ENVIRONMENTAL IMAGE OF METALLURGICAL COMPANY

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Abstract

For many years metallurgical plants belonged to a group of companies polluting the most the natural environment. Legislative rules and consequently made environmental policy of the government forced companies to introduce the sustainable development principles. The metallurgical companies have decided to implement environmental management systems and invest in production facilities and technologies. The investment in production sites and modern solutions resulting in friendly environment does not guarantee the positive attitude of citizens to the company. Measuring opinions and attitudes can help to define environmental image of metallurgical company and assess the effectiveness of environmental investments. The paper is based on face-to-face interview which took place on the Czech market. The primary survey includes 500 questionnaires conducted with respondents living in a city with metallurgical plant. Logistic regression is applied for attitude measurement.

Keywords: environment, image, metallurgical company, attitudes

1. INTRODUCTION

For very long time metallurgical plants belonged to the industries polluting the natural environment the most. New legislation and consequently realized ecological policy of the state obliged companies to introduce the sustainable development principles [1]. Environmental requirements can no longer be further marginalized. The metallurgical companies commenced to heavily invest in environmentally friendly facilities and technologies and implement environmental management systems. Technological changes should be accompanied by efficient communication and PR strategy which could inform about environmental arrangements of metallurgical company and could help to modify rather negative attitude to metallurgical plants. The goal of paper is to analyze how environmental policy can affect company image.

2. ENVIRONMENTAL IMAGE

Environmental management in an enterprise concentrates first and foremost on the reasons of the creation of pollution and its influence on the environment. [2, 3, 4] In formulation of the environmental strategic aims a given enterprise strives at elimination of negative impact on the environment. Environmental aspect is defined as the element of the enterprise (its products or services) which affects or may affect the environment [5]. The influence on the environment should be understood as every change in the environment, both positive and negative, which is fully or partially caused by the activities of the enterprise and/or its products [6]. Environmental policy of the companies is thoroughly perceived by citizens because affects their everyday life. Firms today generally recognize the importance of corporate reputation [7, 8, 9, 10, 11]. They realize that company image is highly affected by the way how companies approach to solving environmental problems and how communicate their environmental policy.

3. RESEARCH METHODOLOGY

The aim of the survey was to identify the image of company based on the oral attitude to the metallurgical company. The study is based on face-to-face interview which took part in October 2013. The sample size included 500 respondents who live in 20 km radius from metallurgical company site. The quota sample was

used as the sampling method for recruiting the respondents. The sample structure is described in **Table 1**. The questionnaire consisted of 21 topical and 4 identification questions (gender, age, education, place of residence). The data were analyzed through PASW 18.0 version.

Table 1 Sample structure according to the gender, education and age

Gender	abs.frequency	rel.frequency
man	245	49%
woman	255	51%
base	**500**	**100%**

Education	abs.frequency	rel.frequency
basic, apprentice	168	33,6%
secondary	256	51,2%
university	76	15,2%
base	**500**	**100%**

Age	abs.frequency	rel.frequency
15-24	101	20,2%
25-34	97	19,4%
35-44	99	19,8%
45-54	65	13,0%
55-64	67	13,4%
65+	71	14,2%
base	**500**	**100%**

The image of the company was examined through attitude to the company. Attitude to the company is a binary dependent variable which informs us how respondents perceive the existence of the company. Positive attitude means the agreement with economic, social and environmental arrangements of company while negative attitude expresses the disapproval with those elements. We suppose that attitude to the company is affected by three independent variables: awareness of environmental or social project, company contribution to the region development and level of environmental arrangements. Because of all independent variables are dummy variables the binary logit model can be applied. The logit model falls somewhere between regression and discriminant analysis. In the model the probability of a binary event taking place should be estimated. Consider an event that has two outcomes: positive attitude to the company or negative attitude. The probability of positive attitude may be modeled using the logit model as [12]:

$$\log_e\left(\frac{p}{1-p}\right) = b_0 + b_1X_1 + b_2X_2 + ... + b_kX_k \quad (1)$$

or

$$\log_e\left(\frac{p}{1-p}\right) = \sum_{i=0}^{k} b_iX_i \quad (2)$$

or

$$p = \frac{\exp\left(\sum_{i=0}^{k} b_iX_i\right)}{1+\exp\left(\sum_{i=0}^{k} b_iX_i\right)} \quad (3)$$

where p = probability of positive attitude to the company
X_i = independent variable i
b_i = logistical coefficient for that predictor variable

Since the probability of an event must lie between 0 and 1, it is impractical to model probabilities with linear regression techniques, because the linear regression model allows the dependent variable to take values greater than 1 or less than 0. The logistic regression model is a type of generalized linear model that extends the linear regression model by linking the range of real numbers to the 0-1 range.

Testing of individual parameters is based on Wald´ statistic. This statistic is a test of significance of the logistic regression coefficient based on the asymptotic normality property of maximum likelihood estimates and is estimated as.

$$Wald = \left(b_i / SE_{b_i} \right)^2 \quad (4)$$

where b_i = logistical coefficient for that predictor variable
SE_{bi} = standard error of the logistical coefficient

Three null hypotheses concerning with application of logit model can be formulated as:

- H_{0A}: Attitude to the company does not depend on awareness of environmental or social project.
- H_{0B}: Attitude to the company does not depend on company contribution to the region development.
- H_{0C}: Attitude to the company does not depend on level of environmental arrangements.

