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Size-Structure Relationship in Manufacturing Enterprises in Transition

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Preliminary notes

The paper describes research on a size-structure relationship in manufacturing enterprises. The research was carried out in 30 manufacturing firms, mainly from the metalworking industry (seven oil and oil derivative processing companies) during the period from 1994 till 2006. Multiple correlation analysis indicated a positive relationship between a firm size and horizontal diversification, and also between a firm size and vertical diversification.
The results showed that there was a high level of correlation between size and organizational structure in metalworking enterprises of a country in transition. The results of this study indicated that manufacturing enterprises of a country in transition followed a global trend of flat organizational structure, which increased enterprises' flexibility and adaptability to changeable environmental factors.

Odnos veličine i strukture proizvodnih poduzeća u tranzicijskim zemljama

Prethodno priopćenje

U članku se opisuje istraživanje odnosa veličine proizvodnog poduzeća i njegove strukture. Istraživanje je provedeno u 30 proizvodnih poduzeća, uglavnom povezanih s metalurškom industrijom (sedam naftnih kompanija i kompanija za preradu naftnih derivata) u razdoblju od 1994. do 2006. godine. Analizom mnogostruke korelacije dokazan je pozitivan odnos veličine poduzeća i horizontalne, kao i vertikalne diverzifikacije
Rezultati pokazuju da postoji visok stupanj korelacije između veličine i organizacijske strukture u metalurškim poduzećima zemlje u tranziciji, ali i da proizvodna poduzeća u tranzicijskim zemljama prate globalni trend plošne organizacijske strukture koja povećava fleksibilnost poduzeća i njegovu prilagodljivost promjenljivim faktorima okoliša.

1. Introduction

The influence of organizational size on organizational structure is one of the most heavily researched issues in organizational theory. Blau's deductive theory of size, structural differentiation and administrative intensity says that the increasing size generates structural differentiation in organizations along various dimensions in deceleration rates.

Armandi and Mills (1982) propose integration and extend the theoretical work of Blau and Hage regarding organizational characteristics and efficiency. They construct a correlation model consisting of propositions relating to organizational size, complexity, stratification, formalization, centralization and two measures of efficiency on 128 savings and loan associations. A positive relationship between size and complexity is supported. Also, a positive relationship is confirmed between complexity and efficiency, complexity and centralization, size and hierarchy of authority, etc.

March and Mannary (1989) analyze the dynamic aspect of size, the effect of growth and the reduction in size on A/P ratio. They discovered that causal inferences about the effect of size on administrative intensity are different when based on data over time and when based on static, cross-sectional data. They also suggest a review of all cross-sectional studies.

There is little evidence in literature on researching the relationship between size and organizational structure in manufacturing sector for an economy in transition. The

possible effect of downsizing the number of employees, liberalization of market, concurrency and the demand for flexible manufacturing may cause structural inertia in some manufacturing enterprises. In cases when organizational structure does not follow change in size as a key contingent factor, the adaptation to changes during a transition time is more difficult. The aim of this research is to investigate a size-structure relationship from a present-day aspect of running a business in a turbulent and dynamic environment.

2. Measurements

Thirty organizations in this study were randomly selected mainly from a metalworking industry of a country in transition (including several oil processing companies). The criteria for choosing the enterprises were the following: 1. an enterprise was from a metalworking industry and; 2. there was a possibility of getting data in the observed period of time (1994-2006) for a longitudinal character of the study.

Determination of the parameters for measuring organizational size and structure was the first step in the research. Primarily, it was agreed that the measure for organizational size would be the total number of full-time employees in each organization. Secondly, total profit and total assets were used as additional measures of enterprises size. Horizontal differentiation was measured as the number of divisions or departments in the organizations. Vertical differentiation was measured as the number of different job positions between the top and bottom of an organization's authority structure.

Also, during the observed period of time, the data for total profit and total assets were collected.

