WHY SHOULD SUPPORT FOR INNOVATIVE PROCESSES DIFFER REGIONALLY? ARE LESS DEVELOPED REGIONS SO DIFFERENT?

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Abstract

The aim of this paper is to elaborate on different models of supporting innovative processes (described by 45 input and output variables) in 319 OECD regions (divided into three groups focused on both knowledge-intensive services (KIS) and manufacturing) so as to achieve the highest level of innovation policy effectiveness. We analyse processes enhancing the growth described by GDP and GVA variables using canonical analysis. Structural models of the relationships between dependent and independent variables for each group show that every group has different factors affecting growth and only in the most developed KIS regions the factors are coherent and mutually reinforcing. Less developed regions are not so different from KIS regions, because innovative processes are in line with the development, but in this group factors influencing KIS and high-tech industries do not sufficiently reinforce each other and thus the growth could be reduced. This might be attributed to an essential gap between KIS and non updated production practices in certain sectors. Understanding these processes, it will be possible to create constructed advantage assumptions leading not only to growth and development in every group of regions, but overall to path renewal and convergence processes in less developed regions.

Key words: innovation policy, innovative processes, path dependency

JEL Code: O21, O31, R11

Introduction

Myrdal (1968) claims that economists more often than other scientists tend to generalize patterns and regularities in a given place, time and culture. What’s more, concepts developed for the growth of one country or region may not fit into other regions or different periods (Phelps Brown, 1972). That is why, after the bloom of innovation policy in the last decade, many attempts at regional innovation policy differentiating can be found in the literature

(Tödtling & Trippl, 2005), which entails many interesting conceptions of creating innovation policy and even categorisation of regions referring to innovative processes (Ajmone & Maguire, 2011; Wintjes & Hollanders, 2010).

1 Innovative processes in regions

All the approaches (Ajmone & Maguire, 2011; Pylak & Chaniotou, 2013; Wintjes & Hollanders, 2010) indicate the existence of different regional specialisations, which can be grouped in knowledge intensive services (KIS) regions and manufacturing regions, including high-tech and low-tech regions, wherein the first group consists of more developed (rich) regions. Although some recent findings (Huang & Ji, 2013; Nishioka, 2013) explain how knowledge capital can be used to build advanced comparative advantage and cause growth, there is still lack of studies that analyse the overall processes in the regions, defining their relationship and reciprocal influence. If that happens, it will be possible to create constructed advantage assumptions (Asheim, Boschma, & Cooke, 2011; Asheim, Moodysson, & Tödtling, 2011; Boschma & Iammarino, 2009) leading not only to growth and development in every group of regions, but overall to path renewal and convergence process in less developed regions.

2 Research design

2.1 General approach

This state of the art has inspired us to take a more in-depth analysis of the effectiveness of innovative processes, which is very hard to achieve, especially in less developed regions (Pylak & Chaniotou, 2013). This lack of efficiency may cause problems in breaking out of path dependency. Although path dependency & path dependency breakthroughs leading to path renewals have been a focus of the school of evolutionary economic geography since the early 1980s (Boschma, 2007; Dobusch & Schuessler, 2013; Martin & Sunley, 2006; Schienstock, 2007), only now can the idea be adapted to different innovation processes models existing in regions.

We assume if the innovative processes supported in regions influence growth coherently and synergistically, that growth is bigger. In other words, less developed regions have difficulties in changing the development path because of two causes: 1) lack of positive factors influencing growth (or existence of weak factors), 2) negative factors minimising the positive influence of existing factors (incoherent development).

2.2 Hypotheses

The initial hypothesis, we put, is connected with groups: *H.1. If region belongs to different group, the innovative processes differ according to the specialisation of the group*. The second hypothesis concerns development growth: *H.2. If the region is influenced by factors both fitting its economy structure and influencing the growth coherently, its development level will be higher.* Thus, if the hypothesis is confirmed, the cause of poor development will be indicated and recommendations for the policy will be derived.

2.3 Data and measurement

The subject of the study is a set of 45 variables describing the inputs and outputs of the innovation process[1] for the 319 OECD regions. Missing data were imputed by a k-NN algorithm. We used the average of each variable for the period 2005-2010. Then, using cluster analysis, we isolated three groups of regions similar in the context of variables. Further, by canonical analysis, we were able to determine structural models of the relationships between dependent and independent variables for each group.

