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Measure of the mining image

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ABSTRACT

Mining is a very important activity for economic and social development, but traditionally research has centered on its technical and operative aspects, instead of studying the image transmitted to the rest of society. This has originated diverse problems, fundamentally due to the information which the population receives via the mass media and which sometimes creates a current of opinion contrary to the development of this extraction activity. In order to resolve the mining communication problems it is necessary to develop a measure of the mining image based on a reliable and valid scale. This is a useful tool in developing a procedure to connect the society with other mining stakeholders and to analyze whether the real image of mining activity is similar to the image transmitted and perceived by society, since the news about the mining industry usually are focused on extreme situations or catastrophes that monopolize the information in the media. In this study a field research based on an attributes scale is developed, with the aim of measuring the mining image. The surveys were carried out in a mining area, where people have direct and real information about the mining industry and its consequences on society, environment and economy.

Introduction

Image is defined by Kotler and Armstrong (2012) as a set of ideas, beliefs and impressions a person mentally has of an object. On the other hand, Santesmases Mestre (2012) considers the "image" as a mental representation of the attributes and perceived benefits of a product or brand. Organizations have to create a suitable image to develop a competitive strategy and a powerful positioning in the market (Aaker, 1995, 1996). Image has been widely studied in the service quality field. Grönroos (2007) considers that in order to increase customer influence a favorable and well-known image is an advantage for any organization. In this context, image has an external impact on customer perceptions of the products and services. Moreover, image is highly related to service quality and customer satisfaction.

In marketing research the concept of image has been studied from different perspectives; such as the brand image (Dobni and Zinkhan, 1990; Dowling, 1986; Rynes, 1991; Biel, 1992; Keller, 1993; Aaker, 1996), the launching of new products (Hem et al., 2001; Ambler and Styles, 1997), retail stores (Peterson and Kerin, 1983; Simmons, 1987; Lewison, 1999; Dickson and MacLachlan, 1990; Severin et al., 2001; Oppewal and Timmermans, 1997; Nevin and Houston, 1980; Rosembloom, 1983) or tourist destinations (Hunt, 1975; Crompton, 1977; Coshall, 2000; Fakeye and Crompton, 1991; Etchner and Ritchie, 1993; Tapachai and Waryszak, 2000; Stern et al., 2001). However, the image of the mining sector has not been studied, in spite of news frequently appearing to inform about problems, ecological disasters or dangerous consequences to the population.

The concept of image has been applied to different areas, such as, products, individual and corporate brands, geographical areas, economic activities, events and even specific people who project a commercial image. On this basis, Dowling (1986) establishes that an image is "the set of meaning by which an object is known and through which people describe, remember and relate to it". From this perspective, the term "object" opens the idea of image to multiple aspects, beyond that of a product or company. In addition, Keller (1993) considers the perceptions on the brand are mirrored as existing memory links in the consumer, whereby centering this concept exclusively on the end user and, therefore, the image concept only exists in the mind of the consumer (McInnis and Price, 1987). Keller (1993) establishes that the associations can be created through the direct experience with the object, by the information perceived through different mass media and by means of the own personal inferences based on the received information and their scales of values. Fig. 1 shows the theoretical model used for designing and testing a scale of measurement of the mining image. The information can be received from different sources as well as in different forms. Firstly, direct information can

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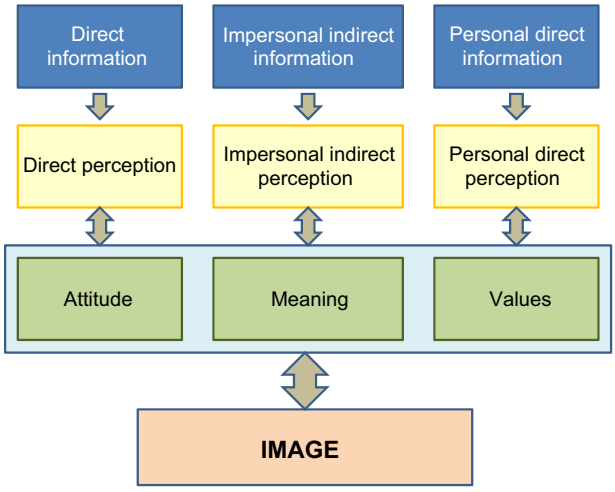

