

SUSTAINABLE DEVELOPMENT FACETS: EXPORTING INDUSTRIAL SECTORS FROM INSIDE

Manuela Tvaronavičienė¹, Agnė Šimelytė², Natalja Lace³

^{1,2}*Vilnius Gediminas Technical University, Faculty of Business Management,
Saulėtekio al. 11, LT-10223 Vilnius, Lithuania*

³*Riga Technical University, 6 Kalnciema Street, Riga LV-1048 Latvia*

Emails: ¹manuela.tvaronaviciene@vgtu.lt; ²agne.simelyte@vgtu.lt; ³Natalja.Lace@rtu.lv

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Abstract. Sustainable development of country economy is being driven by various factors. Economy of each country is comprised of economic sectors. External and internal development drivers differently affect different economic sectors, as a rule. Since economic sectors are not homogeneous, their expanding or contracting depends on behavior of concrete market players; i.e. business companies. The paper aims to reveal factors affecting patterns of development exporting companies attributed to industrial sector and its sub-sectors of Lithuanian economy. Methodology of the investigation is based on development of theoretically grounded questionnaire, targeting revealing factors impacting international competitiveness of industrial companies. Impact of factors, attributed to external business environment, and role of factors attributed to internal development forces are to be indicated. Obtained results, is expected, and would allow to foresee trends and main drivers of further development of exporting Lithuanian industrial sectors.

Keywords: factor analysis, exporting industrial sectors, chemical and chemical products, external and internal drivers

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1. Introduction: approaches toward characterizing of Lithuanian industry¹

The first characteristic of any country's industrial development level is percent of value added, created by industry. Hence, industry share in Lithuanian economy is comparatively high in the EU context. It could be as well claimed that the share is high in the context of developed countries (Tvaronavičienė 2014). Since scarce resources retard economic development,

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Lithuania's industrial development prospective, its competitiveness has to be assessed by taking into account its energy security.

Lithuania is exceptionally energy dependent. Import dependency will persist in nearly observed future, and there is low probability that energy prices would decrease significantly (Miškinis *et al.* 2013; Tvaronavičienė 2014). Hence, activity growth trends of industrial sector and its subsectors and respective energy consumption have to be taken into account, energy intensities estimated. Industrial subsectors threatening increasing energy intensity have to be closely observed, and more energy efficient ones supported. It is unanimously agreed, that countries with

well-developed high-tech industry have competitive advantage over other industrial countries.

Juxtaposing of high-tech industry' shares reveals in selected countries let us reveal that in this respect Lithuania lags behind. Share of high-tech industry in Lithuania is comparatively low and has to be increased: the task is complicated followed by complex implementation (Tvaronavičienė 2014). In order to indicate factors affecting further industrial development, we articulate methodology, which allowed let us glancing at the development drivers through lenses of industrial market players.

2. Methodology of industrial development factors' indication: composition of questionnaire, survey aims and expected results

We intend to identify factors of industry development through survey of Lithuanian exporting companies. Processed obtained primarily data and interpretation of the results, we believe, would allow to shed a light on development processes and would lead to novel insights. Hence, while composing a questionnaire we aim to reveal how multiple factors, distinguished by us, affect development of Lithuanian industry and its subsectors.

Here we need to indicate clearly, that there is a wide range of factors, which impact economic growth. Such processes affect the economic development as migration of labor force (Balkytė, Tvaronavičienė 2011); globalization processes (Lankauskienė, Tvaronavičienė 2012; Tvaronavičienė *et al.* 2013, Antanavičienė 2014); institutions (Tvaronavičienė, Grybaitė 2012); all kind of innovative activities (Dudzevičiūtė, Tvaronavičienė 2011); abundance or scarcity of strategic resources (Vosylius *et al.* 2013, Laužikas, Krasauskas 2013; Vasiliūnaitė 2014, Tvaronavičienė 2014), investments of local or foreign origin (Tvaronavičienė, Lankauskienė 2011, Antanavičienė 2014), financial health (Mačiulis, Tvaronavičienė 2013), economic policy (Tvaronavičienė 2012, Tvaronavičienė 2014) and many not listed factors. All those factors affect economic development simultaneously; in addition their impact differs within different groups of countries (Tvaronavičienė, Lankauskienė 2011, Laužikas, Krasauskas 2013, Tvaronavičienė 2014). Same factors affect structures of countries' economies and influence their transformation patterns (Tvaronavičienė, Lankauskienė 2012, 2013). Since each approach can

