

COMPUTER AIDED SWOT ANALYSIS APPLIED ON EVALUATION OF INNOVATION POTENTIAL IN CENTRAL AND SOUTH-EAST EUROPE

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ABSTRACT: The paper deals with computer aided SWOT analysis addressing the evaluation of innovation potential of Central and South-East European countries. A type of quantitative SWOT analysis was used, due to its high efficiency, leading to fast establishing a generic strategy which could be particularized with real measures able to be applied in order to reach the objectives of improving the innovation achievements. The methodology is based on number of S, W, O, T issues, the accomplishing of SWOT matrix and also establishing the quadrant with the corresponding strategy. The "national" SWOTs, entry data in the algorithm, were part of country studies which were performed by relevant partners from each Central and South-East European country within the framework of SEE-IFA-NETWORK project. The countries were grouped according to Innovation Union Scoreboard 2010 criteria related to innovation performances and relevant strategies were elaborated to improve their innovation achievements.

1. INTRODUCTION

SWOT analysis is a famous instrument used in the process of strategic management. In its classical form, it has been introduced in 1982 by Heinz Weihrich – although there are some other authors who claimed this method in other different forms - management professor at University of San Francisco [1]. The name of this method represents the initials of the four issues needed to be evaluated for its application: Strengths, Weaknesses, Opportunities, and Threats. Initially, Heinz Weihrich called this method TOWS. The basic characteristic of SWOT analysis has to be emphasized: the Strengths and Weaknesses are seen as internal factors, which could be controllable, and can be acted upon. The Opportunities and Threats are external, independent and uncontrollable factors.

2. TYPES OF SWOT ANALYSIS

Generally, two types of methods are applicable: qualitative and quantitative. A detail review of these types is presented in [2].

The qualitative approach, fully described in [1], supposes the combination of all S, W, O, T issues, identified through establishing four corresponding lists, for generating all possible strategies: SO, ST, WO and WT type. This expects a large consume of resources needed to strategies formulation.

The quantitative method recommended by Wheelen and Hunger [3] is more efficient. One of the variant consists in accomplishing only two lists: one for internal analysis and the other for external one. To each element, a weight and a sign (plus or minus) are allocated; the sign which indicates the element placement within the category S or W, respectively O or T. In order to control weights assignment, their sum is 1 if values less than one are used, or 100% if percentage values are used. This type of method involves constructing a grid of four quadrants - one quadrant labelled for each factor. A weighted sum for each couple of variables, strengths / weaknesses and opportunities/ threats, is effectuated. Thus a position in one from the four quadrants of coordinates S-W, O-T is obtained.

The evolution of SWOT analysis has been oriented to accuracy growing, bearing in mind its inevitable subjective character. Hence in 1995, G. Garibaldi introduced a new method, more analytical, so called New SWOT Matrix [4]. The main

advantage of this new method relies on ranking of opportunities and threats resulted from analysis of external environment, understanding their different importance. The factors used in ranking these issues are the probability of their occurrence and the effect on the organisation performances. Thus, instead of four generic strategies as in classic method, six specific strategies resulted by combination of three situations depending on ratio between opportunities and threats - Speculative (Opportunities about equal to Threats), Ideal ("O" more important than "t"), Dangerous ("o" less important than "T") – and two situations involving internal environment - Strengths more important than Weaknesses and "S" less important than "W".

Nowadays, there are also several variants of SWOT analysis aided by computer. One of the most interesting is the Cymeon SWOT Standard [5], which has some connection with New SWOT Matrix in terms of probability of phenomena incidence, affecting the organisations performances. It grasps the dynamics of environment evolution, defining three time frames, called current, short and long term. This will divide the issues into those that organisation will have to handle currently, in the near future and those which are on long term. Each SWOT issue is evaluated through its impact and multiplied by probability of emergence; therefore its importance results.

The sum of the importance coefficients for each of the four types of issue is calculated, e.g. Strengths = Sum (Probability x Impact) for all the issues corresponding to that time frame. The point plotted, corresponding to analyzed organisation, is determined by the difference between the sum of the importance coefficients for strengths minus weaknesses (the 'y' coordinate) and the sum of the importance coefficients for opportunities minus threats (the 'x' coordinate).

Thus, information could be that opportunities will be exploited in short-term, but overall the organisation will be in a position of weaknesses in longer term if it will not approach the requirements of knowledge based society [6].

The weights of probability and impact can be modified in order to visualize dynamically the position in SWOT coordinates. The variation of probability from 0 to 100%, displays the least and the most probable scenario in a dynamic way. It is also can

be shown the evolution of plotted point during the analyzed time interval.

Another important characteristic of SWOT is that the analysis must be achieved in relation to competition. Even if a competency is considered to be high, but is lower than the competitor's one, this issue belongs to weaknesses not to strengths. From this, it results the relative character of SWOT analysis. If the organisation improves its position comparing to that provided by SWOT analysis, it is considered that it has proactive policy orientation. On the contrary, if it will have a worst position in the future than that indicated by SWOT, it has rather an inactive policy [7].