Fig. 1. Image creating process.

produce a perception, which then generates an attitude associated to a meaning and predetermined values. On the other hand, the information can arrive through previous interpretation, known as indirect information. This information can be transmitted by impersonal mass media, such as, television, radio, the press and so on; or by means of a person who transmits the information with or without an interpretation. The perception by the receptor will determine an attitude and an image of the object or event.

A collective image on a given object, event or idea, will generate a public opinion that can directly influence the social, economic, political and legal surroundings. In this sense, image has great importance when it affects a wider and more complex scope of things than just products or companies; such as public administrations, associations, an activity or economic sector, an ideology or public opinion. In this context, not much research nor scientific theories on image composition and evaluation on wider generic concepts other than that of products, exists. Mining is circumscribed in this wider idea that directly affects the possible exploitation of resources necessary for life. The collective distortion of the reality of this economic activity, can determine a current of public opinion contrary to the extraction of the mining wealth. However, when the real image approaches the collective image, we can conclude that the possible decision to be taken, on whether to extract or not extract resources, will be more justified with facts more able to be contrasted.

From this perspective, for a better understanding of the image, it is not only important to know "what is", but also "what is not". Aaker (1996) establishes that one of the most common mistakes made is confusing brand identity (i.e., the associations that the company tries to communicate) with brand image (i.e., the associations that the end users finally perceive). This phenomenon is known as "the brand image pitfall". This affirmation applied to the field of the collective image of an economic activity could be known as "collective image or public opinion pitfall," which normally takes place when the information received is indirect and biased. Therefore, it is possible to confuse the identity of an activity (understood to be the associations that a company or set of companies that make up an activity or sector, tries to communicate) with the image of the activity (i.e., the associations finally perceived by the end users or group of people with the capacity to develop a collective image and, consequently, a current of public opinion).

It is necessary to develop a mining image scale for different reasons. Corporate social responsibility (CSR) in the mining industry is a knowledge field that can give an initial theoretical support. In this context, Walker and Howard (2002) note that CRS and other such voluntary initiatives are important for mining companies to reach some objectives. The first objective deals with the poor public opinion of the sector as a whole, since the opinion of natural resource extraction industries is influenced more by concerns over environmental and social performance than by performance in areas such as product pricing, quality and safety (Rae and Rose, 2001). On the other hand, pressure groups have consistently targeted the local and international legitimacy of the mining sector. Finally, maintaining the operational licenses is a constant challenge for the companies that must negotiate with statemen and local governments and guarantee the sustainability and impact of the extraction activity (Jenkins and Yakovieva, 2006). These circumstances create the need to develop a mining image scale, because managing CSR is essential to pinpoint which are the perceptions and attitudes of society. Therefore, the mining image is the way to connect society with other mining stakeholders in order to guide the decision making process. Moreover, governments take their decisions based on public opinion, where the mining image plays a fundamental role together with the mass media and personal communications. Therefore, based on Kotler and Armstrong's (2012) considerations, we can define the mining image as a set of ideas, beliefs and impressions a person mentally has of the mining activity; developing the mining image in such a way as to connect society with other mining stakeholders to improve communication, shared knowledge, decision making processes and sustainability as well as to reduce the social and environment impact.

The objective of this work is to design and evaluate the reliability and validity of a scale used to measure the image of the mining activity. Since image is a concept which can vary according to how information is received and processed, we exclusively focused this work on people closely linked to the mining sector, either because they have a profound knowledge of it, or work, or reside very close to the mining activity. We begin by describing the methodological steps followed in developing the scale, specifying the geographical surroundings where the field work took place. Then, we present the results of the research, where the different factors which integrate the mining image are described. Then, the reliability and validity of the scale is analyzed and a structural equation model is carried out to contrast the relationship between the factors and the mining image concept. Finally, the main conclusions of the research are discussed.

