. I try my best to talk to him when I'm home, but every time I make an effort to have conversation with him, he becomes upset and shuts down"* (ME07). Other commonly reported negative impacts included missing family milestones and important events, the absence of a "father" figure in the household, and a lack of shared parental responsibility. Same participant has further shared *"When my family show me their pictures of those celebrations, and I'm not in the picture, I feel like I'm losing important family milestone moments from my life"* (ME07).

Additional issues raised by at least two participants each included health impacts associated with night shifts, travel time being counted as part of their off-work period, and feelings of guilt for not being present for their children. Impacts mentioned less frequently (by one participant each) included the risk of occupational injury, fear of frequent flying, divorce, alcoholism, and extramarital affairs in relation to their FIFO work arrangement. In fact, one of the interview participant has shared their personal situation as *"I have started working with FIFO arrangements two years ago, the first year was good but my spousal relationship got bad in the second year, and we finally divorced"* (ME04).

4.4.2 Impacts on Children of Nomadic Herders

For the children of nomadic herders, five out of sixteen interview participants identified job opportunities as a positive impact of mining, and two participants mentioned the economic stimulation that mining activities have brought to the town. Job opportunity was also seen as having an impact on schoolteachers, as one participant has suggested *"Many teachers take temporary jobs in the mining industry during their long summer break, and often they stay on because of the better pay"* (NH12). Although job opportunity was considered as positive impact by the interview participants, there could also be negative impacts associated with it. All remaining participants responded "none" when asked about positive impacts of mining on their children. See Figure 16.

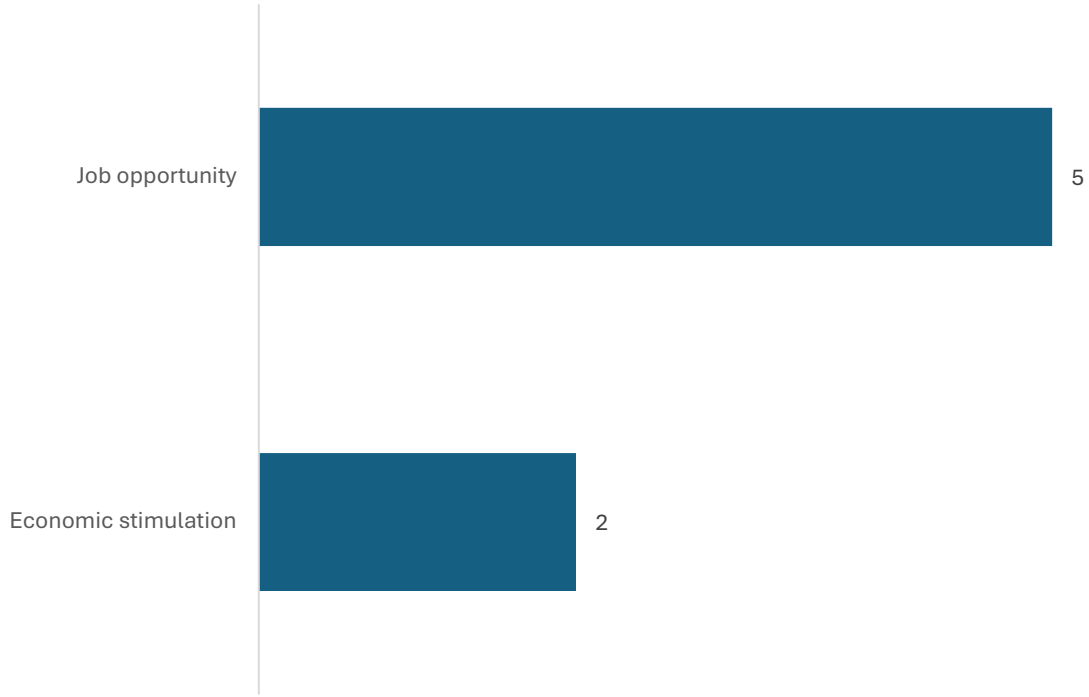

Figure 16: *Positive impacts on children of nomadic herders mentioned by interview participants*

Overall, the majority of nomadic herder participants reported that mining has not brought any positive impacts for their children, with only a few mentioning benefits related to job opportunities or general economic stimulation in the community.

In terms of negative impacts, twelve out of sixteen interview participants reported dust pollution as their primary concern. They described the dust generated by trucks and mining operations as a persistent problem that affects their overall quality of life and particularly respiratory health of their families including their children. One participant has linked the dust pollution to both a common urban issue as well as their children's health as *"I thought I was living in a rural town where air quality is supposed to be excellent, but look at it, the dust pollution is bad. I'm worried for my children's respiratory health"* (NH06). Dust pollution was also referred as chemical contamination as evidence by nomadic herders living in the proximity of a mining pit and complained about visibly changed internal organs of their livestock as seen during slaughter as one said, *"If animals' lungs are noticeably darker, what's going on our lungs?"* (NH14). This contamination was further elaborated as *"Those white goats' cashmere would all turn black because of coal soot and their value would significantly decrease"* (NH15). Nine participants also mentioned groundwater depletion and pasture degradation as significant negative impacts, noting

that these issues directly reduce access to water for both people and animals and limit the quality and availability of grazing land. Noticeable decrease in groundwater in relation to streams was described as *"We used to have flowing streams in the valley decades ago. But now, look, there is nothing. These companies promised to dig a well for the community, but nothing happened. I won't take the well with me when I leave the world, it will be for the future generation herders"* (NH16).

Decreased rainfall, in combination with groundwater depletion and pasture degradation, was mentioned by three participants as an additional stress on already limited natural resources.

Dissatisfaction with local hospital services was reported by twelve participants, who described problems such as poor skills of doctors and nurses, inadequate facilities, insufficient bed capacity, and the absence of obstetric services. One of the participants had recently welcomed a new member to their family and complained *"My daughter had to travel 320 km to Dalanzadgad* (the provincial capital) *for her labor a month ago and travel back with her week-old infant on this horrible road"* (NH10). Another participant has highlighted the CSR of the mining companies saying *"Well, these mining companies have been here for 30 years, and at least they could have helped improve it. Ideally, we should have had a world-class hospital by now"* (NH13).

Nine participants expressed concerns about the influx of people from different parts of the country into Gurvantes soum, while an equal number specifically raised the presence of Chinese migrant workers as a separate and particularly sensitive issue.

Access to education services also emerged as a recurring concern. Eight participants pointed to the insufficient capacity of kindergartens, noting the difficulty of securing a place for their children. Participants also referred to insufficient school capacity, which is managed by operating two shifts per day, limiting time for classes and extracurricular activities. High teacher turnover, mentioned by seven participants, was associated with instability in the learning environment and concerns over the quality of education. Seven participants expressed fears related to violence against children, which has led to an increased need for parents or guardians to accompany their children to and from school to ensure their safety. However, one participant has suggested otherwise saying *"I think the violence issue in town got better because those alcoholics who used to wander around got a job in the mine, so it is more peaceful now"*.

It is worth mentioning other issues related to child protection was mentioned such as *"One of my granddaughters, who is 13, pretty much lives by herself in town as her parents work in the mine. But she lives right next to the family of my other child, so it kind of works out Okay"* (NH03).

Figure 17 provides an overview of the negative impacts of mining as described by nomadic herders. The color coding of the figure indicates common factors that shape these impacts, which are explained in detail in the following section and then explained in the Discussion chapter. Starting from the top, the dark blue color indicates impacts shaped by environmental factors, light blue represents impacts shaped by corporate social responsibility (CSR) factors, green denotes impacts shaped by migration, yellow corresponds to impacts shaped by lifestyle, and the purple color signifies impacts shaped by other factors.

