

Pressure from Consumers as a Determinant of Innovative Activity of Enterprises from Countries of the Visegrad Group

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Summary

Among Visegrad countries the dominating innovations have a demand nature. Strong or very strong pressure from customers (who purchase goods), to introduce new products or to reduce production costs stimulates innovative activity of the surveyed companies. This study illustrates the impact of demand on innovation activity of enterprises of the Visegrad Group. Research was carried out on a large group of enterprises (1,349) in the four Visegrad countries, which is rather rare because of the difficulty in obtaining research material. The aim of this article is to show how variation in the intensity of the pressure from customers to introduce new products and to reduce production costs affects the individual attributes of innovation activity in enterprises of the

Visegrad Group. It was found that without strong or very strong pressure from customers, the company will not commence innovative activity.

Keywords: innovative activity, pressure from customers, Visegrad countries

JEL classifications: O31, O32

6.1. INTRODUCTION

Among Visegrad countries the dominating innovations have a demand nature. Strong or very strong pressure from customers to introduce new products or to reduce production costs stimulates innovative activity of the surveyed companies. Without strong or very strong pressure from customers, the company will not commence innovative activity in any of the studied aspects. The aim of this article is to show how variation in the intensity of the pressure from customers to introduce new products and to reduce production costs affects the individual attributes of innovation activity in enterprises of the Visegrad Group.

Empirical data was obtained in the course of four rounds of business environment studies, conducted in 2008-2009 at the request of the European Bank for Reconstruction and Development (EBRD) and the World Bank. Within the Visegrad Group countries 1349 enterprises were examined. The analysis has a static nature and relates to the period 2006-2008, which is consistent with the methodological standards described in the Oslo Manual. In order to accept or reject the research hypothesis, the independent variables were based on: a) the pressure from customers to market new products, b) pressure from customers to reduce production costs. Factors used as the dependent variable were the occurrence in the company of: a) investing activities, b) R&D, c) the implementation of new products, d) improvement of previously manufactured products, or e) obtaining international certification of quality for manufactured products.

The results of the research are in the field of interest of those responsible for the implementation of innovation policy at every level (national, regional and enterprise scale). The study covers four countries: the Czech Republic, Poland, Slovakia and Hungary. The study illustrates the impact of demand on innovation activity of enterprises of the Visegrad Group. Research had been carried out on a large group of enterprises in four countries of V4, which is not too often done because of the difficulty in obtaining research material.

6.2. LITERATURE REVIEW

Reviewing the literature, we can encounter many criteria for innovation distribution. One of the many criteria is the division of innovation due to the causes evoking it. Therefore, innovations can be divided into supply and demand (Janasz & Koziół, 2007).

Supply innovations in literature are also innovations pushed by technologies. This means that knowledge connected with basic sciences, applied research, design and production stimulate the innovative activity of enterprises (Dosi, 1982; Griliches, 1995; Nelson, 1982). The collection in one place of considerable resources of knowledge and their systematic analysis drives the practical use of the laws and rules known by the enterprises in various areas of science. However, we should note that the very access to the accumulated knowledge, regardless whether it is located inside the enterprise or outside, only constitutes a relevant condition, but is insufficient in itself to conduct the innovative activity. To implement the innovation additionally we need an idea, meaning the idea of how to use the acquired knowledge in practice for the needs of the enterprise.

The demand innovations in literature are also called "innovations drawn by demand". This name results from the fact that these innovations have an external character and are created from the innovation of the buyers (Von Hippel, 1988). They consist of the implementation of innovative processes that constitute the response to the consumer demands. Innovative activity in this sense refers to the flexible response to the changing requirements of consumers (Baran et al., 2012). In a situation of increased demand, enterprises invest more and pursue a more active innovative policy due to the requirements posed by the market (Acemoglu & Linn, 2004; Newell et al., 1999; Popp, 2002; Schmookler, 1966). The satisfaction of more sophisticated requirements favours the raising of the profitability of the enterprises. However, we should remember that demand and consumers vary and they can influence the innovative activity of enterprises in different ways (Adner & Levinthal, 2001).