[1] The variables include: INPUTS: POP (Population density); EMPL_AGR (Share of employment in agriculture, forestry and fishing (ISIC rev4) as a % of total employment at place of work); EMPL_IND (analogous, concerning industry and energy); EMPL_CONS (analogous, concerning construction); EMPL_TRAD (analogous, concerning distributive trade, repairs, transport, accommod., food serv. activities); EMPL_ICT (analogous, concerning information and communication); EMPL_FIN (analogous, concerning financial and insurance activities); EMPL_EST (analogous, concerning real estate activities); EMPL_SCIEN (analogous, concerning prof., scientific, techn. activities, admin., support service activities); EMPL_ADM (analogous, concerning public admin., compulsory s.s., education, human health); EMPL_OTH (analogous, concerning other services); UNEMPL (Unemployment rate); UNEMPL_LONG (Long-term unemployment rate); UNEMPL_YOUTH (Youth unemployment rate); EXP_TOTAL (R&D expenditure total (as % of GDP)); EXP_BUS (analogous, performed by the business sector); EXP_GOV (analogous, performed by the government sector); EXP_HIGH (analogous, performed by the higher education sector); PERS_TOT (R&D personnel total (as % of employment)); PERS_BUS (analogous, employed by the business sector); PERS_GOV (analogous, employed by the government sector); PERS_HIGH (analogous, employed by the higher education sector); TERT_EDU (Tertiary education as % of labour force); OUTPUTS: GDP (Regional GDP per capita, US $ constant PPP, constant (real) prices (year 2005)); GVA (Regional Gross Value Added, total activities per worker, US $ constant PPP, constant prices - GVA series); GVA_IND (analogous, in industry, including energy); HIGHTECH_MAN (High and medium high-technology manufacturing as % of total manufacturing); HIGHTECH_EMPL (analogous, but as % of total employment)); KIS_SERV (Knowledge intensive services as % of total services); KIS_EMPL (analogous, but as % of total employment); PCT_INH (PCT patent applications per million inhabitants (fractional count; by inventor and priority year)); PCT_REG (Percent of PCT co-patent applications that are done within the region); PCT_COUN (analogous, but done within the country); PCT_ABROAD (analogous, but done with foreign regions); PCT_DOMES (Domestic ownership of foreign patents = percent of PCT patents that have 1 or more foreign inventors and 1 or more domestic applicants in the total number of patents owned domestically (i.e. with 1 or more domestic applicants); PCT_FOREIGN (Foreign ownership of domestic patents = percent of PCT patents that have 1 or more domestic inventors and 1 or more foreign applicants in the total number of patents invented domestically (i.e. with 1 or more domestic inventors)); PCT_ICT (Percent of PCT patent applications in ICT); PCT_NANO (Percent of PCT patent applications in nanotech); PCT_BIO (Percent of PCT patent applications in biotech); PCT_MED (Percent of PCT patent applications in medical); PCT_FARMA (Percent of PCT patent applications in pharmaceuticals); PCT_TRANS (Percent of PCT patent applications in emissions abatement and fuel efficiency in transportation); PCT_EMIS (Percent of PCT patent applications in technologies with potential or indirect contribution to emissions mitigation); PCT_RENEW (Percent of PCT patent applications in energy generation from renewable and non-fossil sources); PCT_ENVIR (Percent of PCT patent applications in general Environmental Management (air, water, waste)).

