A multi-component approach to conceptualizing the reputation of the mining industry from a stakeholder perspective

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ABSTRACT

There is a dichotomy in the perception of mining enterprises. On the one hand, mining is one of the world's most important economic sectors. On the other hand, the real or perceived impacts of mining operations raise concerns among stakeholders and contribute to the unfavourable reputation of mining industries. Our study has endeavoured to identify the factors important in the formation of the face of mining among stakeholders. On the basis of an on-line survey focused on four target stakeholder groups in Australia, we have examined a hypothesized multi-criterion assessment framework of the reputation of the industry among these stakeholder groups. Using a stratified random recruitment strategy and snowball sampling, we collected a sample of 330 participants. Our findings identified: (i) needs and expectations of stakeholders about aspects of mining activities that are perceived as the most problematic; (ii) the importance of the type of information sources followed by the stakeholders when shaping their opinion about mining; and (iii) the prevalence of environmental and visual concerns over economic concerns, which has been confirmed among various stakeholder groups. In this study, we highlight the complexity of the relationships between personal factors and attitudes that build the reputation, and we highlight that reputations cannot be managed separately for each group of stakeholders.

1. Introduction

The extraction of minerals and metals is an important economic sector that has faced many controversial issues related above all to the social and environmental impacts of extractive industries (e.g. Owen et al., 2020; Owen and Kemp, 2019). These controversies have led to the expression of various stakeholder opinions about the mining sector, to distrust of the mining industry, and to a negative or confused reputation of mining. According to the International Council on Mining and Metals (ICMM, 2015), the practice on measuring and managing reputation has moved beyond the idea that reputation is exclusively shaped from within companies and the industry. The reputation reflects the beliefs and opinions held by various stakeholders, and the experiences of these stakeholders. In order to understand how to measure and manage the reputation of the industry, it is essential to understand the drivers of the reputation among different stakeholder groups.

In this paper, we define reputation as a multi-dimensional construct reflecting stakeholders' attitudes to the industry. This definition is based on a study by Highhouse et al. (2009), who described reputation as "a collective of individual impressions". Our use of the term 'stakeholders' reflects the traditional definition of stakeholders as "any group or individuals who can affect or is affected by the achievement of the organization's objectives" (Freeman et al., 1984). The study explores the reputation of the mining and metals industry resources sector (further referred to as the mining industry), as perceived at the national level. Mining is understood as the extraction of valuable minerals or other geological materials from the Earth. It includes quarrying and offshore operations. A mine is specified as a surface and deep excavation in the earth from which minerals are taken, and mine rehabilitation is specified as the process used to repair the impacts of mining on the environment (Commonwealth of Australia, 2006).

The aim of this study is to analyse and conceptualize how various

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individual factors and attitudes of stakeholders affect the reputation of the mining industry. Since these factors and attitudes differ between various stakeholders, as shown by Svobodova et al. (2019) and Van der Plank (2016), we address this issue by designing a multi-component assessment framework of the reputation of the industry. The study is located in Australia, one of the world's top mining countries.

2. Theory

There is increasing recognition within the mining industry of the importance of its reputation for competitive advantage, for shareholder value, and for corporate sustainability, as demonstrated by Bini et al. (2018), Ali et al. (2017) and Mikulčić et al. (2016). Studies on corporate sustainability, such as Ioannou and Serafeim (2017) or Lange et al. (2011), have described reputation as an asset of the organization or of the sector that can have both positive and negative outcomes. The literature review by Veh et al. (2018) shows the growing importance of reputation in management research, as reflected in the increasing number of publications on this topic. The authors have confirmed the multidimensional origins of reputation, but have also revealed pluralism and uncertainty about its measurement. As shown by Dowling (2016), reputation assessment frameworks use exclusively cognitive criteria, such as admiration, respect, feelings and trust. Reputations are built not only on the perceptions of operational stakeholders (consumers, employees, shareholders, and regulators) but also on the perceptions of indirect stakeholders such as researchers, ENGOs and the media (Bonini et al., 2009; Ruiz et al., 2014). Each kind of stakeholder has unique perceptions and concerns. People from various stakeholder groups have unprecedented access to information, and may therefore concern themselves with a surprisingly wide array of issues perceived from a wide range of perspectives (West et al., 2016). García Sánchez and Noguera Gámez (2017) demonstrated that information, its asymmetry and disclosure are also significant determinants shaping the reputation. Whilst Deephouse (2000) has argued that the source of information, e.g. the media, can reduce information asymmetry, March and Weil (2009) have also argued that the reliance on these information sources will vary between stakeholder groups due to their differing levels of direct experience with an industry, and other personal factors. Similarly, Walsh et al. (2009) considered the direct and indirect experience of stakeholders with the sector, the level of their satisfaction, and the degree of trust acquired through their experience as important factors in the reputation construct. As shown by Veh et al. (2018), reputation measures have been developed exclusively in the management framework or along only one dimension (e.g. Fombrun, 1996). Most of the previous studies have been multi-sectoral (e.g. Heinberg et al., 2018; Deák and Hajdu, 2013; Brammer and Pavelin, 2006; Berens and Van Riel, 2004), or were exclusively designed for the consumer-oriented sector (e.g. Arli et al., 2017; Shirin and Kleyn, 2017; Weber, 2008). None of these studies was designed specifically for the mining sector. Only ICMM (2015), Martín et al. (2014) and Tuck (2012) investigated the reputation of the mining industry. However personal factors of stakeholders were neglected in these studies.

In order to conceptualize the reputation of the mining industry, it is essential to understand that the reputation follows principles similar to those developed within research in the service quality field - for example, as used by Han and Hyun (2017). The core principle of the service quality field is that the manner in which consumers perceive brands is a key determinant of long-term organization-consumer relationships. ICMM (2015) approached the reputation of the mining industry as a product of what companies and the industry do, and how their actions and behaviour are perceived by those outside the industry. This approach goes to the core of the social licence to operate, which refers to the broad and ongoing acceptance or approval of mining operations by the wider public (Moffat and Zhang, 2014).