The issue of cooperation between an enterprise and its customers has become an important element of development of many organisations. This issue has also become an important topic of numerous publications. For example, in the years 2004-2006 there appeared a number of publications describing the influence of customers' knowledge on the possibility to implement new products for the market (Elofson & Robinson, 2007; Franke & Piller, 2004; Franke et al., 2006;). The issue of the impact of the information obtained by the customers and suppliers on the innovative activity of the enterprises was the subject of interest of Prahalad & Ramaswamy (2000) and Skaggs & Youndt (2004). There are also many studies which illustrate the influence of the customers on the innovative activity of the enterprises in the sector grasp, e.g. in the sector of the sports footwear manufacturers (Fuller et al., 2007), extreme sports equipment (Hienerth, 2006), medical equipment (Lettl et al., 2006), video games (Jeppsen & Molin, 2003) and toys (Seybold, 2006).

The issue of the influence of customers on the innovative activity of the enterprise was also addressed in the deliberations regarding innovations by Chesbrough and co-authors (Chesbrough, 2003; 2006; Chesbrough & Crowther, 2007), Lichtenthaler (2008) and Prandelli et al., (2006). In their discussions, these authors pointed out that in the process of the formulation of the innovations the enterprise cannot conduct the whole innovative activity independently, without cooperation with other units

and consumers. Cooperation between manufacturers or suppliers and customers contributes to the creation of new products and services. Thus understood, cooperation constitutes one of the main areas of the interests of open innovations, which were defined as “the systematic search inside and outside the enterprise, storing and using the knowledge in order to implement the innovative process” (Lichtenthaler, 2011, p. 156). Summing up, we can state that open innovations draw special attention to the diffusion of knowledge “from” and “to” the enterprise (Chesbrough & Crowther, 2006).

6.3. MATERIAL AND METHODS

Empirical data were obtained during the fourth round of business studies, conducted in the years 2008-2009 at the request of the European Bank for Reconstruction and Development (EBOR) and the World Bank. In the area of the countries of the Visegrad Group 1,349 enterprises were examined. Their structure in the division into particular countries is presented in Table 6.1.

Table 6.1. Characteristics of the surveyed enterprises from the countries of the Visegrad Group, 2009.

| No. | Country | Number of enterprises | | | |
|-------|----------------|-----------------------|------------|---------------------------|----------------|
| | | Total | Processing | Dealing with retail trade | Other services |
| 1 | Czech Republic | 250 | 94 | 90 | 66 |
| 2 | Poland | 533 | 172 | 175 | 186 |
| 3 | Slovakia | 275 | 86 | 97 | 92 |
| 4 | Hungary | 291 | 103 | 105 | 83 |
| Total | | 1349 | 455 | 467 | 427 |

Source: Own study based on data obtained during the BEEPS 2009 study¹

The study included trade, service and manufacturing enterprises that employ at least 5 employees full time. All types of offices, including the army, police, health service and education, were excluded. The study involved enterprises belonging to the following sectors, according to the classification ISIC Rev 3.1:

1. group D – Manufacturing,
2. group F – Construction,
3. group G and H – Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods ; Hotels and restaurants
4. group I – Transport, storage and communications.

The study did not include enterprises belonging to Groups J (financial intermediation) or K real estate, renting and business activities) with the exception of sub-sector 72, which includes IT activities. Moreover, the study did not include enterprises dealing with agricultural or mining activities².

¹ Business Environment and Enterprise Performance Survey

² A detailed description of the selection of companies for research has been published on the website: <http://www.enterprisesurveys.org/Methodology>.

The conducted analysis is static and concerns the years 2006-2008, which is consistent with the methodological standards described in the Oslo Manual (OECD, Oslo Manual). In order to accept or reject the basic research hypotheses, the explanatory variables are: a) pressure from the customers to introduce new products to production and b) pressure from the customers to lower the costs of production. In turn, the explained variables include the occurrence in the enterprise of: a) investment activity, b) R&D activity, c) implementation of new products, d) improvement of previously manufactured products, e) obtaining international quality certification for the manufactured products.

The above-mentioned variables are reflected in the questions placed in the questionnaire constructed for the EBOR and the World Bank. These questions were closed, so there was the possibility to select the best answer from a list of potential possibilities³.

Dependent and independent variables adopted in the study were dichotomous, which means that they took on values equal to 0 or 1. For variables describing the innovative activity this means that either the given type of innovative activity of the enterprise occurred (in this case the variable took on the value of 1) or not (the value was 0). Adoption of the dichotomous values for the dependent and independent variables makes it impossible to use the most popular methods of modelling, which include, among others, the multiple regression.