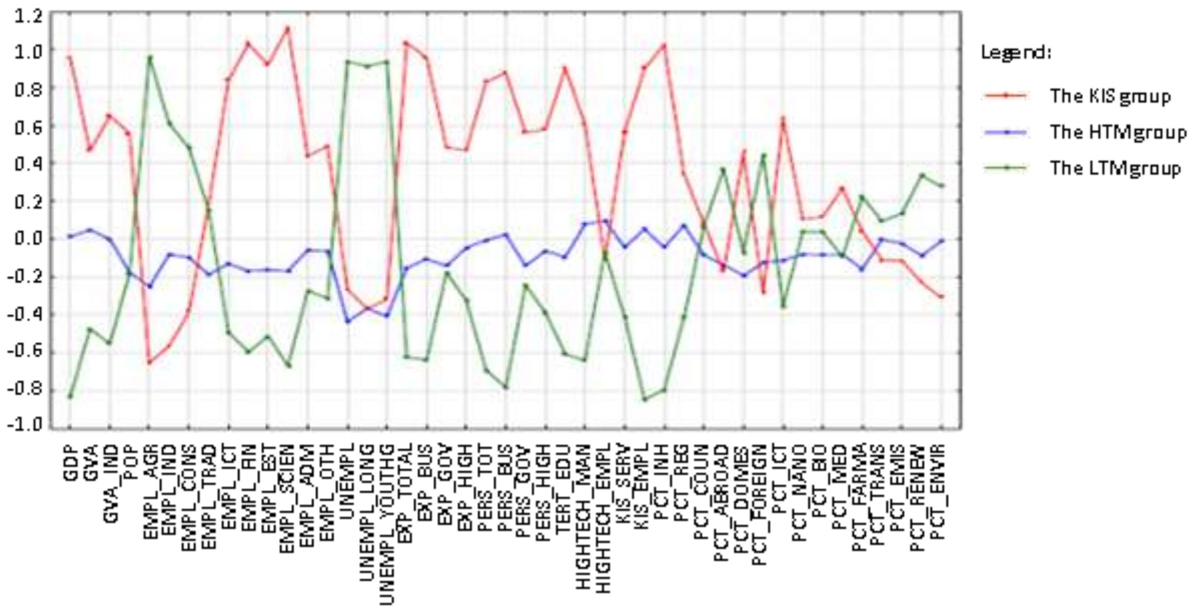
3 Empirical results

3.1 Groups of regions

The application of cluster analysis revealed three main groups of regions, which are compared in Fig. 1. The first group are KIS regions, where over 43% of employees work in KIS (nearly all of the services are KIS), and 26% work in administration. Also the level of tertiary educated labour force is the highest (33.5%) of all the groups, as is the level of R&D expenditures (2.65% of GDP), mostly provided by the business sector (1.7% of GDP) and R&D personnel (2.33% of all the employment). The group submits the highest level of PCT applications (203.8 per million inhabitants). These regions have the highest level of population density (726) and the biggest achievements in GDP ($44,000 per capita). From the other side, the group is characterised by the lowest level of industry share in employment (11.7%), although existing industry is mostly high-tech (44.4% of total manufacturing) and with the highest GVA per worker ($102,612). This group includes mostly capitals and big agglomerations.

The second group is characterised by rather average levels of variables concerning two other groups, but has the highest level of high-tech employment (6.22% of total employment), thus the group can be called HTM (high-technology manufacturing). It consists of regions from Australia, USA, Canada, Japan, Korea, New Zealand, Western and Northern Europe and few capital / central regions from Eastern Europe (Hungary, Slovakia, the Czech Republic). The population density is the same as in third group (160 persons per square kilometre).

Fig. 1: Characteristics of three groups (selected by cluster analysis) in terms of the average value of each variable



Source: own estimation.

The third group is the weakest, with the GDP per capita at the lowest level of $20,000, based on the biggest share of industry (16%), construction (8.65%) and agriculture (10%), with both high tech manufacturing (5.74% of total employment and only 29.13% of manufacturing) and KIS on the lowest level (25.76% of the employment). Thus this group can be called low manufacturing regions (LTM). It is characterised also by the highest level of unemployment (10.76%), including long-term unemployment (4.75%), and youth unemployment (23.9%). What is interesting is that these regions cooperate the most in patent applications with foreign regions and achieve the highest level of patent applications in pharmaceuticals and environmental protection issues. The group consists of the least developed regions from Belgium (1 region), Canada (2 regions), Chile (1 region), the Czech Republic (all apart from two), France (6 regions), Germany (5 regions), Greece (apart from Athens), Hungary (apart from central), Italy (8 regions), Korea (2 regions), Poland (entire), Portugal (apart from Lisbon), Slovak Republic (apart from Bratislava), Spain (12 regions), Turkey (4 regions).

3.2 Innovative processes characteristics in different groups

Canonical analysis revealed different factors (stimulants and destimulants) of innovative processes leading to regional development (defined as GDP and GVA growth) in each group of regions.