Mining industries face real challenges in building their reputation, considering the complexity of the reputation including the direct effects

of particular events. The reputation of the mining industry can directly influence the social, economic, political and legal aspects of industrial operations. The impacts on reputation can be recognized through all scales - operational, national and global. For example, a disaster or catastrophic event in a mine operated by a local mining company can affect the reputation of the entire mining industry. This can create difficulties for ongoing and future projects at global scale, as shown by Owen et al. (2020). For example, the sudden collapse of the tailings dam at the Córrego do Feijão iron ore mine in the town of Brumadinho in Brazil in January 2019 fed into global debates about the risk of mining activities to local communities, with implications for mining companies operated elsewhere.

A systematic approach to measuring the reputation of the mining industry among various stakeholder groups will allow benchmarks to be established regarding the performance of the industry. It will make it possible to evaluate and replicate successful strategies in managing the reputation of the industry in various locations and under different jurisdictions.

3. The reputational framework

The aim of the study is to conceptualize and analyse the factors and their relationships formatting the reputation of the mining industry, as perceived by four target stakeholder groups. Addressing this, we have designed a theoretical multicomponent framework for measuring reputation, which will be tested in this study. The assessment framework is presented in Fig. 1.

The framework is based upon the results of previous research studies, such as Veh et al. (2018), Arli et al. (2017), Nunes and Park (2017), Martín et al. (2014), and Ruiz et al. (2014). The construct of reputation has been developed, and consists of two core parts – individual factors, and attitudes – as shown in Fig. 1. The first part of the framework includes three main groups of personal factors: (a) sources of information about mining, (b) socio-demographic characteristics of the stakeholders, and (c) stakeholders' direct experience with mining. These factors have been further used as independent variables that potentially affect the second part of the framework: attitudes to the mining industry. The attitudinal part contains three components linked to the mining sector and its operations: (i) socio-economic effects of mining, (ii) environmental and visual impacts of mining operations, and (iii) trust in government and industry; communication among key stakeholder groups. The attitudes have been further analysed as dependent variables.

Among individual factors, we recognize two main groups of information: professional information, and information provided by the mass media and by the community, as previously described by Martín et al. (2014). Professional information presents objective facts about mining interpreted by professionals, teachers or researchers (e.g. at universities, or in job training sessions) based on their professional knowledge and experience. Information from the mass media (newspapers, magazines, radio, television, internet), and from the community, is obtained through previous interpretation. This type of information can therefore be influenced by personal views to a greater extent than in the case of professional information.

4. Methods

4.1. Study context

The study was developed and designed in Australia, which possesses vast amounts of mineral and energy resources. Australia has the world's most diverse and most plentiful mineral and energy reserves, such as thermal and metallurgical coal, natural gas, iron ore, bauxite, uranium, precious metals and rare earths (Australian Government, 2020). There are over 270 operating mine sites across the country, in a ratio of 3:1 open-cut/surface to underground mines (ITA, 2018). The resources industry is strongly export-oriented, and has accounted for over 50% of
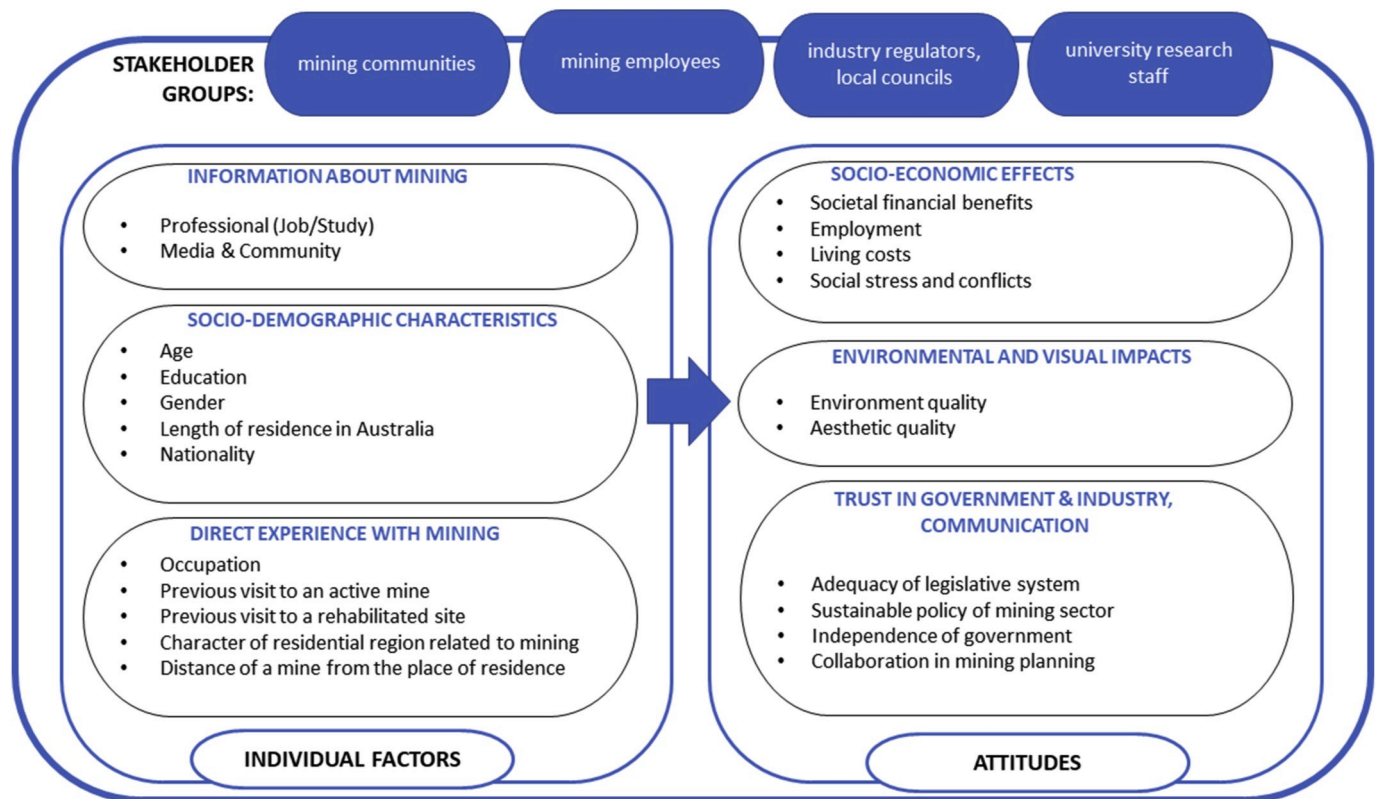
Fig. 1. The proposed assessment framework of factors influencing the reputation of the mining industry. Our study aims to explain the effect of stakeholders' individual factors (main sources of information about mining, socio-demographic characteristics, experience with mining; independent variables) on their attitudes to the mining industry (dependent variables). We hypothesize that these factors and their interrelationships contribute to the formation of the reputation of the industry among target stakeholder groups (mining communities, mining employees, regulators, local councils and university research staff).