For this reason, within the SEE-IFA-NETWORK project, and afterwards in this paper, information provided by country reports from Central and South-East Europe (SEE countries) were considered in reference to those from Innovation Union Scoreboard (IUS) 2010 [9].

Usually, there are some standard elements to be addressed during SWOT analysis. The issues to be considered are from People, Resources, Innovation & Ideas, Marketing, Operations, Finance for S and W or Critical Success Factors and Political, Economic, Social, Technological, Legal and Environmental factors or issues from Porter's model of the Five Forces [10].

SWOT analysis is both effective and carrying great weight, but requires significant resources to be spent. It is more effective when undertaken as a team activity with people from diverse backgrounds and expertise as in SEE-IFA-NETWORK project. This is a similar phenomenon to that obtained during brainstorming as a result of synergetic effect. Due to its complexity, computer aiding becomes a strong request.

Taking into account the importance of human resources in organisation performances, apart from its broader organisational application, SWOT analysis was also developed in personal area for individuals [11].

3. METHODOLOGY

A SWOT analysis aided by computer is achieved, which represents the synthesis of preliminary analyses, based on information provided by Country Studies from each partner organization of SEE-IFA-NETWORK [12]. This synthesis is accomplished under the following assumptions and standing:

- National innovation and finance systems are very diverse, in particular in SE Europe area;
- Old EU member states (countries that joined EU before 2004 as Austria, Italy, Greece);
- New EU member states (countries that joined EU after 2004 (Bulgaria, Romania, Hungary, Slovakia, Slovenia);
- Balkan countries (FYROM, Bosnia&Herzegovina, Croatia, Serbia, Montenegro, Albania);
- Use of IUS as a reference in comparison with SWOT preliminary analyses [9].

Consequently the participating countries in our study were grouped in the following classes:

- Innovation followers: Austria;
- Moderate innovators: Slovenia, Greece and Italy;
- Lower moderate and modest innovators countries: Hungary, Croatia, Romania, Bulgaria and Serbia;

■ Other associated countries not included in IUS 2010: Bosnia & Herzegovina, FYROM and Montenegro.

This is inspired by ranking provided by IUS 2010, which used 25 indicators concerning innovation performance [9]:

- Countries like Denmark, Finland, Germany and Sweden show a performance well above that of the EU27. These countries are the Innovation leaders.
- Countries like Austria, Belgium, Cyprus, Estonia, France, Ireland, Luxembourg, Netherlands, Slovenia and the UK all show a performance close to that of the EU27. These countries are the Innovation followers.
- Countries like Czech Republic, Greece, Hungary, Italy, Malta, Poland, Portugal, Slovakia and Spain are below that of the EU27. These countries are Moderate innovators.
- Countries like Bulgaria, Latvia, Lithuania and Romania are well below that of the EU27. These countries are Modest innovators.

In our study, another version of quantitative SWOT analysis is developed that has the attribute of efficiency, in fact a mix between qualitative and quantitative version previously presented. For that reason, four lists of analyzed elements are elaborated, corresponding to each S, W, O, T category. These four such lists (fig. 1) provided in each country study, represented entry data in our SWOT analysis.

Organisation External environment	S S ₁ S ₂ ...	W W ₁ W ₂ ...
T T ₁ T ₂	ST speculative situation	WT hostile situation/ danger
O O ₁ O ₂	SO ideal situation/ maximum	WO contrasting situation/ dilemma

Figure 1. SWOT matrix comprising four lists

On this basis, the analyzed entity can be framed in a coordinate system with variables S-W, O-T, depending on the level of each variable (see fig. 2). This approach efficiently leads to a type of strategy, specific to one from the four frames [7]:

S-O Strategies (S>W, O>T) combines the most favourable elements "S" from internal analysis and "O" from external one to create a strong competitive advantage – aggressive strategies; the case of Austria in our study;

S-T Strategies (S>W, O<T) are based on strengths of organisation to avoid or reduce the threats from external environment; these could be defending strategies but they could be transformed in attack strategies if a correct evaluation of internal and external forces ratio is achieved, efficiently exploiting the strengths of organisation; this is the case of Italy, Greece and Slovenia in our paper;

W-T Strategies (S<W, O<T) aim at minimizing the weaknesses under conditions of a hostile external environment; these are defending strategies used when organisation is in decline time interval; this is the case of most countries of this European zone;

W-O Strategies (S<W, O>T) combines the weaknesses elements of organisation with opportunities from external

environment, trying to exploit the opportunities using competencies (strengths) acquired through strategic alliances; this is the case of some few countries in the study.

The transition from generic strategy to concrete elaboration (formulation) of each strategy is the subject of second stage of management strategic process, based on factual S, W, O, T elements previously identified. This is an obvious qualitative approach. Based on this, we have identified the needs and gaps for each group of countries trying to find the critical common elements.