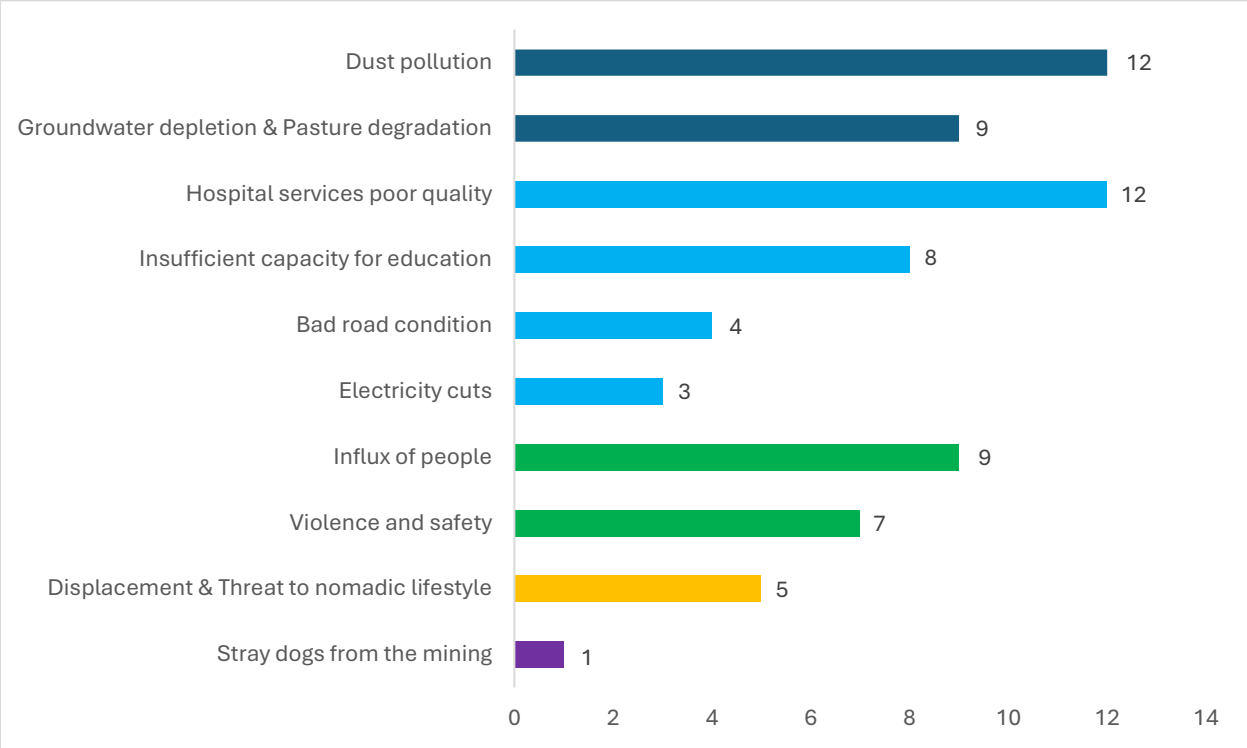

Figure 17: *Negative impacts on children of nomadic herders mentioned by interview participants (N = 15)*

Other notable negative impacts included the displacement of nomadic herders from their traditional land and the broader threat mining poses to the nomadic lifestyle. One participant has complained that *"We are unable to move anymore. There is nowhere else with pasture"* (NH16). This threat, as explained by several participants, stems from their reduced ability to move herds between pastures because increasing areas of land are occupied or restricted by mining operations. Three participants also raised concerns about coal soot contamination. This issue was described in very practical terms, including observations of darker internal organs in livestock after slaughter and visible discoloration in goat cashmere, which participants associated with the impact of air and soil pollution around mining areas.

Additional impacts reported by participants included infrastructure-related issues such as poor road conditions, mentioned by four participants, which they linked to the heavy movement of trucks and vehicles related to mining. Electricity cuts were also noted as a recurring problem, as the soum relies solely on power supplied by Chinese partners. Finally, one participant described problems caused by stray dogs originating from mining camps, which they said pose a threat to livestock by attacking and killing smaller animals. And they further elaborated as *"Actually, I lost my husband because of these dogs. He was fighting with the dogs as they attacked our goats and he fell hurting his back and he had to be hospitalized. Unfortunately, he did not recover from the injury and eventually, passed away"* (NH16).

4.5 EXPLAINING THE SOCIAL IMPACTS OF MINING

While Section 4.4 presented the positive and negative impacts experienced by children of mining employees and nomadic herders, this section examines the underlying factors that contribute to these impacts. These factors have been identified as common themes that shape the social impacts reported by participants. In many cases, these factors interact with one another, creating a complex set of circumstances that influence children's daily lives and overall wellbeing. For clarity, the themes are visually distinguished by different color shades in the figures presented in Section 4.4.

All of the social impacts identified in Section 4.4 were reviewed and grouped into categories based on their common underlying themes, from which the factors explaining these impacts were derived. For example, the Income factor accounts for all positive social impacts, including higher salaries, the ability to afford better education, timely salary payments, job opportunities, and general economic stimulation. Similarly, the Absenteeism factor explains negative impacts such as frequent parental absence from home, disrupted parental involvement, difficulties in communication with children, missed family milestones and important events, the absence of a "father" figure in the household, and a lack of shared parental responsibility.

Table 4: *Factors shaping social impacts.*

Factors	Social Impacts
Income	Higher Salary
	Afford better education
	Job opportunity
	Economic stimulation
CSR	Hospital services poor quality
	Insufficient capacity for education
	Bad road condition
	Electricity cuts
Migration	Influx of people
	Violence and safety
Absenteeism	Spousal Relationships
	Disrupted parental involvement
	Communication challenges with child
	Missed family milestone moments
Environment	Dust pollution
	Groundwater depletion and Pasture degradation
Livelihood	Displacement & Threat to nomadic lifestyle
Other	Stray dogs from the mining camps

These factors summarize the main themes that participants associated with the positive and negative social impacts presented in the previous section. They represent the different areas in which mining activities intersect with family life, community conditions, and children's wellbeing. While each factor captures a specific type of influence, many of the reported impacts overlap across multiple factors. These themes are used in the following sections to organize and describe the results.

This chapter has presented the survey and interview findings, outlining both the background of the research participants and their perspectives and lived experiences as mining employees with FIFO work arrangements and as nomadic herders. The following chapter will build on these results, offering interpretation and analysis to explain their significance and implications.

5 DISCUSSION

This chapter interprets and explains the findings presented in the previous chapter. It begins by addressing Objective 1 of this thesis which is to understand the social context and identify the social impacts of mining on children of mining employees and nomadic herders by offering an in-depth interpretation of the identified impacts. The chapter then proceeds to address Objective 2, which is to explain the social impacts by identifying and analyzing the key factors that shape these impacts. Through this discussion, the chapter situates the results within broader scholarly and contextual understandings of mining, childhood wellbeing, and social dynamics in mining host communities.

5.1 UNDERSTANDING THE SOCIAL CONTEXT AND IDENTIFYING THE SOCIAL IMPACTS OF MINING ON CHILDREN

This section presents the identified social impacts in two parts, beginning with the experiences of mining employees and followed by those of nomadic herders. Within each group, the impacts are further categorized into positive and negative to allow for clearer thematic organization and comparative analysis.

5.1.1 Positive Impacts - Mining Employees

5.1.1.1 Higher Salary

Higher salary was mentioned as the most frequently reported positive impact of mining employment among interview participants, with seven out of eight mining employees emphasizing it as a key benefit, indicating both employment and wealth generation (Azapagic, 2004). This aligns with national labor data, which consistently ranks the mining sector as offering the highest wages in Mongolia. In 2024, the sector's average nominal monthly wage was approximately 5 million Mongolian Tugrug (roughly 2,000 Canadian dollars), nearly double that of most other sectors (National Statistics Office of Mongolia, 2025a). The only agencies that have higher average monthly incomes are international organizations. In addition to base salaries, participants noted the availability of supplementary financial benefits such as child allowances for female employees, family health insurance packages, and on-site work bonuses, which further contribute to household economic stability.

Notably, respondents working for international companies - particularly the Oyu Tolgoi project operated by Rio Tinto - highlighted significantly more competitive remuneration and employment standards compared to local mining firms. These findings suggest that employment in large-scale mining, especially under international operators, can offer tangible economic advantages, potentially improving children's access to education and other wellbeing indicators. However, this economic benefit must be considered alongside the social costs identified elsewhere in this study, including parental absenteeism and weakened family dynamics.

5.1.1.2 Affording Better Education

Access to better education was identified as a benefit of mining. Five out of eight mining employee interview participants identified affording a better education for their children as a positive impact of mining-related income. These participants reported that their enhanced financial capacity enabled them to afford private schooling and extracurricular activities for their children. In the Mongolian context, the gap in perceived quality between public and private education has led many parents to seek private options as their household income increases (Gankhuyag & Banzragch, 2014). In terms of being able to afford better education, one participant expressed this sentiment: *"I expect and believe my children are doing good at school because I send them to private tutoring as I don't have enough time to take care of it myself"* (ME02). This response illustrates both the perceived benefit of income-driven educational opportunities and the underlying reliance on external academic support due to time constraints caused by work arrangements such as FIFO.

However, the impact of mining on education appears to be twofold. While mining employees reported better educational opportunities as a positive outcome, nomadic herders expressed concerns regarding the quality and accessibility of education in their communities. These contrasting experiences are discussed in detail in the following section.

5.1.2 Negative Impacts – Mining Employees

5.1.2.1 Disrupted Parental Involvement

Among the negative impacts reported by mining employees, disrupted parental involvement was the most frequently mentioned concern that is caused by the rotational nature of the FIFO work (Dorow & Jean, 2022). This disruption was commonly linked to the FIFO roster, which restricts the amount of time parents spend at home and diminishes their ability to

consistently participate in their children's upbringing. Participants emphasized their perceived lack of contribution to the behavioral and moral development of their children resulting in less "family times", a theme that resonates with findings from other FIFO related studies (e.g., Gardner et al., 2018(Gardner et al., 2018; Mayes, 2020).