be adopted and grounded, we need to clarify assumptions we formulate. We point out, that despite intense discussion among scholars, majority of them unanimously agree, that main driving forces of economic development are investments (of local and foreign origin), labor force, innovations and scarce resources (Lankauskienė, Tvaronavičienė 2013). In Lithuanian case we put emphasis on energy, since Lithuania is energy dependent (Miškinis *et al.* 2013; Tvaronavičienė 2014). In order to clarify how listed indicators are seen from point of view of industrial market players, we incorporate those questions into survey. The questionnaire is comprised from two major parts, which are named as inside and outside competitiveness factors. Inside competitiveness factors, ranked from into 5 categories from claiming "very important" to "not important at", in our research would include: high quality of production; relatively low production price; low labor cost; low energy intensity; energy efficiency; high labor productivity; high qualification of labor; expenses of labor qualification raise; innovative production methods; R&D expenses; insignificant pollution. Respectively, under outside competitiveness factors, we mean macroeconomic environment (GDP growth, level of country unemployment, inflation); industry sector's expansion or contraction; considerable unmet demand, energy resources' price level; accessibility to financial capital.

Before starting factor analysis of the responses in Chemical and petrochemical industry, let us observe and comment on industrial companies response taken irrespective to the industrial sector they belong.

We received 139 responses out of 600 enterprises questioned (over 8000 exporting industrial enterprises in Lithuania). What is peculiar about responses, that 40% of respondents indicate, that productivity is satisfying; despite, as it was indicated above, high-tech industry development in Lithuania is insufficient. The latest investments are being directed to expansion of productive capacities, rather than R&D (note: investments into energy saving technologies are considered as important). The forces, impacting economic development are being listed in the following order: the first, energy consumption, the second, investments (local are being considered of higher importance compared to those of foreign origin; the third, innovations. Unexpectedly, respondents are rather sceptic about impact of economic policy. Before we go to the factor analysis of chemical industry,

Next step is the extraction of the most significant factors. The factor loading of each variable represents the correlation between the variable and its respective factor. In our analysis, we apply the principle component analysis factor extraction method. Third step is the rotation of factors, which allows better to understand factors and to define correlation between variables and factors. For the rotation we use varimax method with Kaiser normalization. The last step of factor analysis is generation of common factor scores. In this step we apply regression method for calculating common factors. EFA was performed using statistical package for social sciences (SPSS). For the methodological purposes we divide our research into two parts. The first one explores the competitiveness

factors of whole Lithuanian manufacturing sectors, and the second one analyses external and internal competitiveness factors of sub-sector of chemical and chemical products.

3. Discussion of the results

3.1. The external and internal development drives of Lithuanian industrial sectors

Data set was checked for suitability by calculating Cronbach's Alpha, KMO and Bartlett's Test of Sphericity (Table 2). The obtained results indicated that data is suitable for further investigation. In all cases values of Cronbach's Alpha and KMO are higher than 0.5.

Table 2. Results of data-fit for factorial analysis

| | Lithuanian manufacturing industry | | Chemical and chemical products | |
|--|-----------------------------------|------------------|--------------------------------|------------------|
| | Internal factors | External factors | Internal factors | External factors |
| Cronbach's Alpha | 0.821 | 0.622 | 0.775 | 0.563 |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | 0.720 | 0.638 | 0.708 | 0.686 |
| Bartlett's Test of Sphericity, Sig. | 0.000 | 0.000 | 0.000 | 0.000 |

Source: authors' calculation

The results of analysis of internal development drivers of Lithuanian manufacturing industry show that the largest part of variance is explained by two factors. The first factor (variables A8, A9, A10, A11, A12) explains 31,18 per cent and the second one (variables A4, A5, A13, A14) – 13,95 per cent. In total four factors explain more than 62 per cent of the variance. For further analysis, it is recommended (Dumitrescu *et al.* 2013) to retain those factors with the Eigenvalue higher than 1 (the initial variables are standardized, having therefor variation of 1, thus a factor's Eigenvalue is bigger than 1 explains more

than a single's variables variation).