For the purposes of this study calculations were conducted using the Statistica software. In total, within all countries from the Visegrad Group there 160 models were made, from which 25 were statistically significant and which were presented and discussed in the further stages of the study.

Due to the use of the models taking into account only one factor to interpret the examined dependencies, models are presented in the structural form. The key meaning was possessed by the sign standing by the parameter. A positive sign indicates that the probability of the occurrence of the given type of the innovative activity in the enterprise vulnerable to the pressure of the specified intensity from the customers was higher than the probability of the occurrence of the given type of the innovative activity in the enterprises vulnerable to the pressure from the party or customer of different intensity than in the first case. On the other hand, a negative sign means that the probability of the occurrence of the given type of innovative activity in the enterprises vulnerable to the pressure of the certain intensity from a competitor or customer was lower than the probability of the occurrence of the given type of the innovative activity in the enterprises vulnerable to the pressure from the party or the customer of different intensity than in the first case.

For the purposes of the article the following research hypotheses were formed:

Hypotheses 1: In the area of Visegrad countries innovations remain under the strong influence of customer behaviour. Strong or very strong pressure on their side

³ Ibidem.

to introduce new products to manufacturing by the enterprises stimulates the innovative activity of enterprises from Visegrad countries;

Hypothesis 2: The lack of pressure or minimal pressure from the customers to introduce new products to manufacturing by the enterprises does not have has a activating effect on the innovative activity of these enterprises;

Hypothesis 3: The lack of pressure or minimal pressure from the customers to lower the costs of production by the enterprise has a detrimental effect on the innovative activity of the enterprises from the countries of the Visegrad Group;

Hypothesis 4: Strong or very strong pressure from the customers to lower the costs of production by the enterprise has a detrimental effect on the innovative activity of the enterprises from the countries of the Visegrad Group.

6.4. RESEARCH RESULTS

As a result of the conducted calculations, we managed to obtain 14 statistically important models, which illustrate the effect of pressure from the customers to introduce new products to manufacturing in enterprises from countries of the Visegrad Group. The obtained models are presented in Tables 6.2-4. below. The data for the Czech Republic are not included, because all models were statistically insignificant, so not included in the tables.

Table 6.2. The influence of pressure from the customers for the implementation of new products to manufacture on the innovative activity of the enterprises in Hungary, 2009

| Innovation attribute | pressure to introduce new products to manufacturing | | | | | | | | | | | |
|---|---|----------------|----------------|-------------|----------------|----------------|--------------|----------------|----------------|-------------|----------------|----------------|
| | none | | | minimal | | | quite strong | | | very strong | | |
| | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ |
| | T | χ | p | T | χ | p | T | χ | p | T | χ | p |
| Hungary | | | | | | | | | | | | |
| introduction of a new product to manufacturing | - | | | -0.55x+0.17 | | | - | | | - | | |
| | | | | 0.18 | 0.35 | 0.57 | | | | | | |
| | | | | -2.98 | 9.08 | 0.00 | | | | | | |
| improvement of previously manufactured products | - | | | -0.40x+0.66 | | | - | | | - | | |
| | | | | 0.19 | 0.60 | 0.74 | | | | | | |
| | | | | -2.17 | 4.66 | 0.03 | | | | | | |
| Investment activity | -0.49x-0,15 | | | -0.39x+0.30 | | | - | | | - | | |
| | 0.21 | 0.21 | 0.21 | 0.18 | 0.47 | 0.62 | | | | | | |
| | -2.29 | -2.29 | -2.29 | -2.12 | 4.50 | 0.03 | | | | | | |

where:

S – standard error,

T – t-student statistics for the parameter,

χ² – Chi-square compliance test,

P – probability of the model's irrelevance

P₁ – probability of the occurrence of the given phenomena in the examined group of enterprises,

P₂ – probability of the occurrence of the given phenomena in other groups of enterprises,