The phase of data collecting was finished by making a database for 30 enterprises. The structure of this database consisted of the following:

- 66.67 % large enterprises, 26.67 % medium-sized enterprises, 6.67 % small-sized enterprises,
- 23.08 % public properties, 76.92 % stock companies,
- 13.17 % shares in the ownership of natural persons, 41.54% socially owned capital, 37.14 % socially owned capital

3. Results analysis

The results obtained from the observed enterprises during the period of observations (1994-2006) are presented in the table below. The given results represent the average number of levels in an organizational structure and the average span of control (measured on the first level in organizational structure) during the observed period of time.

Table 1. Median for number of levels and span of control

Tablica 1. Medijan brojeva razina i opsega kontrole

Average number of levels in organizational structure and span of control in period 1994-2006 Prosječan broj razina u organizacijskoj strukturi i opseg kontrole u razdoblju 1994.-2006.	Levels Razine	Span of control Opseg kontrole
Large enterprises Velika poduzeća	5	9
Medium enterprises Srednja poduzeća	5	5
Small enterprises Mala poduzeća	4	5

These results indicate that in large enterprises there are more levels in organizational structure and the wider span of control, and vice versa. Horizontal diversification and vertical diversification is pronounced in larger enterprises. This conclusion is in accordance with the Blau's theory of structural diversification.

However, the results in Table 1 do not show the character of changes during the observed period of time. Thus, the term of percentage change was introduced. For each enterprise the percentage change in total profit, the percentage change in total assets, the percentage change in total number of full-time employees, the percentage change in the number of organizational levels representing the vertical diversification, the percentage change in span of control representing the horizontal diversification were calculated for the period 1994-2006.

The analysis of the raw data showed the following:

- From 30 observed enterprises, organizational change was recorded in 16 enterprises, which is 53.33 %. Organizational change (either a change in the number of organizational levels or of the span of control) was recorded in 11 large enterprises which is 36.66 % of the whole sample, but 68.75 % of all large enterprises. Organizational change was recorded in five middle-sized enterprises which are 16.66 % of the whole sample, but 62.5 % of all middle-sized enterprises. Organizational change was not recorded during the observed period of time in small enterprises.
- Although a lot of studies described in organizational literature indicate a rapid growth of small enterprises, the results of this research show that in metal-working enterprises during the period of public economy transitions, large and medium enterprises are liable to undergo organizational changes.

The analysis of the percentage change of the observed parameters showed that:

- The total assets percentage change higher than 25 % had 19 enterprises, which is 63.33 % of all enterprises in the sample;
- The total profit percentage change higher than 25 % had 21 enterprises, which is 76.66 % of all enterprises in the sample;
- The percentage change in the number of full-time employees higher than 25 % had 16 enterprises, which is 53.33 % of all enterprises in the sample.

A multiple regression model was applied to the transformed data in the form of percentage changes.

A significant correlation was established regarding the influence of total profit, total assets and the number of full-time employees on horizontal and vertical diversification. It was established that total profit, total assets and the number of full-time employees had a larger influence on horizontal diversification (0.74) than on vertical diversification (0.62)

In Figure 1 the red area represents enterprises with fewer than 1000 employees, the blue area represents enterprises with more than 5000 employees. 3D surface shows that enterprises with a smaller number of employees have fewer organizational levels and a smaller span of control.

Table 2. Multiple Regression Model

Tablica 2. Model višestruke regresije

% Δ is calculated for period 1994-2006 % Δ izračunat je za razdoblje 1994.-2006.	% Δ Number of organizational levels % Δ broj organi-zacijskih razina	% Δ span of control % Δ opseg kontrole
% Δ profit % Δ profit	0,62	0,74
% Δ assets % Δ sredstva		
% Δ Number of employees % Δ broj zaposlenih		

The time series analysis in Figure 2 shows that during the observed time period we were downsizing the effect present. Also, the results do not indicate the changes in the number of organizational levels, but there is evidence of a wider span of control. The trend of a flat organizational structure is present.