As it is previously mentioned, we also used as reference a professional analysis from Innovation Union Scoreboard (IUS) 2010 in order to avoid an inherent subjective SWOT analysis provided by each country report. Moreover, many elements provided in country reports as internal ones (S, W) were moved to external ones (O, T) from where they properly fit in or viceversa in order to assure as much as possible an accurate analysis.

In order to establish the coordinate position (x, y) of analyzed organization within one of the four quadrants, the following formula is used:

$$(x, y) = ((\sum_{i=1}^m s_i - \sum_{j=1}^n w_j), (\sum_{k=1}^p o_k - \sum_{l=1}^q t_l)) \quad (1)$$

where: s is a certain strength; w - a certain weakness; o - an opportunity; t - a threat; m – number of strengths; n - number of weaknesses; p - number of opportunities; q - number of threats.

The (x,y) coordinates lead to one from the four generic strategies as it is presented in fig. 2:

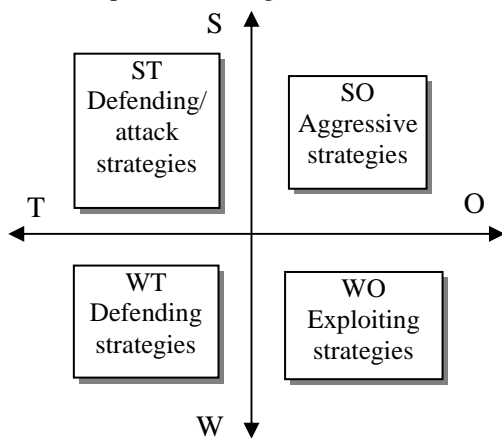


Figure 2. The four quadrants and corresponding strategies

The structure of used computer aided SWOT analysis is presented in fig. 3.

The reader can notice that SWOT analysis is finalised with strategies formulation, but this is only the second stage of strategic management process, preceded by environment analysis. In order to reach SMART objectives, the following stages must be fulfilled: strategies execution, and evaluation and control. The necessary feedback reactions from the fourth stage to previous stages are necessary [8].

The first step to take, in order to achieve the formulated strategies, is represented by characterisation of each country / group of countries vis-à-vis needs (N) and gaps (G) as it will be presented.

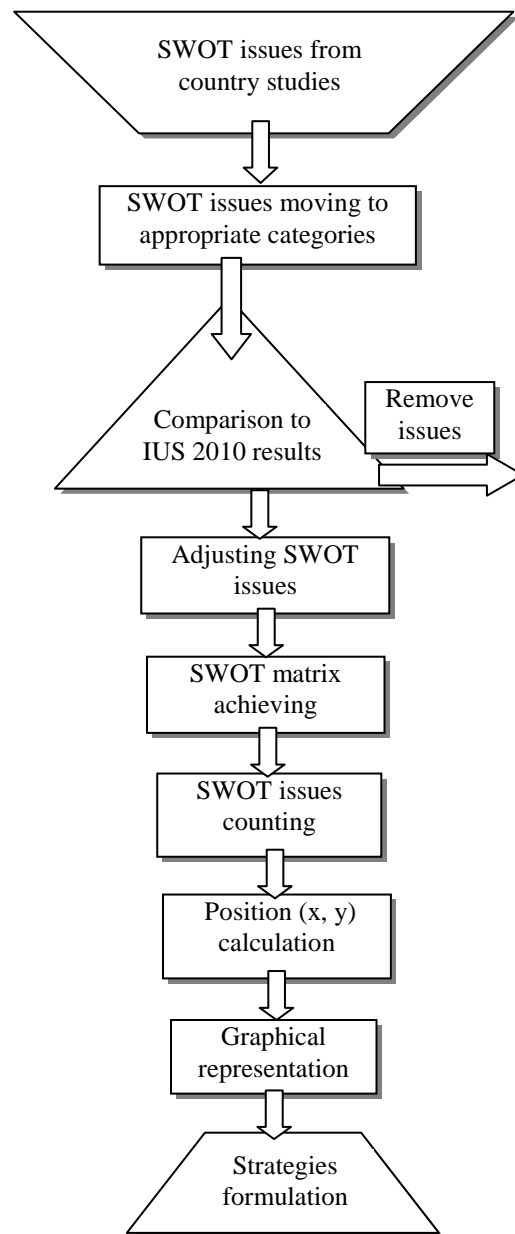


Figure 3. Logical diagram of applied SWOT analysis

4. RESULTS AND DISCUSSION

The countries grouping in respect with innovation performances as it was mentioned before was a basis for homogenous strategies formulation under similar conditions.

4.1. Group A - Innovation followers

The group A included only Austria.

Austria (AT): In this case, Strengths are more than Weakness ($S > W$), and Opportunities more than Threats ($O > T$); thus, SWOT analysis leads to aggressive strategies; the needs resulted and gaps reported to other UE countries from higher categories are:

Needs: Extent to new markets with new products, including green ones; Progressively extend the Austrian types of programs to the whole SE Europe geographic area if the same needs are present.