Scale development

The purpose of measurement in theory testing and research is to provide an empirical estimation of a theoretical construct (Gerbing and Anderson, 1988; Anderson, 1983). The process of measurement involves a sequence of steps that can be followed to guarantee the reliability and validity of the scales developed to measure marketing constructs (Churchill, 1979). According to the procedure suggested by Churchill (1979) and taking into account the proposition of Gerbing and Anderson (1988) to incorporate confirmatory factor analysis (Jöreskog and Sörbom, 1984; Bentler, 1985) for the evaluation of unidimensionality, the development of the mining scale followed this methodology. One of the principal problems in the scale development in this study is that it is pioneer research in the field of image, and it is very difficult to find studies with framework and research contrasting the usefulness of this construct. Thus the different steps of the methodology proposed by Churchill (1979) will be exposed in order to develop the mining image scale.

Specifying the domain of the construct

Traditionally research on mining activity has focused on technical and environmental aspects, since they are the principal concerns of companies and society. Nevertheless, the important consequences that this economic activity produces have expanded the

research disciplines involved. This is the case with marketing, where a specific image study has not been carried out, perhaps because mining is an extraction activity which is not directly related to the end consumer market. However, the interest in different marketing fields of study will increase in the coming years; in fields such us image, communication, public opinion, social marketing, environmental marketing, and so on. An example of this social and environmental concern is the commitment reached in May 2003 by the company members of the International Council of Mining & Metals to implement and measure their performance in 10 sustainable development principles. Among them one must highlight the maintenance of ethical business practices and the upholding of fundamental human rights, in order to improve the environmental performance and integrate sustainability in the decision process of corporations seeking continual improvement in health and safety and contributing to the social, economic and institutional development of the communities linked to this activity through the implementation of effective and transparent community engagement, communication and independently verified reporting arrangements with the interested parties.

The maintenance of ethical business practices and the upholding of fundamental human rights supports three clear aspects that must be included in the mining image: the social impact, the environmental impact and communications. In relation to the social impact Everingham considers that the main focus of attention has been devoted to reducing environmental damage, while less is known about how to manage the social impact of mining. Moreover, the concepts of environmental and social sustainability must be integrated into the governance of mining development through strategic regional plans (Department of State Development, Infrastructure and Planning, 2012). An example of the extensively studied environmental impact is the Leading Practice Sustainable Development Program in Mining that was a collaborative initiative launched in 2006 by the Australian government and the mining industry. The aim was to identify the key issues affecting sustainable development in the mining industry and provide information and case studies to enable a more sustainable basis for its operations. The output of the Program was a series of handbooks relevant to all stages of a mine's life, such as, exploration, feasibility, design, construction, operation, closure and rehabilitation. In this line, the Mineral Resources Landscape developed by Cooper and Giurco (2011), offers an expanded conceptualization of mineral sustainability, spanning production, consumption and recycling and connecting social, ecological, technological, economic and governance domains, across local and global scales (Giurco and Cooper, 2012). Communication is another key marketing variable which is closely related to public opinion (Ruiz Martín et al., 2012). In this context, governments try to take their decisions according to the social view of the problems and their possible solutions (Department of Local Government, Planning, Sport and Recreation, 2007). Thus, the treatment of the mining activity by Public Administrations (Rae and Rose, 2001) is conditioned by the information and news transmitted through of a variety of media: advertisements, annual reports, press, TV, video, websites, and so on (Department of Resources Energy and Tourism, 2006; Jenkins and Yakovieva, 2006). In conclusion, we can see why the aforementioned factors must be included in the mining image construct, and the variables of each factor must be generated according to the literature reviews and the opinion of experts.