total national exports since 2007 (58% in April 2019 – see RBA, 2019). The sector employs approximately 251,700 persons (ABS trend data), which accounts for 2% of the total Australian workforce (LMIP, 2019). Although mining continues to play a dominant role in Australia's economy, public opinion about the mining industry remains controversial and complex, as shown by Van der Plank et al. (2016). Research in this challenging environment has been crucial for understanding the complexity of the relationships involved in forming the reputation of the industry among stakeholders at the national scale.

4.2. Data collection

The study was designed using quantitative data collection activities. We developed an anonymous on-line questionnaire targeting four groups of stakeholders. The following paragraphs describe the sampling approach, the design of the questionnaires, and the structure of the sample.

4.2.1. Sampling approach

Target groups of stakeholders in the mining industry in Australia were selected to reflect the multi-dimensional character of reputation as built on the perception of direct stakeholders as well as indirect stakeholders (Bonini et al., 2009; Ruiz et al., 2014). Our study investigated four groups of stakeholders: direct stakeholders - (1) mining communities (i.e. members of the public living in the vicinity of mining activities), (2) mining employees, - and also indirect stakeholders: (3) industry regulators and local councils, (4) university research staff. These groups were selected on the basis of their presumed different relationship to mining operations and to the mining sector, their experience with mining, and their presumed different main information sources about mining. Mining communities experience mining activities

within the immediate vicinity of their homes (this group does not include personnel working in mines and their immediate families), and they experience the direct impacts of mining. Mining employees have professional experience and knowledge, and are dependent on mining activities for their livelihoods. State and Federal Governments, including regulators and local councils, have institutional experience and knowledge. The university research community can provide an international perspective on mining.

Respondents from four target groups of stakeholders were selected using stratified random selection and snowball sampling, as guided by Goodman (1961). Using an internet search, we developed an initial list containing 200 e-mail addresses per target group through various states of Australia. For mining communities, we developed a list of e-mail addresses covering various community groups and NGOs in different mining regions in Australia. For mining employees, the list contained all mining companies operating in Australia and their contacts. Industry regulators and local councils were selected on the basis of their affiliation to mining operations and regions. The university research staff was selected from three Australian universities that offer courses in mining: Monash University, the University of Queensland, and Federation University Australia. From a list of 800 contacts, a total of 400 respondents were randomly selected (100 from each group) and were invited to complete the questionnaire via e-mail. The subsequent snowball sampling was carried out by the respondents themselves. Based on their own choice, they were asked to send invitations to other people who might be interested in the survey. This part of the snowball sampling was not controlled by the authors. The survey was carried out from August to December 2015.

4.2.2. Questionnaires

The questionnaire was developed according to the standards for

Internet-based experiments (Reips, 2002), and was divided into three thematic parts based on the assessment framework in Fig. 1: (1) participants' characteristics and experience with mining; (2) main information sources about mining; (3) attitudes towards mining. In the first part, we asked participants about their gender, age, education, nationality, occupation or field of study, current place of residence, and how long they have been living in Australia. We further asked about their experience with both underground mining and surface mining, on the distance of their place of residence from an open pit and from an underground mine, and whether they had previously visited an active mine or a rehabilitated site. The second part of the questionnaire asked about participants' main sources of information about mining: mass media (TV, radio, the Internet, newspapers), their studies, their job, or their community. The third part included 10 attitudinal statements about the mining industry in Australia that were focused on three attitudinal components: socio-economic effects of mining (statements S1-4); environmental and visual impacts of mining activities (statements E1-2); trust in government and industry, communication between key actors (statements T1-4). Respondents were asked to evaluate each statement on the 5-point Likert scale, according to their agreement with the statement, as follows: strongly disagree – disagree – neither agree or disagree – agree – strongly agree. The 5-point Likert scale was selected for the survey based on the observation made by Preston and Colman (2000) that 5-point length appears to be more reliable and more valid than shorter or longer scales. The attitudinal statements and their average evaluation are presented in Table 1. These final statements were selected from an initial list of 30 statements via consensus of the authors. The pilot study was conducted in July 2015 and involved 30 respondents from all stakeholder groups.

A total of 330 respondents participated in the survey, which ran for 6 months (July 2015–January 2016). An overall response rate of 82.5% was recorded. All participants took part in the study on a voluntary basis, and their participation was therefore considered to be driven by their interest in mining. Table 2 presents the structure of the survey sample.