Source: Own study based on BEEPS data

Table 6.3. The influence of pressure from the customers for the implementation of new products to manufacture on the innovative activity of the enterprises in Slovakia, 2009

| Innovation attribute | pressure to introduce new products to manufacturing | | | | | | | | | | | |
|---|---|----------------|----------------|-------------|----------------|----------------|--------------|----------------|----------------|-------------|----------------|----------------|
| | none | | | minimal | | | quite strong | | | very strong | | |
| | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ |
| | T | χ | p | T | χ | p | T | χ | p | T | χ | p |
| Slovakia | | | | | | | | | | | | |
| implementation of international quality certification | -0.51x-0.18 | | | -0.50x-0.17 | | | +0.33x-0.39 | | | - | | |
| | 0.23 | 0.24 | 0.43 | 0.21 | 0.25 | 0.43 | 0.16 | 0.48 | 0.35 | | | |
| | -2.23 | 5.17 | 0.02 | -2.35 | 5.73 | 0.02 | 2.11 | 4.45 | 0.03 | | | |
| introduction of a new product to manufacturing | -0.59+0.12 | | | -0.42x+0.11 | | | - | | | +0.62x-0.12 | | |
| | 0.22 | 0.32 | 0.55 | 0.20 | 0.38 | 0.54 | | | | 0.18 | 0.69 | 0.45 |
| | -2.70 | 7.51 | 0.01 | -2.10 | 4.45 | 0.03 | | | | 3.46 | 12.32 | 0.00 |
| improvement of previously manufactured products | - | | | -0.47x+0.58 | | | - | | | - | | |
| | | | | 0.20 | 0.54 | 0.71 | | | | | | |
| | | | | -2.34 | 5.46 | 0.02 | | | | | | |

where:

S – standard error,

T – t-student statistics for the parameter,

χ² – Chi-square compliance test,

P – probability of the model's irrelevance

P₁ – probability of the occurrence of the given phenomena in the examined group of enterprises,

P₂ – probability of the occurrence of the given phenomena in other groups of enterprises,

Source: Own study based on BEEPS data

Table 6.4. The influence of pressure from the customers to the implementation of new products to manufacturing on the innovative activity of the enterprises in Poland, 2009

| Innovation attribute | pressure to introduce new products to manufacturing | | | | | | | | | | | |
|---|---|----------------|----------------|-------------|----------------|----------------|--------------|----------------|----------------|-------------|----------------|----------------|
| | none | | | minimal | | | quite strong | | | very strong | | |
| | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ |
| | T | χ | p | T | χ | p | T | χ | p | T | χ | p |
| Poland | | | | | | | | | | | | |
| introduction of a new product to manufacturing | - | | | - | | | - | | | +0.27x+0.13 | | |
| | | | | | | | | | | 0.12 | 0.66 | 0.55 |
| | | | | | | | | | | 2.26 | 5.13 | 0.02 |
| improvement of previously manufactured products | - | | | -0.83x+0.22 | | | - | | | - | | |
| | | | | 0.41 | 0.27 | 0.59 | | | | | | |
| | | | | -2.03 | 4.39 | 0.04 | | | | | | |
| Investment activity | - | | | -1.00x+0.39 | | | - | | | - | | |
| | | | | 0.40 | 0.27 | 0.65 | | | | | | |
| | | | | -2.44 | 6.47 | 0.01 | | | | | | |

where:

S – standard error,

T – t-student statistics for the parameter,

χ² – Chi-square compliance test,

P – probability of the model's irrelevance

P_1 – probability of the occurrence of the given phenomena in the examined group of enterprises,

P_2 – probability of the occurrence of the given phenomena in other groups of enterprises,

Source: Own study based on BEEPS data

From the models presented in Tables 6.2-4. it was found that the variables of no or minimal pressure from the customers for the introduction of new products had a detrimental effect on almost all examined attributes of the innovative activity, meaning on investment activity, implementation of international quality certification, improvement of previously produced products and introduction of new products to manufacturing. In the case of no or minimal pressure from customers for the introduction of new products to manufacturing, the probability of the introduction of a new product to manufacturing ranged from 0.27 to 0.38 depending on the intensity of pressure and country in the area in which the enterprises functioned. This probability was 42% to 118% lower than the probability of introducing a new product in the enterprises in which there was quite strong or very strong pressure from the customers for the introduction of new products. The confirmation of the above dependency is provided by the models illustrating the influence of very strong pressure for the introduction of a new product in Poland and Slovakia. From these models it was found that the probability of the introduction of a new product in the enterprises in situations where there was very strong pressure from the customers to introduce new products was in the range of 0.66 to 0.69 and was 20% to 53% higher than the probability of introducing new products in enterprises on which there was pressure of less intensity. Minimal pressure from the customers for the introduction of new products to manufacturing has a detrimental effect also on the improvement of previously manufactured products. This probability was from 0.54 to 0.60, depending on the country where the operating enterprise is located, which is 23 to 31% lower than this probability when there was higher pressure.