A culturally specific layer to this concern is captured by the repeated use of the Mongolian term "хүмүүжил", which English does not have a direct equivalent. While it can be loosely translated as "human development," its usage in this context specifically refers to the informal, family-based education and character formation that children are expected to receive during their upbringing from their parents or caregivers. The concept covers not only discipline and behavior management of children, but also the transmission of values, manners, and life skills through consistent parental inheriting and guidance transferred intergenerationally. Interview participants noted that frequent work related absences reduce their ability to interact with their children and provide informal education, and they worried that, over time, this limits their capacity to foster their children's overall development.

5.1.2.2 Communication Challenges with Children

A recurring theme among mining employees was difficulty in communicating with their children, particularly adolescents. Many participants directly linked this communication gap to their physical absence due to FIFO work arrangements. As one participant explained, *"My children are quite extroverted. However, nowadays I'm failing to communicate well with my 13-year-old son. I try my best to talk to him when I'm home, but every time I make an effort to have conversation with him, he becomes upset and shuts down"* (ME07). This quote illustrates not only the strain on parent-child relationships but also the emotional toll on both sides, as parents struggle to maintain meaningful bonds during limited periods at home.

This communication gap and disconnect is consistent with developmental psychology literature, which emphasizes lack of parental interaction due to the FIFO work arrangement, which causes persistence in challenges regarding "parenting problems" such as communication and behavioral control of their children (Carrington & Pereira, 2011); Gardner et al., 2018). The interplay between the child's developmental stage and the parent's availability points to a compounded risk for mining families, where short rotation cycles or long absences may create emotional distance that is difficult to bridge, particularly during key developmental periods. My

research findings suggest that the social impacts of mining are not only tied to physical absence but also to missed emotional and psychological milestones in parent - child relationships.

5.1.2.3 Missed Family Milestone Moments

The data suggest that missing family events due to FIFO work arrangements is a notable social impact experienced by mining employees. Survey findings revealed that approximately 10% of respondents reported missing more than five public holidays or family events over the past year, while nearly half missed such events at least three to four times. These missed occasions included children's birthdays, family celebrations, and national holidays – times that typically reinforce familial bonds and shared identity – exacerbating the family disconnect (Carrington & Pereira, 2011; Dorow & Jean, 2022; Labra et al., 2025).

Interview responses provided further insight into the emotional and psychological consequences of these absences. One participant reflected on the personal toll of being excluded from family memories: *"When my family show me their pictures of those celebrations, and I'm not in the picture, I feel like I'm losing important milestones or events from my life"* (ME07). This comment highlights the cumulative emotional burden that comes with repeated absence, including feelings of detachment.

However, it is worth noting that perspectives varied among interview participants. While three respondents emphasized this as a negative impact, five others minimized its significance, citing adaptive strategies such as postponing celebrations or maintaining emotional connection through video calls. These mixed responses highlight the diversity of coping mechanisms among mining families and suggest that personal values, digital connectivity, and family dynamics may shape how such impacts are experienced.

In addition to missed celebrations, the inability to attend family health emergencies emerged as another significant concern. As illustrated in Figure 12, 70% of survey participants reported missing at least one family medical emergency in the past year due to work commitments. Interview data provided further context, with several participants noting that this issue is particularly acute during winter months when seasonal illnesses like influenza are more prevalent. In such cases, families often rely on extended family members for support. While this arrangement offers some relief, it also introduces additional logistical pressures and increases reliance on others during critical times, particularly when children fall ill.

One participant shared the common frustration and helplessness experienced in these situations: *"I don't know why, but it's always that my baby gets sick when the father is away for work"* (ME01). Another participant described a more serious scenario: *"As we speak, my wife is in the hospital with our child waiting to be medically operated, but I'm not a doctor, so I better be working and earning here to support them financially"* (ME08). This comment highlights the difficult trade-offs faced by mining workers, where economic provision is often prioritized over physical presence, even during high-stakes family situations.

Overall, these findings illustrate how FIFO arrangements can fracture everyday family events and introduce complex emotional negotiations for both parents and children (Gardner et al., 2018). The tension between income security and emotional availability represents a core dilemma for families engaged in FIFO work arrangements, one that is often exacerbated during times of celebration or crisis.

5.1.2.4 Spousal Relationship

When asked about spousal relationship challenges associated with FIFO work arrangements, four out of eight interview participants reported difficulties. However, they also explained they were able to continue in the relationship through understanding and spousal support for each other, all were able to manage their challenges except for one participant. One participant shared a deeply personal account of the gradual deterioration of their marriage: *"I have started working with FIFO arrangements two years ago, the first year was good but my spousal relationship got bad in the second year, and we finally divorced"* (ME04). Sincovich et al. (2018) observed that towns with a high concentration of FIFO workers exhibited higher divorce rates compared to the national average in Australia. Unfortunately, in this case, the consequences of marital breakdown extended beyond the couple themselves, directly affecting their child. The participant explained that they were no longer able to send their four-year-old to kindergarten due to the absence of a caregiver to accompany the child. As a result, the child had to remain in the countryside with their grandparents, highlighting how family disruptions can lead to the exclusion of children from early childhood education.

Notably, this topic appeared to cause a degree of discomfort among several interview participants. Hesitations, pauses, and non-verbal cues suggested that some individuals found the question regarding spousal relationships too personal or emotionally difficult to address. This highlights an important methodological consideration: questions involving intimate or sensitive

aspects of participants' lives, such as marital conflict, require careful framing and delivery to ensure ethical and respectful engagement. While spousal dynamics are relevant in understanding the broader social implications of FIFO work arrangements, researchers must remain careful to respect signs of participant discomfort and be prepared to adjust accordingly. In this study, whenever signs of unease were observed, the conversation was promptly redirected to another topic, and no follow-up questions were pursued unless participants themselves volunteered further information. This approach aimed to balance the pursuit of meaningful insight with ethical responsibility and emotional sensitivity.

5.1.3 Positive Impacts – Nomadic Herders

5.1.3.1 Job Opportunity

Five out of sixteen interview participants from the nomadic herder group identified job opportunities as a positive impact of mining. In most of these cases, participants had at least one family member employed in the mining sector. Interestingly, one interview participant had transitioned from a traditional nomadic lifestyle to employment at the mining site, while two others had previously worked in the mining sector but later returned to their nomadic way of life. This observation may reflect the implementation of Corporate Social Responsibility (CSR) practices (Reed, 2002) particularly in relation to local hiring preferences.

Notably, many other participants responded with a firm “none” when asked about positive impacts, suggesting a strong perception of mining as offering limited local benefit as well as lack of Social License to Operate (SLO) in the area (Robert G. Boutilier & Thomson, 2018). A nuanced contrast also emerged in the terminology used: mining employees tended to highlight “higher salary,” whereas herders more frequently referred to “job opportunity,” highlighting the scarcity of employment options in remote areas such as Gurvantes.

5.1.3.2 Economic Stimulation

Two participants from the nomadic herder group noted that mining activities have brought a degree of economic stimulation to their town. This was attributed to the influx of people and increased movement in and around the community, which in turn has contributed to the growth of side businesses such as food services, small retail shops, and other informal trade as the town population has increased by 30% in the last ten years compare to the national average of 17% population growth over the past decade (National Statistics Office of Mongolia, 2025c). These

responses suggest that, while limited, some economic spillover effects from mining operations are perceived at the local level despite mining's usual economic impact on a country's GDP (Azapagic, 2004) as it is reflected on Mongolia's economy as mining accounts for one third of the national GDP (National Statistics Office of Mongolia, 2025b).

5.1.4 Negative Impacts – Nomadic Herders

5.1.4.1 Air Pollution

Twelve out of sixteen nomadic herders interviewed identified air pollution as a major concern resulting from increased vehicle traffic associated with mining operations as well as the chemical contaminations generated by the mining operation. Participants specifically highlighted the movement of trucks and cars as the primary source of dust, which they perceived to have caused significant deterioration in local air quality. One participant expressed concern by stating, *"I thought I was living in a rural town where air quality is supposed to be excellent, but look at it, the dust pollution is bad. I'm worried for my children's respiratory health"* (NH06). These accounts reflect a shared perception that mining-related transportation is negatively affecting environmental conditions and raising health concerns for local families, particularly children.

In addition to widespread concerns about dust pollution, some nomadic herders particularly those residing in close proximity to mining sites, raised specific concerns about coal soot and other chemical contamination that is present in other open pit mining operations (Csavina et al., 2012). Three interview participants reported that the internal organs of their livestock, especially the intestines and lungs, appeared abnormally darkened upon slaughter. This observation was perceived as a sign of serious contamination and rendered the intestines inedible for household consumption. One participant questioned the broader implications for human health, asking, *"If animals' lungs are noticeably darker, what's going on our lungs?"* (NH14).