The mining activity also produces great developments in other areas of the economy. This is the case of the migration process of people looking for jobs when a new mining activity begins (Lockie et al., 2009). This initial stage requires the highest level of employment, which exceeds the longer-term workforce requirements. This circumstance puts pressure on the housing sector because people need adequate living conditions (Department of Local Government, Planning, Sport and Recreation, 2007; Department of Resources Energy and Tourism, 2011; Australian Government, 2010). Moreover, the development of a mine or a mineral processing operation, also requires land for the placement of operational infrastructures, roads, airports, pipelines, storage facilities and a multitude of other project facilities (Department of Local Government, Planning, Sport and Recreation, 2007; Australian Government, 2010). These are the infrastructures and public services needed to carry out the mining activity (Lockie et al., 2009). Therefore, we can draw two new factors associated with infrastructures and the mining operations. The first factor is the infrastructure related to employment, that is, the housing activity, since workers need a minimum quality of life. The other factor deals with infrastructures required by the mining industry. In conclusion, we proposed a model of five factors to measure the construct of the mining image: (1) social impact, (2) environmental impact, (3) government and communication treatment, (4) employment and housing impact, and (5) infrastructures and industry impact. All these factors form the basis of the economy, because the different activities are related directly to the economic development of towns and countries.

Item generation and data collection

Based on the definitions of the five factors, different Likert-type statements served as the initial pool of items, related to the literature analyzed and the opinion of experts. The experts were interviewed in-depth for the purpose of determining the internal structure of the survey and the variables that should measure the mining image. The initial scale consisted of eighteen items where five are related to the social impact of the mining activity (Esteves, 2008; Department of Resources Energy and Tourism, 2010; Saha et al., 2011), these being: health, education, social services, sports and leisure, and quality of life (Metcalfe, 1982; Torkington et al., 2011; Ivanova et al., 2007). Four variables measured the environmental impact (Auty, 2003; Peprah, 2008; Lockie et al., 2009; Franks et al., 2010; Giurco et al., 2012): influence on the environment, impact on nature, restoration of space/area affected by mining and the influence on agriculture. Four items corresponded to government and communication: the treatment of the Public Administration (Rae and Rose, 2001; Cheshire et al., 2011), the treatment of the mass media and other types of media (Jenkins and Yakovieva, 2006) and two items were socio-emotional variables related to the performance of the information communicated (consciousness of the role of mining and consciousness of the mining products and derivates) (Department of Resources Energy and Tourism, 2006). Two variables are related to the employment and housing factor, having a variable (leisure and quality of life) that can score both in this and in the first factor (Lockie et al., 2009). Finally, three items were elaborated to determine the influence of the infrastructures and the mining industry in the construction of the mining image, such as, infrastructures, industrial sector and public services (Lockie et al., 2009) (see Table 1). The final questionnaire was tested and handed out to 48 experts of diverse professions linked to the mining activity (see Table 2). The objective was to verify the variables used and the suitability of the cross-check questions. Finally, these questionnaires were included in the study.

Also, a personal survey was carried out in the streets of the mining towns of Belmez and Peñarroya-Pueblonuevo (Spain), for the purpose of getting to know the opinion of the people who work or reside near the mining activity. The total population of the mining region is 13,550 people, where 75% reside in Peñarroya-Pueblonuevo and 25% in Belmez; 413 valued surveys were obtained, with a sampling error of $\pm 4.8\%$ and a level of confidence of 95%. The information was treated statistically by means of SPSS and AMOS software.

Table 1
Survey questions.

What is the influence or impact of the mining industry on agriculture?
What is the influence or impact of mining in industry?
What is the influence or impact of mining in the service sector?
What is the influence or impact of the mining in education?
What is the influence or impact of mining on health?
What is the influence or impact of mining on infrastructures?
What is the influence or impact of mining in public services?
What is the influence or impact of mining on the environment?
What is the influence or impact of mining on leisure and the quality of life?
What is the influence or impact of mining on sports?
What is the influence or impact of mining in social services and employment?
What is the influence or impact of mining in housing?
What is the treatment of the mining industry by the mass media?
What is the treatment of the mining activity by Public Administrations?
What is the influence or impact on nature?
What is your evaluation of the restoration of spaces affected by the mining industry?
What is your evaluation of the consciousness of the role of the mining?
What is your evaluation of the consciousness of the mining products and derivates?
Scale of measure used: from 1 – very negative to 6 – very positive.