Tab. 1: Structural model of input and output variables for the KIS group

INPUTS	*Fac. 1*	*Fac. 2*	*Fac. 3*	*Fac. 4*	*Fac. 5*	*Fac. 6*	*Fac. 7*	*OUTPUTS*	*Fac. 1*	*Fac. 2*	*Fac. 3*	*Fac. 4*	*Fac. 5*	*Fac. 6*	*Fac. 7*
POP	0.085	0.392	-0.054	0.143	-0.048	-0.331	0.116	GDP	0.386	0.575	-0.195	0.111	-0.119	0.022	0.352
EMPL_AGR	-0.249	-0.504	-0.304	0.345	-0.155	-0.053	-0.074	GVA	0.449	0.479	0.064	-0.160	-0.241	0.047	0.376
EMPL_IND	-0.595	-0.166	0.022	0.014	-0.095	0.133	-0.077	GVA_IND	0.708	0.006	0.027	-0.017	0.111	0.053	0.275
EMPL_CONS	-0.195	0.160	0.256	0.399	-0.364	0.041	-0.266	HIGHTECH_MAN	-0.131	0.083	0.308	-0.081	0.306	0.303	0.109
EMPL_TRAD	-0.116	0.144	0.395	0.148	-0.088	0.147	-0.035	HIGHTECH_EMPL	-0.624	-0.042	0.017	0.006	0.124	0.416	0.118
EMPL_ICT	-0.301	0.353	-0.112	0.294	0.059	-0.322	-0.071	KIS_SERV	0.094	0.158	-0.021	-0.400	0.187	0.123	-0.093
EMPL_FIN	0.239	0.425	0.097	-0.187	-0.488	0.089	0.221	KIS_EMPL	0.136	0.677	0.014	-0.253	0.284	0.087	-0.081
EMPL_EST	0.546	-0.209	0.114	-0.258	0.176	0.263	0.011	PCT_INH	-0.507	-0.009	-0.196	-0.090	0.328	0.145	0.591
EMPL_SCIEN	0.407	0.493	0.121	-0.059	0.003	0.039	0.319	PCT_REG	-0.265	-0.445	-0.004	-0.070	0.076	-0.052	-0.150
EMPL_ADM	0.421	0.264	-0.167	-0.002	0.438	0.157	-0.225	PCT_COUN	0.078	0.101	-0.109	0.120	-0.178	0.237	-0.172
EMPL_OTH	0.759	-0.224	0.142	-0.187	0.224	0.131	0.116	PCT_ABROAD	-0.455	0.321	-0.248	0.022	-0.386	-0.269	-0.269
UNEMPL	0.028	0.200	0.204	-0.214	0.028	-0.117	-0.086	PCT_DOMES	-0.438	0.166	-0.177	-0.138	-0.432	-0.204	-0.101
UNEMPL_LONG	-0.031	0.010	0.044	-0.060	-0.252	-0.251	-0.092	PCT_FOREIGN	-0.392	0.518	-0.051	0.089	-0.211	-0.501	-0.194
UNEMPL_YOUTH	-0.032	0.042	-0.099	-0.115	0.040	-0.399	-0.064	PCT_ICT	0.180	-0.187	0.251	0.410	0.390	-0.084	0.097
EXP_TOTAL	0.359	-0.359	-0.297	0.160	0.126	0.091	0.358	PCT_NANO	0.535	-0.221	0.188	0.259	-0.222	0.122	0.085
EXP_BUS	-0.119	-0.381	-0.021	-0.069	0.155	-0.007	0.535	PCT_BIO	0.444	0.175	-0.271	0.002	0.284	0.237	-0.200
EXP_GOV	0.557	-0.101	-0.302	0.321	-0.113	0.155	0.052	PCT_MED	0.134	0.126	0.091	-0.232	0.143	0.352	-0.043
EXP_HIGH	-0.003	0.001	-0.328	0.153	0.355	0.205	-0.488	PCT_FARMA	0.143	0.342	-0.178	0.109	0.289	0.061	0.149
PERS_TOT	-0.285	0.289	-0.448	0.224	0.184	-0.201	-0.195	PCT_TRANS	-0.381	-0.155	-0.372	-0.238	-0.006	-0.088	-0.079
PERS_BUS	-0.481	0.235	-0.473	0.101	0.117	0.004	0.057	PCT_EMIS	0.239	-0.356	-0.364	0.146	-0.460	0.101	0.217
PERS_GOV	0.111	0.169	-0.154	0.265	-0.169	-0.029	-0.337	PCT_RENEW	0.176	0.186	-0.028	0.525	-0.059	0.190	-0.427
PERS_HIGH	-0.102	0.263	-0.258	0.123	0.322	-0.385	-0.219	PCT_ENVIR	-0.196	0.113	-0.516	0.078	-0.094	-0.085	-0.468
TERT_EDU	0.008	0.727	-0.083	0.260	0.241	0.100	0.177								

Source: own estimation using canonical analysis.