One herder explained that coal particles in the air had caused the cashmere of their goats to turn visibly darker, significantly lowering its market value saying, *"Those white goats' cashmere would all turn black because of coal soot and their value would significantly decrease"* (NH15). These testimonies reflect broader anxieties among local residents about the long-term health and economic consequences of living in close proximity to intensive coal extraction and transportation activities.

5.1.4.2 Groundwater Depletion and Pasture Degradation

The Gobi Desert is already recognized as an ecologically fragile region experiencing reduced rainfall and increasing aridity (Han et al., 2021). Within this context, groundwater depletion emerged as a significant concern among the interview participants, with nine out of sixteen nomadic herders identifying it as a negative impact of mining. Participants explained that mining companies use heavy equipment to drill deep wells for their operational needs, which they believe has adversely affected traditional manually dug wells used by local herders. One participant remarked, *"We used to have flowing streams in the valley decades ago. But now, look, there is nothing"* (NH16), underscoring the perceived environmental degradation over time.

Additionally, concerns were raised about unfulfilled corporate social responsibility (CSR) (Reed, 2002) commitments related to water access. One participant expressed disappointment, noting, *"These companies promised to dig a well for the community, but nothing happened. I won't take the well with me when I leave the world, it will be for the future generation herders"* (NH16). These responses highlight both environmental impacts illustrated by decreased groundwater storage (Feng et al., 2022) and trust related issues linked to resource use and lack of SLO in the region (Robert G. Boutilier & Thomson, 2018).

Similar to concerns about groundwater depletion, nomadic herders also raised issues related to the reduction in both the size and quality of available pastureland. Participants attributed this degradation to several interrelated factors, including the overuse of groundwater resources by mining operations, the direct loss of grazing areas due to land acquisition and displacement, decreased rainfall in recent years, and the spread of dust pollution generated by mining related traffic and activity. The loss of pasture is particularly severe in the areas that are close to the mining pit in Gurvantes compared to areas that are further away from the site (Sternberg et al., 2025). These conditions collectively contribute to the diminishing suitability of pastures for livestock grazing, which is central to the nomadic herding lifestyle.

5.1.4.3 Hospital services

Another major concern raised by the majority of nomadic herders interviewed was the poor quality of health services available in Gurvantes soum hospital. Twelve out of sixteen participants expressed dissatisfaction with the town hospital, describing the healthcare system as inadequate, particularly for children. Key issues included the absence of essential medical services such as surgical and obstetric care. One participant shared a personal experience: *"My daughter had to*

travel 320 km to Dalanzadgad (the provincial capital) *for her labor a month ago and travel back with her week-old infant on this horrible road"* (NH10).

In discussing the broader context, some interviewees linked the poor health infrastructure to the long-standing presence of the mining sector in the area. It was evident that local communities expected mining companies to invest in and demonstrate commitment toward the provision of social services and infrastructure, particularly hospitals and related facilities as part of their CSR. There was a shared sentiment that mining companies had not fulfilled their corporate social responsibility in contributing to essential services. One participant reflected this frustration: *"Well, these mining companies have been here for 30 years, and at least they could have helped improve it. Ideally, we should have had a world-class hospital by now"* (NH13) bringing CSR and SLO concern again (Reed, 2002; Robert G. Boutilier & Thomson, 2018).

5.1.4.4 Influx in population

Another concern frequently raised by nomadic herders was the influx of people into Gurvantes soum. Participants reported a noticeable increase in population due to both internal migration – individuals and families relocating to settle in the town – and the arrival of FIFO workers who temporarily reside in the area for mining related employment. Many participants labeled the newcomers as "outsiders" or "aliens" referring to those who came from other parts of the country to work in the mining sector. According to the National Statistics Office of Mongolia (2025a), the population of Gurvantes soum has increased by 30% over the past ten years, compared to a national population growth rate of 17% during the same period. This indicates a significantly higher rate of population growth in the soum, which may be linked to the expansion of mining activities and associated in-migration, a problem that has also been observed in small mining host communities, particularly with the influx of young male workers in British Columbia, Canada (Goldenberg et al., 2010b).

In addition to domestic migration, several herders also pointed to the increasing presence of Chinese migrant workers employed in the mining sector. This was often raised as a distinct and more sensitive issue, suggesting underlying concerns rooted in broader societal attitudes. Given Mongolia's largely homogenous population, the arrival of foreign nationals, particularly in concentrated numbers for industrial work, was perceived by some participants as a disruption to local social and cultural dynamics.

5.1.4.5 Education

As discussed in Section 5.1.1, mining has positively impacted the children of mining employees, particularly in enabling access to better educational opportunities such as private schooling and extracurricular programs. This benefit is closely tied to higher household income, which enhances educational investment. However, this positive trend did not recur among the children of nomadic herders. None of the herder participants reported any educational benefits linked to mining. Instead, two prominent negative impacts on education were consistently identified in the interviews.

First, participants expressed concern over the high turnover of teaching staff. One frequently mentioned explanation was that teachers, particularly during their summer break, take up temporary positions in the mining sector due to significantly higher wages. In some cases, these temporary shifts become permanent, resulting in a shortage of teachers. As one herder explained, *"Many teachers take temporary jobs in the mining industry during their long summer break, and often they stay on because of the better pay"* (NH12). Additionally, participants noted an increase in transient teachers, often spouses of mining employees, who relocate to Gurvantes soum but lack long-term commitment to the local education system. This pattern was seen as disruptive to educational continuity and quality.

Second, the strain on educational infrastructure was a major concern. Despite the presence of two secondary schools and three kindergartens in Gurvantes soum, participants described growing pressure on classroom space and childcare availability. Seven out of sixteen herders interviewed specifically mentioned the difficulty of enrolling their children in kindergarten due to limited capacity. Population growth in the town, fueled by the influx of mining workers and their families, has increased the burden on local facilities. The increased demand has led to two-shift schooling, which not only reduces daily instructional time but also limits opportunities for afterschool support and extracurricular activities.

These findings indicate that while mining has enabled some families - particularly those directly employed in the sector - to improve their children's educational outcomes, it has simultaneously contributed to declining educational access and quality for others. The contrast highlights the uneven distribution of social impacts of mining and shows the need for more inclusive and equitable development planning in the impacted regions.

5.1.4.6 Violence and Safety

Child safety emerged as a prominent concern among nomadic herders in Gurvantes soum, particularly in relation to the demographic shifts associated with mining expansion. Many participants expressed unease over the influx of individuals from other regions or "aliens," which was frequently linked to a broader sense of insecurity, especially concerning children's safety in public spaces.

Participants reported a heightened fear of violence or harassment targeting children, which has led to notable changes in community routines. In contrast to previous norms, families and schools have increasingly adopted precautionary measures such as escorting children to and from school. This shift reflects rising anxiety among caregivers and educators about the exposure of children to potential risks. One particularly troubling incident, recalled by several interviewees, involved an alleged attempt by a group of men to force school girls into an unregistered vehicle. Although local police intervened quickly and saved the children, the incident continues to influence parental perceptions and practices surrounding child safety. Since 2017, crimes against children have increased fourfold nationwide from around 15 to over 65 convicted cases annually (National Statistics Office of Mongolia, 2025a), some bringing public attention in which may contribute to heightened public fears of violence or harassment targeting children.

Not all participants shared this sense of decline in public safety. One interviewee (NH14) offered a contrasting perspective, noting that the town had become more peaceful in recent years. They attributed this improvement to the employment of previously disruptive individuals, such as chronic alcohol users, in the mining sector, stating, *"I think the violence issue in town got better because those alcoholics who used to wander around got a job in the mine, so it is more peaceful now."* This observation suggests that while mining introduces new social risks, it may also contribute to stabilizing certain vulnerable segments of the population, even suggesting yet another positive impact.

Another child safety issue raised during the interviews was parental absenteeism. Several participants described situations in which children, particularly adolescents, were left to live semi-independently due to their parents' work commitments. One grandparent explained, *"One of my granddaughters, who is 13, pretty much lives by herself in town as her parents work in the mine. But she lives right next to the family of my other child, so it kind of works out okay"* (NH03). While such informal family arrangements may help mitigate caregiving gaps, they also highlight the

fragility of support systems in mining-affected areas, where access to formal social services remains limited and reliance on extended family networks is high both culturally and practically.

These findings highlight the need to consider child protection not only in terms of direct abuse or violence, but also in relation to structural conditions such as population influx, shifting family dynamics, and gaps in institutional support that affect children's daily security and care. In mining host communities like Gurvantes, the introduction of new actors and intensified economic activity has reshaped both the perceived risks and the resources available to families, producing a complex landscape for child protection that warrants targeted policy attention.