Table 2
Expert interviewed.

Mining managers and tecnicians	8	Trade unionists	2
Mine owners	8	Lawyers	2
University professors	7	Doctors	2
Association presidents	3	Pharmacists	1
School teachers	4	Architects	1
Bank managers	3	Priests	1
Historians	2	Reporters	1
Políticians	2	Economists	1
Total interviewed: 48			

Scale purification

An exploratory factor analysis of principal components was carried out to evaluate the dimensionality of the scale used, determining the number of factors of the construct and the score loading for each item. On this basis, the variables which did not reach a commonalities or factorial loading of 0.50 were deleted. A special case is the variable "leisure and quality of life" that was assigned to the factors "social impact" and "employment and housing impact". Since the score loading in "social impact" was higher, it was included in this factor in the following statistical analysis. Special situations were also produced by the variables "consciousness of the role of the mining" and "consciousness of the mining products and derivates" that were not included in the factor "government and communication treatment". We decided to remove these variables because they did not contribute to explaining the factor and the model. The result of this process of purification was a scale of fourteen variables shown in Table 3. The variables are distributed within the five factors previously mentioned (social impact, environmental impact, infrastructures and industry impact, employment and housing impact, and government and communication treatment), explaining 65.192% of the variance where all the items obtained a load higher than 0.5.

Reliability analysis

The internal consistency between the variables of the scale is measured by means of the reliability study, determining the level of a group of items can measure the same construct (Parameswaran et al., 1979). The Alpha of Cronbach and the construct reliability were calculated for each factor in order to establish the reliability of the mining scale. Table 3 shows that the factors "social impact" and "environmental impact" obtained scores above 0.7, which is a useful level to contrast causal relationships (Nunnally, 1978). Moreover, the reliability of the factors "infrastructures and industry impact" and "employment and housing impact" were of 0.639 and 0.609, respectively. In spite of not achieving the useful level, it can also be accepted in exploratory studies (Nunnally, 1978; Murphy and Davidshofer, 1988; Hair et al., 2010) and future research will be able to improve the reliability by including new variables related to these dimensions (Cortina, 1993). For example, if in the reliability analysis of "employment and housing impact" the variable "leisure and quality of life" is included, the Alpha of Cronbach rises to 0.65. This circumstance can guide the improving process of the mining scale. Finally, the factor "government and communication treatment" has a low reliability of 0.568, below the acceptable level. These results evidence that the variables used in measuring the "government and communication treatment" factor are insufficient and must be increased with items more directly associated with government decisions, the communication of mining stakeholders and public opinion, as the variables related to mining consciousness have not produced the result expected. Future research will be able to take into account these results in order to develop a more reliable mining scale. In relation to construct reliability, Table 4 shows the results obtained. The factors "social impact", "environmental impact" and "infrastructures and industry impact" obtained a value above the minimum level of 0.60 recommended by Bagozzi and Yi (1988). Moreover, the factors "employment and housing impact" and "government and communication treatment" do not provide a good reliability level, again evidencing the limitations of items related to these two dimensions. In relation to the average variance explained all the factors obtained values above 0.5. Therefore, these results confirm that there is a basis to continue developing the mining image scale. Moreover, there are three factors associated with the construct of the scale both theoretically and empirically, and two more which have a strong theoretical support and can improve the empirical results by means of including new variables correlated with these dimensions.