For the development of KIS regions, three factors are needed (see Tab. 1), but the most significant is factor 2 ('Knowledge creation and exploitation by KIS'), which is primarily correlated with a high level of tertiary educated employees (0.73) and a high share of employment in science (0.49) and to a lesser extent by a high share of other services (financial – 0.43 and ICT – 0.35). Also, population density seems to be quite crucial (0.39), which means urbanisation economies can play a crucial role in the knowledge creation and exploitation factor and creating KIS. Less importance can also be placed on R&D personnel (0.29), including personnel employed by the business (0.24) and higher education (0.26) sector, but the R&D expenditures reduce the development level (-0.36), especially conducted by the business sector (-0.38). This means these regions rent their resources to other regions, which is confirmed by the outputs, where positive impact on co-patent applications that are done with foreign regions (0.52) can be seen. Besides, due to this factor these regions create a big share of KIS (0.68), which causes their specialisation and thus the development loop is closed.

However, KIS is not the only factor responsible for growth. The highest level of patent applications (0.59) is caused by factor 7 ('R&D business expenditures enhancing patent applications and growth'), where employment in science (0.32) combined with R&D expenditures (0.36), especially from the business sector (0.54) lead to high level of patent applications (0.59) and thus to higher GDP (0.35) and GVA (0.35), including existing industry (0.27), but one has to keep in mind that *left factor 7* is much less correlated with *right factor7* (0.64) than *left factor 1* with *right factor 1* (0.91). Besides, the impact of factor 7 is not as big as in case of factor 2, and similar to the third crucial factor 1 ('Government support for industry through KIS'). This factor is also connected with various KIS, but through government expenditures on R&D, there can be noted a great increase in GVA in industry (0.71), GVA in general (0.45) and GDP (0.39).

The growth of the second group (HTM) is driven by four factors: factor 5 ('GVA in industry through patents'), factor 6 ('Patents outside high tech manufacturing'), factor 1 ('Knowledge within KIS and high education enhancing GVA in industry') and factor 2 ('Regional government support for knowledge in KIS and high tech'), as shown in Tab. 2. Factors 5 and 6 are very weak, not related to any crucial variables (factor 6 is positively correlated only with the population input variable and factor 5 concerns all the industry), and two latter factors are more KIS oriented, although the latter also influences high tech.