The lack of minimal pressure from the customers to introduce new products also has a detrimental effect on the investment activity and implementation of the international quality certification. In the first case, the probability of the investment - depending on the intensity of the pressure - was from 0.27 to 0.56 and was 32 to 141% lower than the probability of conducting investments in the enterprises on which pressure of a higher intensity than no or minimal pressure was exerted.

On the other hand, in the case of the implementation of the international quality certification, the probability of their implementation in the enterprises, with pressure from the customers to introduce new products to manufacturing was 0.24. A similar value was also achieved for the probability of the implementation of international quality certification in the enterprises where there was minimal pressure from the customers to introduce new products to manufacturing. In both cases, the discussed probability was from 72 to 79% lower than the probability of the implementation of international quality certification in the enterprises on which there was pressure from the customers concerning the introduction of new products to manufacturing above no or minimal pressure, while the occurrence of strong pressure from the customers

to introduce new products to manufacturing stimulated the introduction of the international certification. The probability of the implementation of the international certification in the enterprises where strong pressure was exerted by the customers to introduce new products was 0.48. This was 37% higher than the probability to introduce the international quality certification in the enterprises on which there was lower pressure from the customers to introduce new products to manufacturing.

6.5. THE INFLUENCE OF PRESSURE ON LOWERING THE PRODUCTION COSTS FROM THE CONSUMERS ON THE INNOVATIVE ACTIVITY OF THE ENTERPRISES FROM THE VISEGRAD COUNTRIES

Examining the influence of pressure from customers on lowering the production costs as a result of the conducted calculations, we managed to obtain 11 statistically important models, which are presented in Tables 6.5-7. below.

Table 6.5. The influence of pressure from customers for the lowering of production costs on the innovative activity of enterprises in Hungary, 2009

| Attribute of innovation | Pressure to lower the production costs | | | | | | | | | | | |
|-------------------------|--|----------------|----------------|-------------|----------------|----------------|--------------|----------------|----------------|-------------|----------------|----------------|
| | Like in the others | | | minimal | | | quite strong | | | very strong | | |
| | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ |
| | T | χ | p | T | χ | p | T | χ | p | T | χ | p |
| Hungary | | | | | | | | | | | | |
| R&D activity | -0.39x+0.75 | | | - | | | - | | | - | | |
| | 0.19 | 0.23 | 0.36 | | | | | | | | | |
| | -2.06 | 4.20 | 0.04 | | | | | | | | | |
| investment activity | - | | | -0.42x+0.30 | | | - | | | - | | |
| | | | | 0.19 | 0.45 | 0.62 | | | | | | |
| | | | | -2.21 | 4.89 | 0.03 | | | | | | |

where:

S – standard error,

T – t-student statistics for the parameter,

χ² – Chi-square compliance test,

P – probability of the model's irrelevance

P₁ – probability of the occurrence of the given phenomena in the examined group of enterprises,

P₂ – probability of the occurrence of the given phenomena in other groups of enterprises,

Source: Own study based on BEEPS data

Table 6.6. The influence of pressure of the customers on the lowering of the production costs on the innovative activity of enterprises in Slovakia, 2009