4.3. Data analysis

The effect of participants' socio-demographic characteristics, their experience with mining and their main sources of information on mining activities (as independent nominal variables, Table 2), on their attitudes to mining (as dependent variables, Table 1), was analysed by Generalized Linear Models (GLMs). As a quantitative dependent variable on the 5-point Likert scale, the evaluation of each attitudinal statement (Table 1) was converted into a variable with binomial distribution comprising two vectors – the actual evaluation (from 0 to 5) and the remainder below the maximum evaluation (5). For example, if the actual evaluation was 3, the remainder below the maximum evaluation was 2. The score of 3 is a measure of the participant's agreement with a certain statement, while the remainder of 2 represents the participant's disagreement (the higher this value is, the less the participant agrees with the statement). Following the standard rules in modelling with binomial errors (Crawley, 2007), we used the *cbind* function, and we bound together two vectors of the response variable into a single object 'y', which comprises both vectors. This single object 'y' was used in further analyses as the response variable, instead of using the original evaluation.

For each of the ten attitudinal statements (Table 1) we used a separate model. Subsequently, the significance of a particular explanatory variable (Table 2) was analysed within this model, using GLM, in order to sort the variables in descending order according to their particular significance in the full model (i.e., the most significant variable was placed first in the full model). Apart from these main variables, all double interactions between the variables were included in the full model. The full model was then simplified, i.e. all non-significant variables (p > 0.05) in the last position in the model were excluded step-by-

Table 1

Statements representing attitudes and their evaluation by a sample of 330 respondents on the 5-point Likert scale from 0 to 5 (0 = strongly disagree, 5 strongly agree). Each statement was evaluated by all respondents (N = 330). Evaluation of the statements is summarized by mean (average evaluation) and mode (evaluation that occurred most often).

Attitudes			Evaluation	
Attitudinal component	Statement		Mean	Mode
Socio-economic effects	S1	Mining provides financial benefits for society.	3.86	4
	S2	Mining provides significant employment opportunities; underpinning regional and national development.	3.63	4
	S3	Mining has negative economic impacts (e.g. an increase in living costs or impacts on other industries, e.g. tourism).	3.42	4
	S4	Mining has social and cultural effects on communities (e.g. public health, migration, resettlement, social tension, violence and conflicts).	4.04	4
Environ-mental & visual impacts	E1	Mining has negative environmental impacts, especially on habitats, climate, water and air quality.	4.19	4
	E2	Mining has substantial impacts on aesthetics and visual quality (i.e. visual impacts due to clearing of vegetation, large excavations, dust, and the presence of large-scale equipment, and vehicles).	4.23	4
Trust in government & industry, communica-tion	T1	The regulatory and legislative systems are adequate and are capable of holding the mining industry accountable for the damage caused by mining activities.	2.39	1
	T2	Mining companies integrate sustainable and transparent practices into their operations and make efforts to maintain their Social Licence to Operate.	2.86	4
	T3	Governments are influenced by the mining industry; this can have an effect on the regulatory and legislative processes.	4.25	4
	T4	Rehabilitation planners, mining communities and experts should be involved in the mine design process.	4.48	5

step, using the backward selection procedure (Crawley, 2007). The final model, consisting only of significant main variables and interactions, was checked using standard statistical diagnostics. All analyses were performed using R statistical freeware, version 3.4.2 (R Core Team, 2019).

5. Results

Analysing the multi-component framework of the reputation of the industry, we found out that the most influential individual factors were the types of information sources about mining that stakeholders use, stakeholders' gender, and whether they are employed by the mining industry or not (Table 3 and Supplementary Material 1). The interactions between personal factors had also a significant influence on the stakeholders' opinions (see Supplementary Material 2–4). These findings underlined the complexity of the tested assessment framework.

The following paragraphs demonstrate the results for each of three attitudinal components of the reputation as proposed in the framework. The effect of significant single factors and the most significant

Table 2

Characteristics of respondents as independent variables and the proportion of the sample within particular variable categories (%).

Socio-demographic characteristics	Categories (%)
Age	18–29 years (17.0%); 30–49 years (39.7%); 50–64 years (33.3%); over 65 years (10.0%)
Education	University degree (83.9%); Lower than university level (16.1%)
Gender	Male (57.0%); Female (43.0%)
Length of residence in Australia (i.e. how long the participant has been living in Australia)	Whole life (65.8%); Others (34.2%)
Nationality	Australian (87.3%); Others (12.7%)
Place of residence (i.e. character of the region where the respondent currently lives)	Mining region (18.2%); Non-mining region (18.2%); Metropolitan area (63.6%)
Direct experience with mining	**Categories (%)**
Distance of an open pit mine from the respondent's place of residence	Less than 50 km (33.6%); More than 50 km (44.5%); Don't know (21.8%)
Distance of an underground mine from the respondent's place of residence	Less than 50 km (17.6%); More than 50 km (49.1%); Don't know (33.3%)
Occupation	Mining and/or rehabilitation (33.9%); Others (66.1%)
Place of residence (i.e. character of the region where the respondent currently lives)	Mining region (18.2%); Non-mining region (18.2%); Metropolitan area (63.6%)
Previous visit to an active mine	Yes (77.6%); No (22.4%)
Previous visit to a rehabilitated site	Yes (64.8%); No (35.2%)
Main Information sources	**Categories (%)**
Community	Yes (25.5%); No (74.5%)
Job	Yes (44.2%); No (55.8%)
Mass media	Yes (51.5%); No (48.5%)
Study	Yes (32.1%); No (67.9%)

interactions between the factors on the component is presented in Supplementary Material 1–4. The Supplementary Material provides participants' average evaluation of each factor, details on the findings of the data analyses, such as significance (p-value), degree of freedom (df) and the amount of variability explained by the variable in the data model (dev.).

