1. Project title

Real time data analysis during raw material extraction in developing countries: societal acceptance and ethical use

2. Summary

In developed countries (Sweden, Germany), the real time property testing of mined materials, its online data acquisition and optimization/decision making techniques are standard procedures. Such procedures allow mining enterprises to optimise the process efficiency, reducing the use of materials and energy. However, social acceptance and ethical use of such techniques is still not very well studied.

The demand for mining raw materials in developing country (India) is high due to high growth rate of gross domestic product. Small scale mining and illegal mining brings hazard to miners and less benefit to society. Faced with rising energy costs, scarcer high-grade ores, and tighter profit margins, it is important for a mine to make sense of its data. In addition, a communication gap between exploration/extraction companies, government/local authorities and local people leads to struggle for sharing benefits.

We propose to combine the availability of real time mining techniques from western (developed) countries to the requirement of making sense of data during mining in India (developing country) with respect to its social acceptance and ethical use. The tasks, in order, contain: monitoring of best practices from developed countries (Sweden, Germany), comparative studies in mining technology in developing country (India), analysis of gap between technologies, selection of the technology followed by its application in a mine in India and finally, seeking normative social and ethical standards of the technology. The project offers to Dutch and EU industry data on ethical use and social acceptance of (new) mining technology, proof of concept with the real examples and new market in developing countries.

Key words: Real time mining, Data analytics, Western Europe, India, normative social and ethical standards

Word count: 257

3. Main applicant

4. Co-applicants

5. Type of project and selected "top sector"

Type of project:	SMALL		
Research agenda	*Cross-*	Energy	E1-G3 Assessment models in the

	sectoral agenda:	Creative Industry	transition to a more sustainable energy supply- Future focused supervisory models
		Logistics	CI-G1: Smart wearables-Societally responsible digitization
			L1-G6:Governanace models-Better methods to link innovations to ethical and societal values
Relevant for LMICs:	YES		
Takes place in one LMICs:	YES, India		

6. Fields of research

Main research field (α)	Philosophy	
Subfield	Code	Label
subfield 1	33.25.00	Ethics, Moral Philosophy
Main research field (β)	Earth Science	
Subfield	Code	Label
subfield 1	15.40.00	Petrology, minerology, Sedimentology
Main research field (γ)	Environmental science	
Subfield	Code	Label
subfield 1	50.90.00	Environmental science

7. Intended members of the consortium

Intended members of the consortium		
Name	*Institution*	*Role*
Private partners		
Name	*Organisation and Chamber of Commerce number.*	*Role*

8. Intended members of the research team

Intended members of the research team		
Researchers Duration + Size	*Name (if known) Institution*	*Disciplinary background*

9. Relationship to the agenda of the chosen "top sector" & to representative research

Our research proposal fits 1. E1-G3: Assessment models in the transition to a more sustainable energy supply- Future focused supervisory models, 2. CI-G1: Smart wearables-Societally responsible digitization and 3. L1-G6: Governance models-Better methods to link innovations to ethical and societal values. The concerned top sectors are Energy, Creative Industry and Logistics. Our project is in the direction of National science agenda (NWA in Dutch) question 51 (How can

we make our industry smarter?), 112 (Big Data: How can we collect and use large data sets for realization of values, generating insights and obtain answers?) and 107 (How we can better anticipate the impact of new technology on individuals and society, and the impact of existing technology to better understand and evaluate?). The project offers to Dutch and EU industry data on technology demonstration, proof of concept with the real examples and new market in developing countries. The collaboration between earth sciences with general questionnaire from the national science agenda is direct in line with the research in the top sectors (Energy, Creative Industry and Logistics).We study the governance models (L1) available in European mines (Sweden, Germany) to find better methods to link innovations to ethical and societal values in developing countries (India) (G6).

We account standardization of data analysis in the real time mining technology which is at early stage of the development. The data analysis in our project explains the relationship between various calculation factors (financial, ethical and social) and existing and future innovation technologies in mining. The resulting description and standardization of the impact of technology on society provides input for policy, management of technology companies. In this regard, our research is in line with NWO WOTRO projects. *Word count: 296*

10. Description of the intended research

Problem: Social acceptance and ethical use of the real time property testing of mined materials, its online data acquisition and optimization/decision making techniques is still not prevalent. Mining is often considered as environmentally unfriendly activity; whether or not this is in fact the case depends on the weight described to the future 'gains' in societal and ethical terms. Hence, an ideal approach to responsible innovation requires interdisciplinary research that incorporates: (i) the ethics of technology, to investigate the role of values in design; (ii) institutional theory, to understand the parts played by institutions in realizing values; and (iii) policy, planning and science, technology and society literature.