4. RESEARCH FINDINGS

4.1 Testing of Association between Topical and Identification Variables

The relationship between variables included in logit model (topical variables) and identification variables was measured by the chi-square statistic. The chi-square statistic (χ^2) is used to test the statistical significance of the observed association in a cross tabulation. It assists us in determining whether a systematic association exists between the two variables. Location has statistically significant impact on all variables connected with environmental aspect (awareness of environmental or social project, level of environmental arrangements) and affects also attitude to the company. The impact of demographic variables on topical variables is not statistically evident with exception of association between project awareness and education (see **Table 2**).

Table 2 Testing of Association between Topical and Identification Variables (χ^2)

	age	education	gender	location
project awareness	0,129	**0,003**	0,283	**0,002**
contribution	0,880	0,730	0,210	0,196
arrangements	0,392	0,987	0,878	**0,001**
attitude	0,948	0,116	0,218	**0,037**

4.2 Building logit model

The image of the company was measured through attitude to the company. Respondents with positive attitude represent favourable image of metallurgical company. 63% of respondents show positive attitude (see **Table 1**). Attitude to the company can be validated through the other variables (awareness of environmental or social project, company contribution to the region development and level of environmental arrangements) which inform us about respondent perception of environmental and social activities performed by metallurgical company. Using logit model which has been described in chapter 3 the relationship between attitude to the company (dependent variable) and the other independent variables was tested. The comparison between observed and predicted data shows us that overall success rate of model is 72% (see **Table 3**). The success rate of model is much higher in the case of positive attitude (86.3%) than in the case negative attitude (47%).

Table 3 Classification table

Classification Table[a]

Observed			Predicted		
			attitude		
			negative	positive	Percentage Correct
Step 1	attitude	negative	87	98	47,0
		positive	43	272	86,3
	Overall Percentage				71,8

a. The cut value is ,500

The logit model also computed parameters based on equation (1).

$$\log_e\left(\frac{p}{1-p}\right) = -0{,}993 + 0{,}519\ X_1 + 0{,}619\ X_2 + 1{,}635\ X_3 \quad (5)$$

where p = probability of positive attitude
X_1 = awareness of environmental or social project
X_2 = company contribution to the region development
X_3 = level of environmental arrangements

Coefficients mentioned in equation 5 come from **Table 4**.

Table 4 Variables in the Equation

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	awareness	,519	,212	5,988	1	,014	1,680
	contribution	,619	,206	8,993	1	,003	1,856
	arrangements	1,635	,209	61,280	1	,000	5,131
	Constant	-,993	,205	23,594	1	,000	,370

a. Variable(s) entered on step 1: awareness, contribution, arrangements.

In logistic regression, the log odds, that $\log_e\left(\frac{p}{1-p}\right)$ is a linear function of the estimated parameters Thus, for example, if X_1 is increase by one unit, the log odds will increase by 0.519 units, when the effect of variables X_2 and X_3 is held constant. Thus a_i (0.519) is the size of the increase in the log odds of the dependent variable (attitude to the company) when the corresponding independent variable X_1 (awareness of environmental or social project) is increased by one unit and the effect of the other independent variables is held constant. The sign will determine whether the probability increases (if the sign is positive) or decreases (if the sign is negative). In that context probability of positive attitude is more typical for respondents who perceive high level of environmental arrangements. The impact of all three independent variables on dependent variable (attitude) has been confirmed on the level of significance 95%. Three null hypothesis H_{0A}, H_{0B} and H_{0C} formulated in the chapter 3 were therefore rejected and alternative hypothesis H_{1A}, H_{1B} *and* H_{1C} were accepted.
H_{1A}: Attitude to the company depends on awareness of environmental or social project.
H_{1B}: Attitude to the company depends on company contribution to the region development.
H_{1C}: Attitude to the company depends on level of environmental arrangements.

Table 5 Correlation Matrix

Correlation Matrix

		Constant	awareness	contribution	arrangements
Step 1	Constant	1,000	-,378	-,420	-,661
	awareness	-,378	1,000	-,140	,074
	contribution	-,420	-,140	1,000	,024
	arrangements	-,661	,074	,024	1,000

Table 5 presents the simple correlation between all possible pairs of logistical coefficients. The highest correlation is observed between constant and level of environmental arrangements. Correlations between independent variables mentioned in matrix are not strong.

CONCLUSION

The paper deals with identifying factors which affect metallurgical company image. Company image is expressed through attitude to the company. Attitude to the company as the dependent variable has been tested using three independent variables. Level of company environmental arrangements has the highest impact on attitude to the company from examined variables. This finding stresses the importance of environmental policy and strategy for company image. The article also quantifies the relationship among all variables and defines logit model using logistic regression. The success rate of formulated model is much higher in the case of positive attitude to the company.

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