Gaps: enlarge SMEs participation to all programs.

4.2. Group B - Moderate innovators

The group B comprised Italy, Greece and Slovenia.

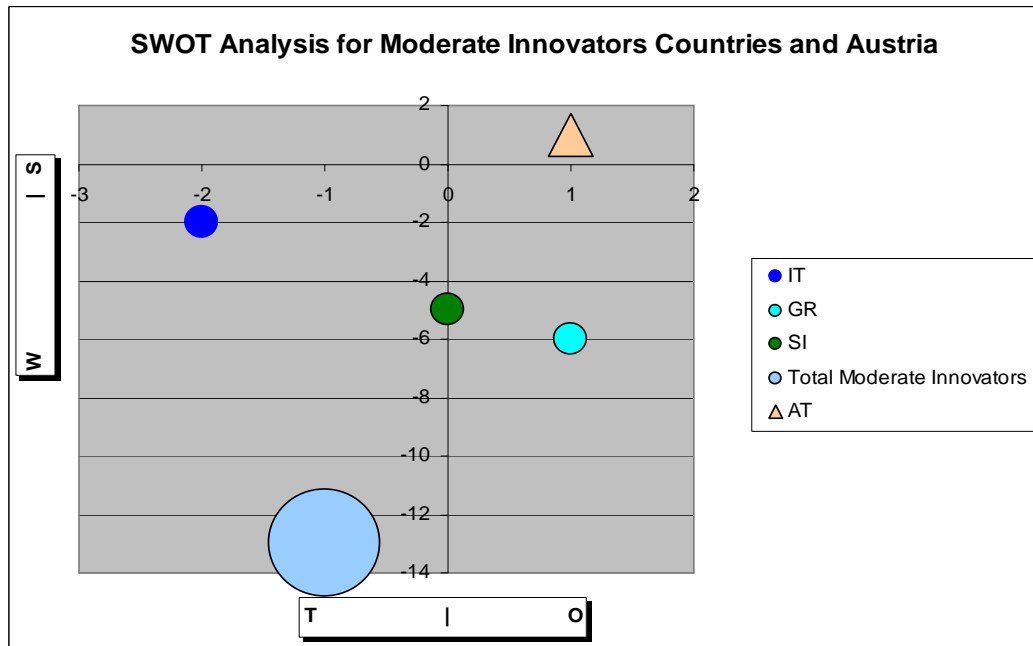


Figure 4. Disposal of innovation performances for group A-B countries

Italy (IT): $S < W$; $O < T$ and on this basis defending strategies W-T are to be adopted: integration/cooperation in Research & Innovation (R&I) with other foreign entities.

Needs and gaps resulted in order to improve innovation performances are:

Needs:

- Reinforce the relations between research, universities and industry/SMEs;
- Focus and education, research, competitiveness to get a long term sustainable development;

Gaps:

- Low investment in R&I;
- Lack of innovative culture;
- High cost intermediate bodies that manage research activities.

Greece (GR): The relations between analyzed issues are: $S < W$; $O > T$; WO Strategy (mini-maxi) has to be adopted; take advantage on "O" by international cooperation / integration.

From SWOT analysis, the following needs are gaps are emphasized:

Needs:

- More importance given to high education to change innovative culture and integration of universities/research/SMEs;
- Applying new ideas from abroad to SMEs - easier to implement on small scale;
- More attention paid and facilitates to young researchers willing to change the innovative culture.

Gaps:

- Low financial bank support to new SMEs and low SMEs investment in R&I;
- Low patent requests coming from organisations, but more from individuals;
- Fuzzy policies regarding innovation;

- Lack of sufficient number of technological innovation.

Slovenia (SI): The SWOT issues are in the following relation: $S < W$; $O = T$; WO Strategy (mini-maxi), in particular, take advantage on "O" by cooperation/integration with abroad entities. The following needs and gaps are highlighted:

Needs:

- Increased connection between research, universities, industry and SMEs;
- Improve taxation systems in R&I to prevent brain drains;
- Life-long learning, public expenditures for R&D.

Gaps:

- Lack of sufficient number of high tech innovation;
- Lack of venture capital;
- Unclear detailed national innovation system and inappropriate budget.

Strategy for Moderate Innovators is formulated in synthesis: Taking into account the relation between analyzed issues, i.e. $S < W$ and $O \approx T$, a WO Strategy (mini-maxi) could be adopted in correlation with the graph synthesis presented in fig. 3; take advantage on "O" by cooperation/integration with abroad entities. The relative common mentioned gaps (representing W) must be solved by exploiting reduced (due to economic crisis frame) "O" in cooperation/integration with EU/SE European entities and satisfying the above mentioned needs. Common SE European/EU R&I projects remain basics instruments to be approached. Appropriate SEE innovation policy is probably the major need to achieve. Closing the gap between universities/ research / industry / SME is a critical next objective. Mutual fund of innovation support could be a common interest. Strategic measures correlated with future European Patent must be taken considering the potential overcoming of crisis.