5.1. Socio-economic effects of mining

This component of the reputation includes the social, economic and cultural effects of mining (Table 1, Statements S1–S4). The stakeholder's main source of information about mining had a key influence on attitudes to the socio-economic impacts of mining. However, different information sources had different impacts. Information from participants' jobs and from the mass media strongly influenced participants' attitudes ($p < 0.05$ for S1 and S3; $p < 0.001$ for S2; see Table 3). The participants who were mainly informed about mining from their jobs, and those working in mining, expressed lower agreement with negative socio-economic effects of mining than other participants did. Information from the mass media had the opposite effect on the stakeholders' attitudes ($p < 0.05$). As shown in Table 3, the information about the participants' community and about their studies did not have such a strong influence on their attitudes ($p < 0.05$). Participants' gender was also found to be a significant factor influencing their perception about the industry ($p < 0.01$). Men generally agreed less with negative socio-economic impacts of mining than women. Detailed results of data analyses are shown in Supplementary Material 1 and 2.

As shown in Table 1, while stakeholders' most frequent evaluation was the same for all socio-economic attitudinal statements (mode$_{S1-S4}$ = 4), statement S4 "Mining has social and cultural effects on communities (e.g. public health, migration, resettlement, social tension, violence and conflicts)" received the highest average agreement among the participants (mean$_{S4}$ = 4.04).

5.2. Environmental and visual impacts of mining

The results showed particularly strong agreement among participants on negative environmental (E1) and visual (E2) impacts of mining (mode$_{E1, E2}$ = 4; mean$_{E1}$ = 4.19, mean$_{E2}$ = 4.23; Table 1). It is apparent that participants perceived both the environmental impacts and the visual impacts of mining very similarly, when affected by information about the participant's job ($p < 0.05$) and mass media ($p < 0.05$), occupation ($p < 0.05$) and gender ($p < 0.01$; Supplementary Material 1). The effect of information sources was stronger on attitudes to environmental impacts than to visual impacts, as shown in Table 3. In terms of gender, there were similarly strong significant effects on both E1 and E2. A significant role of gender in interactions with other factors was apparent. Male participants employed by the mining industry and informed about mining from their job provided lower agreement with

Table 3

The effect of independent variables (socio-demographic characteristics, experience of mining activities and information sources) on particular attitudinal statements (socio-economic effects of mining S1–S4; environmental and visual impacts of underground and surface mining operations E1-E2; trust in government and industry, communication among key stakeholder groups T1-T4; see Table 1 for an explanation). Only single factors are presented. Stars show significant effects as follows: *** – $p < 0.001$, ** – $p = 0.001$–0.01, * – $p = 0.01$–0.05.

Variables	Statements									
Socio-demographic characteristics	S1	S2	S3	S4	E1	E2	T1	T2	T3	T4
Age										
Education	*									
Gender	**		**	***	*	*	**	***		*
Life in Australia										
Nationality		**						*		**
Place of residence										
Experience of mining activities										
Distance of an open pit mine from the respondent's place of residence										
Distance of an underground mine from the respondent's place of residence										
Occupation	*	**	**	*	*	*	*		**	
Place of residence										
Previous visit to an active mine										
Previous visit to a rehabilitated site										
Information sources & learning										
Information source – community										
Information source – job	**	***	**		**	*	*	***	**	
Information source – mass media		**	*	**	*	*	**	*		
Information source – study										*

these impacts than others. Further, men who had visited a mine were more optimistic about the impacts, whereas women without this experience were significantly more sceptical. Detailed results of the data analyses are shown in Supplementary Material 1 and 3.

5.3. Trust in government and industry, communication

According to our results, the reputational component focused on trust in government and industry and communication was significantly influenced by the stakeholder's source of information about mining, her/his occupation, gender and nationality (p < 0.05; Table 3; Supplementary Material 1 and 4). While occupation in the mining sector and the participant's job as the main source of information led to increased agreement with T1 (p = 0.01; mean 2.85 vs 2.02), T2 (p < 0.001; mean 3.34 vs 2.48) and disagreement with T3 (p = 0.003; mean 3.83 vs 4.47), information from mass media had the opposite effect (T1: p = 0.04, mean 2.09 vs 2.70; T2: p = 0.001, mean 2.55 vs 3.20; T3: p = 0.03, mean 4.46 vs 4.03; see Supplementary Material 1). Regarding participants' nationality, foreign nationals perceived the legislative system and the mining sector as more reliable than Australians did (p = 0.02). Men showed generally greater trust in regulatory systems (p = 0.007) and in the mining industry (p = 0.0002) than women (Supplementary Material 1).

Statement T1 that the regulatory and legislative systems are adequate and are capable of holding the mining industry accountable for the damaged cause by mining activities, provoked the strongest disapproval across all stakeholder groups (mode$_{T1}$ = 1; mean$_{T1}$ = 2.39; Table 1). Participants across all stakeholder groups strongly perceived that rehabilitation planners, mining communities and experts should be involved in the mine design process in a collaborative manner (T4). This statement received the highest average evaluation in the study (mean$_{T4}$ = 4.48) and the highest most frequent evaluation was (mode$_{T4}$ = 5; Table 1). Detailed results of the data analyses are shown in Supplementary Material 1 and 4.

6. Discussion

Our study focuses on the reputation of the mining industry as perceived by stakeholders in Australia. The issue has been approached in a conceptual manner, considering individual characteristics of participants and their roles across attitudinal dimensions of the reputation of the industry. A theoretical framework of factors affecting the reputation of the mining industry has been developed and tested. Three attitudinal components of the mining industry's reputation, represented by 10 attitudinal statements have been evaluated by 330 people representing various stakeholders. Four notable lessons can be learned from this survey: (i) a complex design of the assessment framework is necessary in order to identify drivers forming the reputation of the industry, (ii) three top-of-mind issues can pose a significant threat to the reputation of the mining industry, (iii) information provided by various sources is essential in shaping the reputation of the industry, and (iv) socio-demographic profile and direct experience affect the reputation of the industry through interactions with other factors, rather than as single factors.