Validity analysis

The validity of the scale has been determined by taking into account the content, convergent, discriminate and concurrent validity (Saxe and Weitz, 1982; DeVellis, 2003). Borsboom and Mellenbergh (2004) established that a test is valid for measuring an attribute if (a) the attribute exists and (b) variations in the attribute causally produce variation in the measurement outcomes. Assessing a scale's content validity is necessarily qualitative rather than quantitative, involving the analysis of two aspects: "(1) the thoroughness with which the construct to be scaled and its domain are explained and (2) the extent to which the scale items represent the construct's domain" (Parasuraman et al., 1988, pp. 28). First, the scale was elaborated based on the academic literature reviews that, although being scarce, were completed with the practical view of planning and sustainability development studies of the mining activity in determined areas or towns. Also, the in-depth interviews of experts gave support to the validity content and contributed to the purification process of the scale. Finally, the factors predicted by the literature and the opinion of experts were contrasted in the empirical study, eventhough, the scale must extend the number of items. Therefore, the scale can be considered to possess content validity.

The convergent validity determines the level of correlation between variables which measure the same construct (Bagozzi et al., 1979; Peter, 1981; Hair et al., 2010). The convergent validity can be verified by the standardized loading of the variables assigned to each factor (Anderson and Gerbing, 1988). The

Table 3
Dimensionality and reliability of the scale.

Factors	Variables	Loading	% Variance explained	% Cumulative variance	Chonbach's Alpha
Social impact	The influence on health	0.755	15.219	15.219	0.702
	The influence on sports	0.718			
	The influence on education	0.619			
	The influence on leisure and quality of life	0.606			
Environmental impact	The influence on the environment	0.818	15.040	30.259	0.738
	The impact on nature	0.816			
	Restoration of space/area affected by mining	0.732			
Infrastructures and industry impact	The influence on infrastructures	0.785	12.855	43.114	0.639
	The influence in industry	0.705			
	The influence on public services	0.639			
Employment and housing impact	The influence in social services and employment	0.769	11.876	54.990	0.609
	The influence on housing	0.712			
Government and communication	The treatment by Public Administrations of mineral resources exploitation	0.841	10.202	65.192	0.568
	The treatment of mining by the mass media	0.783			

Table 4
First-order confirmatory factor analysis and construct reliability.

Factors	Variables	Construct reliability (average variance extracted)	Standardized loadings (*p*)	Correlation	Confidence intervale
Social impact	The influence on health	0.648 (0.609)	0.558 (0.00)	S-E 0.342	(0.307–0.377)
	The influence on sports		0.654 (0.00)	S-II 0.580	(0.547–0.613)
	The influence on education		0.518 (0.00)	S-EH 0.687	(0.645–0.729)
	The influence on leisure and quality of life		0.709 (0.00)	S-GC 0.199	(0.165–0.247)
Environmental impact	The influence on the environment	0.639 (0.528)	0.801 (0.00)	E-II 0.050	(0.015–0.085)
	The impact on nature		0.747 (0.00)	E-EH 0.195	(0.148–0.242)
	Restoration of space/area affected by mining		0.565 (0.00)	E-GC 0.346	(0.298–0.434)
Infrastructures and industry impact	The influence on infrastructures	0.602 (0.616)	0.687 (0.00)	II-EH 0.649	(0.602–0.696)
	The influence in industry		0.514 (0.00)	II-C 0.146	(0.100–0.192)
	The influence on public services		0.649 (0.00)		
Employment and housing impact	The influence in social services and employment	0.558 (0.663)	0.631 (0.00)	EH-GC 0.305	(0.242–0.368)
	The influence on housing		0.695 (0.00)		
Government and communication	The treatment by Public Administrations of mineral resources exploitation	0.476 (0.654)	0.477 (0.00)		
	The treatment of mining by the mass media		0.831 (0.00)		

Adjusted model results
$\chi^2 = 235.392$, $Df = 67$, $p = 0.000$
GFI = 0.933, CFI = 0.884, RMSA = 0.074
Confidence interval extracted is greater than confidence interval but not with both S-EH and II-EH

conditions to confirm the convergent validity are that these coefficients are to be significant and the loadings are to be above 0.7, although in explanatory studies lower values can be accepted (Hair et al., 2010) together with a strong theoretical support. Table 4 shows that, with the exception of the variable "treatment by Public Administrations", with a factorial score of 0.477, the other variables obtained values above 0.5. These results do not permit the confirmation of convergent validity but provide support to improve the image mining scale, since the results are consistent with the theoretical review but need to include other variables that reinforce the construct validity.