Currently, natural resource industries in developing countries spend just 1% on information technology compared with 5-7% for most other industries. This underinvestment means that mining companies collect data but have a limited understanding of how it can inform and improve their businesses. In addition, a communication gap between exploration/extraction companies, government/local authorities and local people leads to struggle for sharing benefits.

Theoretical framework: There is a lack of information on the effect of social impact of anticipated technology change. Further, the use of data generated by the real time mining technology generates ethical research questions with normative character.

Approach: We intend to use data analysis to determine the impact of value based sensor technology on the mining efficiency. Social and ethical values are added to the technological solutions with the interdisciplinarity, i.e., collaboration between humanities, natural/technical sciences and social and behavioural sciences. We intend to do so in three parts: the social impact of existing technology, anticipating the social impact of real time (future) mining technology and finally assessing that impact. The information gained from the literature survey is an input to the design of legislation and / or policies to ensure as much as possible the standards in a broad sense. Effect of quality variation on

materials and energy consumption can be studied. Thus we position the research nationally and internationally.

To permit the procedure of data analysis during real time mining, we consider corporate governance and standards, corporate social investment (CSI) and define social indicators. We consider the impacts of the new mining procedure to study the reasons of conflicts in raw material extraction in developing countries and seek to reduce or mitigate such conflicts.

Methodology: The project is divided in seven different tasks, spread over one year (May 2017-May 2018).
Task 1: Monitoring of Best practices of real time mining in Europe
    May-June: literature study of current Dutch and EU projects, state of the art real time mining
    July-August:
Task 2 : Comparative studies in developing countries
    May-June: Process mapping
    July-August:
Task 3 : GAP analysis of mining technology between developed and developing countries
    Sept-Oct: Technology used (sensor based tool monitoring, real time ore grade testing etc.)
    Nov-Dec: Regulations (Account ethical and social aspects of the real time mining technology)
Task 4 : Decision on the technology to be analyzed
    Nov-Dec: Prioritization of methods to be developed within the project
Task 5 : Case studies on transparency and corporate social responsibility.
    Jan-Apr:
    Effect of quality variation on materials and energy consumption
    Public Survey with addressed issues: trust, privacy, applicability, security etc.
Task 6: Support systems
    Mar-Apr:
    Test the use of sensor based technology and data analysis against social and ethical aspects
Task 7 : Business Opportunity/Technology transfer
    Mar-Apr: Connection between industry from developed and developing countries
Word count: 812

11. Societal relevance and relevance for the "top sector(s)"
a) Description

Mining is a labor intensive industry, especially in developing countries such as India. Mining can bring economic and social benefits to communities through local job creation and resource revenues, but it can also create social changes that can lead to or worsen social conflicts. Technological developments in mining can put social and ethical values under pressure, such as care for the environment, respect for privacy, security and the quality of social relations. The

causes of social conflict include lack of sufficient consultation and community engagement, lack of accurate information on mining impacts, differing expectations of social and economic benefits, environmental concerns, disputes over land use and economic compensation, artisanal and small scale mining activities, migration to mining areas, and differing acceptance of large-scale mining. In our research project, we consider the impacts of real time mining, e.g., data analysis of granite quality testing to study the reasons of conflicts in raw material extraction and seek to reduce or mitigate such conflicts.

We intend to invite ministry of foreign affairs of Netherlands, mining authority in India, Valorisation Center Tu Delft and NGOs. The societal and ethical side of the project discusses corporate governance and standards, corporate social investment (CSI) and social indicators in permitting procedure. In addition we also study the possibility for multiple uses of land and resources, especially the small holder farming and mining economies upon which people depend at mineralized places. We intend to use objects, devices and sensors which are interlinked and in which they continuously exchange data about the process, staff involved and environmental changes. The knowledge will be utilised to reduce the water use, energy and land disruption, which is related to top sectors energy, water and logistics.The project offers following advantages to the stake holders:
1. Greater transparency of operational performance in real time for operational staff, site management and executives of the organization.
2. Increasing the license to operate by aligning the policies with the consumers (e.g. energy producers) and the social environment (e.g. locals)
3. Gaining socially and economically attractive product ideas (portable ore grade measurement machines)
4. Receiving useful constructive feedback from excellent researchers
5. Finding connections of societal challenges between European (e.g. resource efficiency and raw materials requirement) and India (efficient mining and social welfare)
6. Making innovation processes RRI-proof (RRI=Responsible Research and Innovation from Horizon 2020)
Word count: 409

b) Intended members of the valorisation panel

Intended members of the valorisation panel		
Name	*Organisation / Institution*	*Role*

12. Research ethics

We intend to use the online data storage with value tracking sensors on machines. It is an ethically sensitive part of the project, which we address by ensuring the use of data only for the intended purpose.
Approval by an ethics committee is / might be necessary: NO