4.3. Group C - Lower moderate and modest innovators

The group C comprised Serbia, Croatia, Romania, Bulgaria, Hungary and Slovakia.

Serbia (SB): $S < W$ and $O < T$ and for this reason defending strategies W-T should be adopted, i.e. integration/cooperation in R&I with other foreign entities; great number of “S” should be exploited. The following needs and gaps resulted from the analysis:

Needs:

- Improve legislation and norms pertaining to innovations and Intellectual Property Rights;
- Organizing Stock market of innovations;

innovative products. Several needs and gaps resulted from country SWOT analysis must be faced:

Needs:

- Good correlation of several innovation programs addressing SMEs ready to market products;
- Increase of national funds dedicated to innovating SMEs;
- Various financial instruments to support SMEs innovation projects.

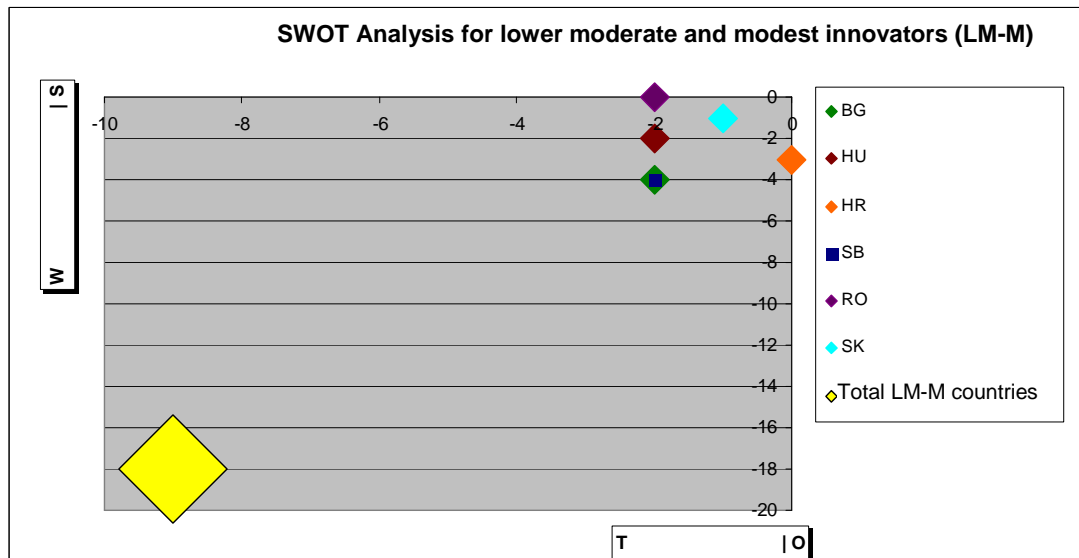


Figure 4. Disposal of innovation performances for group C countries

- Strengthening associations of SME sector, creating SME innovation culture.

Gaps:

- Increase cooperation of SMEs in common R&I SE Europe and EU projects;
- Insufficient using of human resources potential;
- Insufficient financial and institutional support;
- Low level of innovative activities and lack of business innovations.

Croatia (HR): $S < W$ and $O = T$ lead to defending strategies W-T, more specific integration/ cooperation in R&I with other foreign entities, large “O” must be exploited. The following needs and gaps are emphasized:

Needs:

- Exploit appropriate state innovation policies, SMEs oriented by growing SMEs innovative initiatives;
- Increase the participation of SMEs to EU R&I programs and SEE cooperation;
- Improve the patent system to facilitate the SMEs IPR property rights by lowering the costs of patenting.

Gaps:

- Not enough innovation culture among SMEs;
- Not enough SMEs awareness regarding the necessity of innovative products for competitiveness increasing;
- Not sufficient funding of R&I expenditures of SMEs.

Romania (RO): $S < W$ and $O < T$ need applying defending strategies W-T: integration/ cooperation in R&I with other foreign entities, “S” relative equal to “W” should efficiently be used in order to penetrate more attractive markets with

Gaps:

- Annual R&I state budget generally jeopardizes innovation project results;
- Bank support for innovation projects is very weak;
- SMEs and other enterprises hardly managed the expenses without a prior financial support.

Bulgaria (BG): The analyzed issues are in the following relations: $S < W$ and $O < T$; this leads to defending strategies W-T: integration/ cooperation in R&I with other foreign entities. From country SWOT analysis needs and gaps resulted:

Needs:

- Access the EU projects in cooperation to increase the potential of human resources and grow of SMEs funding;
- Improving innovation policies through systemic instruments comprising both national and regional development;
- Improving the connection between industry/SMEs and research/universities.

Gaps:

- Low number of patents in high tech field;
- Lack of instruments for co-financing;
- Lack of instruments for venture capital;
- Lack of long term business development culture.