With respect to the discriminant validity, it measures the level in which two dimensions conceptually similar are different (Belch and Landon, 1977; Bagozzi et al., 1979). The discriminant validity was verified following the method proposed by Anderson and Gerbing (1988), on the basis of determining the confidence intervals of the correlation coefficients between the latent dimensions of the mining image scale, and taking into account that these intervals must not include the value 1. Table 2 shows that there is not a value of 1 in the confidence intervals estimated, confirming the discriminant validity of the scale.

Structural equation model

A structural model was used to demonstrate the relationship between the factors and the mining image construct, where the independent dimensions were the latent factors and the dependent variable was the "mining image". This variable was measured through a specific question on the overall evaluation of the mining image. Fig. 2 shows the structural model with the relationships, standardized regression weights and the probability level. Fig. 2 also presents fit statistics that suggest adequate model fit for the five-dimension structure of the mining image scale. The goodness-of-fit index (GFI) was 0.935. The Bentler's (1990) comparative index (CFI) was 0.894, where values in the high 0.8 range and above were noted as designating adequate fit (Bentler, 1990; Bollen, 1989). The RMSEA was 0.069, less than the maximum level acceptable of 0.08. As Fig. 2 suggests, the model

achieved this criterion, which indicated that the fit of the five-factor model was adequate.

The relationship between the factors and the mining image variable were all significant. The social impact factor has a negative relationship on the mining image of -0.319 ($p=0.004$), demonstrating that mining activity is perceived as a negative influence on the quality of life and the social sustainability. With respect to the environmental impact the relationship is positive 0.139 ($p=0.03$) but very low, evidencing a neutral impact due to a great number of laws, public opinion contrary to the negative effects of the mining activity and the commitment of mining companies to care about the environment. The other three factors show positive and significant relationships with the mining image variable. These results demonstrate that the scale used explains the mining image and therefore the scale developed is useful to measure this construct and fulfills the concurrent validity. However, the scale has some problems related to the reduced number of variables used in some factors, such as the "employment and housing impact" and the "government and communication treatment". Another problem is the low score of some variables that do not reach a loading of 0.5, such as the "treatment by the Public Administrations" (0.468). Nevertheless, there is a strong theoretical support in all the variables of the structural model and, therefore, the research shows a high potential for further enhancing the understanding of mining research and policy making.

Conclusions

We have developed a mining image scale based on a theoretical review and an empirical study in order to determine its reliability and validity. The academic review determined that there is no specific study on this topic and, therefore, this research can be considered as an exploratory study. This circumstance has forced us to look for complementary research and practical studies focused on developing social and environmental planning in areas and towns directly connected to the mining activity. The reasons for developing a mining image scale were discussed, finding in the corporate social responsibility applied to the mining industry, a knowledge field that can be used as an initial theoretical framework were poor public opinion, the pressure of the mining stakeholders and the companies requiring to maintain their operating licenses have produced the necessity of finding out the perceptions and attitudes of society. Moreover, a mining image definition was formulated based on the need to connect society with other mining stakeholders in order to improve communication, shared knowledge, decision making processes and sustainability as well as to reduce the social and environment impact. As conclusion to the theoretical review a five factors model to measure the mining image construct was proposed: (1) social impact, (2) environmental impact, (3) government and communication treatment, (4) employment and housing impact, and (5) infrastructures and industry impact. These factors are linked to tangible and operative impacts of the mining activity.