Tab. 2: Structural model of input and output variables for the HTM group

INPUTS	*Fac. 1*	*Fac. 2*	*Fac. 3*	*Fac. 4*	*Fac. 5*	*Fac. 6*	*Fac. 7*	*OUTPUTS*	*Fac. 1*	*Fac. 2*	*Fac. 3*	*Fac. 4*	*Fac. 5*	*Fac. 6*	*Fac. 7*
POP	-0.456	0.027	-0.224	-0.066	0.103	0.265	-0.410	GDP	0.292	0.251	-0.249	-0.019	0.547	0.305	-0.142
EMPL_AGR	-0.302	-0.559	0.106	0.195	-0.217	-0.289	0.077	GVA	0.096	-0.066	0.006	0.006	0.123	-0.032	-0.127
EMPL_IND	-0.263	0.076	0.725	-0.063	-0.082	-0.183	-0.127	GVA_IND	0.562	-0.324	0.043	-0.201	0.391	0.051	-0.079
EMPL_CONS	0.130	-0.192	0.323	0.114	-0.131	-0.548	-0.299	HIGHTECH_MAN	0.094	0.395	0.323	-0.243	0.032	-0.458	0.111
EMPL_TRAD	0.239	-0.043	0.394	0.207	-0.031	-0.264	-0.198	HIGHTECH_EMPL	-0.480	0.291	0.615	-0.069	0.150	-0.124	-0.064
EMPL_ICT	-0.109	0.172	0.362	-0.005	-0.217	-0.074	-0.474	KIS_SERV	0.369	0.335	0.284	-0.475	-0.399	-0.130	0.159
EMPL_FIN	0.518	0.318	0.007	0.044	0.323	-0.115	-0.088	KIS_EMPL	0.517	0.464	0.109	-0.407	-0.363	-0.080	0.104
EMPL_EST	0.610	-0.003	-0.033	-0.238	0.433	-0.042	-0.050	PCT_INH	-0.636	0.097	-0.063	-0.514	0.283	0.200	0.049
EMPL_SCIEN	0.366	0.111	0.492	0.006	0.134	0.011	-0.444	PCT_REG	-0.145	0.282	-0.243	-0.459	-0.183	-0.140	-0.283
EMPL_ADM	0.582	-0.232	0.335	-0.251	-0.351	0.062	-0.067	PCT_COUN	0.065	-0.238	0.077	-0.086	0.179	-0.159	-0.085
EMPL_OTH	0.491	-0.267	0.212	0.375	0.261	0.046	-0.156	PCT_ABROAD	-0.261	0.363	0.074	-0.071	-0.470	-0.182	0.045
UNEMPL	0.186	0.142	0.241	-0.069	-0.203	-0.287	-0.420	PCT_DOMES	-0.240	0.275	0.034	-0.205	-0.004	-0.334	0.247
UNEMPL_LONG	0.019	-0.130	0.279	0.032	0.214	-0.425	-0.297	PCT_FOREIGN	-0.184	0.238	0.215	-0.068	-0.516	-0.163	-0.238
UNEMPL_YOUTH	0.187	-0.157	0.384	0.185	-0.333	-0.259	-0.337	PCT_ICT	-0.080	-0.035	-0.394	-0.093	-0.157	-0.099	-0.404
EXP_TOTAL	-0.218	-0.005	0.309	-0.281	-0.041	-0.179	-0.477	PCT_NANO	0.030	-0.113	-0.290	-0.031	0.218	-0.129	-0.135
EXP_BUS	-0.378	-0.058	0.372	-0.321	0.131	-0.198	-0.343	PCT_BIO	0.349	0.262	-0.310	-0.121	-0.086	-0.142	0.152
EXP_GOV	0.041	0.031	0.276	0.012	-0.039	-0.019	-0.277	PCT_MED	0.139	0.138	-0.236	-0.038	0.023	-0.395	0.054
EXP_HIGH	0.252	0.078	-0.081	-0.232	-0.330	-0.069	-0.250	PCT_FARMA	0.203	0.243	-0.058	0.064	-0.209	-0.081	-0.079
PERS_TOT	-0.104	0.208	0.251	-0.319	-0.086	-0.223	-0.005	PCT_TRANS	-0.383	-0.099	-0.153	-0.060	0.112	0.093	-0.032
PERS_BUS	-0.398	0.160	0.294	-0.379	0.231	-0.116	-0.040	PCT_EMIS	-0.228	-0.043	-0.563	0.250	0.022	0.051	0.035
PERS_GOV	0.153	0.273	0.300	0.126	0.074	-0.010	-0.087	PCT_RENEW	0.044	0.123	-0.068	-0.152	-0.374	-0.062	0.287
PERS_HIGH	0.062	0.030	0.036	-0.303	-0.397	-0.247	0.136	PCT_ENVIR	0.123	0.128	-0.256	-0.007	-0.234	0.270	0.400
TERT_EDU	0.313	0.329	0.148	-0.416	-0.429	-0.379	0.029								

Source: own estimation using canonical analysis.

What is worth noting is that crucial factor 3 ('R&D supporting high tech industry and KIS') affects neither GDP nor GVA. By increasing employment in industry, science, administration and other services, and even construction or trade, and by incurring expenditures on R&D, and a growing number of R&D personnel in the business and governmental sectors, only high-tech manufacturing and dissemination of KIS grow in the economy.

The third group (LTM) has clear stimulant characteristics, but is also affected by some crucial destimulants (see Tab.3).