6.1. Complex design of the framework is essential in identifying drivers of the reputation of the industry

The clearest contribution to methodological knowledge that has emerged from our study is that the complexity of the proposed framework plays a key role in shaping the reputation of the industry among stakeholders. We have found that some factors influence the attitudinal part of reputation exclusively as single factors, some are influential in their interactions with other factors, and some factors have effects both as single factors and as interacting factors. While significant single factors have a strong position in the framework, the significant interactions

identify the existence of linkages between factors inside and outside attitudinal components. These linkages underpin their interdependence in the framework. In our study, 7 single factors and 33 interactions between factors affected all three attitudinal components of the reputation (Table 3; Supplementary Material 1–4).

6.2. Top-of-mind issues posing a significant threat to the reputation of the industry

The study identified three top-of-mind issues that can cause serious concern among stakeholders and thereby pose a significant threat to the reputation of the mining industry. They are environmental and visual impacts of mining, expert collaboration and community engagement in the life of mine planning, and trust in the regulatory and legislative processes.

The environmental and visual impacts of mining (e.g. impacts on habitat, climate, water, air quality or visual impacts, due to vegetation clearance or due to large-scale excavations) were perceived as very real by the participants. There was quite a high level of general agreement about these impacts among all groups of stakeholders, particularly in the case of participants who received their information on mining from the mass media, women, and those who do not work in mining. As these groups are largely representative of the general public not closely linked to the mining industry, environmental and visual impacts have a high potential to influence the public reputation of the mining industry in a negative manner. Studies such as Fernando et al. (2018), Lechner et al. (2017) and Hendrychová and Kabrna (2016) focused on practical measures to mitigate the environmental and visual impacts of mining. However, in order to improve their reputation, mining enterprises also need to find a way to communicate their sustainable landscape management efforts clearly to the stakeholders. Apart from improving the quality of the information that reaches the stakeholders, as discussed in the next section, nature and landscape stewardship can also be manifested directly via the management of rehabilitated mining sites. Nassauer (1995) has presented a useful concept that facilitates the expression of cues to care in farming or residential landscapes, which can also be utilized in the rehabilitation after mine closure. In addition to design measures supporting the understanding and the acceptance of sustainable site management by stakeholders, Hull et al. (2008) recommend the involvement of an informed landscape steward throughout the process of landscape planning and management as the most efficient measure for increasing the acceptance of the process. The results of our study support the validity of this concept for forming the reputation of the mining industry among stakeholder groups.

Most of the participants (93%) across various stakeholder groups agreed very strongly that rehabilitation planners, mining communities and experts should be involved in the mine design and closure process. This corresponds with the stakeholder perception study by ICMM (2015), which identified engagement with local communities and involvement of relevant experts as a common cross-cutting theme. While remaining a key success factor in implementing corporate social responsibility (Amor-Esteban et al., 2019), effective stakeholder engagement can provide industry with a competitive advantage on a global marketplace (Dobele et al., 2014). It also plays an important role in building trust in the industry (Kusters et al., 2018). As shown by Onkila (2011), stakeholder engagement should consider differences in stakeholder relationships, the actors involved, their relationships and the attributes of stakeholder interest. The approach to stakeholder engagement may need to vary to accommodate these differences. Kusters et al. (2018) talks about the multi-stakeholder platform as various forms of organized collaboration across various stakeholder groups, including coalitions, partnerships, and management boards. The platform can support the joint identification of options for balancing the various interests that may exist. To succeed, it is necessary to engage with relevant stakeholders in a timely manner - ideally at an early stage of the project - using a variety of engagement mechanisms (Owen and Kemp, 2018).

Our study shows that 85% of the participants agreed about governments being influenced by the mining industry. This finding corresponds to findings published in the Grattan Institute Report on influence in Australian politics (Wood et al., 2018), which states that Australians are rightly concerned about the role of special interests in politics. The report found that mining and energy companies accounted for more than a quarter of all recorded lobbyist contacts in Queensland between 2013 and 2018, vastly more than any other sector. This is backed up by successive Transparency International surveys (Transparency International, 2019), which show that perceptions of corruption in Australian government are at the worst levels on record. In addition, 58% of participants disagreed that the regulatory and legislative systems are adequate and are capable of holding the mining industry accountable for the damage caused by mining activities. 40% of the participants disagreed that mining companies integrate sustainable and transparent practices into their operations and make efforts to maintain their Social Licence to Operate. On the other hand, 34% of participants agreed with this statement. Our findings demonstrated, similarly to Viveros (2017) and ICMM (2015), that stakeholders having direct experience with the mining sector (here mining employees) provide significantly more positive perceptions than other stakeholder groups. Edward et al. (2019) suggested that trust is a dynamic concept, which implicitly relies upon the concept of social licence to operate. Both of the concepts have been subject to the new conditions of public debate, where notions of trust and corporate reputation are manifested globally rather than locally. Building a relationship of trust and fair dealings with stakeholders involves improving the social performance of the industry (Owen and Kemp, 2018), engagement and direct communication (Littleboy et al., 2019), and transparency about the benefits and risks (Viveros, 2017).

6.3. The type of information is essential in shaping reputation

Media and other communication practices and technologies push the traditional boundaries of sharing information. Our study indicates that the source of information about mining is the strongest factor affecting the reputation of the mining industry. We found out that various types of information and the way in which they are shared through the mass media affect the reputation. This undermines the myth of the bounded concept of reputation, where 'impacts' or 'stakeholders' can be defined by a particular physical location. The type of information that stakeholders receive influences their attitudes to mining in various ways, depending on the attitudinal components of the reputation. Information about participants' jobs and from the mass media were the two most influential types of information in forming the reputation of the industry. While information from the mass media and from the community generally increased negative attitudes toward the industry, information from participants' job or studies strengthened positive attitudes.