In our case, four factors (Table 3) of which Eigenvalues are higher than 1 have been formed. As it was mention above, the first factor is combined of five variables: expenditure on personnel qualification improvement; innovative production methods; investments into equipment and technologies; expenditure on market research. The second one contains four variables, the third – three (A1, A2, A3) and. The fourth factor is composed of two variables (A7, A8): high level of labour productivity and high qualified labour force.

Table 3. Rotated Component Matrix of Internal Development Drivers of Lithuania's manufacturing industry

| Variable | Component | | | |
|---------------------------------------|-----------|--------|--------|--------|
| | 1 | 2 | 3 | 4 |
| High production quality (A1) | 0.003 | 0.046 | 0.546 | 0.546 |
| Low production costs (A2) | 0.110 | 0.129 | 0.854 | -0.028 |
| Cheap labour force (A3) | 0.141 | 0.266 | 0.657 | -0.126 |
| Low energy intensity (A4) | -0.027 | 0.776 | 0.327 | 0.134 |
| Efficiency of energy consumption (A5) | 0.037 | 0.813 | 0.077 | 0.172 |
| High level labour productivity (A6) | 0.277 | 0.411 | 0.003 | 0.619 |
| High qualified labour force (A7) | 0.255 | -0.111 | -0.162 | 0.726 |

| | | | | |
|---|-------|--------|--------|--------|
| Expenditures on personnel qualification improvement (A8) | 0.588 | 0.126 | 0.038 | 0.203 |
| Innovative production methods (A9) | 0.690 | 0.098 | 0.306 | 0.233 |
| Investment into equipment and technologies (A10) | 0.665 | 0.109 | 0.108 | 0.353 |
| Expenditure on new technologies (A11) | 0.818 | -0.010 | 0.065 | 0.024 |
| Expenditure on market research (A12) | 0.661 | 0.333 | -0.058 | -0.078 |
| Relatively low demand for energy sources in manufacturing (A13) | 0.307 | 0.777 | 0.127 | -0.040 |
| Low environmental pollution caused by the production (A14) | 0.391 | 0.624 | 0.119 | -0.294 |

Source: authors' calculation

From five variables defining drivers of the external development drivers of Lithuanian manufacturing industry, two factors of which Eigenvalue is higher than 1 have been formed (Table 4).

Table 4. Total Variance Explained of of External Competitiveness Factors of Lithuania's industry

| Component | Initial Eigenvalues | | |
|-----------|---------------------|---------------|--------------|
| | Total | % Of Variance | Cumulative % |
| 1 | 2,035 | 40,704 | 40,704 |
| 2 | 1,100 | 22,004 | 62,708 |
| 3 | ,770 | 15,404 | 78,112 |
| 4 | ,620 | 12,406 | 90,518 |
| 5 | ,474 | 9,482 | 100,000 |

Source: authors' calculation

First factor extracted of this research explains 40,704 per cent of total variance. It is composed of three variables (Table 5): the macroeconomical environment (B1), the development of industry (B2), and the large unsatisfied demand (B3). Second factor explains 22,005 per cent of total variance. It is composed of the prices of energy resources (B4) and the availability of financial capital (B5). Following the methodology, we apply regression analysis to identify an impact of a single factor on the development of exporting Lithuanian industrial sectors.

Table 5. Rotated Component Matrix of External Competitiveness Factors of Lithuania's industry

| Variable | Component | |
|--|-----------|-------|
| | 1 | 2 |
| Macro-economical environment (B1) | 0.692 | 0.208 |
| Development of industry (B2) | 0.861 | 0.002 |
| Large unsatisfied demand (B3) | 0.695 | 0.131 |
| Prices of energy resources (B4) | 0.182 | 0.795 |
| Availability of financial capital (B5) | 0.064 | 0.838 |

Source: authors' calculation

We distinguish two dependent variables: the annual revenues (X_1) and the revenues from export (X_2). The multiple regression analysis is performed in two stages. We assume that the linear relationship exists between defined factors and dependent variables.

In the first stage of multiple regression analysis, we calculate factor scores when the development of exporting sectors is based on internal drivers factors. The values of independent variables are entered into the model at the same time. The formulas 2 and 3 are composed of standardized Beta coefficients:

$$X_1 = 0.144F_1 - 0.065F_2 - 0.113F_3 + 0.117F_4 + e_{11} \quad (2)$$

$$X_2 = 0.198F_1 + 0.076F_2 - 0.121F_3 + 0.073F_4 + e_{12} \quad (3)$$

Calculated loading of the factors indicate that annual revenue will grow if factor 1 and factor 4 increases, while the changes of other two factors would have negative influence on annual revenue. Meanwhile, the growth of factor 1, factor 2 and factor 3 will accelerate revenues from export.