Tab. 3: Structural model of input and output variables for the LTM group

INPUTS	*Fac. 1*	*Fac. 2*	*Fac. 3*	*Fac. 4*	*Fac. 5*	*Fac. 6*	*Fac. 7*	*OUTPUTS*	*Fac. 1*	*Fac. 2*	*Fac. 3*	*Fac. 4*	*Fac. 5*	*Fac. 6*	*Fac. 7*
POP	0,358	0,089	0,217	0,085	-0,098	-0,074	0,094	GDP	0,520	0,592	0,391	-0,068	-0,033	0,086	-0,268
EMPL_AGR	0,017	-0,362	-0,684	-0,168	-0,309	-0,107	0,198	GVA	-0,080	0,810	0,253	0,210	-0,163	-0,299	-0,052
EMPL_IND	-0,269	-0,565	0,559	0,097	0,052	-0,294	0,040	GVA_IND	-0,026	0,517	0,200	-0,286	-0,327	-0,272	-0,035
EMPL_CONS	0,072	0,357	0,062	0,372	-0,585	-0,043	-0,229	HIGHTECH_MAN	-0,523	-0,124	0,397	-0,115	-0,088	0,380	-0,181
EMPL_TRAD	0,024	0,321	0,068	0,018	-0,503	-0,163	-0,149	HIGHTECH_EMPL	-0,370	-0,508	0,613	0,167	-0,060	0,120	-0,223
EMPL_ICT	-0,316	0,339	0,270	-0,361	0,117	-0,081	-0,261	KIS_SERV	-0,583	0,072	0,133	-0,411	0,383	0,101	-0,199
EMPL_FIN	-0,233	0,393	0,031	-0,366	-0,067	-0,173	-0,125	KIS_EMPL	-0,318	0,536	0,186	-0,318	0,499	0,326	0,001
EMPL_EST	-0,283	0,053	0,377	-0,243	-0,131	0,075	-0,220	PCT_INH	-0,170	0,398	0,515	-0,499	-0,312	0,203	0,203
EMPL_SCIEN	-0,300	0,559	0,343	-0,274	-0,054	-0,109	-0,109	PCT_REG	0,461	0,295	0,214	-0,146	0,028	-0,517	0,095
EMPL_ADM	-0,512	0,663	0,169	0,054	-0,128	-0,052	0,194	PCT_COUN	-0,311	-0,037	-0,063	-0,164	0,033	0,254	-0,162
EMPL_OTH	0,057	0,521	-0,176	0,060	-0,245	-0,020	0,157	PCT_ABROAD	-0,012	-0,247	-0,178	0,072	0,252	-0,089	-0,661
UNEMPL	-0,021	0,308	-0,085	0,050	0,465	-0,225	0,407	PCT_DOMES	-0,063	-0,012	-0,142	0,223	-0,085	0,449	-0,242

UNEMPL_LONG	-0,547	0,119	-0,139	-0,038	0,171	-0,111	0,114	PCT_FOREIGN	-0,278	-0,338	-0,134	0,026	0,232	0,099	-0,539
UNEMPL_YOUTH	-0,248	0,351	-0,476	0,166	0,420	-0,340	0,214	PCT_ICT	-0,067	0,050	-0,160	-0,037	-0,009	0,185	-0,147
EXP_TOTAL	0,153	0,271	0,605	-0,554	-0,181	-0,083	0,177	PCT_NANO	-0,144	0,029	-0,126	0,140	-0,087	0,003	-0,032
EXP_BUS	-0,016	0,116	0,714	-0,464	-0,241	-0,141	0,055	PCT_BIO	-0,001	0,189	-0,311	-0,193	0,042	-0,095	0,026
EXP_GOV	-0,054	0,345	0,219	-0,418	-0,038	0,155	0,105	PCT_MED	-0,165	0,079	-0,185	0,154	0,327	0,063	0,216
EXP_HIGH	0,318	0,317	0,153	-0,395	-0,003	-0,008	0,419	PCT_FARMA	0,106	0,050	-0,198	0,017	0,093	0,316	0,125
PERS_TOT	0,053	0,484	0,307	-0,294	-0,152	-0,362	-0,161	PCT_TRANS	-0,214	-0,158	0,019	0,148	0,178	0,023	0,133
PERS_BUS	0,100	0,233	0,638	-0,297	-0,178	-0,311	-0,136	PCT_EMIS	0,008	0,008	-0,094	0,065	-0,207	0,082	0,087
PERS_GOV	-0,037	0,487	0,119	-0,154	-0,041	-0,165	-0,127	PCT_RENEW	0,139	0,214	-0,276	0,164	-0,257	-0,027	-0,122
PERS_HIGH	-0,162	0,468	-0,082	-0,257	0,086	-0,366	-0,021	PCT_ENVIR	-0,156	-0,161	-0,311	0,018	0,218	0,081	-0,037
TERT_EDU	0,011	0,542	0,045	-0,466	-0,030	-0,344	-0,003								

Source: own estimation using canonical analysis.