This study has confirmed the information asymmetry in relation to the reputation of the mining industry, as described by García Sánchez and Noguera Gámez (2017). Our findings relate to the findings by March and Weil (2009) that various groups of participants tend to have attitudinal assessments based on ambiguous criteria and evidence, which leads to the disaggregated view of the industry's reputation. However, Deephouse (2000) argued that information intermediaries, such as the mass media, can reduce information asymmetry. This is the exact opposite of our results. We have found that media and community affect the reputation in an opposite way than professional sources of information. Our study has confirmed the divergent effect of these information sources. This asymmetry can be connected with information quality, as previously discussed by Martin (2017). Participants who reported strong agreement with statements asserting that mining has negative impacts, such as environmental effects and rising costs of living, indicated mass media as their main information source. Conversely, those who strongly agreed that mining has positive effects, such as financial profit and employment, were mainly informed about mining from their jobs. Furthermore, participants' low opinion of the

transparency and the capability of governments and industries was strongly linked to the mass media as their main information source, both as a single factor and as an interacting factor. This finding supports the argument of Curran et al. (2009) that mining-related stories generally only reach the public when things go wrong. ICMM (2015) identified a communication barrier between the industry and the media, as the mining industry employees and associations struggle with little success to shape the views of the industry amongst the media. As consequence, the essentially negative mass media coverage of the mining industry that has lasted for at least the past four decades, as argued by Murray (2016), has negatively shaped trust in the mining industry and in the government–industry relationship, and thereby the reputation of the industry.

Our findings further support the observation that information obtained from the community and from the mass media can contain gossip and rumours, and can thus be manipulated and shaped to a greater extent by opinions rather than by facts (Beersma and Van Kleef, 2012; DellaVigna and Kaplan, 2007). By contrast, information sources such as jobs and studies tend to be based on facts, academic education and professional skills (Shepperd et al., 1999). Nevertheless, people working in or studying mining can be influenced by real or potential economic gain from the industry. This can significantly shape their opinions, as has been demonstrated by Evans et al. (2013). Our study has confirmed this finding, particularly in statement S2 on the employment opportunities provided by the mining industry, where the highest agreement was among participants informed about mining from their jobs in the mining sector.

Information gained from the community affected all three attitudinal components of reputation exclusively in interaction with other factors. Participants informed about mining mainly from their community agreed more than others about the negative economic impacts of mining (e.g. an increase in living costs), and their agreement increased with their age. This may be connected with the lower willingness of older people to pay their living costs, as demonstrated by Green and Hendershott (1996) and Mankiw and Weil (1989). Perception of the aesthetic and visual impacts of mining operations was more negative among participants with a university education informed about mining from their community than among others. This finding may be related to the link between university education and a higher level of environmental concern, as demonstrated by Betakova et al. (2016). Participants informed by their communities also disagreed much more strongly than others with the statement that the legislative system adequately held the mining industry accountable for the damages caused by mining. This disagreement was even greater among people without university education. Information provided by communities can especially shape the attitudes of participants who have limited access to other information sources, such as older people and people with a lower level of education. This has been discussed by Patterson (2007) and by Capella and Greco (1989), who found that families and friends were the most important information source for older adults. In addition, Peterson and Sautter (2003) demonstrated that the mass media as a source of information focus more on younger people than on older people. This also correlates with our findings.

6.4. Socio-demographics and direct experience in interaction with other factors

The significant effect of the socio-demographic characteristics of the participants on the attitudinal components of the reputation of the industry was prevalent in interactions rather than as single factors. Only gender was identified as a significant single factor that influenced all three attitudinal components of the framework. Socio-demographic factors constituted 33 significant interactions, affecting in particular attitudes to the socio-economic effects of mining (S1–S4) and trust in the government and in industry (T1-T4). Age and gender were found to be the most influential factors. On the whole, women and older people

expressed more negative attitudes through all components of the reputation. This finding resonates with Bastian et al. (2015). Similarly, Badera and Kocoń (2014) recognized positive support of mining mostly among people in their productive age and younger, which also corresponds to our results.

Education was found to be a very influential factor in the attitudinal component on trust in government and in industry. Participants with university education expressed more positive attitudes in statements on trust in the mining industry and in legislative processes than others. Less educated people generally tended to have more negative attitudes. This concurs with findings by Badera and Kocoń (2014), who suggested that greater trust could be connected with the greater general knowledge of people with university education, and thus their ability to see profits from the mining industry.

Our findings showed that direct experience with mining affected all attitudinal components of the reputation through occupation as the only significant single factor. However, the key effect of direct experience on reputation was in its interactions with other factors. Participants' occupation in mining significantly affected their attitudes to the socioeconomic and environmental effects of mining, always in a way that was more positive toward the mining industry. Occupation was further the strongest factor affecting participants' perception of the statement that governments are influenced by the mining industry. Mining employees agreed with this statement, similarly as other stakeholders, but their level of agreement was the lowest among all groups. At the same time, mining employees had a slightly negative, almost neutral opinion about the adequacy of the legislative system in holding the mining industry accountable for damages from mining operations. While male employees expressed agreement with this statement, female employees substantially disagreed. As Tuck (2012) discussed in his concept of the stakeholder specific reputation of the mining industry, employees as a stakeholder group have greater levels of access to information than external stakeholder groups such as a community, and in contrast to other groups they appear to have a stronger focus on employee factors. Most importantly they have chosen to work within the industry. All these factors can shape their opinions.