Hungary (HU): From country preliminary analysis $S < W$, $O < T$ resulted; on this basis a defending strategy W-T should be adopted; this could be integration / cooperation in R&I with other foreign entities, exploiting the great number of “S”. It should be covered the following items:

Needs:

- A coherent state policy supporting innovation comprising attractive programs for SMEs and cooperation with other research entities;
- Friendly taxing system that encourages SMEs innovation should be elaborated.

Gaps:

- Long term educational programs able to change cultural attitude to sustainable development with impact to SMEs;
- Weak connections of universities and private firms/SMEs;
- Low level of business resources in innovation support;
- Lack of entrepreneurial spirit, negative cultural attitude.

Slovakia (SK): S<W and O<T are the relations between the analyzed issues; defending strategies W-T should be adopted, i.e. integration/cooperation in R&I with other foreign entities.

Needs:

- strengthen awareness and training of businesses on risk capital schemes;
- Identify and eliminate barriers in tax law, commercial law and bankruptcy law.

is also a major need. A strong basis to achieve that is a helpful public-private financial support. The banks are called to be more implicated in this issue. The Central and South-East Europe mutual innovation funding could be of major interest.

4.4. Group D: Associated countries not included in the IUS 2010

The group D comprised Bosnia and Herzegovina, Former Yugoslav Republic of Macedonia and Montenegro.

Bosnia and Herzegovina (BH): Due to the relations between analyzed S<W and O<T, defending strategies W-T should be adopted, consisting in: absolute necessity to integrate/cooperate in R&I with SE Europe entities to increase the basic resources. The following needs and gaps resulted from country SWOT preliminary analysis:

Needs:

- Improve the state innovation policy;
- Improve the access to funding, especially of SMEs;
- Stronger cooperation between research/ high education and business /SMEs;

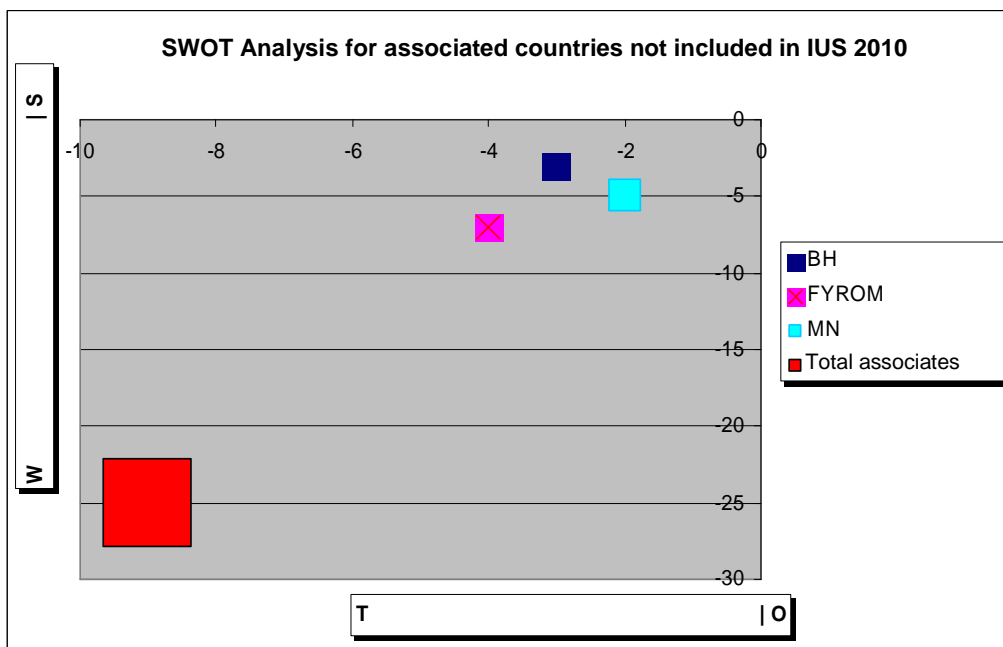


Figure 5. Disposal of innovation performances for group D countries

Gaps:

- Weak ties between academia and industry sectors;
- Establishing regional innovation centres and financial engineering tools for innovation;
- Limited resources of financial and human capital.

Strategy for Lower moderate and modest innovators is formulated on the basis of the relations between analyzed issues S<W and O<T. Therefore a WT Strategy (mini-mini) is put together in correlation to the graph presented in fig. 4. The needs and gaps vary very much within this category of countries. There are some positive experiences to transfer to the others in terms of state R&I management. In order to elaborate a consistent strategy, the non-candidates countries were separately analyzed. A major need to be satisfied is a coherent strategy concerning Central and South-East Europe innovation policy. Complementary instruments to help SMEs to develop innovation projects leading to ready to market products and consequently, strengthen their economic position

- Decrease bureaucracy and implement efficient form of management taken as model from abroad.

Gaps:

- Low number of research units, mainly in business sector;
- Low level of public funding of R&I activities;
- Weak correlation between research and industry/SMEs.