5.1.4.7 Displacement and Threat to Nomadic Lifestyle

The displacement of nomadic herders was mentioned as a recurring concern in the context of mining expansion. Five out of sixteen nomadic herder interview participants raised this issue, with some expressing anxiety about when they themselves might be displaced. In fact, one participant had already given up the nomadic lifestyle and now works at a mining site, a clear example of livelihood transformation as a result of displacement.

A key nuance in this issue lies in the legal versus traditional claims to land. In Mongolia, all land is formally owned by the state, meaning that nomadic herders do not hold legal land titles and thus cannot formally contest land use by mining companies. However, in practice, many herding families have lived and grazed their livestock in these areas for generations. While their legal rights may be limited (Sternberg et al., 2022), their historical and cultural claims are often acknowledged informally in practice.

Traditionally, Mongolian herders relocate four to five times per year in search of better pasture and to maintain ecological integrity. However, the expansion of mining operations has increasingly limited these movements. One participant reflected on this shift, stating: *"We are unable to move anymore. There is nowhere else with pasture"* (NH16). This sentiment illustrates a growing sense of loss not only of land, but also of the core identity of a nomad. Comparable challenges are evident in Nordic mining contexts, where the Sami people have experienced displacement and discrimination, and where stakeholder perspectives on Indigenous rights differ significantly (Lindman et al., 2020). Although mining companies operating on Sami lands argue that they comply fully with legal requirements regarding compensation for damages, public debate on the issue suggests that there remains considerable room for improvement (Ranängen & Lindman, 2017), indicating lack of SLO in this case.

5.1.4.8 Bad Road Conditions

In addition to dust pollution caused by heavy traffic, road infrastructure issues were raised as a distinct concern by four interview participants. While approximately 250 kilometers of the 330-kilometer road connecting Gurvantes soum to the provincial capital, Dalanzadgad, is paved, the remaining 80 kilometers remain unpaved and are in extremely poor condition, characterized by loose sand, frequent bumps, and surface damage. Further infrastructure development of paved highway to the border for coal transportation was made (Sternberg et al., 2025) using local government budget funded through mining companies; however, the participants have stressed the constant use of dirt road as the highway is limited only to certain authorized vehicles. Participants noted that these road conditions significantly hinder travel, particularly during emergencies or in adverse weather. Moreover, the roads within and around Gurvantes itself are largely unpaved and similarly degraded, posing daily challenges for residents, especially for those relying on smaller or less durable vehicles. These poor transportation conditions contribute not only to reduced mobility but also exacerbate health and safety risks for both herders and other community members.

5.1.4.9 Electricity dependency

Another infrastructure-related concern raised by participants was electricity dependency. Gurvantes soum relies entirely on electricity imported from China, and several nomadic herders expressed concern about frequent and unpredictable power outages in the town center. Although most nomadic households live outside the soum center and typically rely on solar panels for their own energy needs, participants still emphasized this issue as a broader community impact. The unreliability of the power supply affects public services and daily life for residents in the soum center, highlighting the vulnerability of essential infrastructure in remote, mining host areas.

5.1.4.10 Other impact

One particularly unusual impact mentioned by a participant involved the proliferation of stray dogs in the area, reportedly originating from mining camps. According to the participant, the number of stray dogs has increased significantly over time, to the point where they have begun attacking local livestock, including sheep and goats. This issue illustrates how unintended ecological consequences of industrial activity can escalate into serious social and personal tragedies. As that participant shared *"Actually, I lost my husband because of these dogs. He was*

fighting with the dogs as they attacked our goats and he fell hurting his back and he had to be hospitalized. Unfortunately, he did not recover from the injury and eventually, passed away" (NH16). This account highlights a deeply personal consequence of what may otherwise be considered a secondary impact of mining, highlighting the complex and far reaching nature of social impacts experienced by host communities.

5.2 EXPLAINING THE SOCIAL IMPACTS

While the previous section examined the social impacts experienced by the target groups, this section analyzes the underlying factors that shape those impacts. By examining the common themes emerging from the data, this analysis aims to provide a deeper understanding of the conditions and dynamics influencing the lived experiences of children of mining employees and nomadic herders in the mining host communities.

Factors shaping the impacts are classified as positive, negative, or neutral, with neutral factors exerting either positive or negative influence depending on the context.

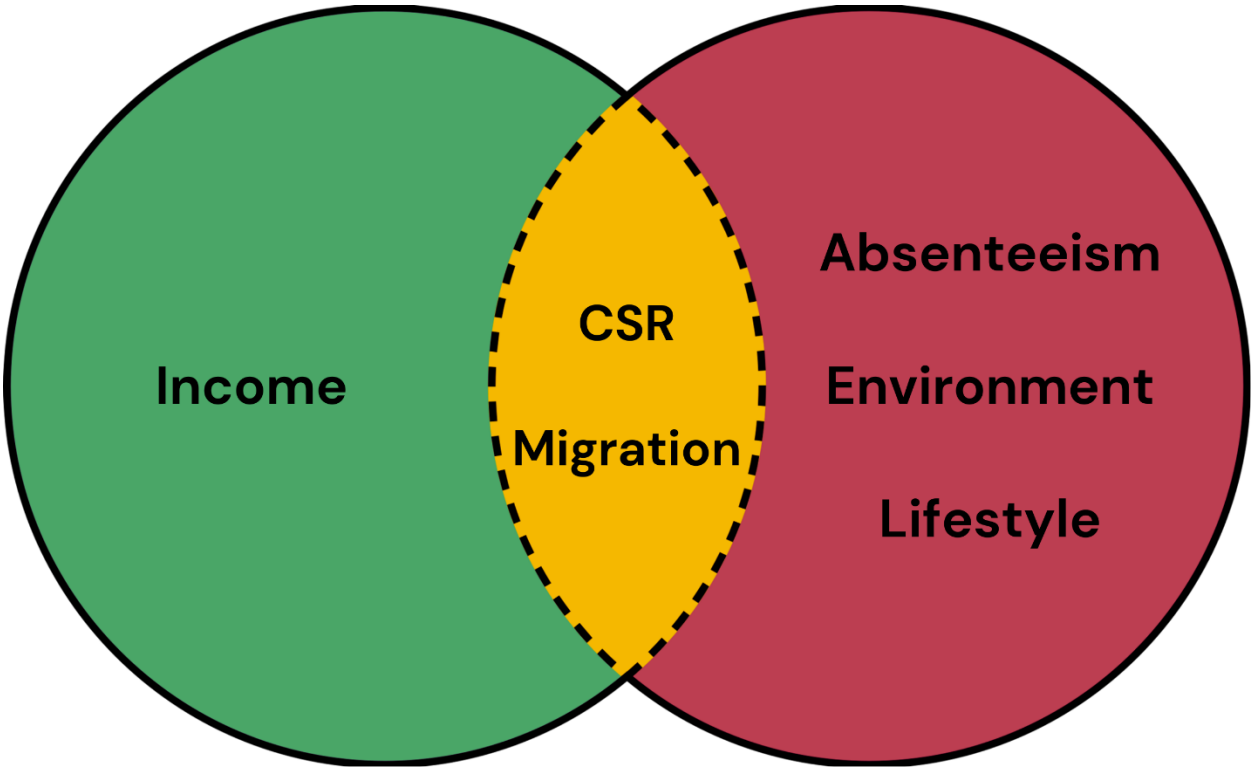

Figure 18: *Factors that shape the social impacts of mining categorized into positive, negative and neutral fields*

Figure 18 illustrates the categorization of factors shaping social impacts. The green area represents factors associated with positive impacts, while the red area indicates factors linked to negative impacts. The overlapping yellow area denotes neutral factors that can shape both positive and negative impacts, depending on the specific context and perspective. These categorizations are elaborated upon in the following section.

5.2.1 Income

The income factor plays a critical role in shaping several positive social impacts at the household level, including improved access to job opportunities, higher wages, timely salary payments, and the capacity to invest in better educational opportunities for children. While the economic contributions of mining are often discussed in terms of national GDP and employment rates at the macro level (Azapagic, 2004), this study highlights the centrality of income as a determinant of social outcomes at the micro level. In particular, mining employees reported that the decision to pursue FIFO employment was made voluntarily and often with full awareness of the associated trade-offs. The financial benefits of such jobs appear to outweigh many of the challenges, especially in households where economic needs are prioritized. As one participant noted, *"Even my child understands it if I explain it through money when he asks why father has to choose to work at a mining site"* (ME01). This underscores how income not only supports material wellbeing but also informs family narratives and justifies difficult choices in resource constrained settings.