The crucial factor (No. 2, ‘KIS and R&D activities of government and high education sector’) affects GDP (0.59), GVA (0.81), including industry (0.52) through growing KIS (0.54) and patent application (0.40), by various input variables, i.e. increase of the service and administration (0.66) share in the economy, R&D expenditures and R&D personnel, mainly from government (0.35 and 0.49) and the higher education (0.32 and 0.47) sector and with the support of tertiary educated employees (0.54). Factor 3 is also very visible (‘Business R&D in industry affecting high-tech and PCT’), which is in line with factor 2 (apart from high tech specialisation). But there are also negative factors (No. 1, ‘Decreasing administration, KIS and high tech’) correlated only with population density (0.36) and R&D expenditures of the higher education sector (0.32) or factor 4 (‘R&D expenditures enhancing KIS’).

Conclusions

We found interesting differences between groups of regions and aspects, which should be emphasized during the creation of innovation policy in every group. Thus hypothesis H.1 is fully confirmed. What is more, in the first (KIS) group there are no problems, the development stimulants are in line with the specialisation of these regions (KIS are enhancing the growth). Besides, the synergy between inputs and outputs (knowledge created by KIS is used to produce a great number of patents that are sold inside and outside the region) can be traced while factors outside the specialisation do not seem to matter for growth (industry or high-technology sectors are even declining the growth). Thus, we can speak of a coherent development leading to high level of GDP per capita and even bigger share of KIS in the economy.

The second group (HTM) seems to have a dichotomous development process. On the one hand, it affects the growth through R&D personnel in the business sector producing patent applications and thus enhancing GVA in industry, but the latter is also increased by KIS and knowledge produced by the higher education and government sectors. On the other hand, the group has a problem with transforming R&D resources and industry (including high-tech industry) into growth, thus the main specialisation does not influence growth (factor 3 has a negative correlation with GDP). Besides, there is no clear answer which sector (KIS or high tech) to support; there is a need for structural re-arrangement within the on-going economy. Nevertheless, hypothesis H.2 is partially confirmed.

The third group (LTM) has perversely large growth opportunities due to the compatibility of the strongest factors and the increase of GDP and GVA, but it faces many problems such as high levels of agriculture and industry in the economy, as well as factors hindering development. Thus there is evidence that the structure of the economy is the real destimulant (although this doesn't mean it has to be changed, but made more knowledge-intensive), which confirms the hypothesis H.2 in the last part. It may be noted, however, that in this group the increase of expenditures on R&D, education, and administration brings tangible benefits to the regions. In contrast to the second group, strengthening the high-tech industries has a positive impact on the development (by a factor 3), but it is also compensated by other factors (1 and 2). The same can be seen as far as KIS is concerned.

The research indicates that KIS is more crucial for growth than high technology industries – and this is confirmed in KIS regions. However, the contribution of KIS to the other two clusters (HTM and LTM) needs to be explored further and tailored, but KIS is certainly responsible for the growth of GVA in industry. In the LTM group KIS needs to be spread in the economy, in the HTM group existing services sectors should specialise in KIS and in the KIS group the specialisation is done, so KIS has to be spread in the economy to a greater extent. As far as high tech sectors are concerned, in the KIS group all the high-tech sectors should be decreased and existing manufacturing should specialise in high tech. In the HTM and LTM group there are no evident recommendations concerning this issue. Nevertheless, the interaction of opposing factors, specialisation factors not being in line with growth, and the cumbersome structure of the economy slows down the development of these regions dramatically.

For further research we suggest to analyse, firstly, the dynamics of change in the groups to find out real causes and effects of the growth and secondly, more in-depth analysis in each group to find out if more specific case studies can be indicated, in which correlation between KIS and high-tech industries are more precise, and thus analyse how KIS influences the latter industries in given case studies. Finally, it is extremely important to find out the spatial relations between regions, the significance of KIS regions selling KIS and knowledge to HTM regions and how the groups need each other.

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