The distance between a participant's place of residence and an open pit mine was another factor that significantly affected his/her attitudes, but only under the influence of other factors. The distance effect was especially strong in attitudes toward the financial benefits for society provided by mining. Our results showed asymmetry in the attitudes towards the industry in communities living in proximity with mining operations, where the costs and the benefits of mining activities are cumulated in a relatively small area. This asymmetry has previously been described by Conde and Billon (2017). It also resonates with the results of Frantál (2016), who investigated attitudes towards coal mining in two mining communities, and found significant differences between residents based on their gender, occupation and age. Participants who had visited an active mine or a rehabilitated area reported generally more positive attitudes to mining than others. However, women were again more sceptical than men. This finding resonates with observations made by Kern and Carpenter (1986), who studied the effect of field activities on students, that direct experience enhances the ability to understand and use acquired information. This higher ability to understand may affect the attitudes. Positive attitudes to the industry supported by direct experience with mining may also be connected with higher interest and motivation, as shown by Paris and Turner (1994).

6.5. Limitations of the study, and future research directions

The investigation of the present framework provides an insight into the concept of the reputation of the mining industry through individual attitudes. The value of this study lies in its analytical multi-criterion approach to reputation as a measurable concept based on interactions between individual factors and attitudes. The study addresses a knowledge gap in consistent measurements of reputation by focusing on the development of a systematic approach that would untangle the complexity of reputation into a conceptualized framework. Although our findings make a contribution to a better understanding of the drivers that form the reputation of the mining industry, we are aware of potential limitations in the study and of the need for future research.

In this study, we have used stratified random selection and snowball sampling as a recruitment strategy to build a sample of participants. Through snowball sampling, participants referred people that they know and who are likely to have similar traits. The goal of the sampling was to obtain a sample from four target stakeholder groups, not a representative sample of the Australian population. Potential sampling bias and a margin of error might therefore be present, in particular an effect of participants' interest in the topic. However, according to Gerlitz and Rieder (2013), snowball sampling is appropriate in exploring national spheres, topic- or activity-based user groups, cultural specificity or dissemination of content. This also resonates with stakeholder network effects, as discussed by Tuck (2012). The participants were selected from four stakeholder groups involved in the mining industry in Australia (see details in the Methods). Future research should consider testing the framework on a representative sample, and to including more stakeholder groups, as done by e.g. ICMM (2015). An international study would reveal effects of cultural differences on reputation. Our respondents were recruited on-line via email invitations. Although the use of the Internet as a communication medium in our study was consistent with the work of Wherett (1999), it has to be recognized that Internet-based surveys have disadvantages as well as advantages, as identified e.g. by Fricker and Schonlau (2002). Future research may consider the use of face-to-face interviews, or a combination of multiple data gathering methods.

We are aware of potential limitations and bias related to possibly different interpretations of the statements by respondents. As argued by Manis (1960), although there is general agreement that a person's attitudes influence his/her interpretation of opinion statements, the direction and the magnitude of this influence remains unclear. To minimize these effects, the attitudinal statements used in this study were pre-selected via consensus of the authors and were tested by 30 various stakeholders in a pilot study. Their design followed a standardized procedure (Krosnick and Smith, 1994) and expressed a variety of meanings: positive (S1, S2) and negative (S3, S4, E1, E2) aspects of mining as well as aspects of trust (T1, T2, T3) and aspects of participation (T4) to prevent bias as much as possible.

Although our study provides a useful methodological framework for an assessment of the reputation of the mining industry at the national level, there is an evident need for additional future research on techniques for measuring and monitoring the reputation of the industry among stakeholder groups over time and through local, national and global scales. This would enable the development of reputational data for the mining industry at sector level and at operational level.

7. Conclusions

This study has introduced a multi-criterion framework for the assessment of stakeholders' attitudes shaping the reputation of the mining industry in Australia. This framework has enabled us to combine and compare the impacts of factors which have so far been studied separately, and therefore to create a more accurate image of the complex process leading to the formation of the reputation of extractive industries. We have shown that the reputation of the industry among stakeholders is highly dependent on the type of information that the stakeholders received from a range of sources. We have demonstrated that information from the media tends to increase the negative reputation of the mining industry throughout all stakeholder groups, while direct and professional experience, and also professional information, increase the positive reputation of mining. However, this increase does not strictly lead to a positive general perception of mining. The overall perception of the mining industry was measured as negative.

From a practical standpoint, our findings have implications for effective management of the reputation of the mining industry. The complexity of the relationships between personal factors and the attitudinal components of the reputation of the industry indicates that reputations cannot be managed separately for each group of stakeholders. We have highlighted the importance of understanding different impacts of professional information and information provided by the mass media and by the community when shaping the reputation of the industry from a stakeholder perspective. We have also illustrated the importance of employing measures to mitigate the environmental and visual impacts of mining, and of clear communication on these efforts.

Reputation will be a key success factor as stakeholders encounter the challenges of transition, and the effects these will incur at project start up and closure (Svobodova et al., 2020). Understanding and managing the reputation both of a company and of the industry as a whole is particularly important in efforts to understand issues that create concerns to stakeholders, to anticipate these issues before they escalate, and to identify strategic opportunities for engagement as they emerge. Knowledge about the construct of the reputation of the industry can be applied in the development of industry strategies, initiatives and programs that are aligned with stakeholder needs and expectations. This can create a platform where trust in extractive industries can be built up, in order to support more sustainable and productive interactions with a variety of stakeholder groups.

CRediT authorship contribution statement

Kamila Svobodova: Conceptualization, Methodology, Validation, Investigation, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Jiri Vojar:** Methodology, Validation, Formal analysis, Data curation, Writing - original draft. **Mohan Yellishetty:** Supervision, Conceptualization, Methodology, Resources, Writing - original draft, Writing - review & editing. **Kristina Janeckova Molnarova:** Writing - original draft, Writing - review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resourpol.2020.101724.

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