5.2.2 Corporate Social Responsibility

One consistent factor identified both in the literature and in the data is CSR, as mining companies today are expected by the stakeholders and public to demonstrate stronger commitments to sustainable development (Moffat & Zhang, 2014; Reed, 2002). CSR influences both positive and negative social impacts. On the positive side, CSR initiatives are often visible in employee related benefits, such as higher salaries and welfare packages. Large scale international projects, such as Oyu Tolgoi, are recognized for explicitly incorporating employee wellbeing into their CSR strategies as noted by several interview participants. Beyond the workforce, CSR is also linked to broader community contributions, including consultations with host communities, infrastructure development, and investments in social services. For instance, the construction of

roads and scale of facilities development in Gurvantes soum over the past two decades can easily be witnessed (Sternberg et al., 2025).

On the negative side, CSR can also generate community discontent when promises remain unmet or when initiatives are perceived as insufficient as trust, fairness and acceptance are crucial factors in social acceptance (Mercer-Mapstone et al., 2018; Saenz, 2019). Inadequate health services or limited infrastructure improvements were highlighted as sources of frustration, undermining the SLO. As noted by one participant (NH13), the gap between community expectations and the actual benefits delivered through CSR can break trust. While perceptions of CSR are often subjective and shaped by individual experiences, the majority of participants expressed critical views about the scale and quality of infrastructure development attributed to mining in Gurvantes soum particularly with regards to poor road conditions, hospital services and insufficient kindergarten facilities. While construction of roads and hospitals were visibly ongoing the speed and timing of them being late was another common complaint among nomadic herders.

5.2.3 Migration

Migration associated with mining activities generates a wide spectrum of social impacts, ranging from population growth and economic stimulation to heightened concerns regarding community safety and social cohesion. These impacts reflect both the perceived opportunities and the tensions that emerge from rapid demographic change in mining-affected areas.

On the positive side, migration contributes to local economic activity and stimulates small and medium-sized businesses, thereby strengthening regional and national economies (Azapagic, 2004). In the case of Gurvantes, the population has increased by approximately 30% over the past decade, compared to a national average of 17%. This growth is closely linked to mining development, which contributes nearly one-third of Mongolia's overall economy (National Statistics Office of Mongolia, 2025b).

On the negative side, migration is often associated with social stressors such as increased risks of violence, substance addiction, and inadequate housing, which collectively intensify concerns over safety and community well-being (Goldenberg et al., 2010). Several interview participants emphasized the growing unease around youth safety, noting that parents frequently feel the need to accompany their teenage children to and from school as a precautionary measure linked to the influx of newcomers.

5.2.4 Absence from home

Absence from home represents one of the most significant negative impacts associated with fly-in fly-out (FIFO) employment. These impacts include disrupted parental involvement, weakened family relationships, and in some cases, increased divorce rates (Carrington & Pereira, 2011; Gardner et al., 2018; Sincovich et al., 2018). In this study, the majority of survey participants reported working under a two-weeks-on, two-weeks-off schedule, which means they are absent from their families in total days for at least half of the year. Such regular and prolonged periods of absence create multiple challenges not only for mining employees but also for their families, particularly their children. Seven out of eight interview participants with FIFO work arrangements identified absenteeism as a key challenge affecting family life.

Another issue highlighted by participants concerns the way travel time is counted as part of their off days. One participant explained: "*Pretty much four out of that fourteen days of my off time is travel*" (ME16). For employees residing in the far eastern regions of the country, the lengthy bus journeys to and from the mining site significantly reduce their effective time at home, further exacerbating the strain on family relationships.

5.2.5 Environment

The environmental factor shapes several negative impacts, including dust pollution (Csavina et al., 2012), groundwater depletion (Feng et al., 2022), and pasture degradation (Sternberg et al., 2025) coupled with other contributing factors such as climate change. These issues profoundly affect the daily lives of nomadic herders, particularly by disrupting access to essential resources and compromising their basic needs such as clean water and fresh air.

For nomadic herders in particular, environmental issues were the foremost concern raised during interviews when asked about the negative impacts of mining. Because these environmental pressures directly disrupt their daily lives and livelihoods, they are not only ecological in nature but also constitute significant social impacts.

5.2.6 Lifestyle

The lifestyle factor shapes impacts that directly affect the everyday lives of nomadic herders and threaten the continuity of their traditional practices and cultural identity. The decline of pastoralism and the loss of grazing land in the Gobi Desert, particularly over the past two decades, have made such impacts unavoidable (Sternberg et al., 2025). This issue extends beyond

Gurvantes soum; it is significant in the Gobi Desert, as nearly one third of Mongolia's population continues to practice nomadism (Sternberg et al., 2025). The restriction of mobility whether through displacement or reduced access to pastures threatens the very foundation of nomadic life.

In mining host communities such as Gurvantes, the relationship between mining operations and herders has become both inevitable and complex. On one hand, mining activities displace herders, forcing them to abandon traditional mobility. On the other hand, some displaced herders relocate toward mining sites in search of employment opportunities. Both dynamics – mining moving into herders' lands and herders moving toward mines – were clearly observed during the fieldwork and data analysis for this research. (Lahiri-Dutt & Dondov, 2017) articulates that nomads in Mongolia are not only confronting the challenges of climate change and poverty but are also seeking to claim a share of mineral resources benefits by directly participating in mining activities.

5.3 Social Impact Assessment as a tool to address social impacts of mining

Social Impact Assessment (SIA) provides important opportunities for countries to address the social impacts and related outcomes of large-scale projects such as mining (Vanclay et al., 2015). In many jurisdictions, such as Canada, SIA has become embedded within legal systems alongside other assessments such as Environmental Impact Assessment (EIA) (Impact Assessment Act, 2019).

However, Mongolia lacks such a legal framework (Sternberg & Ahearn, 2023), and the need for it is highlighted by the findings of this research. Although developing countries face challenges such as conflicting policy objectives, legislative particularities, and institutional limitations such as efficiency (Cao, 2007), the legalization and proper implementation of SIA could help mining companies secure a Social License to Operate (SLO) (Mercer-Mapstone et al., 2018; Saenz, 2019) while also giving voice to vulnerable groups, particularly the children of mining employees and nomadic herders in host communities such as Gurvantes soum.

This discussion chapter has interpreted and explained the social impacts of mining on two distinct groups: the children of mining employees and the children of nomadic herders. The concluding chapter will provide an overview and summary of the study, along with insights and recommendations for future research.

6 CONCLUSION & RECOMMENDATIONS

This chapter concludes the study by presenting the main findings derived from the previous chapters, highlighting the contributions of this research to the wider body of literature, and offering recommendations for future research.

6.1 CONCLUSION

This thesis was guided by two main objectives. The first was to understand the social context and identify the social impacts of mining on children of mining sector employees and those living in mining host communities in the Gobi Desert of Mongolia. The second was to explain these social impacts in greater depth through common factors that shape those impacts.

The findings reveal that the social impacts experienced by children in mining host communities are complex and differentiated according to family background - whether the children belong to mining employees or to nomadic herders. For the children of mining employees, impacts were largely tied to income and parental absence. On one hand, higher salaries enabled families to afford better education and improved living conditions. On the other hand, prolonged parental absence due to FIFO work schedules created challenges such as weakened behavioral control, reduced communication, and in some cases, family breakdown and divorce.

By contrast, for the children of nomadic herders, impacts were primarily socio-environmental and health-related, stemming from dust pollution, groundwater depletion, and pasture degradation. Other impacts related to mining companies' CSRs activities also influenced children's health, access to education, and lack of investment in infrastructure, while also intersecting with wider concerns such as child protection and a threat to traditional livelihoods; and these impacts can be positive or negative depending on the context, legal frameworks and perspectives of the stakeholders.

To better explain these dynamics, seven thematic impact shaping factors were identified. Income emerged as the only factor producing consistently positive impacts, relevant to both groups. CSR and migration were found to produce both positive and negative impacts depending on implementation, perception, and local context, and they too affected both target groups. Parental absence, however, shaped an exclusively negative impact, particularly for children of mining

employees. Meanwhile, environment and lifestyle factors were uniquely emphasized by nomadic herders and similarly shaped only negative impacts.

Taken together, these findings illustrate how income stands out as the sole common positive factor, while negative impacts from education and health challenges related to environmental and cultural disruption are strongly context specific. This highlights the need for targeted interventions and differentiated policy responses that address the distinct lived realities of mining families and nomadic herders in Mongolia's Gobi Desert.

6.2 CONTRIBUTIONS

The primary contribution of this research to the broader literature lies in highlighting the pressing need for further study of Social Impact Assessment (SIA) in mining, particularly in developing countries in Asia such as Mongolia. These contexts face diverse legal and institutional challenges (Cao, 2007), yet most of the existing scholarship is concentrated in high-income countries such as Australia and Canada. The challenges in Central and East Asia are unique due to their cultural, economic, and geographical circumstances, which differ significantly from those of other developing regions. Despite the contrast between high-income and developing countries, this study also explored the similarities and differences in social impacts on children in both urban and nomadic settings, highlighting how mining can affect multiple communities in similar or distinct ways within the same country. Research in these settings can make valuable contributions to global scholarship by addressing existing geographical and contextual gaps, with particular attention to the vulnerabilities of children and nomadic populations.