Performing the second stage of multiple regression analysis, we follow the same methodology.

$$X_1 = 0.087F_1 - 0.084F_2 + e_{13} \quad (4)$$

$$X_2 = 0.057F_1 + 0.008F_2 + e_{14} \quad (5)$$

Calculated loadings of the factors show that annual revenue of exporting Lithuanian industrial sector will increase if factor 1 changes and declines if prices of energy grow and shortage of financial capital arises. However, for both annual revenues and revenues from export the changes of external development factors have lower impact than internal.

3.2. The internal and external development drives of chemical and chemical products sub-sector

The analysis of internal development drivers of chemical and chemical products sub-sector indicated that the largest part of variance is explained by four factors (Table 6). The first factor explains more than 37 per cent.

The second one explains 24,62 per cent of variance. In total four extracted factors explain 85 per cent.

Table 6. Total Variance Explained

| Component | Initial Eigenvalues | | |
|-----------|---------------------|---------------|--------------|
| | Total | % Of Variance | Cumulative % |
| 1 | 5,247 | 37,482 | 37,482 |
| 2 | 3,448 | 24,625 | 62,107 |
| 3 | 1,995 | 14,250 | 76,357 |
| 4 | 1,234 | 8,812 | 85,170 |
| 5 | ,920 | 6,574 | 91,744 |
| 6 | ,649 | 4,635 | 96,379 |
| 7 | ,244 | 1,740 | 98,119 |
| 8 | ,211 | 1,504 | 99,623 |
| 9 | ,053 | ,377 | 100,000 |
| 10 | 5,795E-16 | 4,140E-15 | 100,000 |
| 11 | 2,981E-16 | 2,129E-15 | 100,000 |
| 12 | -1,093E-16 | -7,804E-16 | 100,000 |
| 13 | -4,349E-16 | -3,106E-15 | 100,000 |
| 14 | -4,636E-16 | -3,311E-15 | 100,000 |

Source: authors' calculation

The first factor is composed of seven variables (A1, A2, A3, A4, A12, A13, A14) (Table 7). Four of these variables are strongly correlated as their loadings ranged from 0.816 to 0.937. Each of these variables is highly significant as the internal drive for developing chemical and chemical products sub-sector. The second factor comprised of four variables (A7, A8, A10, A11). Two of them have strong positive relationship with factor 2. The third factor composed of one variable (A7), which explains more than 14 per cent of whole variance and its initial Eigenvalue is nearly 2. This result leads to the assumption that the high level of labour productivity is one of the major drivers affecting the development of chemical and chemical products sub-sector. The fourth factor comprised of two variables (A5, A9) and explains 8,8 per cent of the variance. One of the variables *the innovative production methods* are negative correlated as the loading is -0.859.

Table 7. Rotated Component Matrix

| Variable | Component | | | |
|---|-----------|--------|--------|--------|
| | 1 | 2 | 3 | 4 |
| High production quality (A1) | 0.937 | -0.123 | 0.087 | -0.017 |
| Low production costs (A2) | 0.679 | 0.457 | 0.494 | 0.144 |
| Cheap labour force (A3) | 0.622 | -0.650 | -0.153 | 0.085 |
| Low energy intensity (A4) | 0.816 | -0.002 | 0.036 | -0.112 |
| Efficiency of energy consumption (A5) | 0.462 | 0.174 | 0.360 | 0.742 |
| High level of labour productivity (A6) | 0.150 | 0.095 | 0.937 | -0.073 |
| High qualified labour force (A7) | -0.067 | 0.856 | -0.223 | -0.146 |
| Expenditures on personnel qualification improvement (A8) | 0.093 | 0.676 | -0.518 | 0.402 |
| Innovative production methods (A9) | 0.119 | 0.132 | 0.256 | -0.859 |
| Investment into equipment and technologies (A10) | 0.074 | 0.884 | 0.267 | 0.138 |
| Expenditure on new technologies (A11) | -0.257 | 0.791 | 0.136 | -0.063 |
| Expenditure on market research (A12) | 0.831 | -0.385 | 0.277 | 0.132 |
| Relatively low demand for energy sources in manufacturing (A13) | 0.893 | -0.232 | 0.200 | 0.104 |
| Low environmental pollution caused by the production (A14) | 0.732 | 0.208 | -0.365 | 0.225 |