| Attribute of innovation | Pressure to lower the production costs | | | | | | | | | | | |
|---|--|----------------|----------------|-------------|----------------|----------------|--------------|----------------|----------------|-------------|----------------|----------------|
| | Like in the others | | | minimal | | | quite strong | | | very strong | | |
| | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ |
| | T | χ | p | T | χ | p | T | χ | p | T | χ | p |
| Slovakia | | | | | | | | | | | | |
| introduction of international quality certification | -0.62x-0.15 | | | - | +0.34x-0.37 | | | - | | | | |
| | 0.21 | 0.22 | 0.44 | | 0.16 | 0.48 | 0.35 | | | | | |
| | -2.89 | 8.80 | 0.00 | | 2.10 | 4.43 | 0.04 | | | | | |
| introduction of a new product to manufacturing | -0.54x+0.13 | | | - | | | | - | | | | |
| | 0.20 | 0.34 | 0.55 | | | | | | | | | |
| | -2.69 | 7.39 | 0.01 | | | | | | | | | |
| improving previously manufactured products | - | | | - | +0.34x-0.37 | | | - | | | | |
| | | | | | 0.17 | 0.76 | 0.64 | | | | | |
| | | | | | 2.01 | 4.09 | 0.04 | | | | | |
| investment activity | - | | | -0.55x+0.36 | | | - | | | | | |
| | | | | 0.21 | 0.42 | 0.64 | | | | | | |
| | | | | -2.68 | 7.24 | 0.01 | | | | | | |

where:

S – standard error,

T – t-student statistics for the parameter,

χ² – Chi-square compliance test,

P – probability of the model's irrelevance

P₁ – probability of the occurrence of the given phenomena in the examined group of enterprises,

P₂ – probability of the occurrence of the given phenomena in other groups of enterprises,

Source: Own study based on BEEPS data

Table 6.7. The influence of pressure of the customers on the lowering of the production costs on the innovative activity of enterprises in Poland, 2009

| Attribute of innovation | Pressure to lower the production costs | | | | | | | | | | | |
|---|--|----------------|----------------|-------------|----------------|----------------|--------------|----------------|----------------|-------------|----------------|----------------|
| | Like in the others | | | minimal | | | quite strong | | | very strong | | |
| | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ | s | p ₁ | p ₂ |
| | T | χ | p | T | χ | p | T | χ | p | T | χ | p |
| Poland | | | | | | | | | | | | |
| introduction of international quality certification | -0.40x-0.49 | | | - | | | | - | | | | |
| | 0.15 | 0.19 | 0.31 | | | | | | | | | |
| | -2.67 | 7.40 | 0.01 | | | | | | | | | |
| introduction of a new product to manufacturing | -0.36x+0.28 | | | - | | | | - | | | | |
| | 0.13 | 0.50 | 0.61 | | | | | | | | | |
| | -2.71 | 7.39 | 0.01 | | | | | | | | | |
| investment activity | - | | | -0.92x+0.39 | | | - | +0.28x+0.29 | | | | |
| | | | | 0.42 | 0.30 | 0.65 | | 0.12 | 0.72 | 0.61 | | |
| | | | | -2.18 | 5.02 | 0.02 | | 2.26 | 5.18 | 0.02 | | |

where:

S – standard error,

T – t-student statistics for the parameter,

χ² – Chi-square compliance test,

P – probability of the model's irrelevance

P_1 – probability of the occurrence of the given phenomena in the examined group of enterprises,

P_2 – probability of the occurrence of the given phenomena in other groups of enterprises,

Source: Own study based on BEEPS data

Based on the presented models in Tables 6.5-7., it can be stated that the lack of even minimal pressure from the customers to lower the production costs had a detrimental effect on R&D activity, investment activity, implementation of the international quality certification and the introduction of new products to manufacturing. The probability to conduct the investment in the group of enterprises when the customers exerted minimal pressure connected with the lowering of the production costs ranged from 0.30 to 0.45, 38% to 117% lower than the probability of conducting the investment in the group of enterprises experiencing pressure of intensity different than minimal, meaning quite strong or very strong pressure or the complete lack of pressure. In turn, the probability of conducting the investment in the group of enterprises on which there was very strong pressure from the customers on lowering the production costs was 0.72, which was 18% higher than the probability of conducting the investment in the group of enterprises on which there was pressure from customers concerning the lowering of production costs of intensity other than very strong.

Similar conclusions can be drawn from the model, which illustrates the dependency between the lack of pressure from the customers to lower the production costs and the R&D activity. The probability of the occurrence of the R&D activity in enterprises where there was no pressure from the customers to lower the production costs was 0.23, 56% lower than the probability of the occurrence of the R&D activity in the enterprises on which there was at least minimal pressure from the customers to lower the production costs.