Very little work has examined the social impacts of mining on children specifically, and this study contributes to filling that gap by offering insights that may be applicable across global contexts. At the same time, the intersection of mining and nomadic populations represents a unique challenge, providing a novel perspective that enriches both regional and global debates on the social dimensions of mining.

6.3 RECOMMENDATION FOR FUTURE RESEARCH AND POLICY MAKING

Legalizing Social Impact Assessment (SIA) with comprehensive requirements and group specific guidelines is essential. Because social impacts include multiple dimensions - environmental, economic, cultural, and health as explained in this research - one option for

Mongolia could be to integrate SIA into the existing Environmental Impact Assessment law, rather than mandating a separate stand-alone law. Such legal frameworks should mandate the identification and mitigation of social impacts that are uniquely experienced by different community groups, particularly vulnerable populations such as the children of mining employees and the children of nomadic herders in mining host communities of the Gobi Desert. This includes, for example, the recognition and protection of stronger herder rights to communal land and water resources (Sternberg et al., 2025).

Further research could examine alternative approaches to impact assessment, such as regional assessments that identify common impacts across specific areas rather than focusing solely on individual projects. Likewise, strategic level assessments are particularly relevant in countries like Mongolia, where most large-scale mining projects are of national importance, and could provide insight into cumulative impacts. In addition, a closer examination of mining legacies - especially issues related to mine closure from both environmental and social perspectives - will be an important area for future contributions to the literature on the impacts of mining in Mongolia.

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APPENDICES

APPENDIX A: QUALTRICS SURVEY INFORMATION LETTER

Project Title: Social Impact of Mining on Children: A case study in Gobi Desert of Mongolia

Faculty Supervisor: Dr. Felicitas Egunyu, School of Environment, Recourses and Sustainability, University of Waterloo, felicitas.egunyu@uwaterloo.ca

Student Investigator(s): Battumur Batbayar, School of Environment, Resources and Sustainability, University of Waterloo, bbatbayar@uwaterloo.ca

This letter explains what the study is about, what participation involves, possible risks and benefits, and your rights as a survey participant. You may print/save a copy for your records. If you do not understand something in the letter, please ask one of the investigators before consenting to participate.

What is the study about?

Social impact assessment of mining projects is not a common practice in Mongolia as there is no law in the country that requires it, yet mining exploration and exploitations are occurring all over the country, particularly in the Gobi Desert region, creating economic and social impacts. The purpose of this study is to identify the potential social impact of mining on the children of host communities including nomadic herders, local residents of Gobi Desert, Mongolia and immediate family members of the mining sector employees that have fly-in, fly-out job rotations.

What does participation involve?

It will involve an online questionairre of approximately 15-20 minutes. Your will first be asked some demographic information such as age, gender, education level, marital status and number of children you have. The remaining questions ask about your perspectives on social impact of mining on children in relation to your (or your spouse's) fly-in, fly-out job rotation in the mining sector in Mongolia. With your permission, anonymous quotations from the open-ended responses may be used in papers and publications.

Further, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher. If you wish to withdraw your study data after participating, please contact Battumur Batbayar . You can request your data be removed from

the study up until February 28, 2025 as it is not possible to withdraw your data once papers and publications have been submitted to publishers.

Please note that withdrawal is limited if you are participating in the survey only as your identity will not be collected.

Who may participate in the survey?

To participate in this survey, you (or your spouse) must have fly-in, fly-out rotational employment in the mining sector in the Gobi Desert region of Mongolia and you also must have a child(ren) aged between 0-18 years of age.

Is participation in the survey voluntary?

Participation in this survey is voluntary. You may stop participating it at any time by not submitting your responses and closing your web browser. You can also skip questions that you do not wish to answer.

Will I receive anything for participatin in the survey?

No.

What are the possible benefits of the survey?

Participation in this study will not provide any personal benefit to you. Data from this study may contribute to the public discussion on social impact of mining on children.

What are the risks associated with the survey?

There are no known or anticipated risks associated with participation in this study. If a question or the topic makes you uncomfortable, you can choose not to provide a response.

How is data collected, stored and protected?

If you are interested in participating in an interview following the survey, you will be asked to provide your name and contact information. We will replace this information with a code to keep your identity confidential. When results are reported, your identity will be confidential. Data collected during this study will be retained for at least 3 years to which only researchers associated with this project will have access. The data will not be shared publicly.

At the end of the survey you will be asked if you are interested in participating in an interview to further discuss about Social impact of mining on children. If you answer “Yes” or “Maybe”, you will have to provide your email address for the interview scheduling or for further clarifications about the interview. If you answer “No”, no problem, you will be completed with the survey.

You will be completing the study by an online survey operated by Qualtrics. Qualtrics has implemented technical, administrative, and physical safeguards to protect the information provided via the Services from loss, misuse, and unauthorized access, disclosure, alteration, or destruction. However, no Internet transmission is ever fully secure or error free. We do not collect or use internet protocol (IP) addresses or other information which could link your participation to your computer or electronic device.

Who is funding this study?

This study is funded by a University of Waterloo faculty starter grant from Dr. Egunyu Felicitas.

Has this study received ethics clearance?

It has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #46762). If you have questions for the Board, contact the Office of Research Ethics, toll-free at 1-833-643-2379 (Canada and USA), 1-519-888-4440, or reb@uwaterloo.ca

Who should I contact if I have questions regarding my participation in the study?

For all other questions or if you would like additional information to assist you in reaching a decision about participation, please contact me by email at bbatbayar@uwaterloo.ca . You can also contact my supervisor, Dr. Felicitas Egunyu at 519-888-4567 ext. 40039 or email felicitas.egunyu@uwaterloo.ca .

APPENDIX B: SURVEY QUISTIONNAIRE

Survey questions for Social Impact of Mining on Children: A case study in GobiDesert of Mongolia

1. I have read the information presented in the recruitment poster about the study being conducted by Battumur Batbayar from the School of Environment, Resources and Sustainability at the University of Waterloo, Ontario, Canada.

I am aware that answers I will give in this survey will be analyzed and published in graduate thesis and other international journals.

I am aware that I may withdraw my consent at any time without penalty by advising the researcher. Data cannot be withdrawn after results have been published.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB # 46762). If you have questions for the Board, contact the Office of Research Ethics, toll-free at 1-833-643-2379 (Canada and USA), 1-519-888-4440, or reb@uwaterloo.ca.

For all other questions contact Battumur Batbayar at email, bbatbayar@uwaterloo.ca or through phone number, at +976 99224240

- I hereby agree, of my own free will, to participate in this survey.
- I agree to the use of anonymous quotations in any paper or publication that comes from this research
- I agree to allowing my study data to be used for future purposes and publications.

- Yes
- No

2. Age group *

Mark only one oval.

- Under 18
- 18-29
- 30-39
- 40-49
- 50-59
- Above 60

3. Gender *

Mark only one oval.

- Female
- Male

4. Education level *

Mark only one oval.

- No formal eduction
- Secondary school
- High school diploma
- Bachelor's degree or higher

5. Marital status *

Mark only one oval.

- Single
- Married
- Common law partnership Divorced
- Widowed
- Other:

6. How many children do you have? *

Mark only one oval.

- 1
- 2
- 3
- 4
- 5 and above

7. Please indicate the age of each of your children *

8. Do your child(ren) go to kindergarten or school? *

Mark only one oval.

- Kindergarten
- School
- None

9. How long have you (or your spouse) worked in mining sector? *

10. How does your (or your spouse's) fly-in, fly-out rotation work? How many weeks on/off?*

11. On average, how long do you (or your spouse) must be absent from home for work? *

12. During last one year from today, how many times did you miss important events (birthdays, holidays, celebrations etc) in your family due to work? *

13. What were the important events you missed in your family? *

14. During last one year from today, how many times did you miss important events in your children's school or kindergarten (graduations, performances, sports events etc)? *

15. What were the important events you missed in your children's school/kindergarten? *

16. During last one year from today, how many times did you (or your spouse) need your spouse's company for hospital emergencies? *

17. If possible, would you be willing to relocate to your (or your spouse's) work location? Why or why not? *

18. Are you interested in participating in an interview for about 60 minutes to further talk about this subject? *

- Yes
- No
- Maybe

19. Please insert your email address if you answered "Yes" or "Maybe" to the previous question. Please put NA if you answered "No". *

APPENDIX C: SURVEY RECRUITMENT SCRIPT

Hello,

My name is Battumur Batbayar and I am a Master's student working under the supervision of Dr. Felicitas Egunyu in the School of Environment, Resources and Sustainability at the University of Waterloo in Ontario, Canada. I am contacting you because you recently provided your name and contact details through my research questionnaire and indicated you would be interested in being contacted regarding an interview about your (or your spouse's) employment modality of fly-in, fly-out rotations. The reason that I am contacting you is that we are conducting a study on Social Impact of Mining on children in Gobi Desert, Mongolia. We are currently inviting people to participate in this study. The inclusion criteria are that participants (or their spouse) must have a job with fly-in, fly-out rotation in one of the mining operations located in Gobi Desert, Mongolia and they must have a child(ren) under 18 years of age.