The reliability analysis evidenced that the factors "social impact" and "environmental impact" obtained acceptable scores and the factors "infrastructures and industry impact" and "employment and housing impact" reached values above 0.6. However, the factor "government and communication" did not achieve the useful level. The results confirm that there is a basis to continue developing the mining image scale, since there are three factors that support both theoretically and empirically, and two factors with a strong theoretical base that must increase the variables in order to improve the reliability of the construct. Moreover, the content and discriminant validities was contrasted but not the convergent validity, which again evidenced that two factors "employment and housing impact" and "government and communication treatment" need to include new variables related to the latent dimension in order to reach the minimum level to validate the scale. After, a structural equation model was carried out, demonstrating that all the factors are related significantly with the variable "mining image" and, consequently, the concurrent validity. Furthermore, the relationship between social impact and mining image is negative, because the concern of the mining activity has focused principally on the environment and infrastructures. The other factors have a positive relationship, being the environmental impact the factor with the lowest score, due to the severe consequences that the mining activity can produce in nature. Although the overall fit meets the

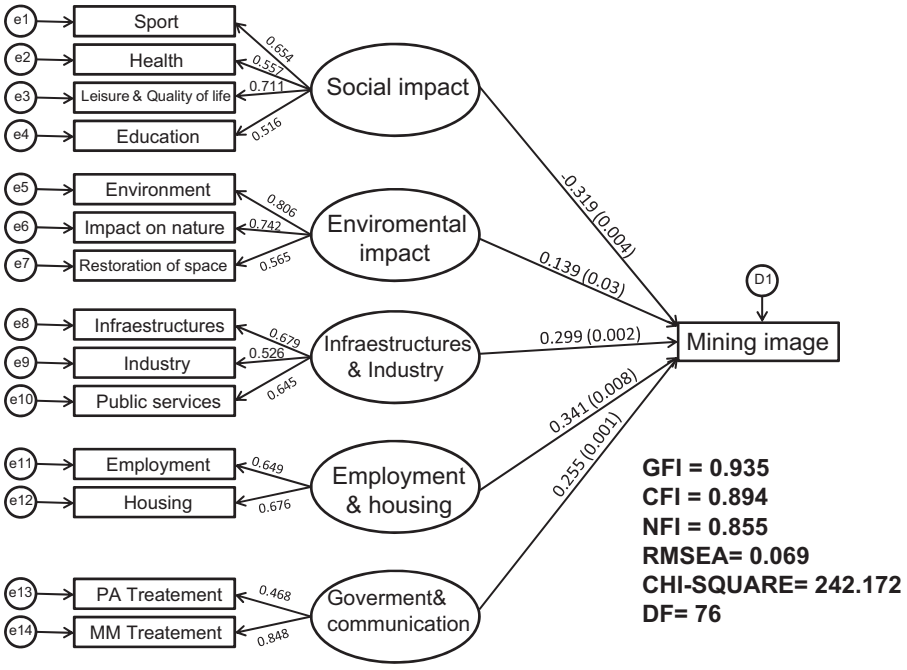

Fig. 2. Structural equation model.

cut-off values in SEM, the fit index combinations involving (CFI, NFI, RMSEA) failed to provide strong goodness of model fit measure.

Future research may improve this important field of study, taking into account the suggestions proposed in this paper. For the purpose of generalizing the method for other applications, this proposed mining scale should be tested in a variety of different contexts beyond what was shown here. Also it would be interesting to include other types of variables such as cognitive, emotional or behavioral, despite the fact that the two socio-emotional variables used did not produce the results expected. Other limitation is that the common method bias error that is attributable to the measurement method rather than to the constructs the measures represent (Podsakoff and Organ, 1986; Podsakoff et al., 2003) was not specifically handled, and future research should include this analysis. Finally, the mining image scale developed could form the foundation of future studies focused on analyzing the relationship between the real perceived image of the people who live near the mining activity, which have direct and less biased information, and the people which received all their information and knowledge through the mass media. This gap determines the information and communication performance of the mining activity with respect to society and other mining stakeholders.

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