Former Yugoslav Republic of Macedonia (FYROM): On the basis of relations S<W and O<T, defending strategies W-T should be formulated, in particular: strong need to integrate/cooperate in R&I with SE Europe entities to grow main resources. It should be examined the following needs and gaps:

Needs:

- Improve cooperation between universities, research centres and business/SMEs;
- Improve regional cooperation, e.g. SE Europe integration to increase needed SME resources;

- Access the EU projects in cooperation to increase all needed resources and SMEs funding;
- Technological and industrial development zones/parks comprising foreign investments and including SMEs;
- Improve innovation policies, encouraging human resources development.

Gaps:

- Lack of R&I resources funding, human resources, infrastructure;
- Low level of high educational process;
- Low number of R&D staff in the business sector.

Montenegro (MN): In this case, the same relations are found: $S < W$ and $O < T$. Thus, similar defending strategies W-T should be adopted, addressing mainly the strong requirement to integrate / cooperate in R&I with SE Europe entities to enhance main resources. Therefore the specific needs and gaps have to be considered:

Needs:

- Knowledge transfer to industry / SMEs;
- Lack of funding both from public sources and public ones.

Gaps:

- Weak correlation between research institutions and companies;
- Obsolete technology.

Strategy for group D countries: This strategy is correlated to the synthesis of chart presented in fig. 5. If they would be EU member states, countries in this category might be in the group “modest innovators”. In this respect, the general comment is that the few opportunities have to be addressed by increasing cooperation between research units from SE Europe/EU space. The high lack of funding could be solved by common research projects, including SMEs. The patent funding in SE Europe region could be essential for further development of SMEs from this group of countries.

4.5. Strategy in SEE-IFA network

Overall, within countries in Central and South East Europe (target countries of SEE-IFA-NETWORK project) several issues could be mentioned, as it follows:

STRENGTHS:

- There is a coordinated cooperation / complementarities with other institutions dealing with (research – development) – innovation;
- There are many complementarities with other EU / national funding sources;
- SMEs (companies in general) have cooperation with academic sector or other knowledge providers – usually strong R&D sector (at least in some economic sectors);
- In some countries, there is an increased cooperation between SMEs with financial organisations (banks, credit companies, investment funds);
- Actors in R&D area, easily cooperate with partners from other EU Member States, also as a result of “single country” (EU as such, is seen as an open market, European research area is becoming a reality);
- SMEs are opened to cooperate in order to bring new ideas into products/technologies;

- Customisation of validated ideas/ products/ technologies to local markets seems to be still the main activity of multinational companies acting in SE of Europe;
- In all countries there is a stable legislative framework;
- Even across one country, there is a concentration of innovation potential in some areas (regionalization) ;
- Focus on IPR;
- Internationalization of RD&I;
- Good education system in some countries.

WEAKNESSES:

- Sometimes there are duplication of SMEs related activities among R&D actors;
- Delays in introduction of innovation into markets – systematic issue;
- Lack of business culture based on innovation;
- Innovation is not seen as a key factor for competitiveness;
- Bureaucracy - companies has to earn money not drafting papers;
- Lack of awareness on available mechanisms for supporting SMEs in hard times;
- Inflexibility of tax system; there are no innovation specific incentives in fiscal systems;
- Lack of risk-capital companies.

OPPORTUNITIES:

- EU as a single market (for products and knowledge);
- Green economy (eco-innovation);
- Highly skilled scientists at low cost;
- Unification of RDI policies;
- Synergies with other EU innovation related funding;
- Development of IT networks as a support for innovation.

THREATS:

- Actual economic crisis; companies are focused on short term horizons and not on long one – have no vision;
- Public budgetary constraints;
- Brain drain and not brain circulation yet;
- Decrease of public support for innovation;
- Lack of cooperation between SMEs representatives and decision makers;
- Low investments in innovation (in general), in particular in SMEs;
- Restrictions in using traditional financial instruments (e.g. bank loans); reluctance for new financial mechanisms;
- Copyrights and IPR;
- Focus more on innovation, not on commercial value of a patent/results;
- No communication with other public institutions;
- Reliance of “foreign” IPR.

Taking into account the mentioned issues, an overall strategy for Central and South-East European countries regarding innovation could be formulated as a ST strategy, basically consisting in efficiently exploiting the strengths and avoiding or reducing the threats of a hostile environment.

In the previous analysis, in order to improve the innovation potential within the analyzed countries, an essential issue is the integration of RD&I work of industry/ research institute / universities. So, it could be of utmost interest to discuss about the related thesis - European paradox, that is also present in Central and South East Region, and has been hotly debated in the past (Pavitt 2001 and Dosi et al. 2005) [13]. The term

suggests that, although several European universities are achieving high grade research, their scientific results are rarely transformed into marketable innovations because of the lack or deficient technological transfer.