Participation in this study involves interview via Zoom where you will be asked about your (or your spouse's) employment modality of fly-in, fly-out rotation and its potential social impact on your child(ren). Participation in this study would take approximately 60 min of your time.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board.

Data and information collected during this interview will be analyzed and reported in my Master's thesis and articles, and they will be published in the University of Waterloo's thesis platform and other scientific journals. However, individual identities such as name, employer, age, and sex will not be disclosed.

Please let me know your preferred time and date (during business hours) for the interview and I will do my best to adjust to your schedule. Should there be a schedule conflict between us, I will contact you for a possibility of re-schedule.

If you are interested in participating, please contact me at bbatbayar@uwaterloo.ca indicating your availability. I will then send a confirmation email indicating that you have been signed up for an interview and provide you with further information concerning the location of the study. If you need to cancel your appointment, please contact me at the email listed above.

Sincerely,

Battumur Batbayar

APPENDIX D: INTERVIEW INFORMATION LETTER

Project Title: The Social Impact of Mining on Children: A case study in the Gobi Desert, Mongolia

Faculty Supervisor: Dr. Felicitas Egunyu, School of Environment, Recourses and Sustainability, University of Waterloo, felicitas.egunyu@uwaterloo.ca

Student Investigator(s): Battumur Batbayar, School of Environment, Resources and Sustainability, University of Waterloo, bbatbayar@uwaterloo.ca

This letter explains what the study is about, what participation involves, possible risks and benefits, and your rights as a research participant. You may print/save a copy for your records. If you do not understand something in the letter, please ask one of the investigators before consenting to participate.

Social impact assessment of mining projects is not a common practice in Mongolia as there is no law in the country that requires it, yet mining exploration and exploitations are occurring all over the country, particularly in the Gobi Desert region, creating economic and social impacts. The purpose of this study is to identify the potential social impact of mining on the children of host communities including nomadic herders, local residents of Gobi Desert, Mongolia and immediate family members of the mining sector employees that have fly-in, fly-out job rotations.

Perspectives of mining host community members and mining sector employees (and their spouses) are crucial to investigate the social impact of mining on children as they provide perspectives and opinions based on their lived experiences.

Participation in this study is voluntary. It will involve an interview of approximately 60 min in length to take place in a mutually agreed upon location. You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher. If you wish to withdraw your study data after participating, please contact the researchers. You can request your data be removed from the study up until 31 December 2024 as it is not possible to withdraw your data once papers and publications have been submitted to publishers.

With your permission, the interview will be audio recorded to facilitate collection of information, and later transcribed for analysis. Shortly after the interview has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or clarify any points that you wish.

Your identity will be confidential. Your name will not appear in any thesis or report resulting from this study, however, with your permission anonymous quotations may be used. Data collected during this study will be retained for at least 3 years to which only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB #46762). If you have questions for the Board, contact the Office of Research Ethics, toll-free at 1-833-643-2379 (Canada and USA), 1-519-888-4440, or reb@uwaterloo.ca.

For all other questions or if you would like additional information to assist you in reaching a decision about participation, please contact me by email at bbatbayar@uwaterloo.ca. You can also contact my supervisor, Dr. Felicitas Egunyu at 519-888-4567 ext. 40039 or email felicitas.egunyu@uwaterloo.ca

I hope that the results of my study will be of benefit to those directly involved in the study, other community members not directly involved in the study, as well as to the broader research community.

I very much look forward to speaking with you and thank you in advance for your assistance in this project.

Yours Sincerely,

Battumur Batbayar

APPENDIX E: INTERVIEW GUIDE – MINING EMPLOYEES

Research Project: Social Impact of Mining on children: A case study in Gobi Desert of Mongolia
INTERVIEW GUIDE – Mining Employees

Date: ……

Province: …… Town: ……

Interview code: ……

Interview start: ……. Interview Stop: …….

Introduction

Mining can help employees and their families by providing competitive salaries, good social status and comfortable working conditions. However, there are negative social impacts associated with mining. There is a little research about social impact of mining on children in Mongolia. The purpose of this research is to identify the potential social impacts of mining on children in Mongolia.

The study has following three parts:

Section 1 - Personal information

1. Do you work in the mining sector or does your spouse work?
2. How long have you (or your spouse) been working in mining sector?
3. What is the schedule of your (or your spouse's) fly-in, fly-out rotation? On average, how long do you (or your spouse) must stay away from home for work in a year?
4. Do your children go to school? If yes, which school do they go to?

Section 2 – Mining Benefits and Impacts

1. Can you describe the benefits of working in the mining sector?
2. Can you describe challenges and difficulties of working in the mining sector?
3. What do you think are the impacts of your absenteeism for work on your children?
4. What would you do if your child or you need medical help when your spouse is absent for work?
5. How often do you miss important events in your family and how do you feel about it?

6. Have your children ever expressed their opinions or emotions to you regarding your fly-in, fly-out absenteeism due to work?

7. Do you think you have any relationship issues with your spouse due to your job absenteeism?

8. Does your employer address (or is there any support on) the issue of social impact on your children due to your absenteeism at work?

9. Do you know of any policy, bi-laws, or practices that your employer makes an effort to address/mitigate any potential social impacts on your children?

Section 3 – Organizations working to mitigate mining impacts

1. Are you aware of any local or international NGOs, institutions and local government agencies that address the issue of social impact of mining?

2. Do you know about the purpose and agenda of these NGOs and local authorities?

3. How would you evaluate their performance? Do you have any recommendations or feedback to these organizations?

4. If you were in charge, what would you do to address any potential social impacts of mining, particularly on children?

THE END

APPENDIX F: INTERVIEW GUIDE – NOMADIC HERDERS

Research Project: Social Impact of Mining on children: A case study in Gobi Desert of Mongolia
INTERVIEW GUIDE – Nomadic Herders

Date: ……

Province: …… Town: ……

Interview code: ……

Interview start: ……. Interview Stop: …….

Introduction

Mining can help communities by providing alternative sources of income and other social welfares and benefits. However, there are negative social impacts associated with mining. There is a little research about social impact of mining on children in Mongolia. The purpose of this research is to identify the potential social impacts of mining on children in Mongolia.

The study has three parts, the first one involves identifying the impacts of mining on host communities. Through this interview, I would like to find out more about the effects of mining in the community.

Section 1 - Personal information

1. What do you do for living?
2. How long have you been living in this community?
3. How many children do you have and what are their ages?
4. Do your children go to school? If yes, which school do they go to?

Section 2 – Mining Benefits and Impacts

1. Can you describe the mining activity in your community?
2. Are you or anyone in your family engaged in mining? If, yes, can you describe what you/they do?

Benefits of Mining

3. Can you tell me how mining has benefited you and your family?
4. According to you, how has mining benefited your village/town?

Impacts of mining

5. How has mining affected you?

6. How has mining affected your family?

7. How has mining affected your community?

Section 3 – Organizations working to mitigate mining impacts

1. Are you aware of any local or international NGOs, institutions and local government agencies that address the issue of social impact of mining?

2. Do you know about the purpose and agenda of these NGOs and local authorities?

3. How would you evaluate their performance? Do you have any recommendations or feedback to these organizations?

4. If you were in charge, what would you do to address any potential social impacts of mining, particularly on children?

THE END

APPENDIX G: INTERVIEW WRITTEN CONSENT FORM

WRITTEN CONSENT FORM - INTERVIEWS with Nomadic Herders

Study Title: Social Impact of Mining on Children: A case study in Gobi Desert of Mongolia

By providing your consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

I have read the information presented in the information letter about the study being conducted by Battumur Batbayar from the School of Environment, Resources and Sustainability at the University of Waterloo, Ontario, Canada. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses.

I am also aware that sections from the interview may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher. Data cannot be withdrawn after results have been published.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (REB # 46762). If you have questions for the Board, contact the Office of Research Ethics, toll-free at 1-833-643-2379 (Canada and USA), 1-519-888-4440, or reb@uwaterloo.ca.

For all other questions contact Battumur Batbayar at email, bbatbayar@uwaterloo.ca or through phone number, at +976 99224240

0YES 0NO I agree, of my own free will, to participate in this study.

0YES 0NO I agree to have my interview audio recorded.

0YES 0NO I agree to the use of anonymous quotations in any paper or publication that comes from this research

0YES 0NO I would like to review and approve my quotations before they are used as study results.

Participant Name: _____ (Please print)

Participant Signature: ____________________________

Date: ____________________________