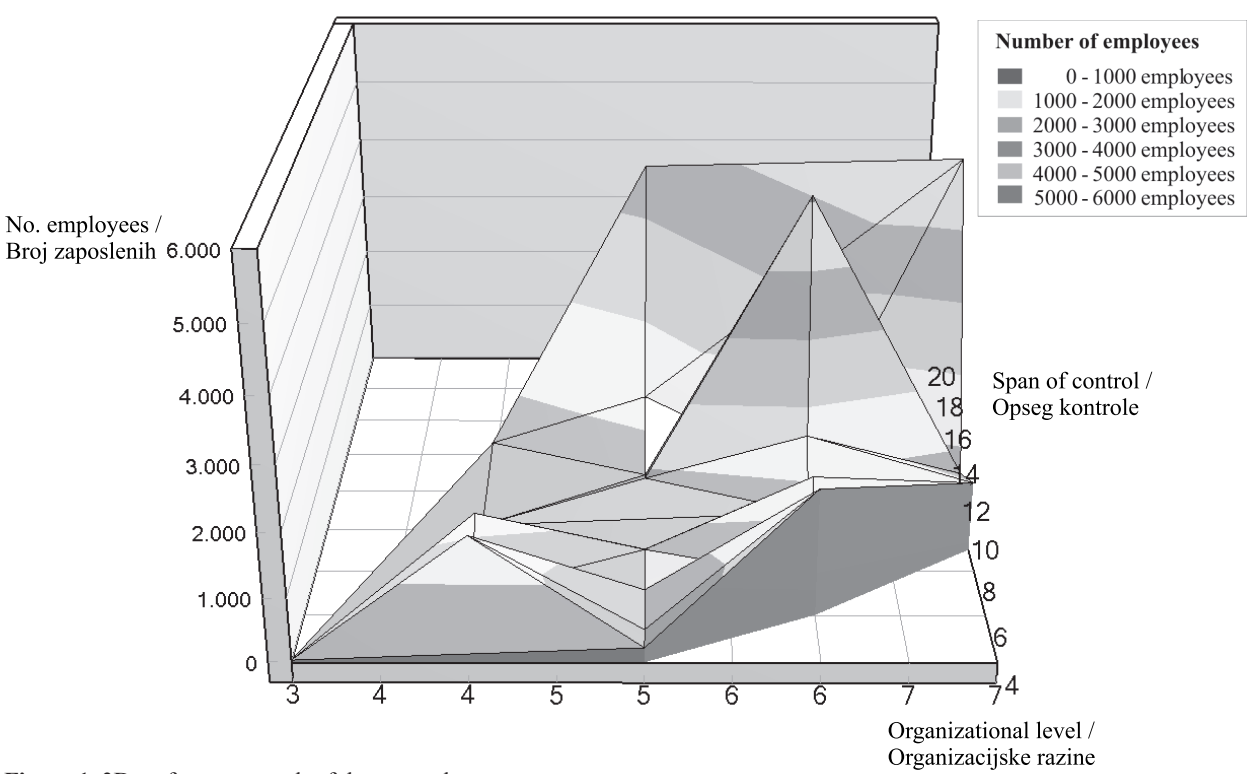

Figure 1. 3D surface as a result of the research

Slika 1. 3D površina kao rezultat istraživanja

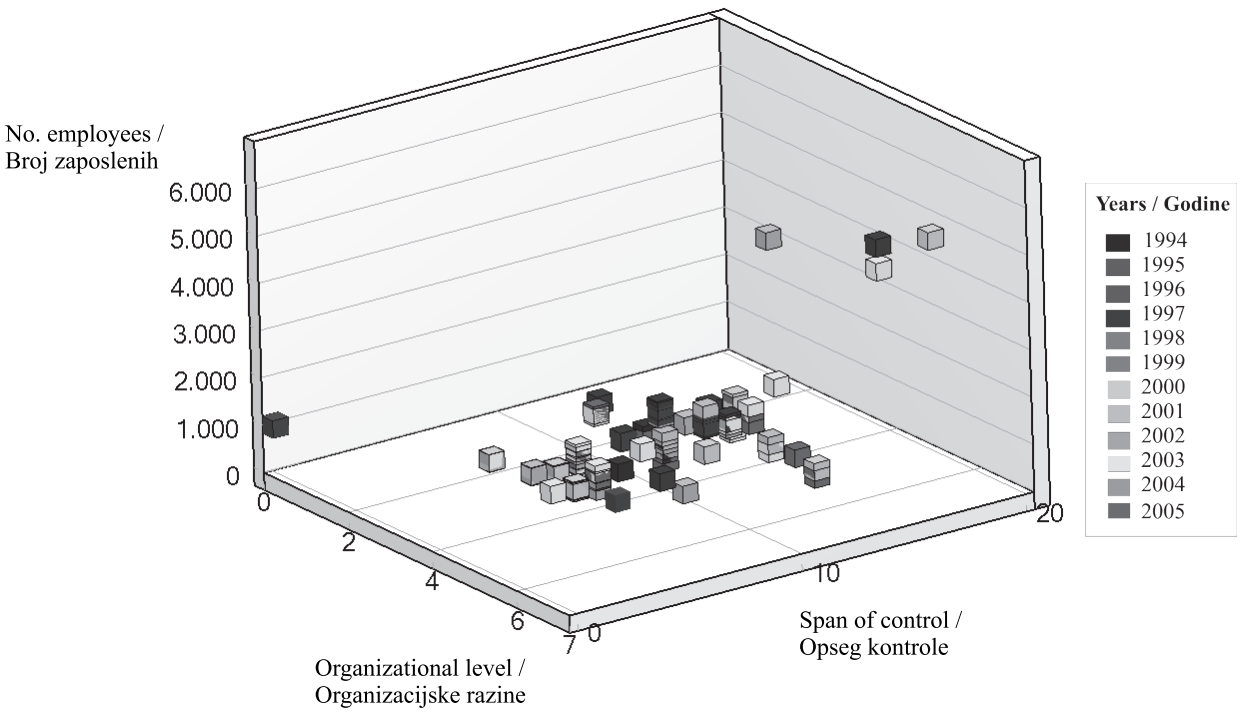

Figure 2. Time series
Slika 2. Vremenski nizovi

4. Findings and conclusions

The paper shows the results of the research of the size-structure relationship in metalworking industry of a country in transition. A longitudinal analysis on a random sample of 30 enterprises was carried out during 1994-2006.

The results of the research indicate the following:

- It was determined, on the basis of the results, that for large enterprises the median for the number of organizational levels was 5, and for the span of control, on the first organizational level, the median was 9; for medium-size enterprises the median for the number of organizational levels was 5, and the median for the span of control was also 5; for small-sized enterprises the median for the number of organizational levels was 4 and for the span of control the median was 5. These data shows that the number of organizational levels, as well as the span of control is larger for large enterprises and vice versa. Hence, the hypothesis under test that organizational size has an influence on organizational structure is confirmed.
- Comparing the dynamic changes in organizational size parameters (total profit, total assets, total number of full-time employees) and examining the influence these changes have on the organizational structure's parameters (number of organizational levels and span of control) the following is concluded: the size of an enterprise, being either large, medium or small, is of no relevance in the sense of classification, for investigating the influence of size on the structure. Thus, the term of a percentage change in the observed parameters was introduced. Measuring the percentage change during the recordable period of time for a defined set of size and structure parameters, we made a reliable database for further application of multi-regression models.
- The research was carried out during the period of transition. The effect of privatization on the research results was excluded because only several of 30 observed enterprises were privatized during 2005 and 2006, which is a short time for investigating the possible influence. However, the business activity which accompanies preparations for the process of privatization, such as downsizing the number of

employees, market liberalization implying a profit reduction etc., is undoubtedly present in the research results.

- A significant multiple correlation between the parameters of organizational size and the number of organizational levels (0.62) was identified.
- During the observed period of time a significant multiple correlations between the parameters of organizational size and the span of control (0.75) were established. This confirms that organizational size is highly correlated with horizontal diversification.
- The correlation coefficient between the percentage change in the number of organizational levels and the percentage change in the span of control during the observed period of time is 0.48, which does not offer some significant link. In most cases, the change in the span of control was recorded. The change in the number of organizational levels does not always follow the change in the span of control. This indicates that horizontal diversification occurs more often than vertical diversification.

3D surface gives better oversight of a downsizing effect and a time series diagram shows a trend of "flatness" of organizational structures.

Several conclusions reached after analyzing the research results indicate that organizational structures in the metalworking enterprises of a country in transition adapt to changes in organizational size as a key contingent factor. This was induced by lack of organizational inertia during the observed period of time.

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