Source: authors' calculation

In the next step we perform the multiple regression analysis. The following formulas were made:

$$X_1 = 0.365F_1 + 0.474F_2 - 0.097F_3 + 0.181F_4 + e_{C1} \quad (6)$$

$$X_2 = 0.423F_1 + 0.297F_2 - 0.171F_3 + 0.659F_4 + e_{C2} \quad (7)$$

The first formula represents relationship between the annual revenue of the companies in the sub-sector of chemical and chemical products and internal development drivers of the chemical and chemical prod-

ucts sub-sector. The obtained loadings show that high-qualified labour force, expenditures on personnel qualification improvement, investment into equipment and technologies, and expenditures on new technologies significantly affect the annual revenue. This impact is expressed as the loading of factor 2 (0.474), which is the highest, compared to others.

Analysing the second mathematical expression we draw conclusion that the revenues from export in

this sub-sector mostly influenced by efficiency of energy consumption and applied innovative production methods. In this case the loading of the most influencing factor is much higher than others (0.659). Two factors of external drivers of the development of chemical and chemical products sub-sectors, which Eigenvalue is higher 1, have been extracted (Table 8). The first factor comprised of four variables out of five explains more than 64.3 per cent of variance. The other factor explains 26.1 per cent of variance. Obtained results reveal that all variables highly correlated with factors as the loading range from 0.772 to 0.961. Formed equations (8 and 9) show that the factor 1 has notable affect on the annual revenues. Meanwhile, the second one is irrelevant as it is loading equal to 0.042

Table 8. Total Variance Explained

| Component | Initial Eigenvalues | | |
|-----------|---------------------|---------------|--------------|
| | Total | % Of Variance | Cumulative % |
| 1 | 3,216 | 64,313 | 64,313 |
| 2 | 1,309 | 26,184 | 90,498 |
| 3 | ,319 | 6,373 | 96,871 |
| 4 | ,122 | 2,440 | 99,311 |
| 5 | ,034 | ,689 | 100,000 |

Table 9. Rotated Component Matrix of External competitiveness factors of chemical industry

| Variable | Component | |
|--|-----------|--------|
| | 1 | 2 |
| Macro economical environment (B1) | 0.961 | 0.155 |
| Development of industry (B2) | 0.772 | -0.610 |
| Large unsatisfied demand (B3) | 0.912 | 0.147 |
| Prices of energy resources (B4) | 0.291 | 0.943 |
| Availability of financial capital (B5) | -0.866 | -0.182 |

Source: authors' calculation

$$X_1 = 0.462F_1 + 0.042F_2 + e_{C3} \quad (8)$$

$$X_2 = -0.253F_1 + 0.5F_2 + e_{C4} \quad (9)$$

Hence, the influence of factor 2 on the revenue from export is significant. Concluding, our obtained results revealed that external drivers greater affect sub-sector of chemical and chemical products rather than whole exporting industry.

Conclusions

Sustainable development of the economy is based on various factors, which differ within specific sub-sectors. The article explored internal and external development drivers of whole Lithuanian industry. Statistical data showed that sub-sector of chemical and chemical products has been the one of the most growing sectors in Lithuania since 2000. For that reason, it was chosen to determine if the same internal and external development drivers affect one of the most growing industrial sub-sector and the whole Lithuanian exporting industry. Fourteen internal and five external development drivers were distinguished. Results revealed that some differences exist.

The analysis of internal development drivers of exporting Lithuanian sector, indicated that two of four factors affect the growth of annual revenues while the growth of factor 1 (five drivers), factor 2 and factor 3 accelerate revenues from export. Meanwhile, in the chemical and chemical products industry annual revenues are determined by three of four factors. The analysis of internal development drivers of chemical and chemical products showed that the same factors affect annual revenues and revenues from export. These results proved that chemical and chemical products sector is highly dependent on export. Exploring external development drivers, we found out that for both annual revenues and revenues from export the changes of external development factors have lower impact than internal in whole exporting sectors.

However, the sub-sector of chemical and chemical products is considerably more dependent of external development drivers than whole exporting industrial sectors.

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