Also the probability of introducing international quality certification in the enterprises from the three investigated countries (fourth case – Czech Republic was not included because of statistically non significant models) of the Visegrad Group was significantly lower than in the group of enterprises where there was pressure from the customers to lower the production costs. The probability of introducing these certification by the enterprises was examined by country, in ranging from 0.19 in Poland to 0.22 in Slovakia. This probability was even two times lower than the probability of introducing the certification in the enterprises in which there was stronger pressure from the customers concerning the lowering of the production costs. The confirmation of the above observation is the model stimulating the influence of quite strong pressure from the customers on the lowering of the production costs on the probability of the international quality certification. This probability was 0.48 and it was 37% higher than the probability of introducing international quality certification in the enterprises where pressure from the customers to lower the production costs of intensity was different than quite strong.

The same dependency also exists in case of the introduction of a new product to manufacturing. Also in this case the probability to introduce new products to

manufacturing in enterprises experiencing no pressure from customers was lower than the probability of introducing a new product in the enterprises on which there was at least minimal pressure from the customers to lower the production costs. This probability ranged from 0.34 to 0.50 and was 22% to 62% lower than the probability of introducing a new product in the enterprises, on which there was at least minimal pressure from customers to lower the production costs.

The probability of improving previously manufactured products in enterprises where there was quite strong pressure from the customers to lower the production costs was higher than the probability of improving the previously manufactured products in the group of enterprises where customer pressure to lower the production costs of intensity differed from quite strong pressure. This probability was 0.76 and was 19% lower than the probability of improving the previously manufactured products in enterprises under pressure from customers to lower production costs that had an intensity different than quite strong.

6.6. CONCLUSIONS

Analysing the probit models presented in the third and fourth part, the validity of the accepted hypothesis can be confirmed: in the area of countries of the Visegrad Group innovations are strongly stimulated by customers. The obtained models confirm that strong or very strong pressure from customers to introduce new products to manufacturing by the enterprises stimulates the implementation of the international certification and the introduction of new products to manufacturing.

The findings also confirm the second hypothesis, according to which the probability of the occurrence of the innovative activity in enterprises under no or only minimal pressure from the customers for the introduction of new products to manufacturing was lower than the probability of the occurrence of the innovative activity in enterprises where there was quite strong or strong pressure to introduce new products to manufacturing. The obtained models confirm the detrimental influence of the lack of pressure or of minimal pressure from customers to introduce new products to manufacturing on the implementation of the international quality certification, investment activity, improvement of the previously manufactured products and introduction of new products to manufacturing.

The obtained models mean that if there is demand for new products from customers, then the enterprises from the countries of the Visegrad Group adapt to this demand. However, in the situation of the lack of impulse from the customers or competitors, the enterprises refrain from innovative activity, not seeing the need for it, or not having too many free resources available to them. When pressure for innovation is lacking, resources which would be devoted to innovative activity are directed to other areas of the activity of the enterprise.

Also the third and fourth hypotheses were confirmed in the obtained probit models. No or minimal pressure from the customers to lower the production costs by the enterprise has a detrimental effect on R&D activity, investment activity,

implementation of international quality certification and introduction of new products to manufacturing. While the strong or very strong pressure from the customers to lower the production costs by the enterprise has a detrimental effect on the investment activity, introduction of the international quality certification and improvement of previously manufactured products.

In conclusion, probit models concerning Visegrad countries are dominated by models with no or minimal pressure from customers. This means that the surveyed enterprises do not often experience pressure from customers concerning either the introduction of new products into the production phase or lowering production costs. On the other side, if pressure from customers occurs, the companies adapt to it.

This particular article illustrates the importance of customers in the innovative activity of enterprises. The arguments presented in the article, which have also been verified by the empirical data, confirm the validity of the conclusions, concerning open innovation and the impact of customers on innovative activities of companies. The conclusions presented in this paper emphasise the key role of pressure from customers in the innovative activity of enterprises. Note that the literature distinguishes between customer impact on innovations drawn by demand and drawn by supply factors. The conclusions in this article concern only innovation of demand nature; the impact of customer demand on supply-side innovations requires separate research and empirical verification.

A unique contribution of the article to the scientific development and literature of the subject is the use of probit modelling for the purposes of determining the impact of various intensities of pressure from customers to introduce new products and reduce production costs on different aspects of innovative activity of enterprises of the Visegrad countries.

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