Many publications emphasise that excellence is a prerequisite for transfer of knowledge (Mansfield 1995, Narin et al. 1997, Van Pottelsberghe 2007, Azoulay et al. 2006, Breschi et al. 2007) [13]. Although scientific excellence is difficult to quantify, the number of publications and citations per 1000 inhabitants/scientists are often used in this sense. The European paradox also acts under this aspect. EU15 and Austria from SEE countries have number of publications and citations comparable with USA but in terms of market transfer, the results are not at all similar. Another condition to be fulfilled is quality teaching, achieved in several universities. Overall, the results of Central and South-East European countries are far of EU average or away the level of excellence, even Austria and Slovenia are among the leading countries in this respect in 2010.

Nevertheless, the focus on activities of technological transfer will be essential to attain high efficiency in research results exploitation.

In terms of international comparison with other world zones, the situation stands as it follows [9]. From the non-EU European countries, Switzerland is the on the whole innovation leader, exceeding all Member States. Switzerland's achievements are also above that of the EU27 and display an exceptional performance in Intellectual assets and in most of the Economic effects indicators.

The US and Japan are keeping their lead over the EU27 as it results from a performance comparison based on a smaller set of 12 indicators provided by IUS 2010: Human resources (new doctorate graduates per 1000 population aged 25-34; percentage population aged 25-64 having completed tertiary education), Open, excellent and attractive research systems (International scientific co-publications per million population; Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country), Public finance and support, Firm investments (Business R&D expenditures as % of GDP), Linkages & entrepreneurship (Public-private co-publications per million population), Intellectual assets (PCT patents applications per billion GDP; PCT patent applications in societal challenges per billion GDP, e.g. climate change, health etc.), Medium and high-tech product exports as % total product exports, Knowledge-intensive services exports as % total service exports, License and patent revenues from abroad as % of GDP

The comparison with the BRIC countries in the same terms also highlights that the EU27 is maintaining its lead towards India and Russia. Compared to China and Brazil, the EU still has a clear innovation performance lead. Nevertheless, based on the mentioned above 12 indicators, this lead is fast turning down.

The US performance gap against EU 27 is mainly explained by higher scores in License and patent revenues from abroad, Public-private co-publications, Tertiary education and Business R&D expenditure. The actual trends show that the US performance is improving faster particularly regarding New doctorate degrees, License and patent revenues and International co-publications. However, the EU surpasses the US in indicators such as Public R&D expenditure and

Knowledge-intensive services exports and its performance is growing faster in 6 indicators, including Public R&D expenditures and PCT patent applications in societal challenges. The US innovation performance exceeds EU 27 mostly by strong private investment in R&D and a successful commercialisation of technological knowledge.

The performance lead of Japan over the EU27 is less noticeable, but not decreasing either. Japan is visibly ahead in Business R&D expenditure and is growing faster than the EU from this point of view.

The overall process of catching up, performed by countries from groups A, B, C, can be shown using two types of convergence generally used in growth studies: σ -convergence and β -convergence. There is σ -convergence if the spread in innovation performance across a group of economies falls during a time interval. This spread in convergence is measured by the ratio of the standard deviation and the average performance of the Member States. This parameter has been reduced over a five year period. If a less innovative country tends to grow faster than a more innovative country, then β -convergence applies. It can be measured by the partial correlation between growth in innovation performance over time and its initial level: when this correlation is negative, there is β -convergence. The correlation between "2006" innovation performance and innovation growth is -0.421 indicating the existence of beta convergence.

Despite the fact that innovation performance of EU 27 recorded apparent weaknesses in the last few years, the catching-up countries achieved high values of growth rates in terms of 25 indicators used in IUS 2010. Countries like Portugal with a growth rate of 8.31%, Estonia (6.59%), Slovenia (6.52%), Bulgaria (6.15%), Malta (6.42%) and Romania (5.23%) are the leaders in this field. This could be a factor of EU innovation growing in the next years.

5. CONCLUSIONS

Analysing the high complexity of issues and their interaction included in SWOT analyses of countries from Central and South-East Europe was a real challenge. Thus, in order to aggregate the results obtained from preliminary countries SWOT analyses, a computer aided analyses represented a strong need in order to formulate some coherent strategies addressing the innovation performances.

Some additional aspects regarding SWOT synthesis has to be emphasized: Countries SWOT are heterogeneous. Local mentalities and cultures strongly affect the analysis; Communication and cooperation between different institutions dealing either with innovation or with finance are sometimes at the lowest level. The two parties are rarely "on the same frequency", this state leading to lack of combination of instruments available to SMEs; In the new EU member states, SME sector is less mature than in old ones; innovation (input of knowledge in general) is not seen as a critical factor for future development. Furthermore, those (a few) who understand that innovation could bring them to a consolidated position on a specific market, are relying on non-national IPR.

Under these very difficult economic circumstances, innovative SMEs are looking at academic sector for new solutions that might support them to overpass the crisis, to restructure their businesses and to find alternative markets for some products. This could be the enhancement of desired technological transfer in order to achieve sustainable competitive advantage.

6. ACKNOWLEDGEMENTS

The results published in this paper were obtained during the researches deployed in the SEE IFA Network project financed by JTS.

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